MITSUBISHI PAJERO

WORKSHOP MANUAL

FOREWORD

This Workshop Manual contains procedures for removal, disassembly, inspection, adjustment, reassembly and installation, etc. for service mechanics.
Use the following manuals in combination with this manual as required.

WORKSHOP MANUAL	
ENGINE GROUP	PWEE□□□□ (Looseleaf edition)
ELECTRICAL WIRING	PHJE9026
PARTS CATALOGUE	B6035604A□

All information, illustrations and product descriptions contained in this manual are current as at the time of publication. We, however, reserve the right to make changes at any time without prior notice or obligation.

MITSUBISHI MOTORS CORPORATION

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PWJE9086-E

REVISED

GENERAL

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NOTES

HOW TO USE THIS MANUAL

E01BAATa

SCOPE OF MAINTENANCE, REPAIR AND SERVICING EXPLANATIONS

This manual provides explanations, etc. concerning procedures for the inspection, maintenance, repair and servicing of the subject model. Note, however, that for engine- and transmission-related component parts, this manual covers only on-vehicle inspections, adjustments, and the removal and installation procedures for major components. For detailed information concerning the inspection, checking, adjustment, disassembly and reassembly of the engine, transmission and major components after they have been removed from the vehicle, please refer to the separate manuals covering the engine and the transmission.

SERVICE ADJUSTMENT PROCEDURES

"Service adjustment procedures" are procedures for performing inspections and adjustments of particularly important locations with regard to the construction and for maintenance and servicing, but other inspections (for looseness, play, cracking, damage, etc.) must also be performed.

INSPECTION

Under this title are presented inspection and checking procedures to be performed by using special tools and measuring instruments and by feeling, but, for actual maintenance and servicing procedures, visual inspections should always be performed as well.

DEFINITION OF TERMS

STANDARD VALUE

Indicates the value used as the standard for judging the quality of a part or assembly on inspection or the value to which the part or assembly is corrected and adjusted. It is given by tolerance.

LIMIT

Shows the standard for judging the quality of a part or assembly on inspection and means the maximum or minimum value within which the part or assembly must be kept functionally or in strength. It is a value established outside the range of standard value.

REFERENCE VALUE

Indicates the adjustment value prior to starting the work (presented in order to facilitate assembly and adjustment procedures, and so they can be completed in a shorter time).

CAUTION

Indicates the presentation of information particularly vital to the worker during the performance of maintenance and servicing procedures in order to avoid the possibility of injury to the worker, or damage to component parts, or a reduction of component or vehicle function or performance, etc.

MODEL INDICATIONS

The following abbreviations are used in this manual for classification of model types.

2400 : Indicates models equipped with the 2,351 cm^3 (143.5 cu. in.) <4G64> petrol engine.
3000 : Indicates models equipped with the 2,972 cm^3 (181.3 cu. in.) <6G72> petrol engine.
3500 : Indicates models equipped with the 3,497 cm^3 (213.3 cu. in.) <6G74> petrol engine.
2500D : Indicates models equipped with the 2,477 cm^3 (151.2 cu. in.) <4D56> Diesel engine.
2800D : Indicates models equipped with the 2,835 cm^3 (173.0 cu. in.) <4M40> Diesel engine.
MPI : Indicates the multi-point injection, or engines equipped with the multi-point injection.
M/T : Indicates the manual transmission, or models equipped with the manual transmission.
A/T : Indicates the automatic transmission, or models equipped with the automatic transmission.
A/C : Indicates the air conditioner.

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EXPLANATION OF MANUAL CONTENTS

Indicates procedures to be performed before the work in that section is started, and procedures to be performed after the work in that section is finished.

Maintenance and Servicing Procedures

(1) A diagram of the component parts is provided near the front of each section in order to give the reader a better understanding of the installed condition of component parts.
(2) The numbers provided within the diagram indicate the sequence for maintenance and servicing procedures; the symbol N indicates a non-reusable part; the tightening torque is provided where applicable.

- Removal steps:
  The part designation number corresponds to the number in the illustration to indicate removal steps.
- Disassembly steps:
  The part designation number corresponds to the number in the illustration to indicate disassembly steps.
- Installation steps:
  Specified in case installation is impossible in reverse order of removal steps.
  Omitted if installation is possible in reverse order of removal steps.
- Reassembly steps:
  Specified in case reassembly is impossible in reverse order of disassembly steps.
  Omitted if reassembly is possible in reverse order of disassembly steps.

Classifications of Major Maintenance/Service Points

When there are major points relative to maintenance and servicing procedures (such as essential maintenance and service points, maintenance and service standard values, information regarding the use of special tools, etc.), these are arranged together as major maintenance and service points and explained in detail.

◀■▶ : Indicates that there are essential points for removal or disassembly.
▶■◀ : Indicates that there are essential points for installation or reassembly.

Indicates (by symbols) where lubrication is necessary. In this example, multipurpose grease is to applied (where indicated) to the knuckle.

Symbols for Lubrication, Sealants and Adhesives

Information concerning the locations for lubrication and for application of sealants and adhesives is provided, by using symbols, in the diagram of component parts or on the page following the component parts page, and explained.

: Grease (multipurpose grease unless there is a brand or type specified)

: Sealant or adhesive

: Brake fluid or automatic transmission fluid

: Engine oil or gear oil

: Adhesive tape or butyl rubber tape

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Indicates the group number.

Indicates the page number.

Indicates the group title.

Indicates the section title.

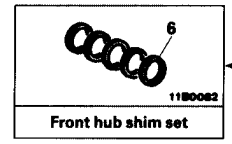
26-22 FRONT AXLE – Knuckle

KNUCKLE

REMOVAL AND INSTALLATION

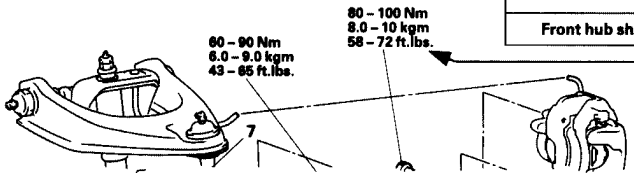
E26NA--

Pre-removal and post-installation Operation
- Removal and installation of the front hub (Refer to P. 26-12.)

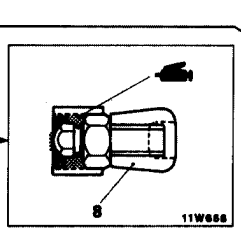


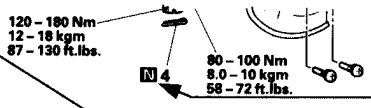
Front hub shim set

Repair kit or set parts are shown. (Only very frequently used parts are shown.)



Denotes tightening torque

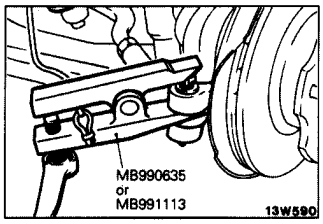




Denotes non-reusable part

Removal steps
1. Dust cover
2. Split pin
3. ◆◆ Connection for tie rod assembly and knuckle
4. Split pin
5. ◆◆ Connection for lower ball joint and knuckle
6. Split pin
7. ◆◆ Connection for upper ball joint and knuckle
8. Knuckle

Operating procedures, cautions, etc. on removal, installation, disassembly and reassembly are described.



SERVICE POINTS OF REMOVAL

E26NBAE

3. DISCONNECTION OF TIE ROD ASSEMBLY AND KNUCKLE

Caution
1. **Use cord to bind the special tool closely so it won't become separated.**
2. **The nut should be loosened only, not removed.**

This number corresponds to the number appearing in "Removal steps", "Disassembly steps", "Installation steps" or "Reassembly steps".

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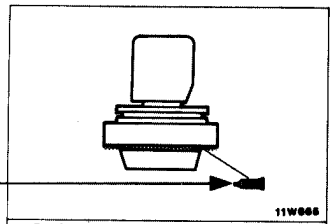
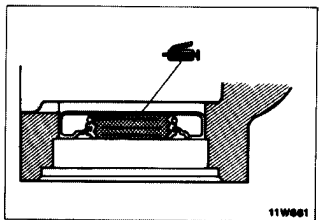
26-42 FRONT AXLE – Differential Carrier

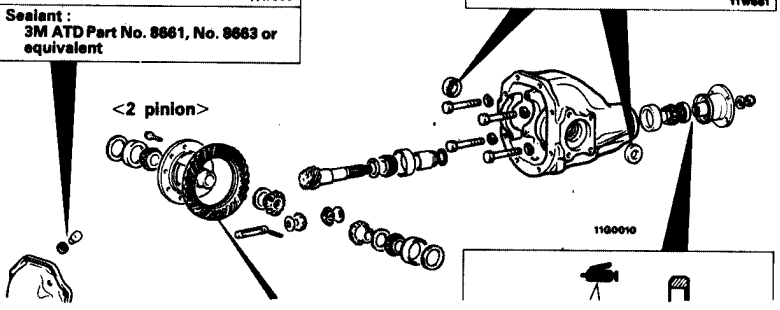
LUBRICATION, SEALING AND ADHESION POINTS

The title of the page (following the page on which the diagram of component parts is presented) indicating the locations of lubrication and sealing procedures.



Sealant :
3M ATD Part No. 8661, No. 8663 or equivalent





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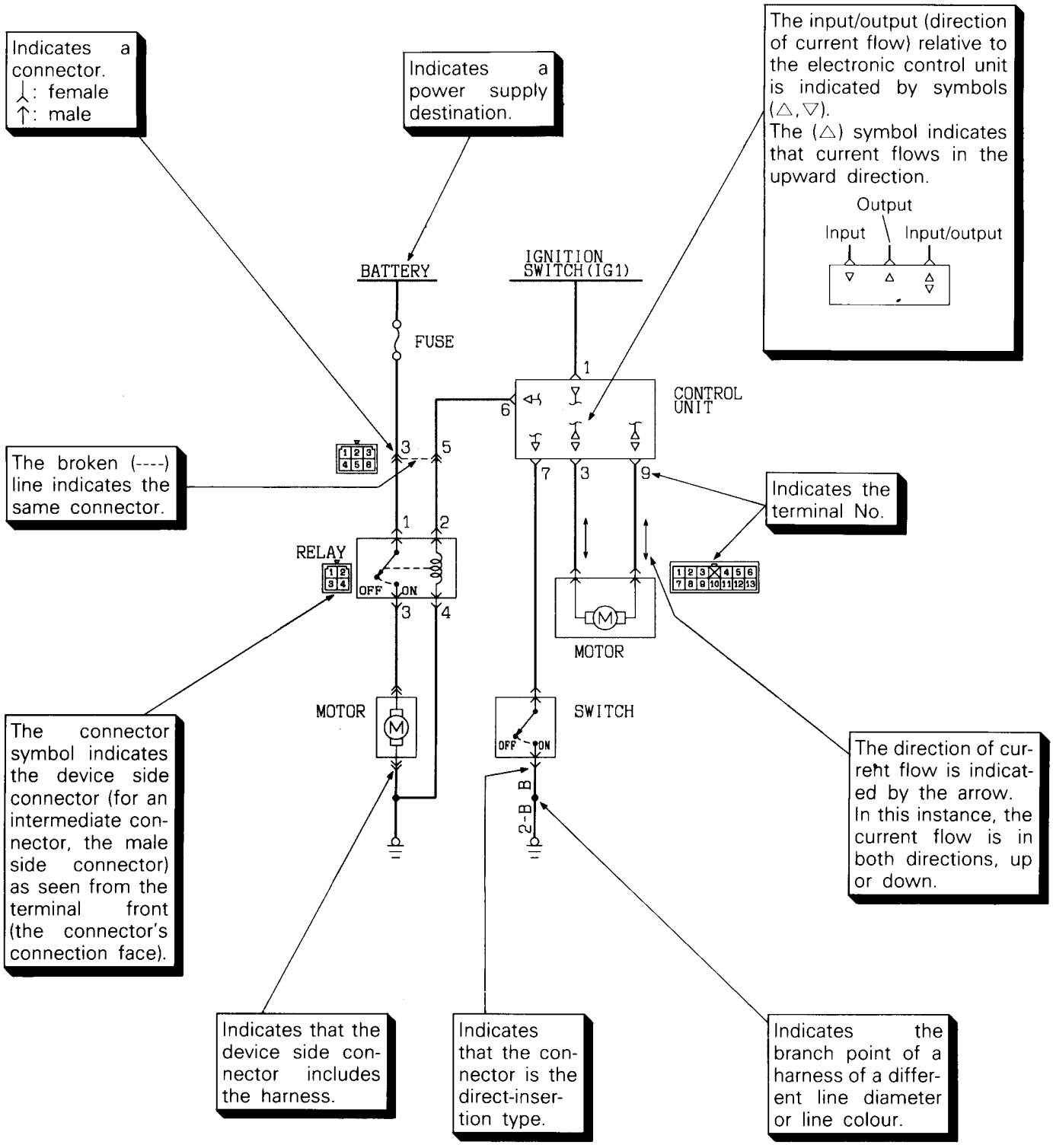
EXPLANATION OF CIRCUIT DIAGRAMS

The symbols used in circuit diagrams are used as described below.

NOTE
For detailed information concerning the reading of circuit diagrams, refer to the separate manual of "ELECTRICAL WIRING".



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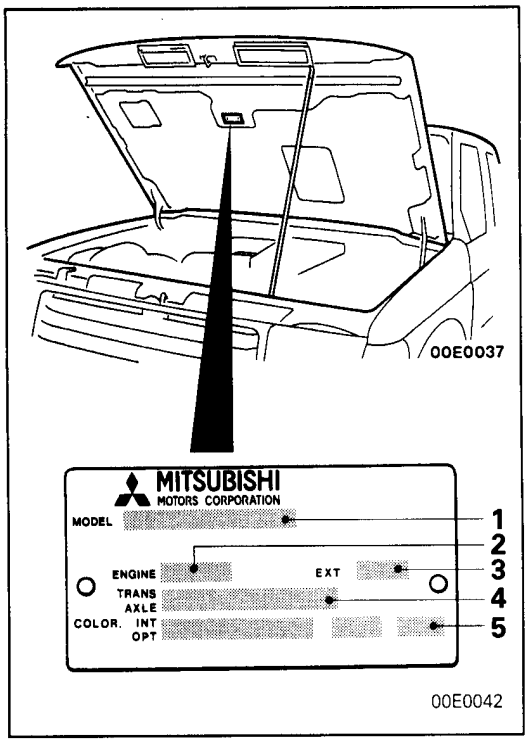

VEHICLE IDENTIFICATION

VEHICLE INFORMATION CODE PLATE E01DD--

Vehicle information code plate is riveted on the hood inner panel.
The plate shows model code, engine model, transmisson model, and body colour code.

1. MODEL

V43WG RXEL6

- Model series
- Vehicle model

2. ENGINE

6G72

- Engine model

3. EXT

CA6A

- Exterior code

4. TRANS
AXLE

V4AW2 4875

- Rear differential reduction
- Transmission model

5. COLOR, INT
OPT

R25 87V 03V

- Equipment code
- Interior colour code
- Body colour code

For monotone colour vehicles, the body colour code shall be indicated. For two-tone or three-way two-tone colour vehicles, each colour code only shall be indicated in series.

MODEL

E01DA--

Vehicles built up to October, 1993

<2-DOOR MODELS>

Model code		Body style	Engine model	Transmission model	Fuel supply system
V21C	NSEL6	Canvas top	4G64 [2,351 cm^3 (143.5 cu.in.)]	V5M21 (5M/T)	MPI
V24C	NSFL6		4D56 [2,477 cm^3 (151.2 cu.in.)] with turbocharger and inter-cooler	V5MT1)(5M/T)	Injection
V23C	GRHEL6	Canvas top with wide fender	6G72 [2,972 cm^3 (181.3 cu.in.)]	V4AW2 (4A/T)	MPI
V21W	NHEL6	Wagon	4G64 [2,351 cm^3 (143.5 cu.in.)]	V5M21 (5M/T)	MPI
V24W	NAFL6	Wagon	4D56 [2,477 cm^3 (151.2 cu.in.)] with turbocharger and inter-cooler	V5MT1 (5M/T)	Injection
	NBFL6				
	NDFL6				
	NHFL6/R6				
V24WG	NCFL6	Wagon with wide fender			
	NXFL6/R6				
V23W	GNXEL6/R6		6G72 [2,972 cm^3 (181.3 cu.in.)]		MPI
	GRXEL6/R6			V4AW2 (4A/T)	

<4-DOOR MODELS>

Model code		Body style	Engine model	Transmission model	Fuel supply system
V41W	NHEL6	Wagon	4G64 [2,351 cm^3 (143.5 cu. in.)]	V5M21 (5M/T)	MPI
V44W	NDFL6		4D56 [2,477 cm^3 (151.2 cu. in.)] with turbocharger and inter-cooler	V5MT1 (5M/T)	Injection
	NDFCL6	Wagon without 3rd seat row			
	NHFL6/R6	Wagon			
	RHFL6/R6			V4AW2 (4A/T)	
V44WG	NXFL6/R6	Wagon with wide fender		V5MT1 (5M/T)	
	RXFL6/R6			V4AW2 (4A/T)	
	NXFCL6	Wagon with wide fender, without 3rd seat row		V5MT1 (5M/T)	
	RXFCL6			V4AW2 (4A/T)	
V43W	NHECL6	Wagon without 3rd seat row	6G72 [2,972 cm^3 (181.3 cu. in.)]	V5MT1 (5M/T)	MPI
	RHECL6			V4AW2 (4A/T)	
	GNXEL6/R6	Wagon with wide fender		V5MT1 (5M/T)	
	GRXEL6/R6			V4AW2 (4A/T)	
	GNXECL6	Wagon with wide fender, without 3rd seat row		V5MT1 (5M/T)	
	GRXECL6			V4AW2 (4A/T)	

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Vehicles built from November, 1993
<2-DOOR MODELS>

Model code		Body style	Engine model	Transmission model	Fuel supply system
V24C	NSFL6	Canvas top	4D56 [2,477 cm^3 (151.2 cu. in.)] with turbocharger and inter-cooler	V5MT1 (5M/T)	Injection
V23C	GNHEL6	Canvas top with wide fender	6G72 [2,972 cm^3 (181.3 cu. in.)]		MPI
	GRHEL6			V4AW2 (4A/T)	
V21W	NHEL6	Wagon	4G64 [2,351 cm^3 (143.5 cu. in.)]	V5M21 (5M/T)	
V24W	NDFL6		4D56 [2,477 cm^3 (151.2 cu. in.)] with turbocharger and inter-cooler	V5MT1 (5M/T)	Injection
	NHFL6/R6				
	NAFL6				
	NBFL6				
V24WG	NXFL6/R6	Wagon with wide fender			
	NCFL6				
V23W	GNXEL6/R6		6G72 [2,972 cm^3 (181.3 cu. in.)]		MPI
	GRXEL6/R6			V4AW2 (4A/T)	
V25W	GNXML6/R6		6G74 [3,497 cm^3 (213.3 cu. in.)]	V5M31 (5M/T)	
	GRXML6/R6			V4AW3 (4A/T)	

<4-DOOR MODELS>

Model code		Body style	Engine model	Transmission model	Fuel supply system
V46W	NDFL6	Wagon	4M40 [2,835 cm^3 (173.0 cu. in.)] with turbocharger and inter-cooler	V5M31 (5M/T)	Injection
	NDFCL6	Wagon without 3rd seat row			
	NHFL6/R6	Wagon			
	RHFL6/R6			V4AW3 (4A/T)	
	NAFL6			V5M31 (5M/T)	
	NAFCL6	Wagon without 3rd seat row			
	NBFL6	Wagon			
	RBFL6			V4AW3 (4A/T)	
V46WG	NXFL6/R6	Wagon with wide fender		V5M31 (5M/T)	
	RXFL6/R6			V4AW3 (4A/T)	
	NCFL6			V5M31 (5M/T)	
	RCFL6			V4AW3 (4A/T)	
V43W	GNXEL6/R6		6G72 [2,972 cm^3 (181.3 cu. in.)]	V5MT1 (5M/T)	MPI
	GRXEL6/R6			V4AW2 (4A/T)	
V45W	GNXML6/R6		6G74 [3,497 cm^3 (213.3 cu. in.)]	V5M31 (5M/T)	
	GRXML6/R6			V4AW3 (4A/T)	

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Model code		Body style	Engine model	Transmission model	Fuel supply system
V44W	NDFL6	Wagon	4D56 [2,477 cm^3 (151.2 cu. in.)] with turbocharger and inter-cooler	V5MT1 (5M/T)	Injection
	NDFCL6	Wagon without 3rd seat row			
	NHFL6	Wagon			
	RHFL6			V4AW2 (4A/T)	
V44WG	NXFL6/R6	Wagon with wide fender		V5MT1 (5M/T)	
	RXFL6/R6			V4AW2 (4A/T)	

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Vehicles built from June, 1994
<2-DOOR MODELS>

Model code		Body style	Engine model	Transmission model	Fuel supply system
V24C	NSFL6	Canvas top	4D56 [2,477 cm^3 (151.2 cu. in.)] with turbocharger and inter-cooler	V5MT1 (5M/T)	Injection
V23C	GNHVL6/R6	Canvas top with wide fender	6G72 [2,972 cm^3 (181.3 cu. in.)]		MPI
	GRHVL6/R6			V4AW3 (4A/T)	
V24W	NDFL6	Wagon	4D56 [2,477 cm^3 (151.2 cu. in.)] with turbocharger and inter-cooler	V5MT1 (5M/T)	Injection
	NHFL6/R6				
	NAFL6				
	NBFL6				
V24WG	NXFL6/R6	Wagon with wide fender			
	NCFL6				
V26WG	NXFL6/R6		4M40 [2,835 cm^3 (173.0 cu. in.)] with turbocharger and inter-cooler	V5M31 (5M/T)	
	NCFL6				
V23W	NHVL6	Wagon	6G72 [2,972 cm^3 (181.3 cu. in.)]	V5MT1 (5M/T)	MPI
	GNXVL6/R6	Wagon with wide fender			
	GRXVL6/R6			V4AW3 (4A/T)	
V25W	GNXML6/R6		6G74 [3,497 cm^3 (213.3 cu. in.)]	V5M31 (5M/T)	
	GRXML6/R6			V4AW3 (4A/T)	

<4-DOOR MODELS>

Model code		Body style	Engine model	Transmission model	Fuel supply system
V46W	NDFL6	Wagon	4M40 [2,835 cm^3 (173.0 cu. in.)] with turbocharger and inter-cooler	V5M31 (5M/T)	Injection
	NDFCL6	Wagon without 3rd seat row			
	NHFL6/R6	Wagon			
	RHFL6/R6			V4AW3 (4A/T)	
	NAFL6			V5M31 (5M/T)	
	NAFCL6	Wagon without 3rd seat row			
	NBFL6	Wagon			
	RBFL6			V4AW3 (4A/T)	
V46WG	NXFL6/R6	Wagon with wide fender		V5M31 (5M/T)	
	RXFL6/R6			V4AW3 (4A/T)	
	NCFL6			V5M31 (5M/T)	
	RCFL6			V4AW3 (4A/T)	

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Vehicles built from June, 1994
<2-DOOR MODELS>

Model code		Body style	Engine model	Transmission model	Fuel supply system
V24C	NSFL6	Canvas top	4D56 [2,477 cm^3 (151.2 cu. in.)] with turbocharger and inter-cooler	V5MT1 (5M/T)	Injection
V23C	GNHVL6/R6	Canvas top with wide fender	6G72 [2,972 cm^3 (181.3 cu. in.)]		MPI
	GRHVL6/R6			V4AW3 (4A/T)	
V24W	NDFL6	Wagon	4D56 [2,477 cm^3 (151.2 cu. in.)] with turbocharger and inter-cooler	V5MT1 (5M/T)	Injection
	NHFL6/R6				
	NAFL6				
	NBFL6				
V24WG	NXFL6/R6	Wagon with wide fender			
	NCFL6				
V26WG	NXFL6/R6		4M40 [2,835 cm^3 (173.0 cu. in.)] with turbocharger and inter-cooler	V5M31 (5M/T)	
	NCFL6				
V23W	NHVL6	Wagon	6G72 [2,972 cm^3 (181.3 cu. in.)]	V5MT1 (5M/T)	MPI
	GNXVL6/R6	Wagon with wide fender			
	GRXVL6/R6			V4AW3 (4A/T)	
V25W	GNXML6/R6		6G74 [3,497 cm^3 (213.3 cu. in.)]	V5M31 (5M/T)	
	GRXML6/R6			V4AW3 (4A/T)	

<4-DOOR MODELS>

Model code		Body style	Engine model	Transmission model	Fuel supply system
V46W	NDFL6	Wagon	4M40 [2,835 cm^3 (173.0 cu. in.)] with turbocharger and inter-cooler	V5M31 (5M/T)	Injection
	NDFCL6	Wagon without 3rd seat row			
	NHFL6/R6	Wagon			
	RHFL6/R6			V4AW3 (4A/T)	
	NAFL6			V5M31 (5M/T)	
	NAFCL6	Wagon without 3rd seat row			
	NBFL6	Wagon			
	RBFL6			V4AW3 (4A/T)	
V46WG	NXFL6/R6	Wagon with wide fender		V5M31 (5M/T)	
	RXFL6/R6			V4AW3 (4A/T)	
	NCFL6			V5M31 (5M/T)	
	RCFL6			V4AW3 (4A/T)	

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Model code		Body style	Engine model	Transmission model	Fuel supply system
V43W	NHVL6/R6	Wagon	6G72 [2,972 cm^3 (181.3 cu. in.)]	V5MT1 (5M/T)	MPI
	RHVL6/R6			V4AW3 (4A/T)	
	GNXVL6/R6	Wagon with wide fender		V5MT1 (5M/T)	
	GRXVL6/R6			V4AW3 (4A/T)	
V45W	GNXML6/R6		6G74 [3,497 cm^3 (213.3 cu. in.)]	V5M31 (5M/T)	
	GRXML6/R6			V4AW3 (4A/T)	
V44W	NDFL6	Wagon	4D56 [2,477 cm^3 (151.2 cu. in.)] with turbocharger and inter-cooler	V5MT1 (5M/T)	Injection
	NDFCL6	Wagon without 3rd seat row			
	NHFL6	Wagon			
V44WG	NXFL6/R6	Wagon with wide fender			

MODEL CODE

E01DB--

V	4	3	W	G	H	N	X	E	C	L	6
1	2	3	4	5	6	7	8	9	10	11	12

1. Sort
   V : PAJERO

2. Chassis type
   2 : Standard wheelbase with rear coil suspension
   4 : Long wheelbase with rear coil suspension

3. Development order
   1 : 2,351 cm^3 (143.5 cu. in.) petrol engine <4G64>
   3 : 2,972 cm^3 (181.3 cu. in.) petrol engine <6G72>
   4 : 2,477 cm^3 (151.2 cu. in.) Diesel engine <4D56>
   5 : 3,497 cm^3 (213.3 cu. in.) petrol engine <6G74>
   6 : 2,835 cm^3 (173.0 cu. in.) Diesel engine <4M40>

4. Body type
   C : Canvas top
   W : Wagon

5. Fender specification
   G : Wide fender
   None : Standard fender

6. Roof type
   H : Kick-up roof
   None : Standard roof

7. Transmission type
   N : 5 × 2-speed manual transmission
   R : 4 × 2-speed automatic transmission

8. Trim code
   A : GL
   B : GLX
   C : GLS
   D : GL for Wagon
   H : GLX
   S : GL for Canvas top
   X : GLS, GLZ

9. Exhaust emission specification
   E : MPI, SOHC
   F : Turbocharger with inter-cooler
   M : MPI, DOHC
   V : MPI, SOHC–24 valve

10. Interior specification
    C : Without 3rd seat row
    None : Standard interior

11. Steering wheel location
    L : Left hand
    R : Right hand

12. Destination
    6 : For Europe

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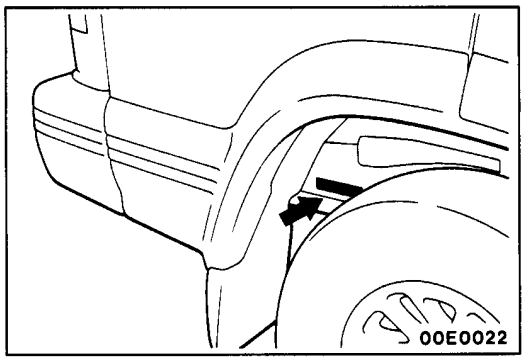

CHASSIS NUMBER

E01DCAT

The chassis number is stamped on the side wall of the frame near the right rear wheel.

⏃	J	M	B	0	N	V24	0	M	J	3	00001	⏃
	1	2	3	4	5	6	7	8	9	10	11	

1. Asia

2. Japan

3. MITSUBISHI
   - A : Right hand drive for Europe
   - B : Left hand drive for Europe

4. Sort
   - 0 : 4 or 2-door with tailgate (backdoor)
   - A : 2-door semi-open (canvas top)

5. Transmission
   - N : 5 × 2-speed manual transmission
   - R : 4 × 2-speed automatic transmission

6. Development oder
   - V21 : 2,351 cm^3 (143.5 cu. in.) Petrol engine <2-door models>
   - V23 : 2,972 cm^3 (181.3 cu. in.) Petrol engine <2-door models>
   - V24 : 2,477 cm^3 (151.2 cu. in.) Diesel engine <2-door models>
   - V25 : 3,497 cm^3 (213.3 cu. in.) Petrol engine <2-door models>
   - V26 : 2,835 cm^3 (173.0 cu. in.) Diesel engine <2-door models>
   - V41 : 2,351 cm^3 (143.5 cu. in.) Petrol engine <4-door models>
   - V43 : 2,972 cm^3 (181.3 cu. in.) Petrol engine <4-door models>
   - V44 : 2,477 cm^3 (151.2 cu. in.) Diesel engine <4-door models>
   - V45 : 3,497 cm^3 (213.3 cu. in.) Petrol engine <4-door models>
   - V46 : 2,835 cm^3 (173.0 cu. in.) Diesel engine <4-door models>

7. Body style
   - 0 : Frame

8. Model year
   - M : 1991
   - N : 1992
   - P : 1993
   - R : 1994
   - S : 1995

9. Plant
   - J,P,Y : Oye Plant of Nagoya Motor Vehicle Works

10. Engine specification
    - 0 : Without turbocharger, with catalyzer
    - 3 : With turbocharger, without catalyzer

11. Serial number
    - 00001 ~

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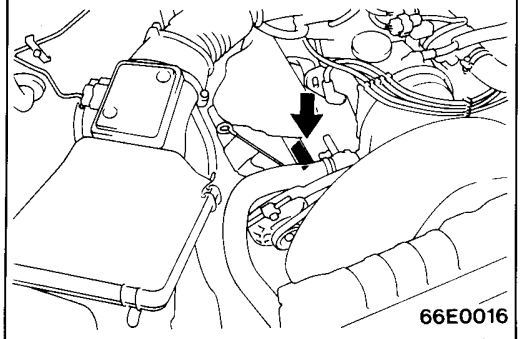
<4G64>



66E0016

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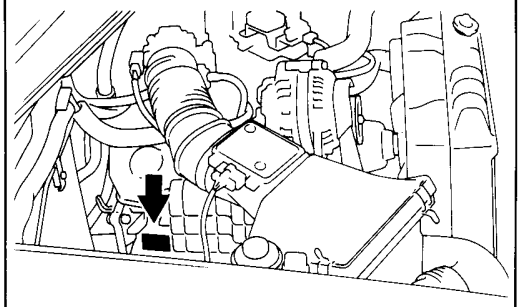

66E0015

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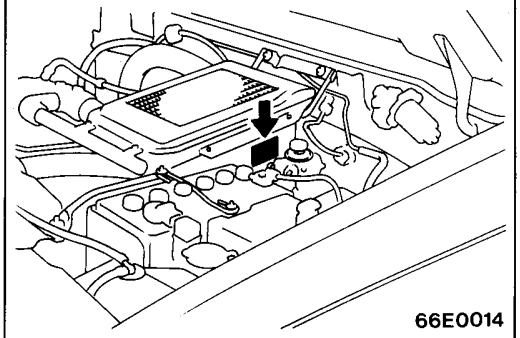

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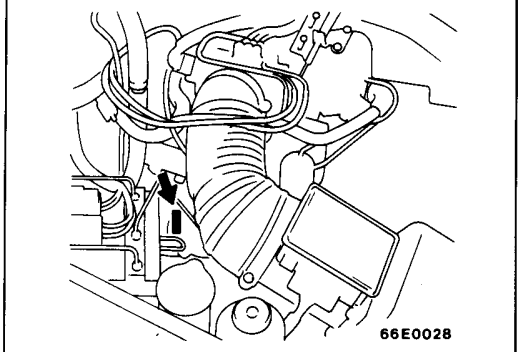

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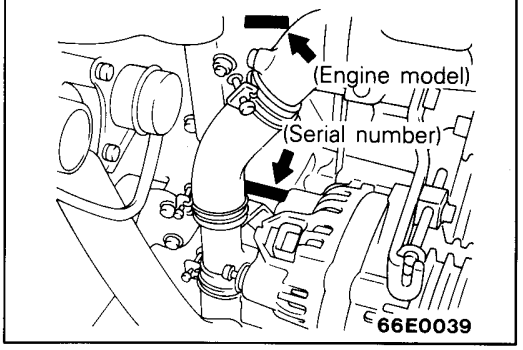

66E0039

ENGINE MODEL NUMBER

E01DEAB

The engine model number is stamped at the cylinder block.

These engine model numbers are as shown in the following.

Engine model	Engine displacement
4G64	2,351 cm^3 (143.5 cu.in.)
6G72	2,972 cm^3 (181.4 cu.in.)
6G74	3,497 cm^3 (213.3 cu.in.)
4D56	2,477 cm^3 (151.2 cu.in.)
4M40	2,835 cm^3 (173.0 cu.in.)

The engine serial number is stamped near the engine model number, and the serial number cycles, as shown below.

<4G64, 4D56, 4M40>

Engine serial number	Number cycling
AA0201 to YY9999	AA0201 - - - - - - - → AA9999 AB0001 - - - - - - - → AY9999 BA0001 - - - - - - - → YY9999

<6G72, 6G74>

[Vehicles built up to May, 1993]

Engine serial number	Number cycling
AA0201 to YY9999	AA0201 - - - - - - → AA9999 AB0001 - - - - - - → AY9999 BA0001 - - - - - - → YY9999

[Vehicles built from June, 1993]

Engine serial number	Number cycling
A09990 to Y99999	A09990 - - - - - - → A99999 B00001 - - - - - - → Y99999

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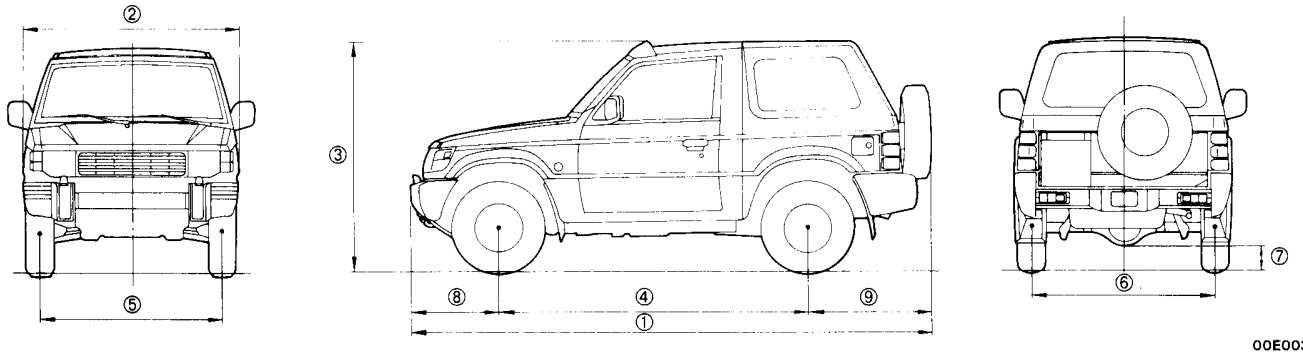
NOTE

MAJOR SPECIFICATIONS

E01FA--

<Vehicles built up to October, 1993>
CANVAS TOP



00E0038

Items		V21CNSEL6	V24CNSFL6	V23CGRHEL6
Dimensions	mm (in.)			
Overall length	①	4,075 (160.4)		4,145 (163.2)
Overall width	②	1,695 (66.7)		1,785 (70.3)
Overall height (unladen)	③	1,815 (71.5)		1,815 (71.5)
Wheelbase	④	2,420 (95.3)		2,420 (95.3)
Track-front	⑤	1,420 (55.9)		1,465 (57.7)
Track-rear	⑥	1,435 (56.5)		1,480 (58.3)
Ground clearance (laden)	⑦	215 (8.5) or 205 (8.1)*1		215 (8.5)
Overhang-front	⑧	675 (26.6)		720 (28.3)
Overhang-rear	⑨	980 (38.6)		1,005 (39.6)
Weight	kg (lbs.)			
Kerb weight		1,530 – 1,655 (3,373 – 3,648)	1,665 – 1,800 (3,648 – 3,968)	1,705 – 1,835 (3,758 – 4,045)
Max. gross vehicle weight		2,200 (4,850) or 2,300 (5,070)*2	2,300 (5,070)	2,350 (5,180)
Max. front axle load		1,100 (2,425)	1,100 (2,425)	1,200 (2,645)
Max. rear axle load		1,450 (3,196) or 1,500 (3,306)*2	1,450 (3,196)	1,450 (3,196)
Seating capacity		4		
Engine				
Model		4G64	4D56	6G72
Total displacement	cm³ (cu. in.)	2,351 (143.5)	2,477 (151.2)	2,972 (181.3)
Transmission				
Type		5-speed manual	5-speed manual	4-speed automatic
Model		V5M21	V5MT1	V4AW2

NOTE
*1 : With rear differential lock
*2 : Vehicles for Sweden or Denmark

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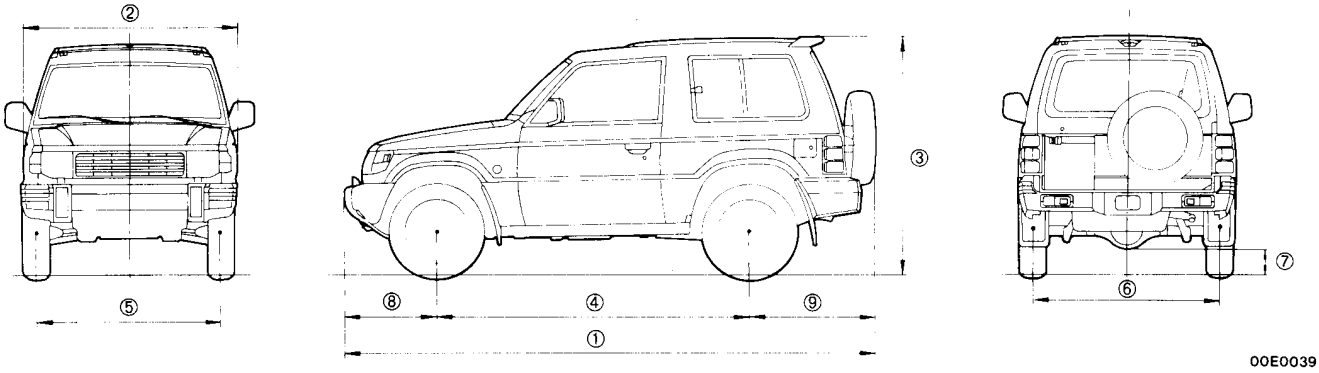
METAL TOP

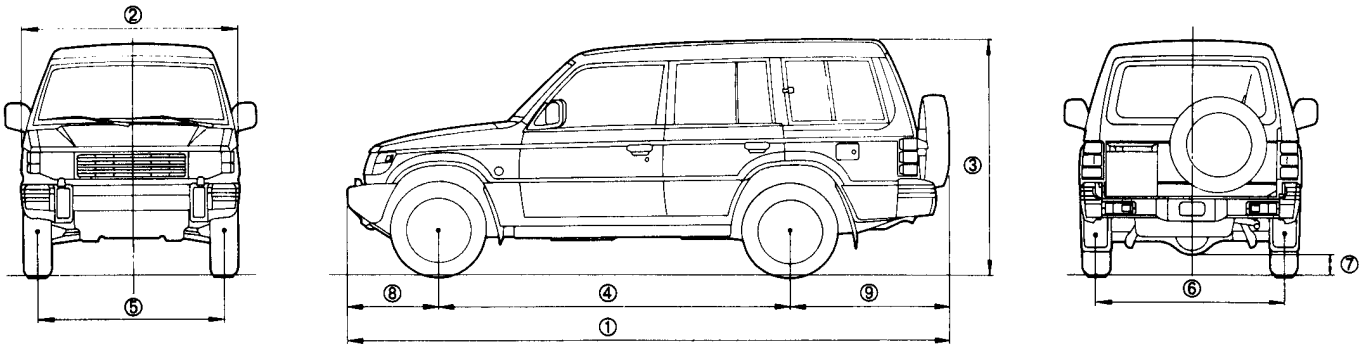


Items		V21WNHEL6	V24WNAFL6 V24WNBFL6 V24WNDFL6 V24WNHFL6/R6	V24WGNCFL6 V24WGNXFL6/R6	V23WGNXEL6/R6 V23WGRXEL6/R6
Dimensions mm (in.)					
Overall length	①	4,120 (162.2) or 4,075 (160.4)*3		4,145 (163.2)	
Overall width	②	1,695 (66.7)		1,785 (70.3)	
Overall height (unladen)	③	1,805 (71.1)		1,815 (71.5)	
Wheelbase	④	2,420 (95.3)		2,420 (95.3)	
Track-front	⑤	1,420 (55.9)		1,465 (57.7)	
Track-rear	⑥	1,435 (56.5)		1,480 (58.3)	
Ground clearance (laden)	⑦	215 (8.5) or 205 (8.1)*1		225 (8.8) or 215 (8.5)*1	
Overhang-front	⑧	720 (28.3) or 675 (26.6)*3		720 (28.3)	
Overhang-rear	⑨	980 (38.6)		1,005 (39.6)	
Weight kg (lbs.)					
Kerb weight		1,580 – 1,710 (3,483 – 3,769)	1,730 – 1,900 (3,813 – 4,188) or 1,680 – 1,820*3 (3,703 – 4,012)	1,755 – 1,905 (3,869 – 4,199)	1,740 – 1,855 (3,836 – 4,089)
Max. gross vehicle weight		2,200 (4,850) or 2,350 (5,180)*2	2,300 (5,070)	2,300 (5,070)	2,350 (5,180)
Max. front axle load		1,100 (2,425)	1,100 (2,425)	1,100 (2,425)	1,200 (2,645)
Max. rear axle load		1,450 (3,196) or 1,500 (3,306)*2	1,450 (3,196)	1,450 (3,196)	1,450 (3,196)
Seating capacity		5			
Engine					
Model		4G64	4D56		6G72
Total displacement cm³ (cu. in.)		2,351 (143.5)	2,477 (151.2)		2,972 (181.3)

Items	V21WNHEL6	V24WNAFL6 V24WNBFL6 V24WNDFL6 V24WNHFL6/R6	V24WGNCFL6 V24WGNXFL6/R6	V23WGNXEL6/R6 V23WGRXEL6/R6
Transmission Type Model	5-speed manual V5M21	5-speed manual or 4-speed automatic*4 V5MT1 or V4AW2*4		

NOTE
*1 : With rear differential lock
*2 : Vehicles for Sweden or Denmark
*3 : V24WNDFL6
*4 : V23WGRXEL6/R6

WAGON



00E0040

<VEHICLES WITH PETROL ENGINE>

Items		V41WNHEL6	V43WGNXEL6/R6 V43WGNXECL6 V43WNHECL6*11	V43WGRXEL6/R6 V43WGRXECL6 V43WRHECL6*11
Dimensions mm (in.)				
Overall length	①	4,700 (185.0)	4,725 (186.0)	
Overall width	②	1,695 (66.7)	1,785 (70.3)	
Overall height (unladen)	③	1,855 (73.0)	1,865 (73.4)	
Wheelbase	④	2,725 (107.3)	2,725 (107.3)	
Track-front	⑤	1,420 (55.9)	1,465 (57.7)	
Track-rear	⑥	1,435 (56.5)	1,480 (58.3)	
Ground clearance (laden)	⑦	210 (8.3) or 200 (7.9)*1	210 (8.3)	
Overhang-front	⑧	720 (28.3)	720 (28.3)	
Overhang-rear	⑨	1,255 (49.4)	1,280 (50.4)	

NOTE
*1 : With rear differential lock
*11 : Vehicles for Sweden

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Items	V41WNHEL6	V43WGNXEL6/R6 V43WGNXECL6 V43WNHECL6*11	V43WGRXEL6/R6 V43WGRXECL6 V43WRHECL6*11
Weight kg (lbs.)			
Kerb weight	1,790 – 1,945 (3,946 – 4,287)	1.915 – 2.070 (4,221 – 4,563) or 1,890 – 2,045*5 (4,166 – 4,508) or 1,824 – 1,844 (4,021 – 4,065)*11	1,910 – 2,065 (4,210 – 4,552) or 1,885 – 2,040*6 (4,155 – 4,497) or 1,824 – 1,844 (4,021 – 4,065)*11
Max. gross vehicle weight	2,560 (5,643)	2,650 (5,842) or 2,500 (5,511)*11	2,650 (5,842) or 2,500 (5,511)*11
Max. front axle load	1,100 (2,425)	1,200 (2,645)	1,200 (2,645) or 1,100 (2,425)*11
Max. rear axle load	1,650 (3,637)	1,650 (3,637)	1,650 (3,673)
Seating capacity	7	7 or 5*5,*6	
Engine			
Model	4G64	6G72	
Total displacement cm³ (cu. in.)	2,351 (143.5)	2,972 (181.3)	
Transmission			
Type	5-speed manual	5-speed manual	4-speed automatic
Model	V5M21	V5MT1	V4AW2

NOTE
*5 : V43WGNXECL6
*6 : V43WGRXECL6
*11 : Vehicles for Sweden

<VEHICLES WITH DIESEL ENGINE>

Items		V44WNDFL6 V44WNDFCL6 V44WNHFL6/R6	V44WRHFL6/R6	V44WGNXFL6/R6 V44WGNXFCL6	V44WGRXFL6/R6 V44WGRXFCL6
Dimensions mm (in.)					
Overall length	①	4,655 (183.3) or 4,700 (185.0)*7	4,700 (185.0)	4,725 (186.0)	
Overall width	②	1,695 (66.7)	1,695 (66.7)	1,785 (70.3)	
Overall height (unladen)	③	1,855 (73.0)	1,855 (73.0)	1,865 (73.4)	
Wheelbase	④	2,725 (107.3)	2,725 (107.3)	2,725 (107.3)	
Track-front	⑤	1,420 (55.9)	1,420 (55.9)	1,465 (57.7)	
Track-rear	⑥	1,435 (56.5)	1,435 (56.5)	1,480 (58.3)	
Ground clearance (laden)	⑦	210 (8.3) or 200 (7.9)*1	210 (8.3) or 200 (7.9)*1	210 (8.3)	
Overhang-front	⑧	675 (26.6) or 720 (28.3)*7	720 (28.3)	720 (28.3)	
Overhang-rear	⑨	1,255 (49.4)	1,255 (49.4)	1,280 (50.4)	

NOTE
*1 : With rear differential lock
*7 : V44WNHFL6/R6

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Items	V44WNDFL6 V44WNDFCL6 V44WNHFL6/R6	V44WRHFL6/R6	V44WGNXFL6/R6 V44WGNXFCL6	V44WGRXFL6/R6 V44WGRXFCL6
Weight kg (lbs.)				
Kerb weight	1,865 – 2,000 (4,111 – 4,409) or 1,840 – 1,975*8 (4,056 – 4,354) or 1,915 – 2,110*7 (4,221 – 4,651)	1,895 – 2,100 (4,177 – 4,629)	1,945 – 2,115 (4,287 – 4,662) or 1,920 – 2,090*9 (4,232 – 4,607)	1,935 – 2,105 (4,265 – 4,640) or 1,910 – 2,080*10 (4,210 – 4,585)
Max. gross vehicle weight	2,650 (5,643)	2,650 (5,643)	2,650 (5,643)	2,650 (5,643)
Max. front axle load	1,100 (2,425)	1,100 (2,425)	1,100 (2,425)	1,100 (2,425)
Max. rear axle load	1,650 (3,637)	1,650 (3,637)	1,650 (3,637)	1,650 (3,637)
Seating capacity	7 or 5*8	7	7 or 5*9	7 or 5*10
Engine				
Model	4D56			
Total displacement cm^3 (cu. in.)	2,477 (151.2)			
Transmission				
Type	5-speed manual	4-speed automatic	5-speed manual	4-speed automatic
Model	V5MT1	V4AW2	V5MT1	V4AW2

NOTE
*7 : V44WNHFL6/R6
*8 : V44WNDFCL6
*9 : V44WGNXFCL6
*10 : V44WGRXFCL6

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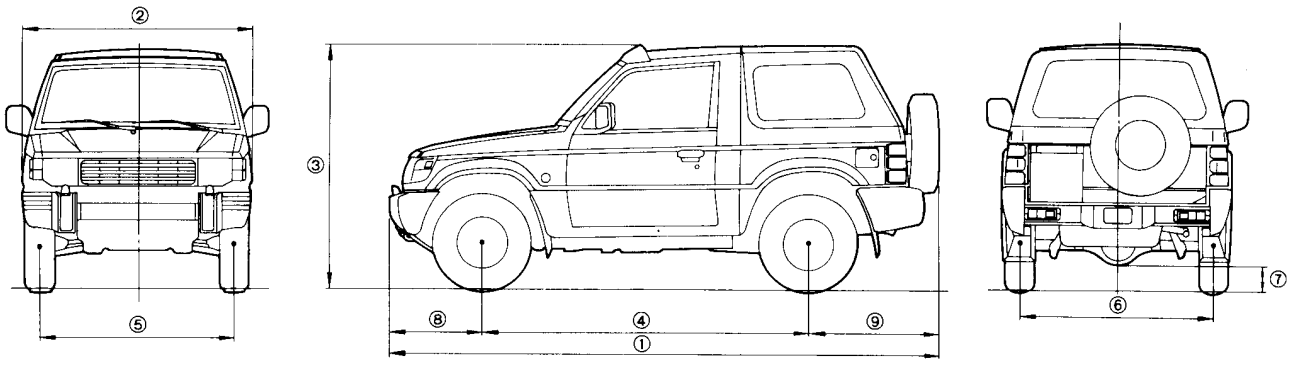
<Vehicles built from November, 1993>
CANVAS TOP



00E0038

Items		V24CNSFL6	V23CGNHEL6	V23CGRHEL6
Dimensions mm (in.)				
Overall length	①	4,075 (160.4)	4,145 (163.2)	
Overall width	②	1,695 (66.7)	1,785 (70.3)	
Overall height (unladen)	③	1,805 (71.1)	1,815 (71.5)	
Wheelbase	④	2,420 (95.3)	2,420 (95.3)	
Track-front	⑤	1,420 (55.9)	1,465 (57.7)	
Track-rear	⑥	1,435 (56.5)	1,480 (58.3)	
Ground clearance (laden)	⑦	215 (8.5)	215 (8.5)	
Overhang-front	⑧	675 (26.6)	720 (28.3)	
Overhang-rear	⑨	980 (38.6)	1,005 (39.6)	
Weight kg (lbs.)				
Kerb weight		1,665–1,800 (3,670–3,968)	1,705–1,835 (3,758–4,045)	
Max. gross vehicle weight		2,300 (5,070)	2,350 (5,180)	
Max. front axle load		1,100 (2,425)	1,200 (2,645)	
Max. rear axle load		1,450 (3,196)	1,650 (3,637)	
Seating capacity		4		
Engine				
Model		4D56	6G72	
Total displacement cm^3 (cu. in.)		2,477 (151.2)	2,972 (181.3)	
Transmission				
Type		5-speed manual	5-speed manual	4-speed automatic
Model		V5MT1	V5MT1	V4AW2

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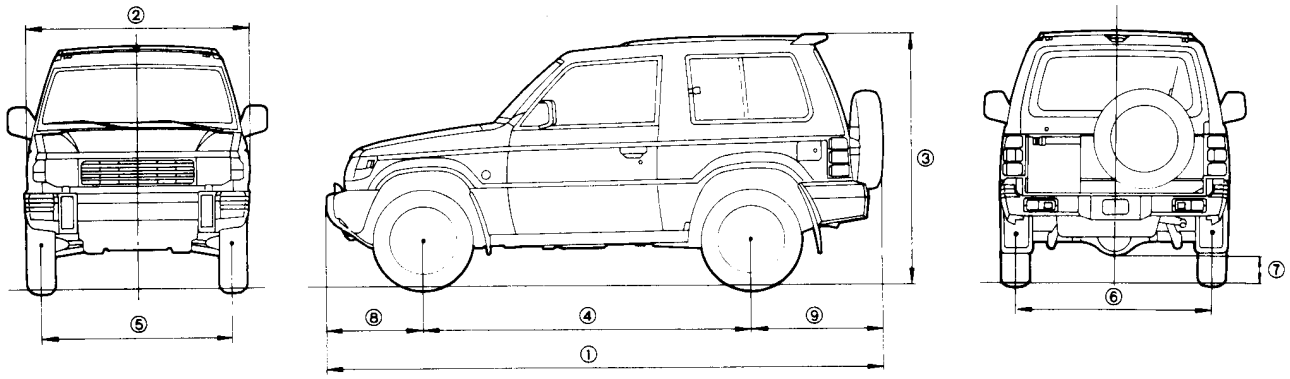
METAL TOP



00E0039

<VEHICLES WITH PETROL ENGINE>

Items		V21WNHEL6	V23WGNXEL6/R6 V23WGRXEL6/R6	V25WGNXML6/R6 V25WGRXML6/R6
Dimensions mm (in.)				
Overall length	①	4,120 (162.2)	4,145 (163.2)	4,145 (163.2)
Overall width	②	1,695 (66.7)	1,785 (70.3)	1,785 (70.3)
Overall height (unladen)	③	1,805 (71.1)	1,815 (71.5)	1,845 (72.6)
Wheelbase	④	2,420 (95.3)	2,420 (95.3)	2,420 (95.3)
Track-front	⑤	1,420 (55.9)	1,465 (57.7)	1,465 (57.7)
Track-rear	⑥	1,435 (56.5)	1,480 (58.3)	1,480 (58.3)
Ground clearance (laden)	⑦	215 (8.5)	215 (8.5)	205 (8.1)
Overhang-front	⑧	720 (28.3)	720 (28.3)	720 (28.3)
Overhang-rear	⑨	980 (38.6)	1,005 (39.6)	1,005 (39.6)
Weight kg (lbs.)				
Kerb weight		1,580–1,710 (3,483–3,769)	1,740–1,855 (3,836–4,089)	1,810–1,925 (3,990–4,243)
Max. gross vehicle weight		2,200 (4,850) or 2,205 (4,861)*1	2,350 (5,180)	2,350 (5,180)
Max. front axle load		1,100 (2,425)	1,200 (2,645)	1,200 (2,645)
Max. rear axle load		1,450 (3,196)	1,650 (3,638)	1,650 (3,638)
Seating capacity		5		
Engine				
Model		4G64	6G72	6G74
Total displacement cm^3 (cu. in.)		2,351 (143.5)	2,972 (181.3)	3,497 (213.4)
Transmission				
Type		5-speed manual	5-speed manual or 4-speed automatic*2	5-speed manual or 4-speed automatic*3
Model		V5M21	V5MT1 or V4AW2*2	V5M31 or V4AW3*3

NOTE
*1 : Vehicles for Norway
*2 : V23WGRXEL6/R6
*3 : V25WGRXML6/R6

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<VEHICLES WITH DIESEL ENGINE>

Items		V24WNAFL6 V24WNDFL6	V24WNBFL6 V24WNHFL6/R6	V24WGNCFL6 V24WGNXFL6/R6
Dimensions mm (in.)				
Overall length	①	4,075 (160.4)	4,120 (162.2)	4,145 (163.2)
Overall width	②	1,695 (66.7)	1,695 (66.7)	1,785 (70.3)
Overall height (unladen)	③	1,805 (71.1)	1,805 (71.1)	1,815 (71.5)
Wheelbase	④	2,420 (95.3)	2,420 (95.3)	2,420 (95.3)
Track-front	⑤	1,420 (55.9)	1,420 (55.9)	1,465 (57.7)
Track-rear	⑥	1,435 (56.5)	1,435 (56.5)	1,480 (58.3)
Ground clearance (laden)	⑦	215 (8.5)	215 (8.5)	225 (8.9)
Overhang-front	⑧	675 (26.6)	720 (28.3)	720 (28.3)
Overhang-rear	⑨	980 (38.6)	980 (38.6)	1,005 (39.6)
Weight kg (lbs.)				
Kerb weight		1,680–1,820 (3,703–4,012)	1,730–1,900 (3,813–4,188)	1,755–1,905 (3,869–4,199)
Max. gross vehicle weight		2,300 (5,070)	2,300 (5,070)	2,300 (5,070)
Max. front axle load		1,100 (2,425)	1,100 (2,425)	1,100 (2,425)
Max. rear axle load		1,450 (3,196)	1,450 (3,196)	1,450 (3,196)
Seating capacity		5		
Engine				
Model		4D56		
Total displacement cm^3 (cu. in.)		2,477 (151.2)		
Transmission				
Type		5-speed manual		
Model		V5MT1		

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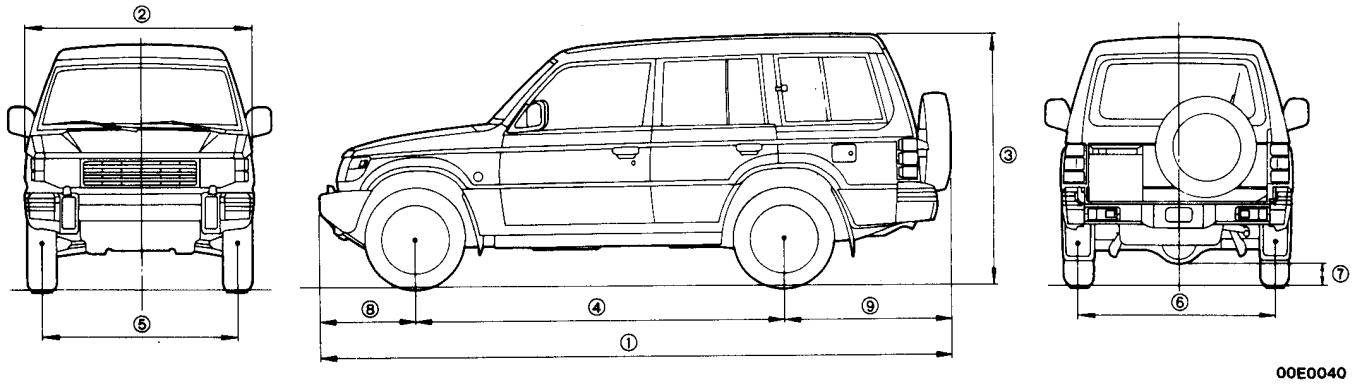
WAGON



<VEHICLES WITH PETROL ENGINE>

Items		V43WGNXEL6/R6	V43WGRXEL6/R6	V45WGNXML6/R6	V45WGRXML6/R6
Dimensions mm (in.)					
Overall length	①	4,725 (186.0)		4,725 (186.0)	
Overall width	②	1,785 (70.3)		1,785 (70.3)	
Overall height (unladen)	③	1,870 (73.6)		1,895 (74.6)	
Wheelbase	④	2,725 (107.3)		2,725 (107.3)	
Track-front	⑤	1,465 (57.7)		1,465 (57.7)	
Track-rear	⑥	1,480 (58.3)		1,480 (58.3)	
Ground clearance (laden)	⑦	215 (8.5)		205 (8.1)	
Overhang-front	⑧	720 (28.3)		720 (28.3)	
Overhang-rear	⑨	1,280 (50.4)		1,280 (50.4)	
Weight kg (lbs.)					
Kerb weight		1,925–2,085 (4,243–4,596)	1,920–2,080 (4,232–4,585) or 1,922–2,012*4 (4,237–4,435)	1,990–2,145 (4,387–4,728)	1,985–2,140 (4,376–4,717)
Max. gross vehicle weight		2,650 (5,842)	2,650 (5,842) or 2,600 (5,732)*4	2,720 (5,996)	2,720 (5,996)
Max. front axle load		1,200 (2,645)	1,200 (2,645)	1,200 (2,645)	1,200 (2,645)
Max. rear axle load		1,650 (3,637)	1,650 (3,637)	1,780 (3,924)	1,780 (3,924)
Seating capacity		7			
Engine					
Model		6G72		6G74	
Total displacement cm^3 (cu. in.)		2,972 (181.3)		3,497 (213.4)	
Transmission					
Type		5-speed manual	4-speed automatic	5-speed manual	4-speed automatic
Model		V5MT1	V4AW2	V5M31	V4AW3

NOTE
*4 : Vehicles for Sweden

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<VEHICLES WITH DIESEL ENGINE>

Items		V46WNDFL6 V46WNAFL6	V46WNDFCL6 V46WNAFCL6	V46WNBFL6 V46WNHFL6/R6
Dimensions mm (in.)				
Overall length	①	4,655 (183.3)		4,700 (185.0)
Overall width	②	1,695 (66.7)		1,695 (66.7)
Overall height (unladen)	③	1,885 (74.2)		1,885 (74.2)
Wheelbase	④	2,725 (107.3)		2,725 (107.3)
Track-front	⑤	1,420 (55.9)		1,420 (55.9)
Track-rear	⑥	1,435 (56.5)		1,435 (56.5)
Ground clearance (laden)	⑦	190 (7.5)		190 (7.5)
Overhang-front	⑧	675 (26.6)		720 (28.3)
Overhang-rear	⑨	1,255 (49.4)		1,255 (49.4)
Weight kg (lbs.)				
Kerb weight		1,960–2,095 (4,321–4,618)	1,920–2,055 (4,232–4,530)	2,010–2,180 (4,431–4,806)
Max. gross vehicle weight		2,720 (5,996)	2,720 (5,996)	2,720 (5,996)
Max. front axle load		1,200 (2,645)	1,200 (2,645)	1,200 (2,645)
Max. rear axle load		1,780 (3,924)	1,780 (3,924)	1,780 (3,924)
Seating capacity		7	5	7
Engine				
Model		4M40		
Total displacement cm^3 (cu. in.)		2,835 (173.0)		
Transmission				
Type		5-speed manual		
Model		V5M31		

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Items		V46WRBFL6 V46WRHFL6/R6	V46WGNCFL6 V46WGNXFL6/R6	V46WGRCFL6 V46WGRXFL6/R6
Dimensions mm (in.)				
Overall length	①	4,700 (185.0)	4,725 (186.0)	
Overall width	②	1,695 (66.7)	1,785 (70.3)	
Overall height (unladen)	③	1,885 (74.2)	1,895 (74.6)	
Wheelbase	④	2,725 (107.3)	2,725 (107.3)	
Track-front	⑤	1,420 (55.9)	1,465 (57.7)	
Track-rear	⑥	1,435 (56.5)	1,480 (58.3)	
Ground clearance (laden)	⑦	190 (7.5)	205 (8.1)	
Overhang-front	⑧	720 (28.3)	720 (28.3)	
Overhang-rear	⑨	1,255 (49.4)	1,280 (50.4)	
Weight kg (lbs.)				
Kerb weight		2,005–2,175 (4,420–4,795)	2,040–2,175 (4,497–4,795)	2,045–2,180 (4,508–4,806)
Max. gross vehicle weight		2,720 (5,996)	2,720 (5,996)	2,720 (5,996)
Max. front axle load		1,200 (2,645)	1,200 (2,645)	1,200 (2,645)
Max. rear axle load		1,780 (3,924)	1,780 (3,924)	1,780 (3,924)
Seating capacity		7		
Engine				
Model		4M40		
Total displacement cm^3 (cu. in.)		2,835 (173.0)		
Transmission				
Type		4-speed automatic	5-speed manual	4-speed automatic
Model		V4AW3	V5M31	V4AW3

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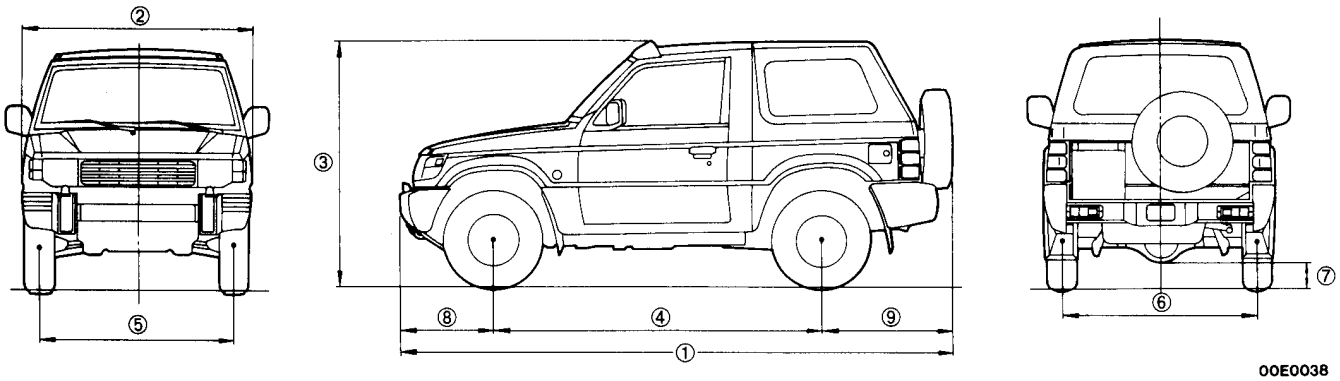
ADDED

Items		V44WNDFL6 V44WNDFCL6 V44WNHFL6/R6	V44WGNXFL6/R6	V44WGRXFL6/R6
Dimensions mm (in.)				
Overall length	①	4,655 (183.3) or 4,700 (185.0)*6	4,725 (186.0)	
Overall width	②	1,695 (66.7)	1,785 (70.3)	
Overall height (unladen)	③	1,855 (73.0)	1,865 (73.4)	
Wheelbase	④	2,725 (107.3)	2,725 (107.3)	
Track–front	⑤	1,420 (55.9)	1,465 (57.7)	
Track–rear	⑥	1,435 (56.5)	1,480 (58.3)	
Ground clearance (laden)	⑦	210 (8.3) or 200 (7.9)*5	210 (8.3)	
Overhang-front	⑧	675 (26.6) or 720 (28.3)*6	720 (28.3)	
Overhang-rear	⑨	1,255 (49.4)	1,280 (50.4)	
Weight kg (lbs.)				
Kerb weight		1,865–2,000 (4,111–4,409) or 1,840–1,975*7 (4,056–4,354) or 1,915–2,110*6 (4,221–4,651)	1,945–2,115 (4,287–4,662)	1,935–2,105 (4,265–4,640)
Max. gross vehicle weight		2,650 (5,643)	2,650 (5,643)	2,650 (5,643)
Max. front axle load		1,100 (2,425)	1,100 (2,425)	1,100 (2,425)
Max. rear axle load		1,650 (3,637)	1,650 (3,637)	1,650 (3,637)
Seating capacity		7 or 5*7	7	7
Engine				
Model		4D56		
Total displacement cm^3 (cu. in.)		2,477 (151.2)		
Transmission				
Type		5-speed manual	5-speed manual	4-speed automatic
Model		V5MT1	V5MT1	V4AW2

NOTE
*5 : With rear differential lock
*6 : V44WNHFL6/R6
*7 : V44WNDFCL6

<Vehicles built from June, 1994>
CANVAS TOP

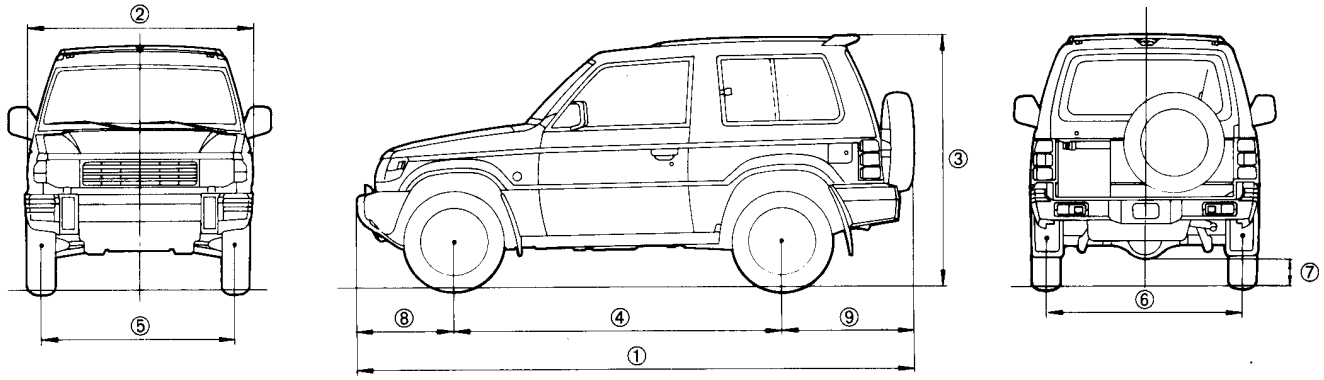


00E0038

Items		V24CNSFL6	V23CGNHVL6/R6	V23CGRHVL6/R6
Dimensions mm (in.)				
Overall length	①	4,075 (160.4)	4,145 (163.2)	
Overall width	②	1,695 (66.7)	1,785 (70.3)	
Overall height (unladen)	③	1,805 (71.1)	1,845 (72.6)	
Wheelbase	④	2,420 (95.3)	2,420 (95.3)	
Track–front	⑤	1,420 (55.9)	1,465 (57.7)	
Track–rear	⑥	1,435 (56.5)	1,480 (58.3)	
Ground clearance (laden)	⑦	205 (8.1)	215 (8.5)	
Overhang-front	⑧	675 (26.6)	720 (28.3)	
Overhang-rear	⑨	980 (38.6)	1,005 (39.6)	
Weight kg (lbs.)				
Kerb weight		1,665–1,800 (3,670–3,968)	1,735–1,865 (3,825–4,112)	1,725–1,855 (3,803–4,090)
Max. gross vehicle weight		2,510 (5,534)	2,350 (5,181)	2,350 (5,181)
Max. front axle load		1,100 (2,425) or 1,070 (2,359)*1	1,200 (2,646) or 1,030 (2,271)*1	1,200 (2,646) or 1,030 (2,271)*1
Max. rear axle load		1,650 (3,638) or 1,565 (3,450)*1	1,650 (3,638) or 1,405 (3,097)*1	1,650 (3,638) or 1,405 (3,097)*1
Seating capacity		4		
Engine				
Model		4D56	6G72	
Total displacement cm^3 (cu. in.)		2,477 (151.2)	2,972 (181.3)	
Transmission				
Type		5-speed manual	5-speed manual	4-speed automatic
Model		V5MT1	V5MT1	V4AW3

NOTE
*1 : Vehicles for Belgium and France

METAL TOP



<VEHICLES WITH PETROL ENGINE>

00E0039

Items		V23WNHVL6	V23WGNXVL6/R6	V23WGRXVL6/R6	V25WGNXML6/R6 V25WGRXML6/R6
Dimensions mm (in.)					
Overall length	①	4,120 (162.2)	4,145 (163.2)		4,145 (163.2)
Overall width	②	1,695 (66.7)	1,785 (70.3)		1,785 (70.3)
Overall height (unladen)	③	1,835 (72.2)	1,845 (72.6)		1,845 (72.6)
Wheelbase	④	2,420 (95.3)	2,420 (95.3)		2,420 (95.3)
Track–front	⑤	1,420 (55.9)	1,465 (57.7)		1,465 (57.7)
Track–rear	⑥	1,435 (56.5)	1,480 (58.3)		1,480 (58.3)
Ground clearance (laden)	⑦	205 (8.1)	215 (8.5)		205 (8.1)
Overhang-front	⑧	720 (28.3)	720 (28.3)		720 (28.3)
Overhang-rear	⑨	980 (38.6)	1,005 (39.6)		1,005 (39.6)
Weight kg (lbs.)					
Kerb weight		1,735–1,865 (3,825–4,112)	1,760–1,875 (3,880–4,134)	1,770–1,885 (3,902–4,156)	1,810–1,925 (3,990–4,243)
Max. gross vehicle weight		2,350 (5,180)	2,350 (5,180)	2,350 (5,180)	2,350 (5,180)
Max. front axle load		1,200 (2,645) or 1,030 (2,271)*1	1,200 (2,645) or 1,030 (2,271)*1	1,200 (2,645) or 1,030 (2,271)*1	1,200 (2,645) or 1,050 (2,315)*1
Max. rear axle load		1,650 (3,638) or 1,405 (3,097)*1	1,650 (3,638) or 1,405 (3,097)*1	1,650 (3,638) or 1,405 (3,097)*1	1,780 (3,924) or 1,345 (2,965)*1
Seating capacity		5			
Engine					
Model		6G72	6G72	6G72	6G74
Total displacement cm^3 (cu. in.)		2,972 (181.3)	2,972 (181.3)	2,972 (181.3)	3,497 (213.4)
Transmission					
Type		5-speed manual	5-speed manual	4-speed automatic	5-speed manual or 4-speed automatic*2
Model		V5MT1	V5MT1	V4AW3	V5M31 or V4AW3*2

NOTE
*1 : Vehicles for Belgium and France
*2 : V25WGRXML6/R6

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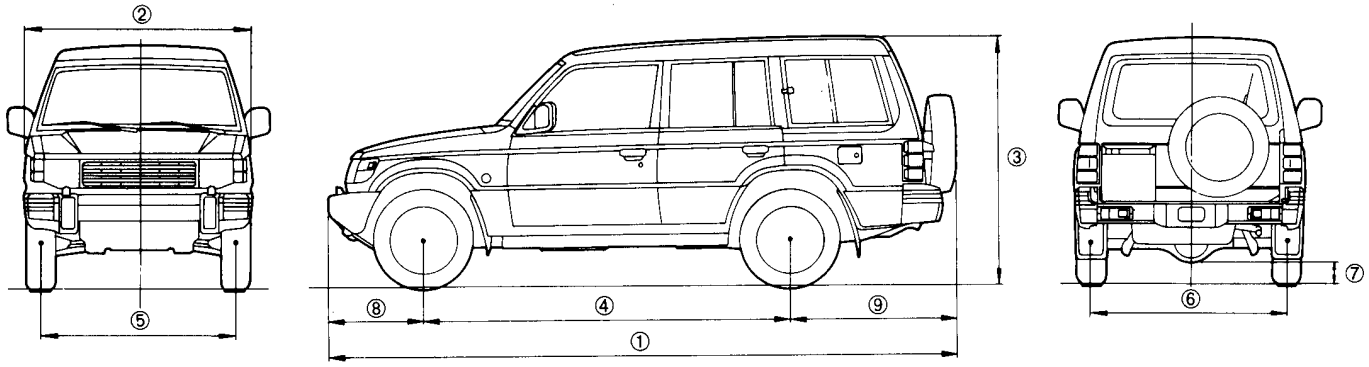
<VEHICLES WITH DIESEL ENGINE>

Items		V24WNAFL6 V24WNDFL6	V24WNBFL6 V24WNHFL6/R6	V24WGNCFL6 V24WGNXFL6/R6	V26WGNCFL6 V26WGNXFL6/R6
Dimensions mm (in.)					
Overall length	①	4,075 (160.4)	4,120 (162.2)	4,145 (163.2)	4,145 (163.2)
Overall width	②	1,695 (66.7)	1,695 (66.7)	1,785 (70.3)	1,785 (70.3)
Overall height (unladen)	③	1,805 (71.1)	1,805 (71.1)	1,815 (71.5)	1,845 (72.6)
Wheelbase	④	2,420 (95.3)	2,420 (95.3)	2,420 (95.3)	2,420 (95.3)
Track–front	⑤	1,420 (55.9)	1,420 (55.9)	1,465 (57.7)	1,465 (57.7)
Track–rear	⑥	1,435 (56.5)	1,435 (56.5)	1,480 (58.3)	1,480 (58.3)
Ground clearance (laden)	⑦	205 (8.1)	205 (8.1)	225 (8.9)	205 (8.1)
Overhang-front	⑧	675 (26.6)	720 (28.3)	720 (28.3)	720 (28.3)
Overhang-rear	⑨	980 (38.6)	980 (38.6)	1,005 (39.6)	1,005 (39.6)
Weight kg (lbs.)					
Kerb weight		1,680–1,820 (3,703–4,012)	1,730–1,900 (3,813–4,188)	1,755–1,905 (3,869–4,199)	1,855–2,005 (4,090–4,420)
Max. gross vehicle weight		2,510 (5,534)	2,510 (5,534)	2,510 (5,534)	2,510 (5,534)
Max. front axle load		1,100 (2,425) or 1,070 (2,359)*1	1,100 (2,425) or 1,070 (2,359)*1	1,100 (2,425) or 1,070 (2,359)*1	1,200 (2,646) or 1,115 (2,458)*1
Max. rear axle load		1,650 (3,638) or 1,565 (3,450)*1	1,650 (3,638) or 1,565 (3,450)*1	1,650 (3,638) or 1,565 (3,450)*1	1,780 (3,924) or 1,440 (3,175)*1
Seating capacity		5			
Engine					
Model		4D56			4M40
Total displacement cm^3 (cu. in.)		2,477 (151.2)			2,835 (173.0)
Transmission					
Type		5-speed manual			5-speed manual
Model		V5MT1			V5M31

NOTE
*1 : Vehicles for Belgium and France

WAGON



00E0040

<VEHICLES WITH PETROL ENGINE>

Items		V43WNHVL6/R6 V43WRHVL6/R6	V43WGNXVL6/R6 V43WGRXVL6/R6	V45WGNXML6/R6	V45WGRXML6/R6
Dimensions mm (in.)					
Overall length	①	4,700 (185.0)	4,725 (186.0)	4,725 (186.0)	
Overall width	②	1,695 (66.7)	1,785 (70.3)	1,785 (70.3)	
Overall height (unladen)	③	1,890 (74.4)	1,900 (75.0)		
Wheelbase	④	2,725 (107.3)	2,725 (107.3)	2,725 (107.3)	
Track-front	⑤	1,420 (55.9)	1,465 (57.7)	1,465 (57.7)	
Track-rear	⑥	1,435 (56.5)	1,480 (58.3)	1,480 (58.3)	
Ground clearance (laden)	⑦	205 (8.1)	215 (8.5)	205 (8.1)	
Overhang-front	⑧	720 (28.3)	720 (28.3)	720 (28.3)	
Overhang-rear	⑨	1,255 (49.4)	1,280 (50.4)	1,280 (50.4)	
Weight kg (lbs.)					
Kerb weight		1,925–2,085 (4,243–4,596) or 1,920–2,105*3 (4,233–4,641)	1,950–2,110 (4,299–4,652)	1,990–2,145 (4,387–4,729)	1,985–2,140 (4,376–4,718)
Max. gross vehicle weight		2,650 (5,842)	2,650 (5,842)	2,720 (5,996)	2,720 (5,996)
Max. front axle load		1,200 (2,645) or 1,075 (2,370)*1	1,200 (2,645) or 1,075 (2,370)*1	1,200 (2,645) or 1,090 (2,403)*1	1,200 (2,645) or 1,090 (2,403)*1
Max. rear axle load		1,650 (3,637)	1,650 (3,637)	1,780 (3,924)	1,780 (3,924) or 1,670 (3,682)*1
Seating capacity		7			
Engine					
Model		6G72		6G74	
Total displacement cm^3 (cu. in.)		2,972 (181.3)		3,497 (213.4)	
Transmission					
Type		5-speed manual or 4-speed automatic*3	5-speed manual or 4-speed automatic*4	5-speed manual	4-speed automatic
Model		V5MT1 or V4AW3*3	V5MT1 or V4AW3*4	V5M31	V4AW3

NOTE
*1 : Vehicles for Belgium and France
*3 : V43WRHVL6/R6
*4 : V43WGRXVL6/R6

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<VEHICLES WITH DIESEL ENGINE>

Items		V46WNDFL6 V46WNAFL6	V46WNDFCL6 V46WNAFCL6	V46WNBFL6 V46WNHFL6/R6
Dimensions mm (in.)				
Overall length	①	4,655 (183.3)		4,700 (185.0)
Overall width	②	1,695 (66.7)		1,695 (66.7)
Overall height (unladen)	③	1,890 (74.4)		1,890 (74.4)
Wheelbase	④	2,725 (107.3)		2,725 (107.3)
Track–front	⑤	1,420 (55.9)		1,420 (55.9)
Track–rear	⑥	1,435 (56.5)		1,435 (56.5)
Ground clearance (laden)	⑦	190 (7.5)		190 (7.5)
Overhang-front	⑧	675 (26.6)		720 (28.3)
Overhang-rear	⑨	1,255 (49.4)		1,255 (49.4)
Weight kg (lbs.)				
Kerb weight		1,960–2,095 (4,321–4,618)	1,920–2,055 (4,232–4,530)	2,010–2,180 (4,431–4,806)
Max. gross vehicle weight		2,720 (5,996)	2,720 (5,996)	2,720 (5,996)
Max. front axle load		1,200 (2,645) or 1,145 (2,524)*1	1,200 (2,645) or 1,145 (2,524)*1	1,200 (2,645) or 1,145 (2,524)*1
Max. rear axle load		1,780 (3,924) or 1,655 (3,649)*1	1,780 (3,924) or 1,655 (3,649)*1	1,780 (3,924) or 1,655 (3,649)*1
Seating capacity		7	5	7
Engine				
Model		4M40		
Total displacement cm^3 (cu. in.)		2,835 (173.0)		
Transmission				
Type		5-speed manual		
Model		V5M31		

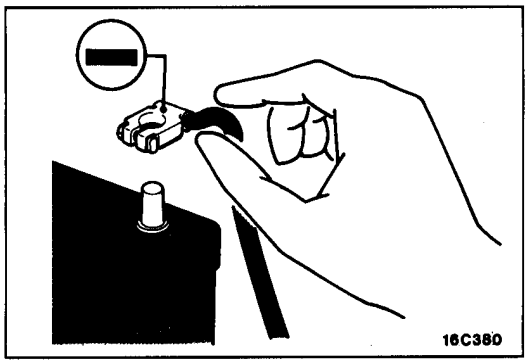
NOTE
*1 : Vehicles for Belgium and France

Items		V46WRBFL6 V46WRHFL6/R6	V46WGNCFL6 V46WGNXFL6/R6	V46WGRCFL6 V46WGRXFL6/R6
Dimensions mm (in.)				
Overall length	①	4,700 (185.0)	4,725 (186.0)	
Overall width	②	1,695 (66.7)	1,785 (70.3)	
Overall height (unladen)	③	1,890 (74.4)	1,890 (74.4)	
Wheelbase	④	2,725 (107.3)	2,725 (107.3)	
Track–front	⑤	1,420 (55.9)	1,465 (57.7)	
Track–rear	⑥	1,435 (56.5)	1,480 (58.3)	
Ground clearance (laden)	⑦	190 (7.5)	205 (8.1)	
Overhang–front	⑧	720 (28.3)	720 (28.3)	
Overhang–rear	⑨	1,255 (49.4)	1,280 (50.4)	
Weight kg (lbs.)				
Kerb weight		2,005–2,175 (4,420–4,795)	2,040–2,175 (4,497–4,795)	2,045–2,180 (4,508–4,806)
Max. gross vehicle weight		2,720 (5,996)	2,720 (5,996)	2,720 (5,996)
Max. front axle load		1,200 (2,645) or 1,145 (2,524)*1	1,200 (2,645) or 1,145 (2,524)*1	1,200 (2,645) or 1,145 (2,524)*1
Max. rear axle load		1,780 (3,924) or 1,655 (3,649)*1	1,780 (3,924) or 1,655 (3,649)*1	1,780 (3,924) or 1,655 (3,649)*1
Seating capacity		7		
Engine				
Model		4M40		
Total displacement cm^3 (cu. in.)		2,835 (173.0)		
Transmission				
Type		4-speed automatic	5-speed manual	4-speed automatic
Model		V4AW3	V5M31	V4AW3

NOTE
*1 : Vehicles for Belgium and France

Items		V44WNDFL6	V44WNDFCL6	V44WNHFL6	V44WGNXFL6/R6
Dimensions mm (in.)					
Overall length	①	4,655 (183.3)	4,655 (183.3)	4,700 (185.0)	4,725 (186.0)
Overall width	②	1,695 (66.7)	1,695 (66.7)	1,695 (66.7)	1,785 (70.3)
Overall height (unladen)	③	1,860 (73.2)	1,860 (73.2)	1,860 (73.2)	1,870 (73.6)
Wheelbase	④	2,725 (107.3)	2,725 (107.3)	2,725 (107.3)	2,725 (107.3)
Track–front	⑤	1,420 (55.9)	1,420 (55.9)	1,420 (55.9)	1,465 (57.7)
Track–rear	⑥	1,435 (56.5)	1,435 (56.5)	1,435 (56.5)	1,480 (58.3)
Ground clearance (laden)	⑦	205 (8.1)	205 (8.1)	205 (8.1)	215 (8.5)
Overhang–front	⑧	675 (26.6)	675 (26.6)	720 (28.3)	720 (28.3)
Overhang–rear	⑨	1,255 (49.4)	1,255 (49.4)	1,255 (49.4)	1,280 (50.4)
Weight kg (lbs.)					
Kerb weight		1,865–2,000 (4,112–4,409)	1,840–1,975 (4,057–4,354)	1,915–2,110 (4,222–4,652)	1,945–2,115 (4,288–4,663)
Max. gross vehicle weight		2,650 (5,842)	2,650 (5,842)	2,650 (5,842)	2,650 (5,842)
Max. front axle load		1,100 (2,425) or 1,090 (2,403)*1	1,100 (2,425) or 1,090 (2,403)*1	1,100 (2,425) or 1,090 (2,403)*1	1,100 (2,425) or 1,090 (2,403)*1
Max. rear axle load		1,650 (3,637)	1,650 (3,637)	1,650 (3,637)	1,650 (3,637)
Seating capacity		7	5	7	7
Engine					
Model		4D56			
Total displacement cm^3 (cu. in.)		2,477 (151.2)			
Transmission					
Type		5-speed manual			
Model		V5MT1			

NOTE
*1 : Vehicles for Belgium and France



PRECAUTIONS BEFORE SERVICE E01GA--

SERVICING THE ELECTRICAL SYSTEM

Before replacing a component related to the electrical system and before undertaking any repair procedures involving the electrical system, be sure to first disconnect the negative (–) cable from the battery in order to avoid damage caused by short-circuiting.

Caution

1. **Before connecting or disconnecting the negative cable, be sure to turn off the ignition switch and the lighting switch.**
   (If this is not done, there is the possibility of semi-conductor parts being damaged.)
2. **For MPI-equipped models and ECI turbo - equipped models, after completion of the work steps (when the battery's negative (–) terminal is connected), warm up the engine and allow the engine to idle for approximately five minutes under the conditions described below, and then check that the idling is satisfactory.**
   Engine coolant temperature: 80°–95°C (176°–203°F)
   Lights, electric fans, accessories: OFF
   Transmission: neutral position
   (automatic transmission models: "N" or "P")
   Steering wheel: neutral (centre) position

IN ORDER TO PREVENT VEHICLES FROM FIRE

"Improper installation of electrical or fuel related parts could cause a fire. In order to retain the high quality and safety of the vehicle, it is important that any accessories that may be fitted or modifications/repairs that may be carried out which involve the electrical or fuel systems, MUST be carried out in accordance with MMC's Information/Instructions".

ENGINE OILS

Health Warning

Prolonged and repeated contact with mineral oil will result in the removal of natural fats from the skin, leading to dryness, irritation and dermatitis. In addition, used engine oil contains potentially harmful contaminants which may cause skin cancer. Adequate means of skin protection and washing facilities must be provided.

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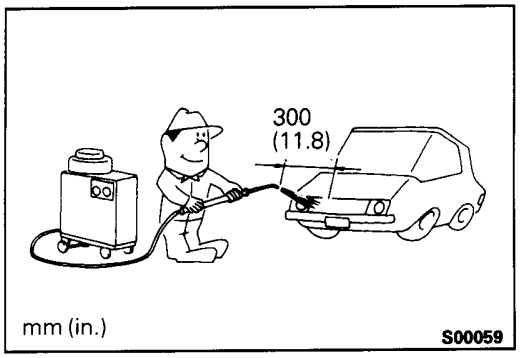
Recommended Precautions

The most effective precaution is to adapt working practices which prevent, as far as practicable, the risk of skin contact with mineral oils, for example by using enclosed systems for handling used engine oil and by degreasing components, where practicable, before handling them.

Other precautions:

- Avoid prolonged and repeated contact with oils, particularly used engine oils.
- Wear protective clothing, including impervious gloves where practicable.
- Avoid contaminating clothes, particularly underpants, with oil.
- Do not put oily rags in pockets, the use of overalls without pockets will avoid this.
- Do not wear heavily soiled clothing and oil-impregnated foot-wear. Overalls must be cleaned regularly and kept separate from personal clothing.
- Where there is a risk of eye contact, eye protection should be worn, for example, chemical goggles or face shields; in addition an eye wash facility should be provided.
- Obtain First Aid treatment immediately for open cuts and wounds.
- Wash regularly with soap and water to ensure all oil is removed, especially before meals (skin cleansers and nail brushes will help). After cleaning, the application of preparations containing lanolin to replace the natural skin oils is advised.
- Do not use petrol, kerosine, diesel fuel, gas oil, thinners or solvents for cleaning skin.
- Use barrier creams, applying them before each work period, to help the removal of oil from the skin after work.
- If skin disorders develop, obtain medical advice without delay.



VEHICLE WASHING E01GA--

If high-pressure car-washing equipment or steam car-washing equipment is used to wash the vehicle, be sure to note the following information in order to avoid damage to plastic components, etc.

- Spray nozzle distance: 300 mm (11.8 in.) or more
- Spray pressure: 4 MPa (40 kg/cm², 569 psi) or less
- Spray temperature: 82°C (180°F) or less
- Time of concentrated spray to one point: within 30 sec.

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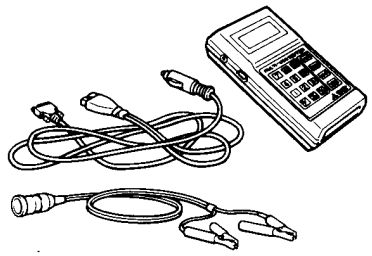
Multi-use tester sub assembly



ROM pack

MULTI-USE TESTER <Vehicles built up to October, 1993>

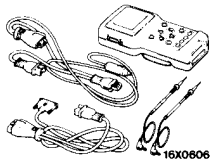
(1) To operate the MUT, refer to the "Multi-use Tester Operation Instructions".

Caution
Connection and disconnection of the MUT should always be made with the ignition switch in the OFF position.

(2) Always use a ROM pack that is appropriate for the vehicle.

ROM pack	Applicable models
MB991419	1992 models
MB991481	1992, 1993 models

MUT-II sub-assembly



ROM pack

16X0607

MUT-II <All models>

Refer to the MUT-II OPERATING INSTRUCTIONS for instructions on handling the MUT-II.

Caution
Connection and disconnection of the MUT-II should always be made with the ignition switch in the OFF position.

SUPPLEMENTAL RESTRAINT SYSTEM (SRS)-AIR BAG

E00AF10AA

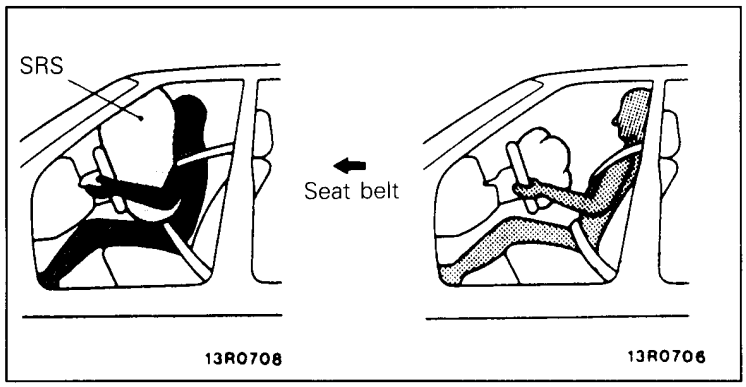
GENERAL INFORMATION

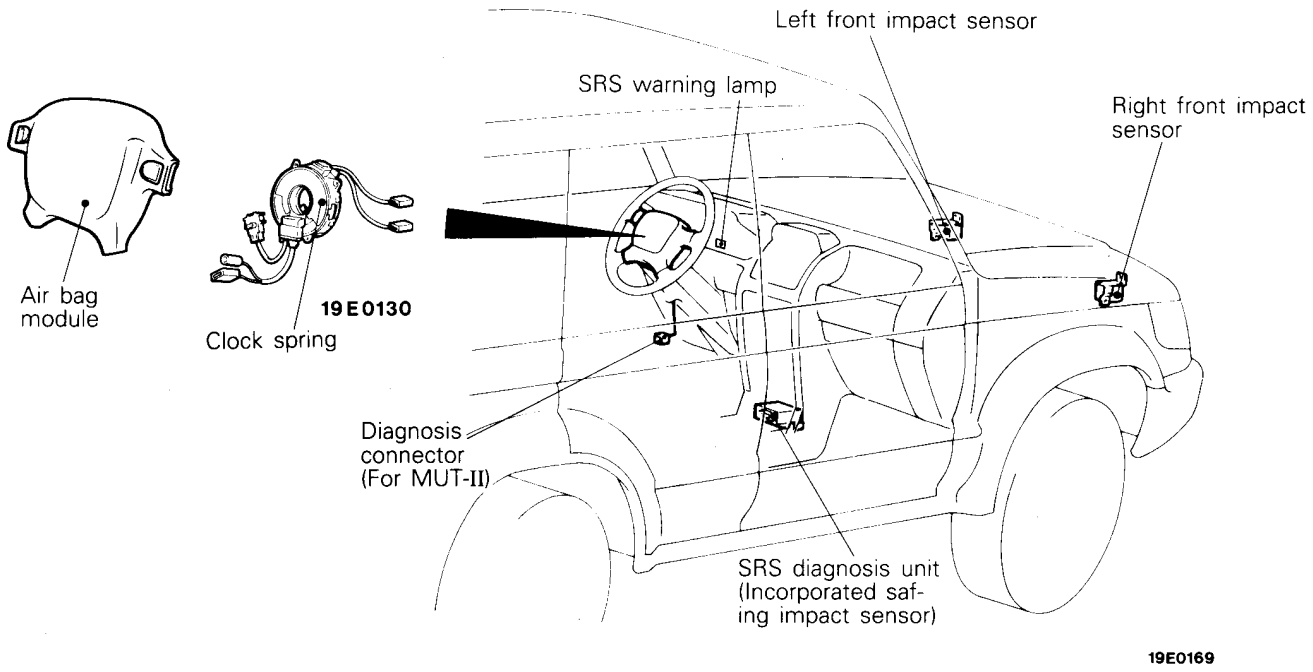
The Supplemental Restraint System (SRS) is designed to supplement the driver's seat belt to help reduce the risk or severity of injury to the driver by activating and deploying an air bag in certain frontal colisions.

The SRS consists of: left front and right front impact sensors one located, on the right and left radiator support panel; an air bag module located in the centre of the steering wheel, which contains the folded air bag and an inflator unit; the SRS diagnosis unit located in front of the shift lever, which monitors the system, and which contains a safing impact sensor; an SRS warning lamp located on the instrument panel, which indicates the operational status of the SRS, and clock spring interconnection located within the steering column; wiring.

The SRS is designed so that the air bag will deploy when the safing sensor, plus either or both of the left front and right front impact sensors simultaneously activate while the ignition switch is "ON". That is designed to occur in frontal or near-frontal impacts of moderate to severe force.

Only authorized service personnel should do work on or around the SRS components. Those service personnel should read this manual carefully before starting any such work. Extreme care must be used when servicing the SRS to avoid injury to the service personnel (by inadvertent deployment of the air bag) or the driver (by rendering the SRS inoperative).





SRS SERVICE PRECAUTIONS

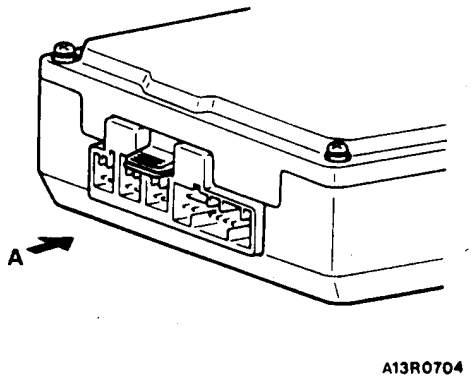
E00AF11AA

1. In order to avoid injury to yourself or others from accidental deployment of the air bag during servicing, read and carefully follow all the precautions and procedures described in this manual.
2. Do not use any electrical test equipment on or near SRS components, except those specified on GROUP 52B – Special Tools and Test Equipment.
   Never use an analogue ohmmeter.
3. **Never Attempt to Repair the Following Components:**
   - Front Impact Sensors
   - SRS Diagnosis Unit (SDU)
   - Clock Spring
   - Air Bag Module

   If any of these components are diagnosed as faulty, they should only be replaced, in accordance with the INDIVIDUAL COMPONENTS SERVICE procedures in this manual.
4. Do not attempt to repair the wiring harness connectors of the SRS. If any of the connectors are diagnosed as faulty, replace the wiring harness. If the wires are diagnosed as faulty, replace or repair the wiring harness according to the following table.

SDU Terminal No.	Harness Connector (No. of Terminals, Colour)	Destination of Harness	Corrective Action
1	2 pins, red	Dash wiring harness → Clock spring	Correct or replace each wiring harness. Replace clock spring
2			
7 and 8	14 pins, red	–	–
9		Dash wiring harness → Diagnosis connector	Correct or replace each wiring harness
10		Dash wiring harness → Control wiring harness → Dash wiring harness → Ignition switch (ST)	
11		Dash wiring harness → Junction block (fuse No. 4)	
12		Dash wiring harness → Junction block (fuse No. 8)	
13		Dash wiring harness → Instrument panel wiring harness → SRS warning lamp	
14			
16		Dash wiring harness → Front wiring harness → Front impact sensor (LH)	Replace with sensor cable*
17			
15		Dash wiring harness → Front wiring harness → Front impact sensor (RH)	
18			
19		Dash wiring harness → Earth	Correct or replace dash wiring harness
20			

NOTE
(1) The sensor cable marked with* is available as service part.
(2) The sensor cable used as a replacement part is routed along the dash wiring harness and front wiring harness.



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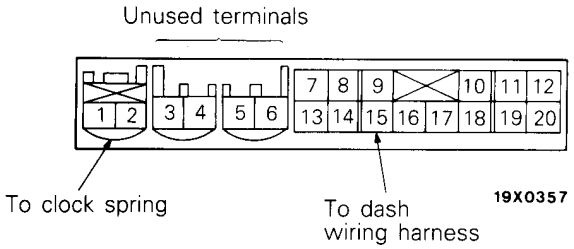
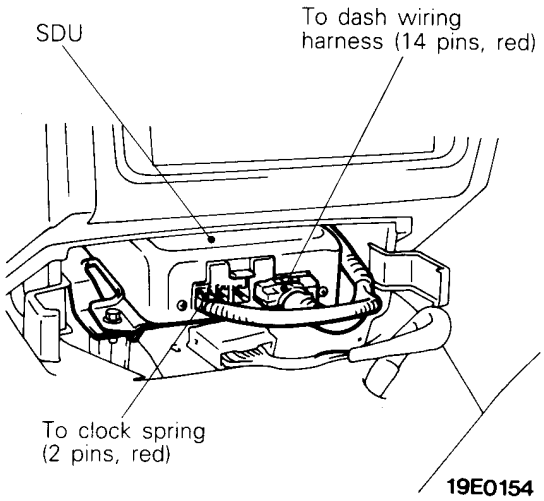
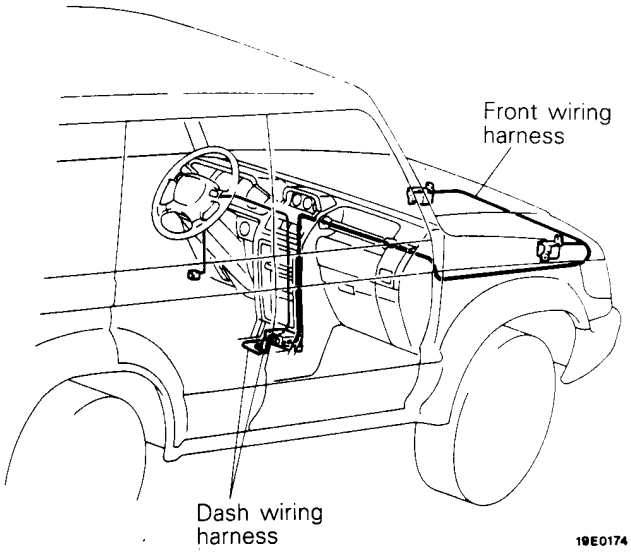
View A

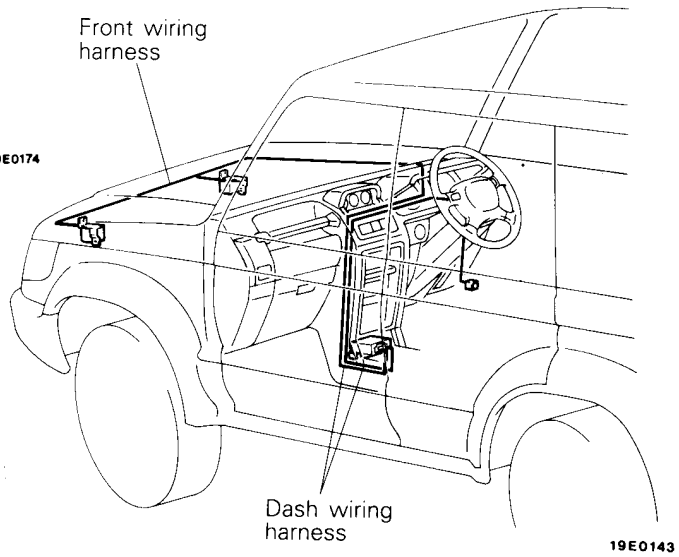




<L.H. drive vehicles>



<R.H. drive vehicles>



5. **After disconnecting the battery cable, wait 60 seconds or more before proceeding with the following work. The SRS system is designed to retain enough voltage to deploy the air bag for a short time even after the battery has been disconnected, so serious injury may result from unintended air bag deployment if work is done on the SRS system immediately after the battery cables are disconnected.**
6. SRS components should not be subjected to heat over 93°C, so remove the front impact sensors, SRS diagnosis unit, air bag module and clock spring before drying or baking the vehicle after painting.
   Recheck SRS system operability after re-installing the components.
7. Whenever you finish servicing the SRS, check the SRS warning lamp operation to make sure that the system functions properly. (Refer to GROUP 52B – Troubleshooting.)
8. Make certain that the ignition switch is OFF when the MUT-II is connected or disconnected.
9. If you have any questions about the SRS, please contact your local distributor.

NOTE
SERIOUS INJURY CAN RESULT FROM UNINTENDED AIR BAG DEPLOYMENT, SO USE ONLY THE PROCEDURES AND EQUIPMENT SPECIFIED IN THIS MANUAL.

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NOTES

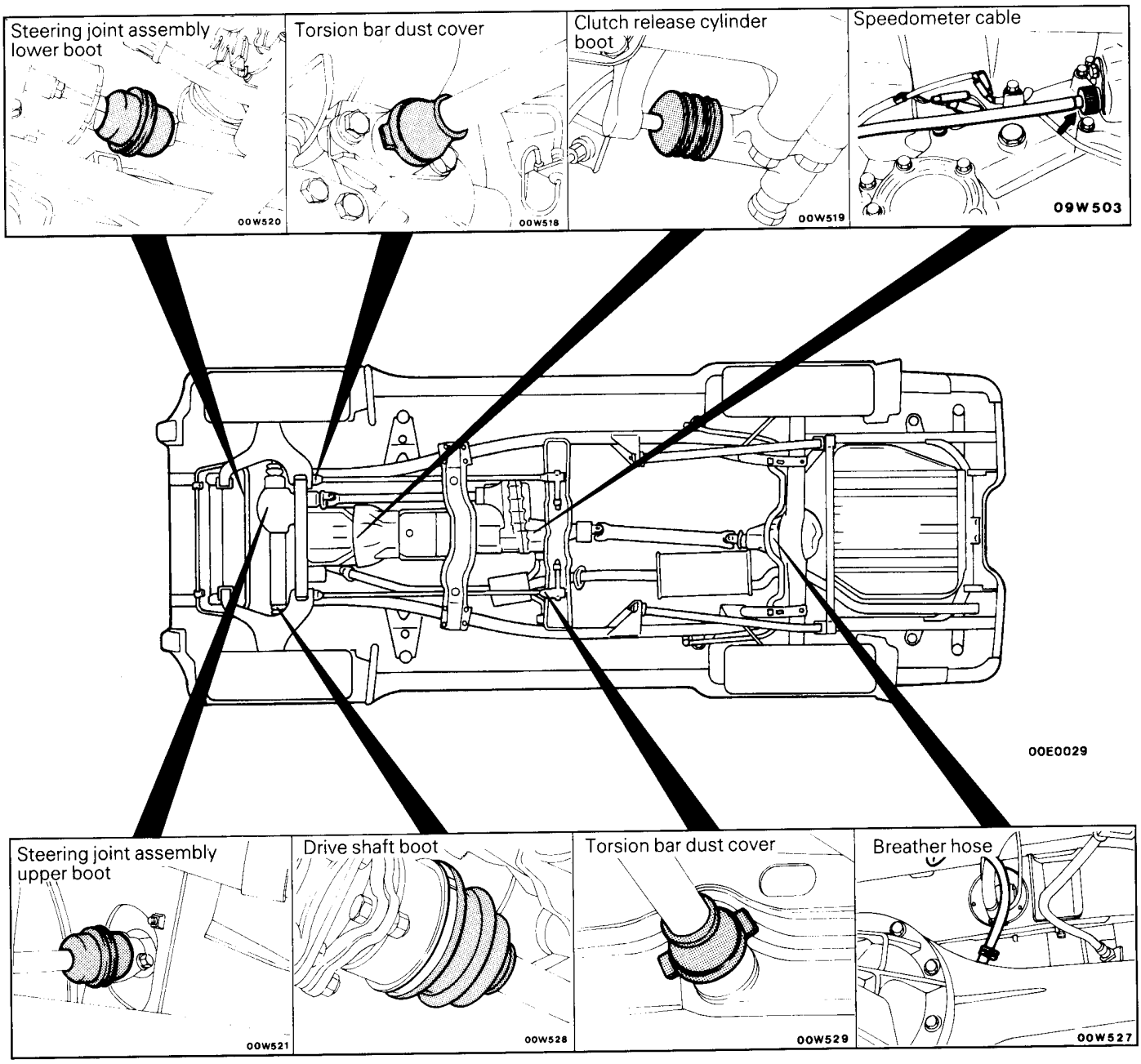
TREATMENT BEFORE/AFTER THE FORDING OF A STREAM

E01IAAA

INSPECTION AND SERVICE BEFORE FORDING A STREAM

Vehicles which are driven through water, or which may possibly be driven through water, should be subjected to the following inspections and maintenance procedures in advance.

- Seal the speedometer cable with a water-resistant grease or tape.
- Inspect the dust boots and breather hose for cracks or damage, and replace them if cracks or damage are found.



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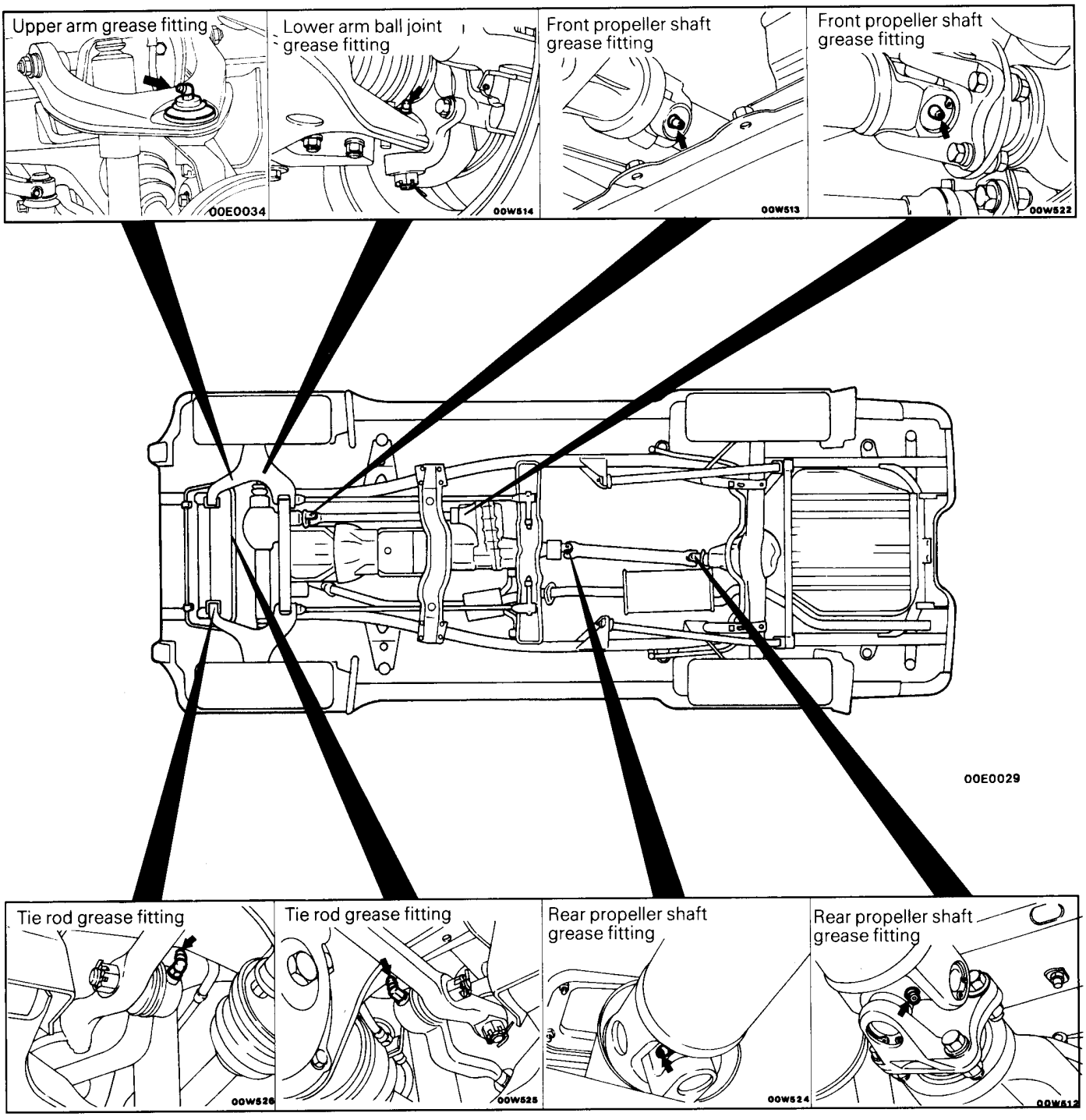
- Apply grease to the lubricating points of the front suspension, steering linkage and propeller shaft.

  NOTE
  For the lubricating points of vehicles equipped with a mechanical winch, refer to GROUP 51.



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INSPECTION AND SERVICE AFTER FORDING A STREAM

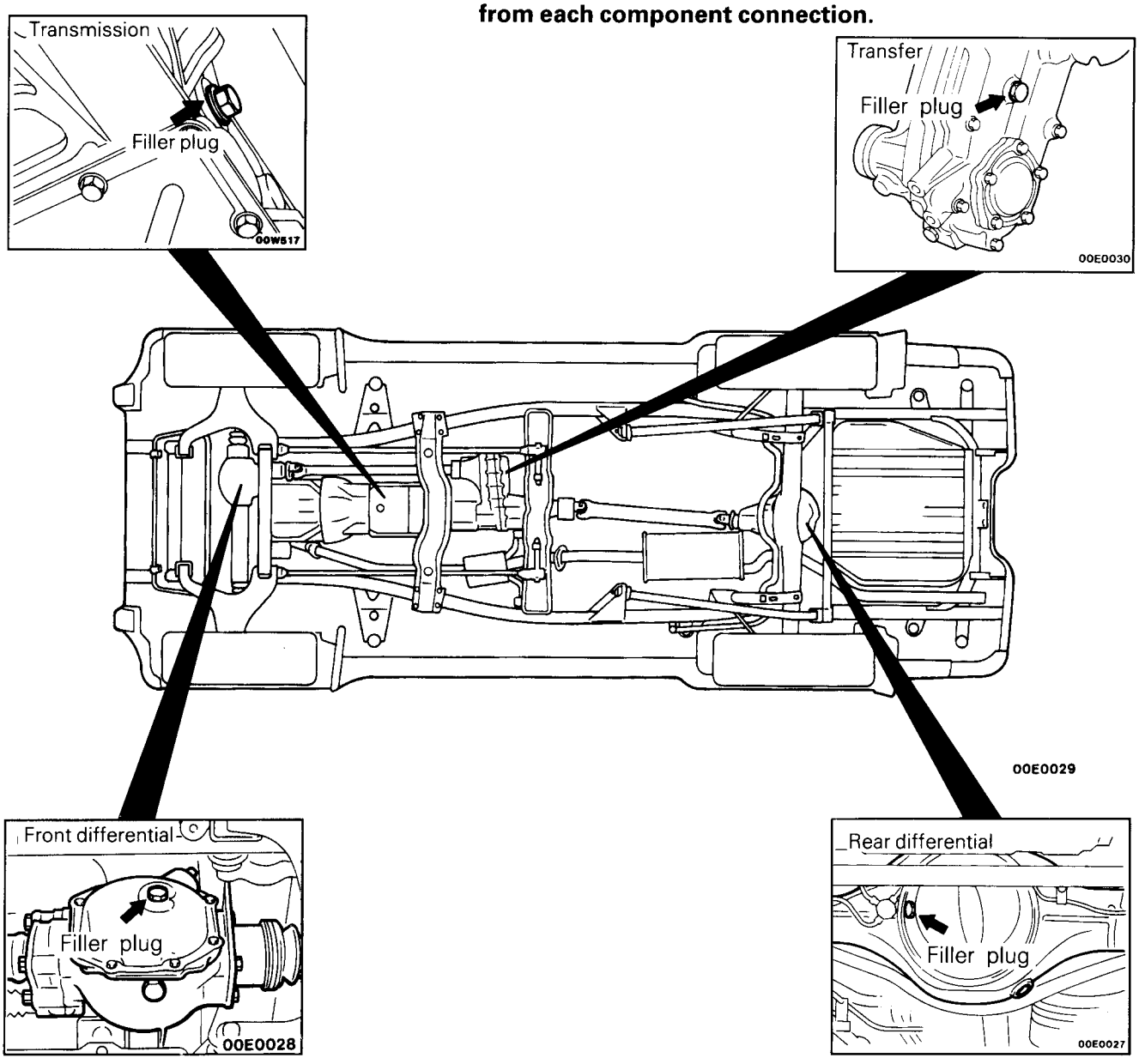
After fording a stream, check the following points. If abnormal condition is evident, clean, replace or lubricate.

- Check for water, mud, sand, etc. in the rear brake drum, clutch housing, starter motor, brake pipe and fuel pipe.
- Check for water in the fluid or oil inside the front differential, rear differential, transmission and transfer.
- Apply grease to the lubricating points of the front suspension, steering linkage and propeller shaft.

NOTE
For the lubricating points of vehicles with a mechanical winch, refer to GROUP 51.

- Check all boots and breather hoses for cracks and damage.

Caution
Check to be sure that there are no water and mud entering from each component connection.



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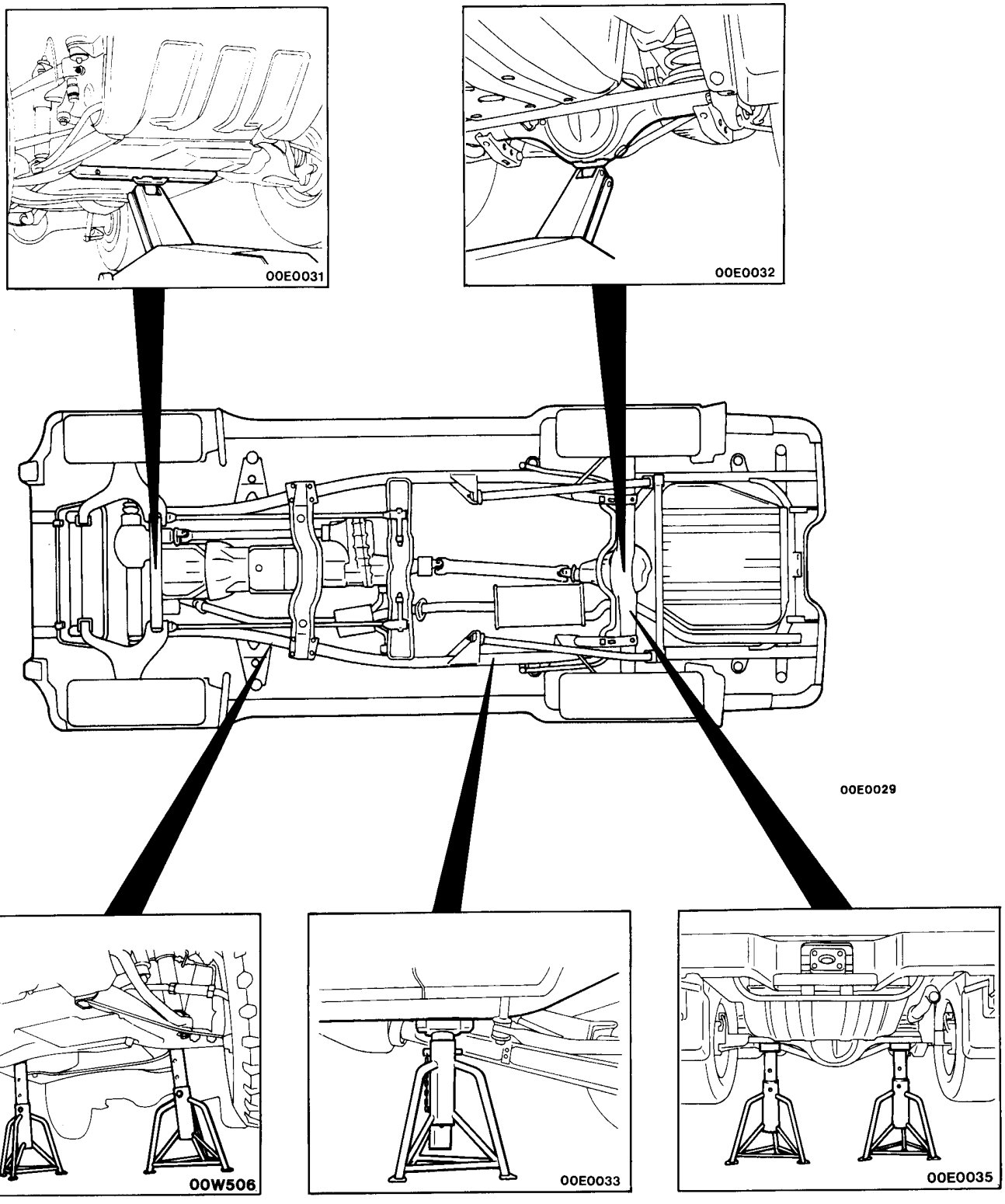
SUPPORT LOCATIONS FOR LIFTING AND JACKING

E01LB--

Caution
Do not support the vehicle at locations other than specified supporting points. If do so, this will cause damage etc..

SUPPORT POSITIONS FOR A GARAGE JACK AND AXLE STANDS



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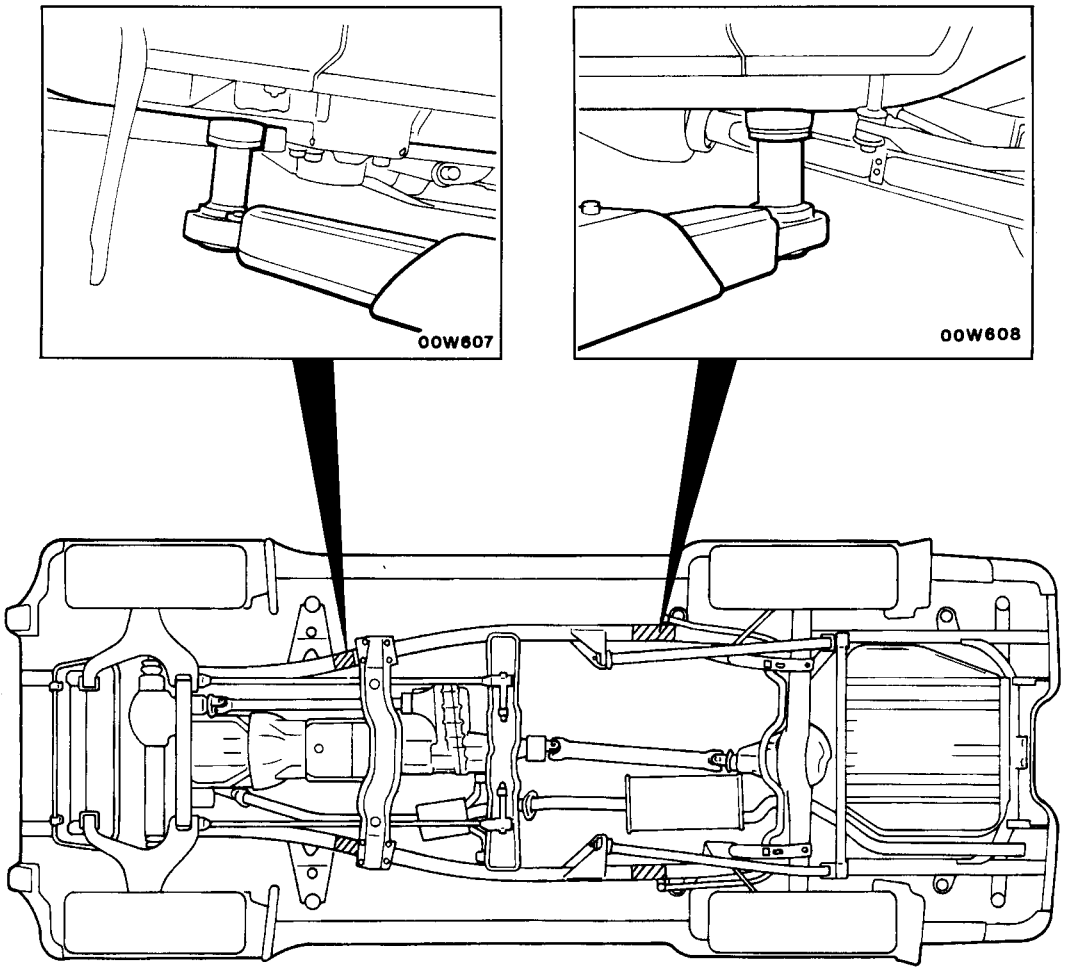
SUPPORT POSITIONS FOR A SINGLE-POST LIFT OR DOUBLE-POST LIFT

Caution
When service procedures require removing rear suspension, fuel tank, spare tyre and rear bumper, place additional weight on rear end of vehicle or anchor vehicle to hoist to prevent tipping of centre of gravity changes.



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STANDARD PARTS-TIGHTENING-TORQUE TABLE

E01MA--

Each torque value in the table is a standard value for tightening under the following conditions.
(1) Bolts, nuts and washers are all made of steel and plated with zinc.
(2) The threads and bearing surface of bolts and nuts are all in dry condition.

The values in the table are not applicable:
(1) If toothed washers are inserted.
(2) If plastic parts are fastened.
(3) If bolts are tightened to plastic or die-cast inserted nuts.
(4) If self-tapping screws or self-locking nuts are used.

Standard bolt and nut tightening torque

Bolt nominal diameter (mm)	Pitch (mm)	Torque Nm (kgm, ft.lbs.)		
		Head mark ④	Head mark ⑦	Head mark ⑧
M5	0.8	2.5 (0.25, 1.8)	5 (0.5, 3.6)	6 (0.6, 4.3)
M6	1.0	5 (0.5, 3.6)	9 (0.9, 6.5)	10 (1.0, 7.2)
M8	1.25	12 (1.2, 8.7)	22 (2.2, 16)	25 (2.5, 18)
M10	1.25	24 (2.4, 17)	45 (4.5, 33)	53 (5.3, 38)
M12	1.25	42 (4.2, 30)	83 (8.3, 60)	98 (9.8, 71)
M14	1.5	73 (7.3, 53)	140 (14.0, 101)	160 (16.0, 116)
M16	1.5	113 (11.3, 82)	210 (21.0, 152)	240 (24.0, 174)
M18	1.5	170 (17.0, 123)	310 (31.0, 224)	350 (35.0, 253)
M20	1.5	230 (23.0, 166)	420 (42.0, 304)	490 (49.0, 354)
M22	1.5	310 (31.0, 224)	570 (57.0, 412)	660 (66.0, 477)
M24	1.5	400 (40.0, 289)	750 (75.0, 542)	870 (87.0, 629)

Flange bolt and nut tightening torque

Bolt nominal diameter (mm)	Pitch (mm)	Torque Nm (kgm, ft.lbs.)		
		Head mark ④	Head mark ⑦	Head mark ⑧
M6	1.0	5 (0.5, 3.6)	10 (1.0, 7.2)	12 (1.2, 8.7)
M8	1.25	13 (1.3, 9.4)	24 (2.4, 17)	28 (2.8, 20)
M10	1.25	26 (2.6, 19)	50 (5.0, 36)	58 (5.8, 42)
M10	1.5	24 (2.4, 17)	45 (4.5, 33)	55 (5.5, 40)
M12	1.25	47 (4.7, 34)	95 (9.5, 69)	105 (10.5, 76)
M12	1.75	43 (4.3, 31)	83 (8.3, 60)	98 (9.8, 71)

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MAIN SEALANT AND ADHESIVE TABLE

E00ZA--

Application	Recommended brand
1. Sealants for engine accessories	
(1) Sealing between rocker cover and camshaft bearing cap (4G6 DOHC and 6G7 engines only)	3M ATD Part No. 8660 or equivalent
(2) • Sealing between semi-circular packing and rocker cover and between semi-circular packing and cylinder head • Oil pressure switch	3M ATD Part No. 8660 or equivalent
(3) Engine coolant temperature switch, Engine coolant temperature sensor, Thermo valve, Thermo switch, Joints, Engine coolant temperature gauge unit (large size)	3M Nut Locking Part No. 4171 or equivalent
(4) Engine coolant temperature gauge unit (small size, MD091056 only)	3M ATD Part No. 8660 or equivalent
(5) Oil pan (except 4G5 engine)	MITSUBISHI GENUINE Part No. MD970389 or equivalent
(6) Water pump, Thermostat case (4G9 and 6A1 engines only)	MITSUBISHI GENUINE Part No. MD970389 or equivalent
2. Sealing between glass and weatherstrip	
(1) • Sealing between tempered glass and weatherstrip	3M ATD Part No. 8513 or equivalent
• Sealing between body flange and weatherstrip	3M ATD Part No. 8509 or equivalent
(2) Sealing between laminated glass and weatherstrip	3M ATD Part No. 8509 or equivalent

Application	Recommended brand
3. Adhesion with ribbon sealer • Waterproof film for door • Fender panel • Splash shield • Mud guard • Rear combination lamp	3M ATD Part No. 8625 or equivalent
4. Adhesives for interior trim	
(1) Adhesion of polyvinyl-chloride sheet	3M Part No. EC-1368 or equivalent
(2) Adhesion of door weatherstrip to body	3M ATD Part No. 8001 or 3M ATD Part No. 8011 or equivalent
(3) Sealing between grommet or packing and metal seal	3M ATD Part No. 8513 or equivalent
(4) • Adhesion of headlining and other interior trim materials • Adhesion of fuel tank to pad	3M Part No. EC-1368 or 3M ATD Part No. 8080 or equivalent
5. Body sealant • Sealing of sheet metal, drip rail, floor, body side panel, trunk, front panel and the like joints • Sealing of tailgate hinges	3M ATD Part No. 8531 or 3M ATD Part No. 8646 or equivalent

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Application	Recommended brand
6. Chassis sealant (1) ● Sealing of flange surfaces and threaded portions ● Fuel gauge unit packing	3M ATD Part No. 8659 or equivalent
(2) Sealing of flange surfaces, threaded portions, packing and dust cover ● Differential carrier packing ● Dust covers for ball joint and linkage ● Steering gear box packing and shims ● Steering gear housing rack support cover and top cover ● Mating surface of knuckle arm flange	3M ATD Part No. 8663 or equivalent
(3) Sealing between accelerator arm bracket and toeboard	Drying sealant
(4) Sealant for drum brake shoe hold-down pin and wheel cylinder	3M ATD Part No. 8513 or equivalent
7. Fast bonding adhesive Adhesion of all materials except polyethylene, polypropylene, fluorocarbon resin or other materials with highly absorbent surface	3M ATD Part No. 8155 or equivalent
8. Anaerobic fast bonding adhesives (1) Fixing of bolts and screws ● Tightening of drive gear to differential case ● Bolts for coupling tilt steering upper column with lower column (2) Fixing of bearing, fan, pulley and gear connections (3) Sealing of small recess or flange surface	3M Stud locking Part No. 4170 or equivalent
9. Undercoat	3M ATD Part No. 8864 or equivalent

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ENGINE

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E11AA--

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NOTES

SPECIFICATIONS

GENERAL SPECIFICATIONS

E11CA--

Items	4G64	6G72–12 VALVE	6G72–24 VALVE	6G74
Total displacement cm³ (cu.in.)	2,351 (143.5)	2,972 (181.4)	2,972 (181.4)	3,497 (213.3)
Bore x Stroke mm (in.)	86.5 x 100 (3.41 x 3.94)	91.1 x 76 (3.59 x 2.99)	91.1 x 76 (3.59 x 2.99)	93 X 85.8 (3.66 X 3.38)
Compression ratio	8.5	8.9	9.0	9.5
Firing order	1-3-4-2	1-2-3-4-5-6	1-2-3-4-5-6	1-2-3-4-5-6
Combustion chamber	Compact type	Compact type	Pentroof type	Pentroof type
Valve mechanism	Single camshaft	Double camshaft	Double camshaft	Four camshaft
Camshaft drive by	Cogged belt	Cogged belt	Cogged belt	Cogged belt
Valve timing				
Intake	Open: BTDC20° Close: ABDC64°	Open: BTDC19° Close: ABDC59°	Open: BTDC19° Close: ABDC45°	Open: BTDC11.5° Close: ABDC60.5°
Exhaust	Open: BBDC64° Close: ATDC20°	Open: BBDC59° Close: ATDC19°	Open: BBDC49° Close: ATDC15°	Open: BBDC43.5° Close: ATDC20.5°
Rocker arm	Slipper type	Roller follower type	Roller follower type	Roller follower type
Lash adjuster	Equipped	Equipped	Equipped	Equipped
Spark plug				
NGK	BPR6ES-11	BPR5ES-11	PFR6J-11	PFR5J-11
NIPPON DENSO	W20EPR11	W16EPR11	PK20PR-P11	PK16PR-P11

Items	4D56	4M40
Total displacement cm³ (cu.in.)	2,477 (151.2)	2,835 (173.0)
Bore x Stroke mm (in.)	91.1 x 95 (3.59 x 3.74)	95 x 100 (3.74 x 3.94)
Compression ratio	21	21
Injection order	1-3-4-2	1-3-4-2
Combustion chamber	Swirl type	Swirl type
Valve mechanism	Single camshaft	Single camshaft
Camshaft drive by	Cogged belt	Double chain
Valve timing		
Intake	Open: BTDC20° Close: ABDC49°	Open: BTDC19° Close: ABDC53°
Exhaust	Open: BBDC55° Close: ATDC22°	Open: BBDC60° Close: ATDC16°
Rocker arm	Roller follower type	–
Lash adjuster	Not-equipped	Not-equipped

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SERVICE SPECIFICATIONS

E11CB--

Items	4G64	6G72–12 VALVE	6G72–24 VALVE	6G74
Standard value				
Drive belt tension mm (in.)				
Alternator-V ribbed type				
When checked	–	8–10 (0.31–0.39)	A: 5–7 (0.20–0.28) B: 8.5–10.5 (0.33–0.41)	A: 5–7 (0.20–0.28) B: 8.5–10.5 (0.33–0.41)
When a new belt is installed	–	6.5–8 (0.26–0.31)	A: 5.5–6.5 (0.22–0.26) B: 8–9 (0.31–0.35)	A: 5.5–6.5 (0.22–0.26) B: 8–9 (0.31–0.35)
When the used belt is installed	–	9 (0.35)	A: 4–5 (0.16–0.20) B: 5.5–7.5 (0.22–0.30)	A: 4–5 (0.16–0.20) B: 5.5–7.5 (0.22–0.30)
Alternator-V type				
When inspecting and installing when the belt is reused	7–10 (0.28–0.39)	–	–	–
When a new belt is installed	7–10 (0.28–0.39)	–	–	–
Power steering oil pump				
When checked	6–10 (0.24–0.39)	9–14.5 (0.35–0.57)	10.5–14.5 (0.41–0.57)	13–17 (0.51–0.67)
When a new belt is installed	5.5 (0.22)	8.0 (0.31)	9.5–11.5 (0.37–0.45)	11–13 (0.55–0.63)
When the used belt is installed	7.0 (0.28)	10 (0.39)	11.5–13.5 (0.45–0.53)	14–16 (0.55–0.67)
Air-conditioner compressor				
When checked and the used belt is installed	6.5–7.5 (0.26–0.30)	6.5–7.5 (0.26–0.30)	6.5–7.5 (0.26–0.30)	6.5–7.5 (0.26–0.30)
When a new belt is installed	5–6 (0.20–0.24)	5–6 (0.20–0.24)	5–6 (0.20–0.24)	5–6 (0.20–0.24)
Basic ignition timing	5°BTDC±2°	5°BTDC±2°	5°BTDC±3°	5°BTDC±3°
Idle speed r/min.	750±100	700±100	700±100	700±100
CO concentration and HC concentration at idle				
CO concentration %	0.5 or less	0.5 or less	0.5 or less	0.5 or less
HC concentration ppm	100 or less	100 or less	100 or less	100 or less
Compression pressure kPa (kg/cm^2, psi) [250–400 r/min.]	1,180 (12.0, 171)	1,180 (12.0, 171)	1,180 (12.0, 171)	1,270 (13.0, 185)
Intake manifold vacuum kPa (mmHg, in.Hg)	67 (500, 20)	69 (520, 20)	69 (520, 20)	69 (515, 20)
Timing belt tension mm (in.)	14 (0.55)	–	–	–
Timing belt "B" tension mm (in.)	5–7 (0.20–0.28)	–	–	–

NOTE
A : Between the water pump pulley and the crankshaft pulley
B : Between the water pump pulley and the alternator pulley

Items	4G64	6G72–12 VALVE	6G72–24 VALVE	6G74
Limit				
Compression pressure kPa (kg/cm^2, psi)	min. 870 (8.9, 127)	min. 870 (8.9, 127)	min. 870 (8.9, 127)	min. 900 (9.2, 131)
Compression pressure difference of all cylinders kPa (kg/cm^2, psi)	max. 98 (1.0, 14)	max. 98 (1.0, 14)	max. 98 (1.0, 14)	max. 98 (1.0, 14)

Items	4D56	4M40
Standard value		
Drive belt tension mm (in.)		
Alternator-V type		
When checked	11–14 (0.43–0.55) 15–18 (0.59–0.71)*1	8–11 (0.31–0.43)
When a new belt is installed	9–12 (0.35–0.47) 13–16 (0.51–0.63)*1	8–9 (0.31–0.35)
When the used belt is installed	11–14 (0.43–0.55) 15–18 (0.59–0.71)*1	9–11 (0.35–0.43)
Power steering oil pump		
V type		
When checked	8–13.5 (0.31–0.53)	–
When a new belt is installed	7.0 (0.28)	–
When the used belt is installed	9.5 (0.37)	–
V ribbed type		
When checked	8–12 (0.31–0.47)	–
When a new belt is installed	6–8 (0.24–0.31)	–
When the used belt is installed	9–11 (0.35–0.43)	–
Air-conditioner compressor		
When checked and the used belt is installed	6.5–7.5 (0.26–0.30)	6–8 (0.24–0.31)
When a new belt is installed	5–6 (0.20–0.24)	5–6 (0.20–0.24)
Injection timing	7°ATDC, 9°ATDC*2	12°ATDC, 6°ATDC*2
Stroke of injection pump plunger mm (in.)	1±0.03 (0.0394±0.0012)	1±0.03 (0.0394±0.0012)
Idle speed r/min.	750±100	800±100
Idle up speed (for anti-skid brake) r/min.	1900±100	–
Idle up speed (for air conditioner) r/min.	900±50	900±50

NOTE
*1: Double belt type
*2: Vehicles with supercharging pressure control system.

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Items	4D56	4M40
Standard value		
Compression pressure kPa (kg/cm², psi) [250–400 r/min.]	2,650 (27.0, 384) 3,040 (31.0, 441)*1	2,840 (29.0, 412)
Valve clearance (at hot) mm (in.)	0.25 (0.001)	0.25 (0.001)*2 0.35 (0.014)*3
Timing belt tension mm (in.)	4–5 (0.16–0.20)	
Timing belt "B" tension mm (in.)	4–5 (0.16–0.20)	
Limit		
Compression pressure kPa (kg/cm², psi)	min. 1,920 (19.2, 273) 2,240 (22.4, 319)*1	min. 2,260 (23, 327)
Compression pressure difference of all cylinders kPa (kg/cm², psi)	max. 300 (3.0, 43)	max. 290 (3.0, 43)

NOTE
*1: Vehicles with water cooled turbocharger
*2: Intake side
*3: Exhaust side

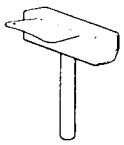
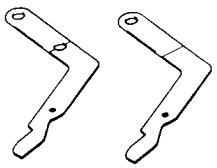
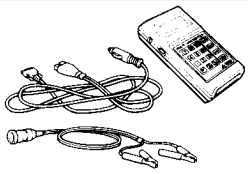
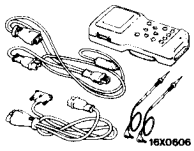
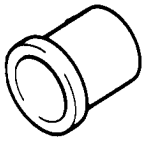
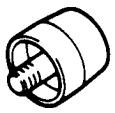
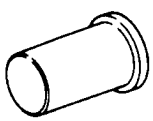
SEALANTS AND ADHESIVES

E11CE--

Item	Specified sealant and adhesive	Remarks
Oil pan	MITSUBISHI GENUINE PART No. MD997110 or equivalent	Semi-drying sealant
Rocket cover Semi-circular packing	3M ATD Part No. 8660 or equivalent	
Timing belt cover gasket	3M ATD Part No. 8001 or equivalent	Drying adhesive

SPECIAL TOOLS

E11DA--

Tool	Number	Name	Use
	MD998727	Oil pan sealer cutter	Removal of oil pan
	MD998782	Valve lifter set	Removal of roller rocker arm
	MB991341	Multi-use tester sub assembly	Checking of the engine idling speed <Vehicles built up to October, 1993>
	MB991360	ROM pack	
 16X0606	MB991502	MUT-II sub assembly	Idle speed inspection <All models>
16X0607		ROM pack	
	MD998306	Camshaft oil seal installer	Guide for installing camshaft oil seal
	MD998307	Camshaft oil seal guide	
	MD998375	Crankshaft front oil seal installer	Installation of crankshaft front oil seal
	MD998285	Crankshaft front oil seal guide	

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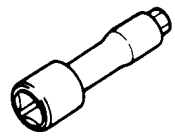
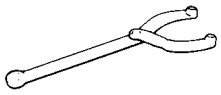
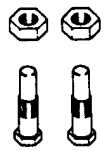
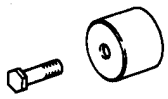
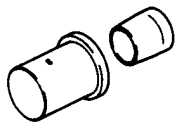
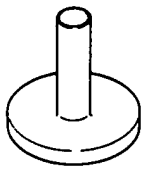
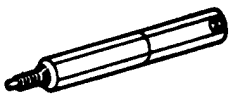
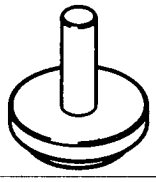
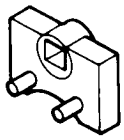
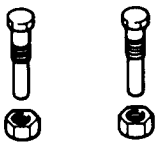
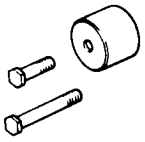
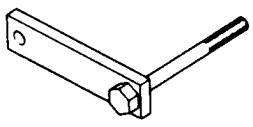
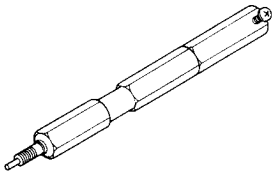
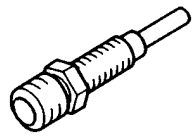
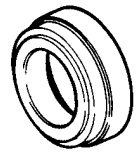
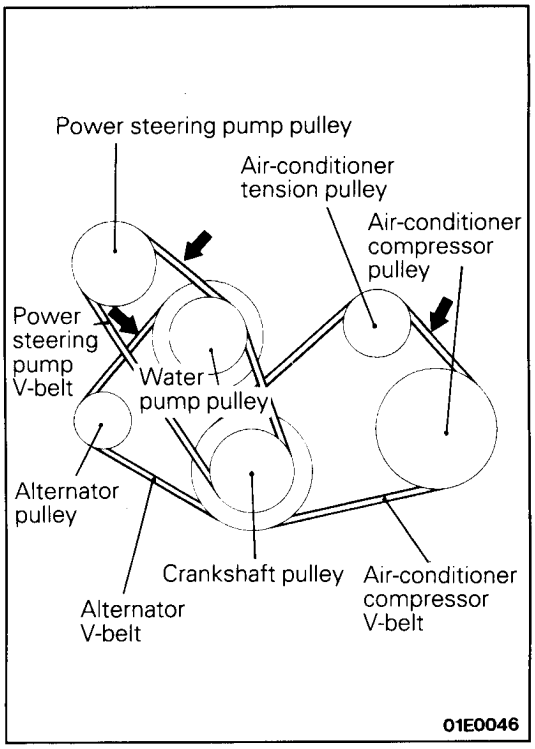
Tool	Number	Name	Use
	MD998051	Wrench, cylinder head bolt	Loosening and tightening of cylinder head bolt
	MB990767	End yoke holder	Supporting the sprocket and shaft pulley when attaching or detaching them
	MD998715	Pin	Supporting the sprocket when the camshaft sprocket bolt is loosened. Used together with MB990767 <6G72>
	MD998716	Crankshaft wrench	Used if the crankshaft needs to be rotated to attach the timing belt, etc. When the piston and connecting rod assembly is assembled. <6G72>
	MD998713	Camshaft oil seal installer	Press fitting the camshaft oil seal <6G72>
	MD998717	Crankshaft front oil seal installer	Press fitting crankshaft front oil seal <6G72>
	MD998718	Crankshaft rear oil seal installer	Press fitting crankshaft rear oil seal
	MD998384	Prestroke measuring adapter	Adjusting injection timing <4D56>
	MD998721	Crankshaft pulley holder	Removal and installation of crankshaft pulley
	MD998381	Camshaft oil seal installer	Installation of camshaft oil seal <4D56>

Tool	Number	Name	Use
	MD998382	Crankshaft front oil seal guide	Installation of crankshaft front oil seal <4D56>
	MD998383	Crankshaft front oil seal installer	
	MD998376	Crankshaft rear oil seal installer	Installation of crankshaft oil seal <4G64>
	MD998769	Crankshaft pulley spacer	Used if the crankshaft needs to be rotated to attach the timing belt etc.
	MD998767	Socket wrench	Adjustment of timing belt
	MD998754	Crankshaft pulley holder	Supporting the crankshaft pulley when crankshaft bolt and pulley are removed or reinstalled. Use together with MB990767 <6G74, 4M40>
	MD998761	Camshaft oil seal installer	Installation of camshaft oil seal <6G74>
	MD998781	Flywheel stopper	Holding of drive plate
	MH063302	Measuring device	Inspection and adjustment of fuel injection timing <4M40>

Tool	Number	Name	Use
	MH062393	Compression gauge adapter	Measurement of compression pressure <4M40>
	MB991559	Camshaft oil seal installer	Press fitting the camshaft oil seal (For 6G72–24 VALVE engine left bank)



ENGINE <4G64>

SERVICE ADJUSTMENT PROCEDURES

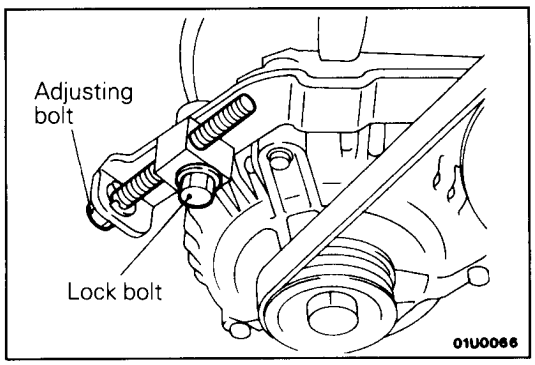
DRIVE BELTS TENSION INSPECTION AND ADJUSTMENT

E11FQBD

(1) Check that the belts are not damaged
(2) Check the tension by pulling or pushing at the centre of the belt between pulleys with a force of 100 N (10 kg, 22 lbs.) as shown in the figure. Measure the drive belt flexion.

Standard value:

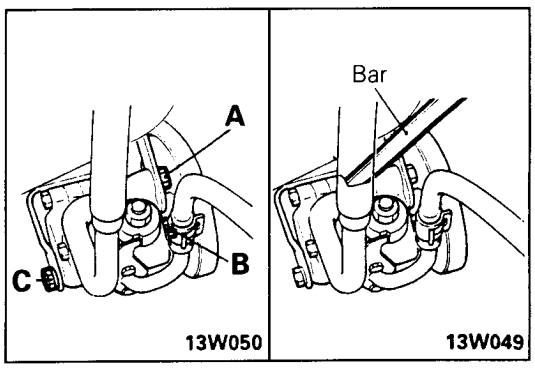
Alternator	**7–10 mm (0.28–0.39 in.)**
Power steering oil pump	**6–10 mm (0.24–0.39 in.)**
Air-conditioner compressor	**6.5–7.5 mm (0.26–0.30 in.)**



TENSION ADJUSTMENT OF THE ALTERNATOR DRIVE BELT

(1) Loosen the nut on the alternator pivot bolt.
(2) Loosen the lock bolt.
(3) Turn the adjusting bolt to adjust the belt so that the amount of flexion is at the standard value.
(4) Tighten the lock bolt.
(5) Tighten the nut on the alternator pivot bolt.
(6) Crank the engine once or more.
(7) Check the belt tension.

Standard value: 7–10 mm (0.28–0.39 in.)



TENSION ADJUSTMENT OF POWER STEERING OIL PUMP DRIVE BELT

(1) Loosen power steering pump fixing bolts (A), (B) and (C).
(2) Move power steering pump, tension belt moderately and adjust.
(3) Tighten the fixing bolts (A), (B) and (C) in that order.
(4) Crank the engine once or more.
(5) Check the belt tension.

Standard value:

Used belt	**7 mm (0.28 in.)**
New belt	**5.5 mm (0.22 in.)**

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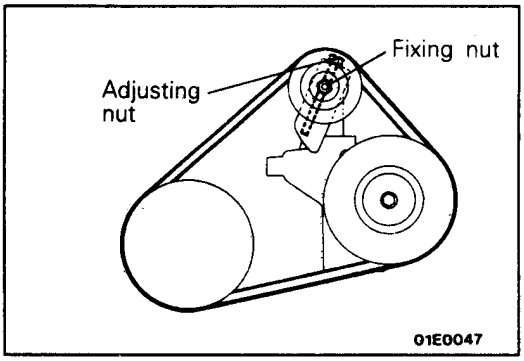

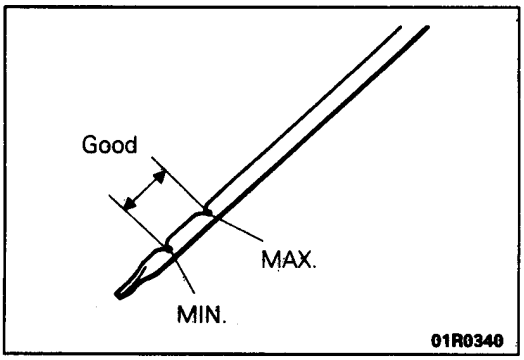

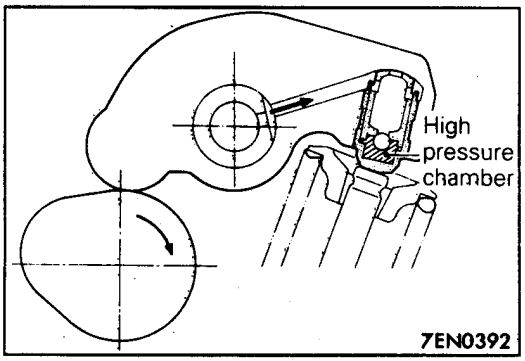

TENSION ADJUSTMENT OF AIR CONDITIONER COMPRESSOR DRIVE BELT

(1) Loosen tension pulley fixing nut.
(2) Adjust belt tension.
(3) Tighten fixing nut.
(4) Crank the engine once or more.
(5) Check the belt tension.

Standard value:

Used belt	**6.5–7.5 mm (0.26–0.30 in.)**
New belt	**5–6 mm (0.20–0.29 in.)**

LASH ADJUSTERS INSPECTION E11FBAH

NOTE
Directly after starting the engine or while the engine is running, if an abnormal sound (clattering) that seems to be coming from the auto-lash adjuster is heard and doesn't stop, carry out the following inspection.

(1) Check the engine oil and refill or replace the oil if necessary.
NOTE
1. If there is a small amount of oil, air is being sucked in through the oil strainer and is getting into the oil passage.
2. If the amount of oil is greater than specified then the oil is mixed by the crankshaft and a large amount of air is mixed into the oil.
3. Air and oil will not separate easily in oil that has degenerated, and the amount of air mixed into the oil will increase.

If the air mixed in with the oil due to the above reasons gets into the high pressure chamber of the auto-lash adjuster, the air inside the high pressure chamber will be compressed when the valve is open and the auto-lash adjuster will overcompress, resulting in an abnormal noise when the valve closes. This is the same effect as if the valve clearance is adjusted to be too large by mistake.
In this case, when the air that has got into the auto-lash adjuster is expelled, the condition will return to normal.

(2) Start the engine and gently race* the engine several times (10 times or less).
If the abnormal noise is stopped by the racing, air has been released from the high pressure chamber, and the functioning of the auto-lash adjuster has returned to normal.
* After gradually increasing the engine speed from idle speed to 3,000 r/min (in 30 seconds), gradually reduce the engine speed back to idle speed (in 30 seconds).

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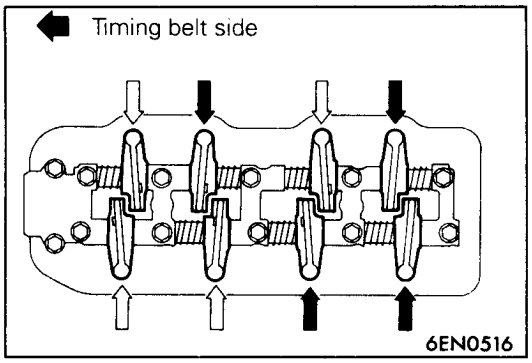
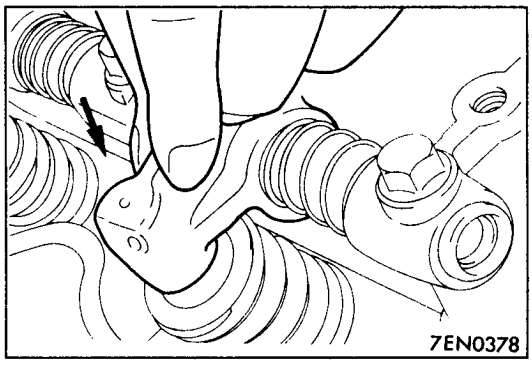
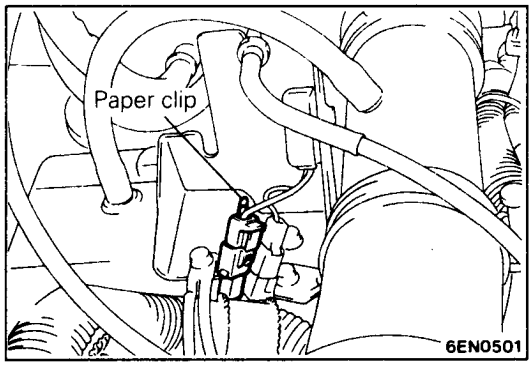
NOTE
1. If the vehicle is parked on a slope for a long time, the oil will be sometimes reduced in the auto-lash adjuster, and air will enter the high-pressure chamber when the engine is started.
2. After the vehicle is parked for a long time, the oil will go out of the oil passage. Since it takes a little time to supply oil to the auto-lash adjuster, air sometimes enters the high-pressure chamber.



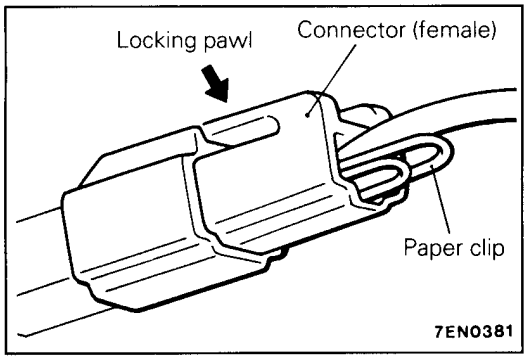




(3) If the abnormal noise is not stopped by the racing, check the auto-lash adjuster by the following procedure.
   1 Stop the engine.
   2 Set the engine No. 1 cylinder to the compressing top dead centre position.
   3 Push the rocker arm in the locations indicated by ⇦ in the illustration at left to check if the rocker arm moves down or not.
   4 Slowly turn the crankshaft 360° clockwise.
   5 Check the rocker arm in the locations indicated by ⬅ in the illustration at left using the same procedure in step 3.
   6 If the rocker arm moves down when it is pushed, replace the auto-lash adjuster;
   When replacing the auto-lash adjuster, install after bleeding the air from all of the auto-lash adjusters, and then carry out the checks in steps 1 to 5.
   In addition, if the rocker arm feels extremely stiff when it is pushed and does not move down, the autolash adjuster is normal, so investigate for some other cause of the abnormality.
   NOTE
   For the procedure for bleeding the air from the autolash adjusters, refer to the Engine Workshop Manual.

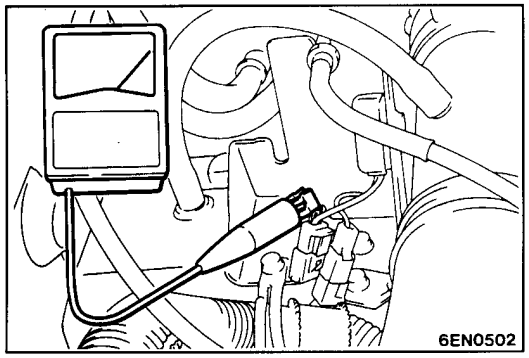
IGNITION TIMING INSPECTION AND ADJUSTMENT E11FUBC

(1) Perform inspection and adjustment with the vehicle in the following condition.
- Engine coolant temperature: 80–95°C (176–203°F)
- Lights and all accessories: OFF
- Transmission: Neutral
- Steering wheel: Straight forward position



(2) Insert a paper clip into the 1-pin connector between the primary side of the ignition coil and the noise filter. The connector should not be disconnected.

Caution
Insert the paper clip along the terminal from the opposite side to the locking pawl of the female connector, as shown in the illustration.



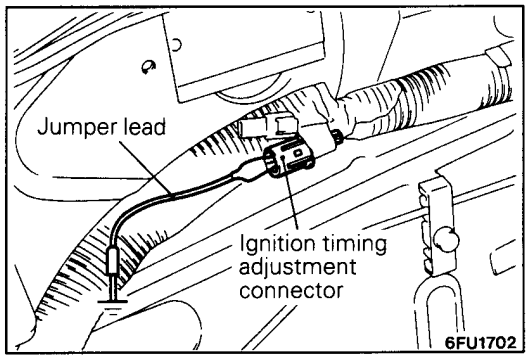
(3) Connect a primary voltage detection-type speedometer to the paper clip.

NOTE
Do not use the multi-use tester (MUT) or MUT-II. When the multi-use tester or MUT-II is connected to the diagnosis connector, the ignition timing will be unchanged, instead of reverting to the standard ignition timing.

(4) Start the engine and run it at idle speed.
(5) Check that the idle speed is at the standard value.

Standard value: 750±100 r/min

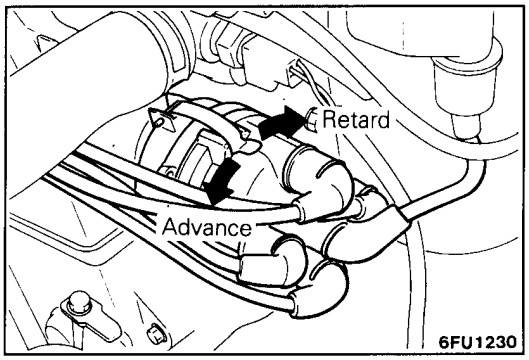
(6) Turn the ignition switch to "OFF".
(7) Install the timing light.
(8) Remove the waterproof female connector from the ignition timing adjustment connector (brown).
(9) Use a jumper lead to earth the ignition timing adjustment terminal.



NOTE
Earthing the ignition timing adjustment terminal will change the ignition timing to standard.

(10) Start the engine and run it at idle speed.
(11) Inspect the standard ignition timing.

Standard value: 5°BTDC±2°



(12) If the timing is outside the standard value, adjust by turning the distributor.

NOTE
The ignition timing will be retarded if the distributor is turned in a clockwise direction, and advanced if it is turned in an anti-clockwise direction.

(13) After adjusting the ignition timing, tighten the mounting nut, being careful not to move the distributor.
(14) Stop the engine, remove the jumper lead from the ignition timing adjustment connector (brown), and return the connector to its original condition.

(15) Start the engine and check that ignition timing is at the standard value.

Standard value: Approx. 8°BTDC

NOTE
1. Ignition timing is variable within about ±7°, even under normal operating conditions.
2. Also, it is automatically advanced further by about 5° to 10°BTDC at higher altitudes.

(16) Sealing tape is to be attached to the fitting nut for vehicles for Switzerland.

NOTE
Sealing tape has been attached at the factory for all other vehicles.

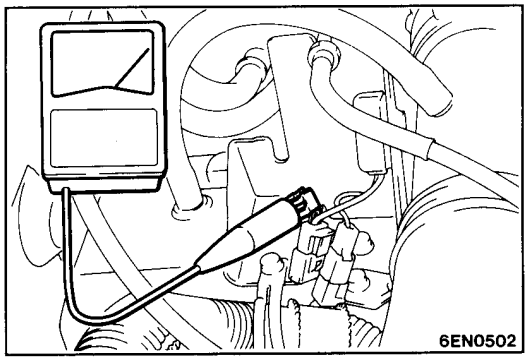
IDLE SPEED INSPECTION E11FXCT

(1) Perform inspection and adjustment with the vehicles in the following condition.
- Engine coolant temperature: 80–95°C (176–203°F)
- Lights and all accessories: OFF
- Transmission: Neutral

(2) Check that the standard ignition timing is at the standard value, and adjust if it is outside the standard value.

Standard value: 5°BTDC±2°

(3) After turning the ignition switch to OFF, connect the multi-use tester (MUT) or MUT-II to the diagnosis connector (white).
(4) Start the engine and run it at idle speed.
(5) Let it idle for 2 minutes.
(6) Select item no. 22 on the MUT or MUT-II and take a reading of the idle speed.


6EN0502

Curb idle speed: 750±100 r/min

NOTE
Idle speed is automatically controlled by the idle speed control (ISC) system.

(7) If it is outside the standard value, refer to GROUP 13 – Check Chart Classified by Problem Symptoms and check the MPI components.

IDLE MIXTUTRE INSPECTION

(1) Before inspection and adjustment, set vehicles in the following condition:
- Engine coolant temperature: 80–95°C (176–203°F)
- Lamps, electric cooling fan and all accessories: OFF
- Transmission: Neutral

(2) Verify if the basic ignition timing is within the standard value.

Standard value: 5°±2° BTDC

(3) After turning the ignition switch to OFF, connect either MUT or MUT-II to the diagnosis connector (white).
(4) Start the engine and run it at 2,500 r/min for 2 minutes.
(5) Set the CO, HC tester.
(6) Check the CO concentration and the HC concentration at idle.

Standard value:
CO concentration: 0.5% or less
HC concentration: 100 ppm or less

(7) If the concentrations are outside the standard value, check the following items:
- Self-diagnosis output
- Feed back control (When the feedback control is carried out normally, the output signal of the oxygen sensor changes between 0–400mV and 600–1,000mV at idle.)
- Combustion pressure
- Injector
- Ignition coil, spark plug cable, spark plug
- Leak in the EGR system and in the EGR valve
- Evaporative emission control system
- Compression pressure

NOTE
Change the three-way catalyst when the CO and HC concentrations do not remain inside the standard value, even though the result of the inspection is normal on all items.

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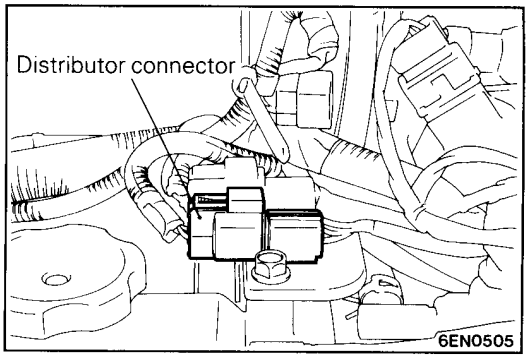
COMPRESSION PRESSURE INSPECTION E11FGBO

(1) Before inspection, check that the engine oil, starter and battery are normal. Also, set the vehicle to the following condition:
- Engine coolant temperature: 80–95°C (176–203°F)
- Lights and all accessories: OFF
- Transmission: Neutral

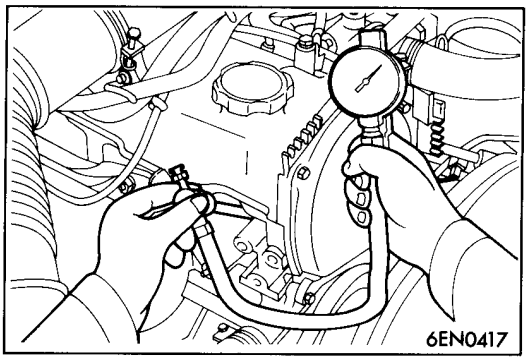
(2) Disconnect the spark plug cables.
(3) Remove all of the spark plugs.
(4) Disconnect the distributor connector.

NOTE
Doing this will prevent the engine control unit from carrying out ignition and fuel injection.



(5) Cover the spark plug hole with a rag etc., and after the engine has been cranked, check that no foreign material is adhering to the rag.

Caution
1. **Keep away from the spark plug hole when cranking.**
2. **If compression is measured while water, oil, fuel, etc., that has come from cracks is inside the cylinder, these materials will become heated and will gush out from the spark plug hole, which is dangerous.**



(6) Set the compression gauge to one of the spark plug mounting holes.
(7) Crank the engine with the throttle valve fully open and measure the compression pressure.

Standard value: 1180 kPa (12.0 kg/cm^2, 171 psi.)
Limit: 870 kPa (8.9 kg/cm^2, 127 psi.) minimum

(8) Measure the compression of all the cylinders, and check that the pressure differences of the cylinders are below the limit.

Limit: 98 kPa (1.0 kg/cm^2, 14 psi.) maximum

(9) If there is a cylinder with compression or a compression difference that is outside the limit, pour a small amount of engine oil through the spark plug hole, and repeat the operations in steps (7) and (8).
① If the compression increases after oil is added, the cause of the malfunction is a worn or damaged piston ring and/or cylinder inner surface.
② If the compression does not rise after oil is added, the cause is a burnt or defective valve seat, or pressure is leaking from the gasket.

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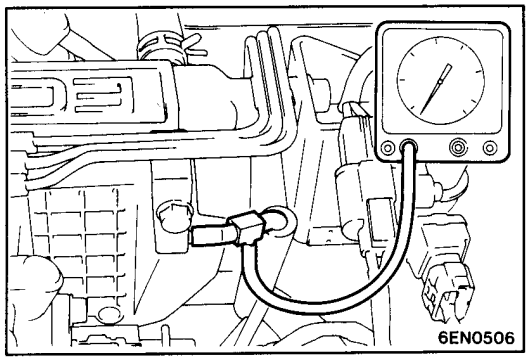
(10) Connect the distributor connector.
(11) Install the spark plugs and spark plug cables.
(12) Use the multi-use tester to erase the self-diagnosis codes.

NOTE
This will erase the malfunction code resulting from the crank angle sensor connector being disconnected.

MANIFOLD VACUUM INSPECTION E11FWAU

(1) Perform inspection and adjustment with the vehicle in the following condition.
- Engine coolant temperature: 80–95°C (176–203°F)
- Lights and all accessories: OFF
- Transmission: Neutral
- Steering wheel: Straight forward position

(2) Check that the idle speed is at the standard value.
Standard value: 750±100 r/min


6EN0506

(3) Install the T-joint to the vacuum hose between the air intake plenum and the fuel pressure regulator, and connect the vacuum gauge.
(4) Check the negative pressure when the engine is idling.
Standard pressure: 67 kPa (500 mmHg, 20 in.Hg)
(5) If not within specification, refer to following chart for cause and repair.

Symptom	Probable cause	Remedy
Vacuum gauge reads under standard value but pointer is stable.	• Delayed ignition timing.	• Adjust ignition timing.
Vacuum gauge pointer fluctuates slowly.	• Idle mixture concentration too rich.	• Check fuel injection system.
Vacuum gauge reading decreases irregularly.	• Idle mixture concentration too lean.	• Check fuel injection system.
Vacuum gauge pointer decreases about 4–21 kPa (30–160 mmHg, 1.18–6.30 in.Hg) intermittently.	• Burned, warped or pitted valves.	• Install new valves.
Vacuum gauge pointer suddenly decreases about 33 kPa (250 mmHg, 9.84 in.Hg) from standard value and then returns.	• Blown cylinder head gasket.	• Install new cylinder head gasket.

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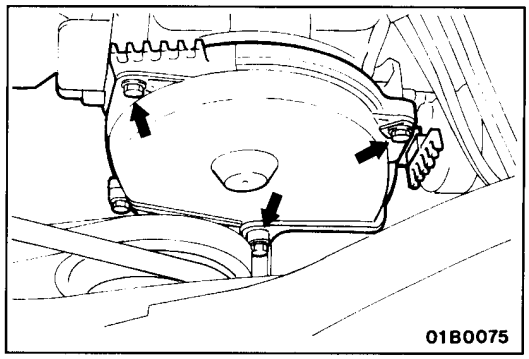
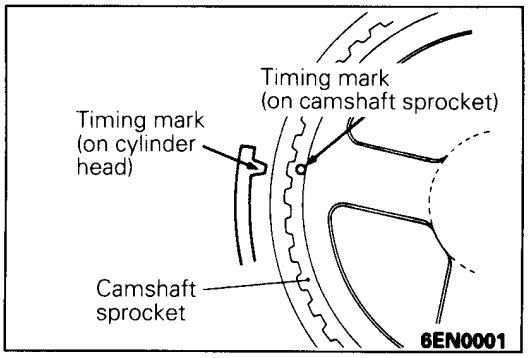


TIMING BELTS TENSION ADJUSTMENT E11FFDE

Two access holes are provided in the timing belt front lower cover. Therefore, timing belt tension can be readjusted following the procedure below without removing the timing belt front lower cover. However, timing belt "B", which drives the right silent shaft, cannot be adjusted without removing the cover.

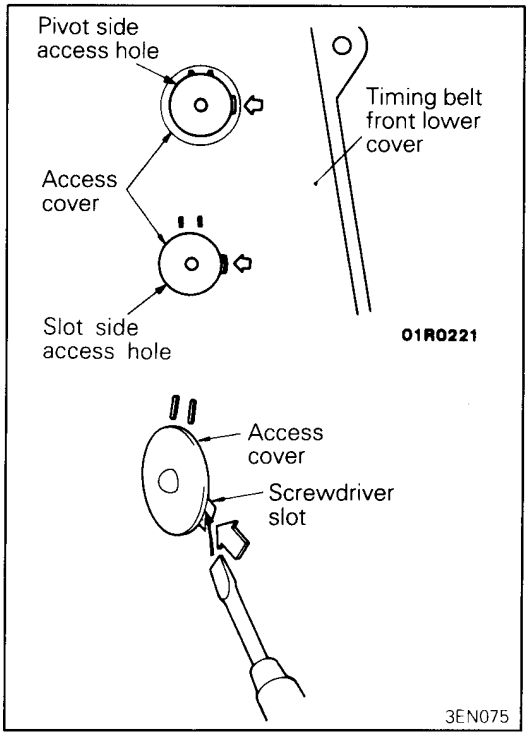
(1) Remove the timing belt front upper cover.

(2) Turn the crankshaft in the clockwise direction and check the timing belt around its entire circumference for abnormalities.



(3) Align the timing mark on the camshaft sprocket with the timing mark on the cylinder head.

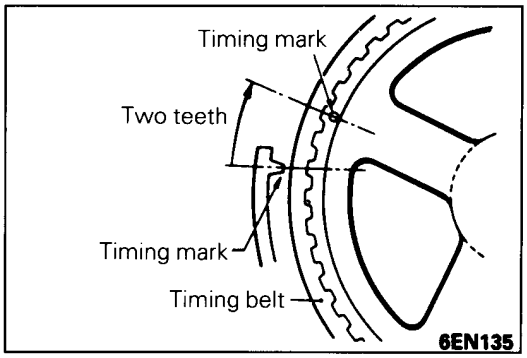
Caution
When aligning the timing mark, be sure not to turn the crankshaft in the counterclockwise direction as this can cause improper belt tension.



(4) Remove the air conditioner compressor drive belt and the alternator drive belt.

(5) Remove the 2 access covers from timing belt front lower cover. There are easily removed by inserting a screwdriver into the slots indicated by the raised arrows in the timing belt cover and twisting.

(6) Insert a special tool (MD998051) through the pivot side access hole and loosen the tensioner spacer (used also as the tensioner locking nut) 1/2-1 turn. Next insert a 14 mm (0.55 in.) socket wrench through the slot side access hole and loosen the tensioner locking bolt 1/2-1 turn.



(7) Turn the crankshaft and the camshaft sprocket clockwise two teeth.

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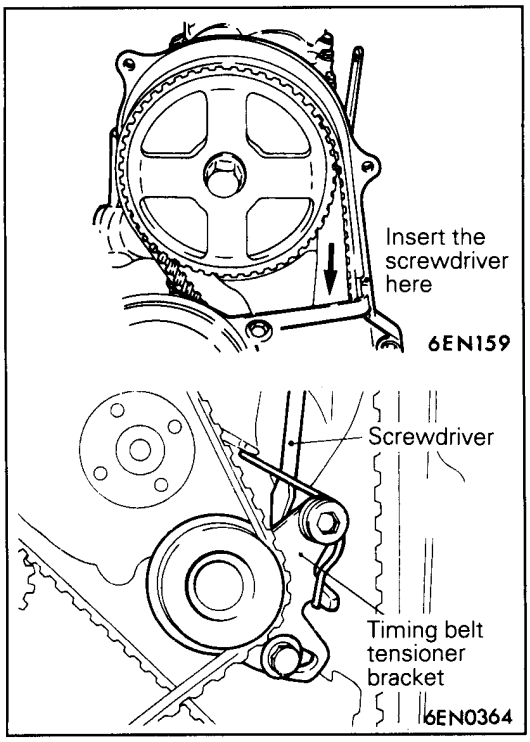
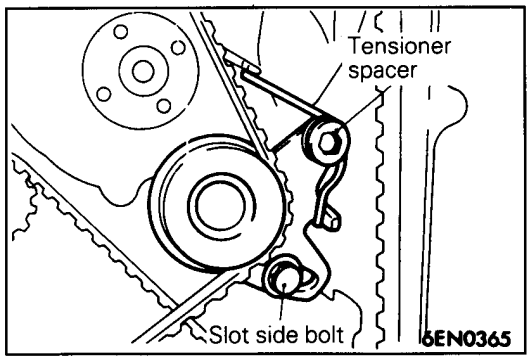


(8) Timing belt tension should be automatically adjusted by the preceding steps. However, in the event the timing belt tensioner has become stuck, loosen it by inserting a flat-tip screwdriver into the top of timing belt front lower cover and pushing the tensioner bracket in the direction of belt tension.

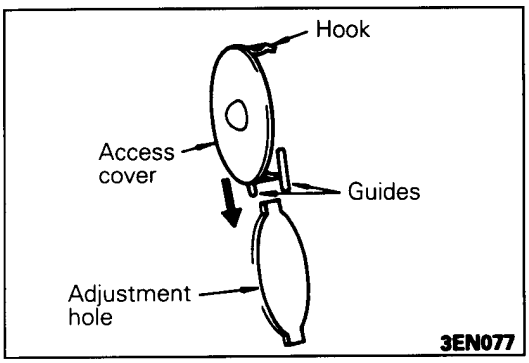
Caution
As the object here is merely to loosen the stuck tensioner, be sure not to apply any more pressure with the screwdriver than is required.

NOTE
For purposes of explanation, the illustration at left shows the timing belt with the timing belt front lower cover removed.



(9) First tighten the tensioner slot side bolt, and then tighten the pivot side tensioner spacer.

Caution
If the pivot side tensioner spacer is tightened first, the tensioner will rotate with it and belt tension may become loose.



(10) Install the access covers to the access holes of timing belt front lower cover. The access cover may be easily installed by passing the hooks between the guides and sliding it in.
(11) Install the timing belt front upper cover.

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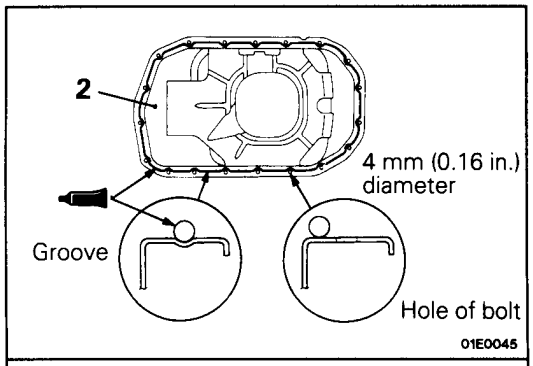
OIL PAN AND OIL SCREEN

REMOVAL AND INSTALLATION

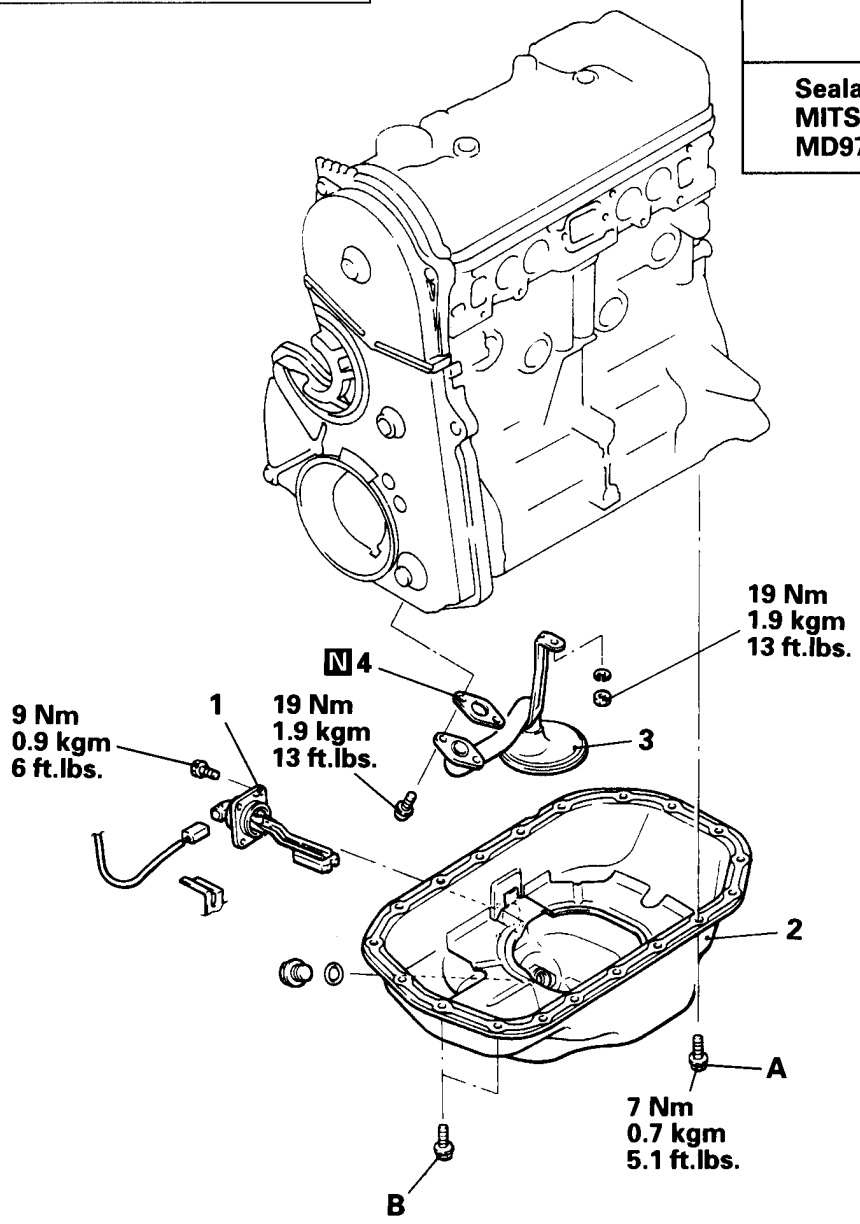
E11KA--

Pre-removal and Post-installation Operation
Removal and Installation
- Under Skid Plate, Undercover
- Front Exhaust Pipe (Refer to GROUP 15 – Exhaust Pipe and Mufflers.)

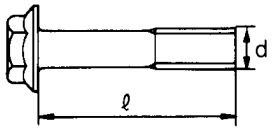
Draining and Supplying
- Engine Oil (Refer to GROUP 13 – Service Adjustment Procedures.)



Sealant:
MITSUBISHI GENUINE Part No. MD970389 or equivalent



Removal steps
1. Engine oil level sensor
2. Oil pan
3. Oil screen
4. Gasket

Symbol	d × ℓ mm (in.)	Note
A	6 × 10 (0.24 × 0.39)	
B	6 × 8 (0.24 × 0.31)	

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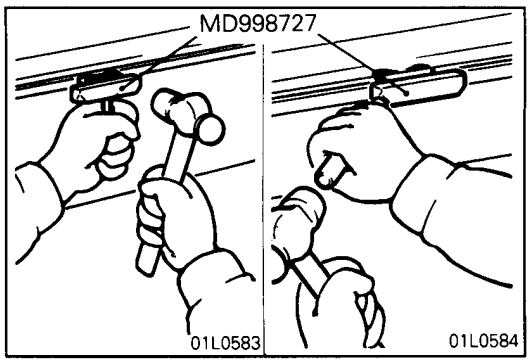


SERVICE POINTS OF REMOVAL E11KBBJ

2. REMOVAL OF OIL PAN/3. OIL SCREEN

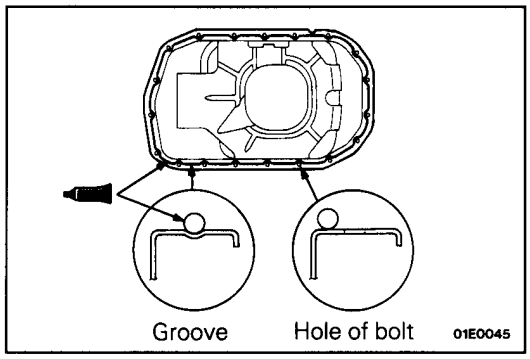
(1) Remove oil pan bolts.
(2) Tap the special tool in between the oil pan and cylinder block.
(3) Slide the special tool by tapping it at an angle to peel off the oil pan.

Caution
The use of a screwdriver or chisel in place of the special tool can damage the gasket seat surface and cause oil leakage.

(4) Slide the oil pan and remove the oil screen mounting bolts, and then remove the oil pan and the oil screen together.

INSPECTION E11KEAB1

- Check oil pan for cracks.
- Check oil pan sealant-coated surface for damage and deformation.
- Check oil screen for cracked, clogged or damaged wire net and pipe.



SERVICE POINTS OF INSTALLATION E11KDBJ

3. INSTALLATION OF OIL SCREEN/2. OIL PAN

(1) Remove sealant from oil pan and cylinder block mating surfaces.
(2) Degrease the sealant-coated surface and the engine mating surface.
(3) Apply the specified sealant around the gasket surface of oil pan as specified in illustration.

Specified sealant: MITSUBISHI GENUINE PART No. MD970389 or equivalent

NOTE
The sealant should be applied in a continuous bead approximately 4 mm (16 in.) in diameter.

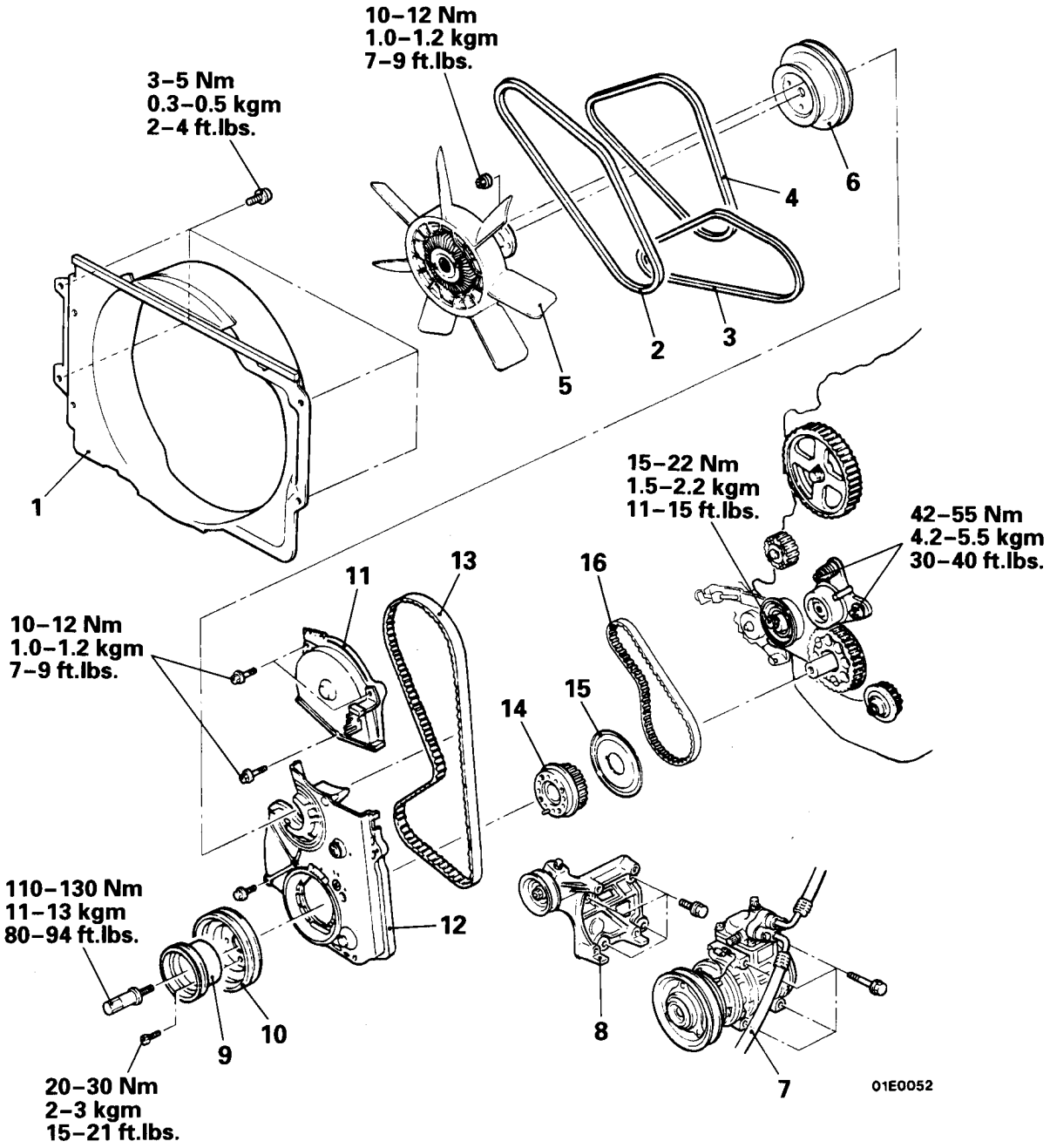
(4) Assemble oil pan and oil screen to cylinder block within 15 minutes after applying the sealant.

Caution
After installing the oil pan, wait at least 30 minutes before starting the engine.

TIMING BELT AND TIMING BELT "B"

E11GA--

REMOVAL AND INSTALLATION



Removal steps

1. Radiator fan shroud
- Adjustment of Drive Belts Tension (Refer to P.11-6)
2. Drive belt (Power steering)
3. Drive belt <A/C>
4. Drive belt (Alternator)
5. Cooling fan assembly
6. Water pump pulley
7. Air conditioner compressor
8. Air conditioner compressor bracket
9. Power steering pump crankshaft pulley
10. Crankshaft pulley
11. Timing belt upper cover
12. Timing belt lower cover
13. Timing belt
14. Crankshaft sprocket
15. Flange
16. Timing belt "B"

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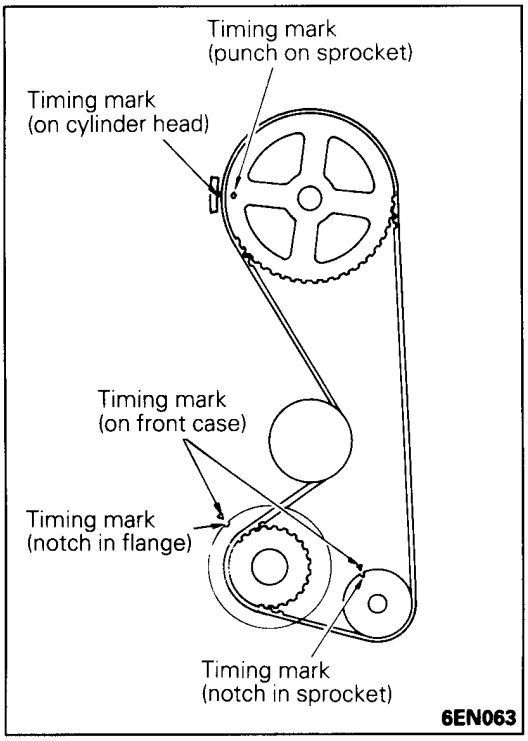
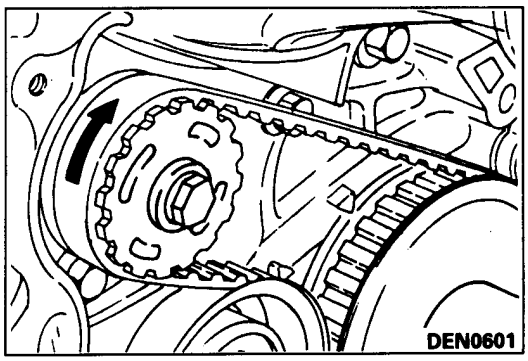


SERVICE POINTS OF REMOVAL E11GBEC

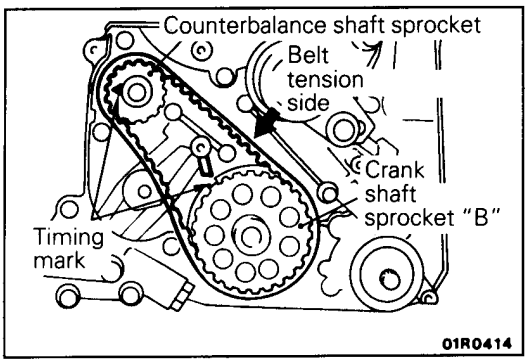
13. REMOVAL OF TIMING BELT

(1) Rotate the crankshaft clockwise and align the timing mark.
(2) If the timing belt is to be re-used, use chalk to mark (on its flat side) an arrow indicating the clockwise direction.



16. REMOVAL OF TIMING BELT "B"

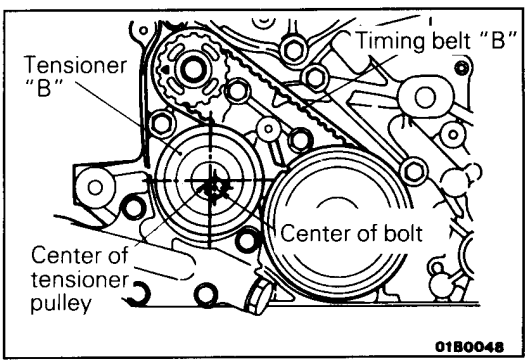
If the timing belt is to be re-used, use chalk to mark (on its flat side) an arrow indicating the clockwise direction.



SERVICE POINTS OF INSTALLATION E11GDEC

16. INSTALLATION OF TIMING BELT "B"

(1) Ensure that crankshaft sprocket "B" timing mark and the counterbalance shaft sprocket timing mark are aligned.
(2) Fit timing belt "B" over crankshaft sprocket B and the counterbalance shaft sprocket. Ensure that there is no slack in the belt.



(3) Temporarily fix the timing belt "B" tensioner such that the center of the tensioner pulley is to the left and above the center of the installation bolt, and temporarily attach the tensioner pulley so that the flange is toward the front of the engine.

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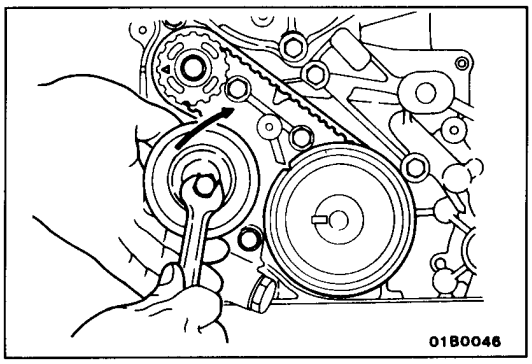
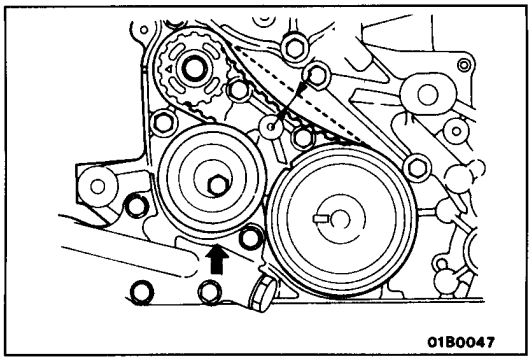


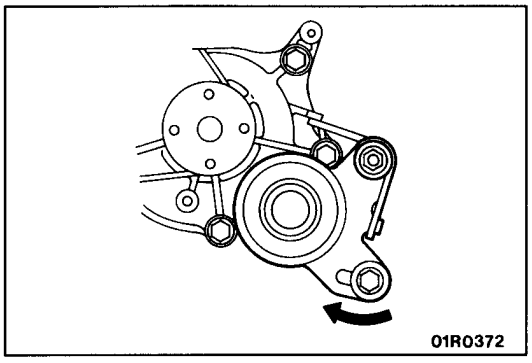
(4) Holding the timing belt "B" tensioner up with your finger in the direction of the arrow, place pressure on the timing belt so that the tension side of the belt is taut. Now tighten the bolt to fix the tensioner.

Caution
When tightening the bolt, ensure that the tensioner pulley shaft does not rotate with the bolt. Allowing it to rotate with the bolt can cause excessive tension on the belt.



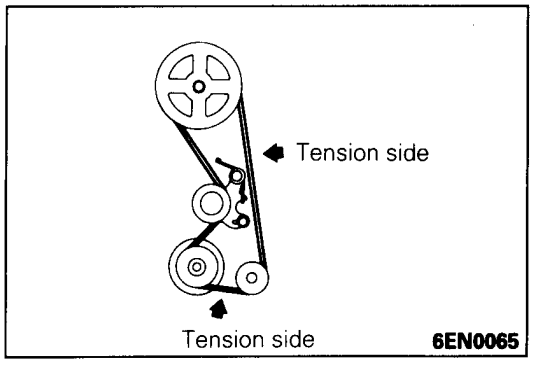
(5) Check to ensure that when center of span on tension side is depressed with index finger in direction of arrow, tension of belt is up to specification.

Standard value: 5–7 mm (0.20–0.28 in.)

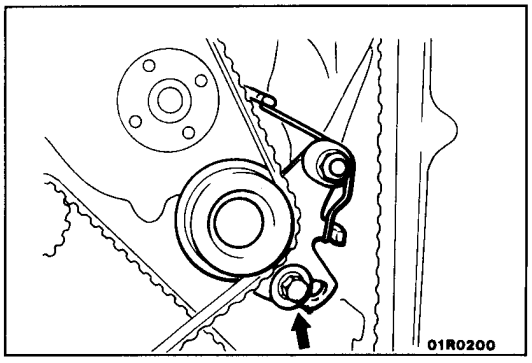


13. INSTALLATION OF TIMING BELT

(1) Ensure that the timing marks of the camshaft sprocket, the crankshaft sprocket, and the oil pump sprocket are all aligned.
(2) Move tensioner pulley toward water pump and temporarily secure tensioner.



(3) Install timing belt. While making sure that tension side of belt is not slackened, install timing belt onto crankshaft sprocket, oil pump sprocket and camshaft sprocket in that order.



(4) Loosen tensioner mounting bolt. By so doing, tensioner will be moved by spring and will apply tension to belt.

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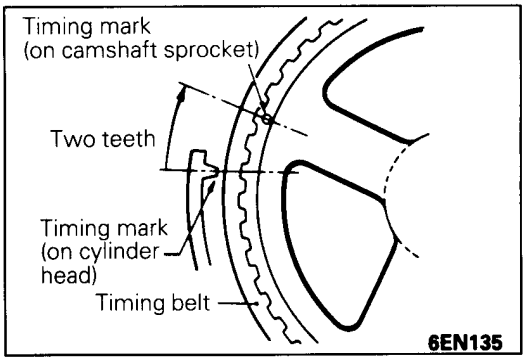
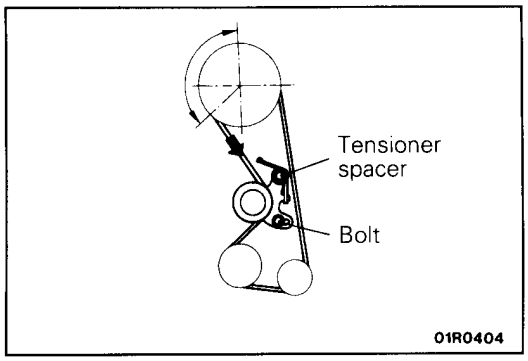


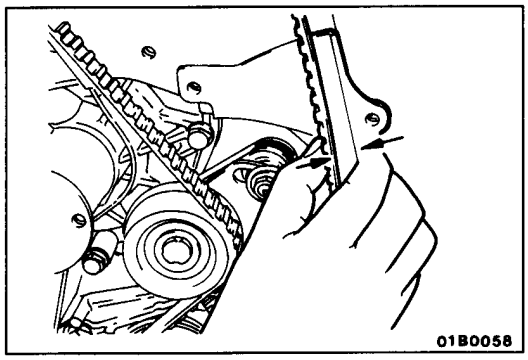
(5) Turn the crankshaft in normal direction (clockwise) by two teeth of the camshaft sprocket.

Caution
As the purpose of this procedure is to apply the proper amount of tension on the timing belt, be sure not to rotate the crankshaft counterclockwise or place pressure on the belt to check the amount of tension.



(6) Putting pressure clockwise on the tensioner (in the direction of the arrow) such that no portion of the belt raises out in portion A, place the belt on the camshaft sprocket such that the belt sprocket teeth are fully engaged. Tighten the tensioner bolt and tensioner spacer, in that order.

Caution
If the tensioner spacer is tightened first, the tensioner will rotate with it and belt tension be thrown out of adjustment. Always tighten the bolt first.



(7) Check to see that the clearance between the outside of the belt and the cover are within the standard value by grasping the tension side (between the camshaft sprocket and oil pump sprocket) of the center part of the timing belt between the thumb and index finger.

Standard value: 14 mm (0.55 in.)

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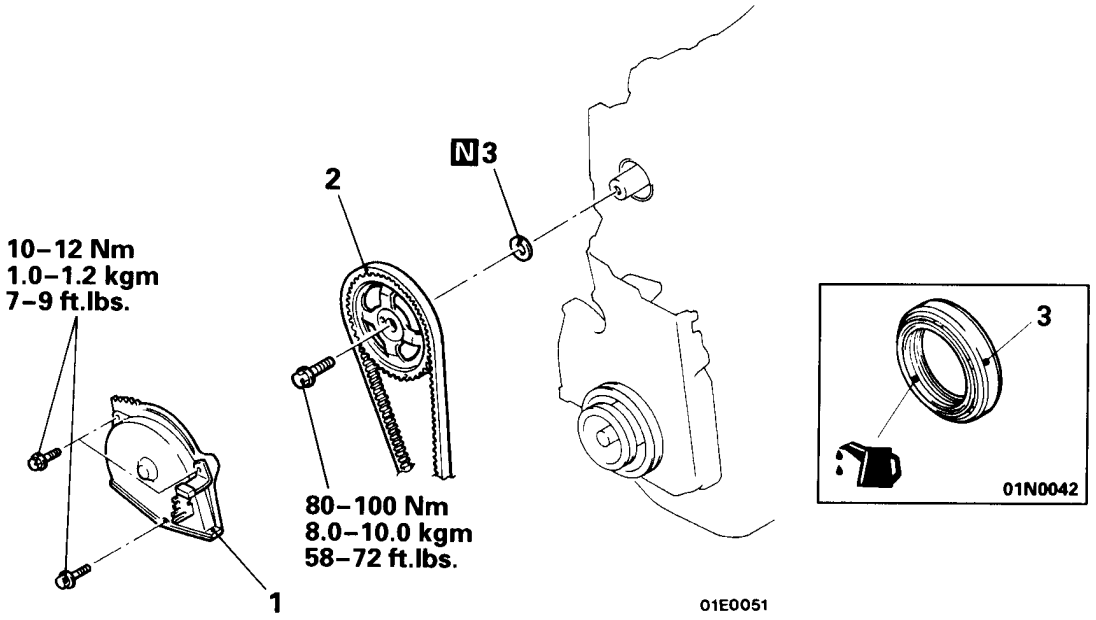
CAMSHAFT OIL SEAL

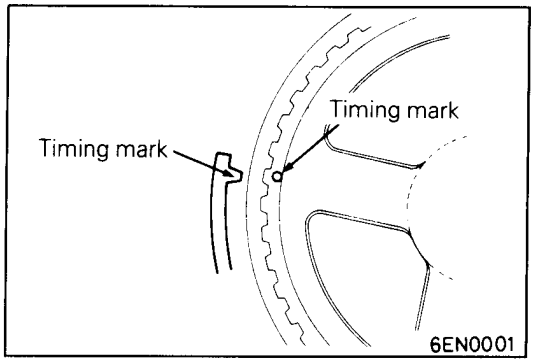
E11VA-A

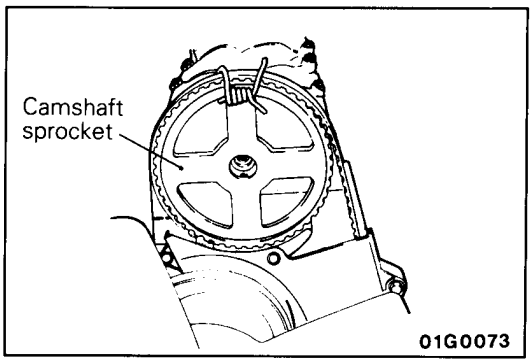
REMOVAL AND INSTALLATION



Removal steps

1. Timing belt upper cover
2. Camshaft sprocket
3. Camshaft oil seal





SERVICE POINTS OF REMOVAL

E11VBAC

2. REMOVAL OF CAMSHAFT SPROCKET

(1) Remove camshaft clockwise (to the right) and align timing marks.

(2) Remove camshaft sprocket with timing belt and place it on timing belt front lower cover.

Caution
Do not rotate crankshaft after removing camshaft sprocket.

NOTE
Secure camshaft sprocket and timing belt with wire etc., to prevent them from slipping out of place.

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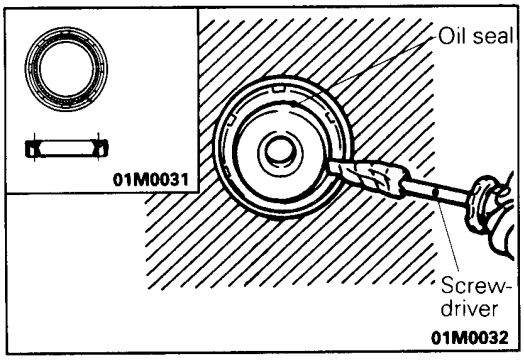
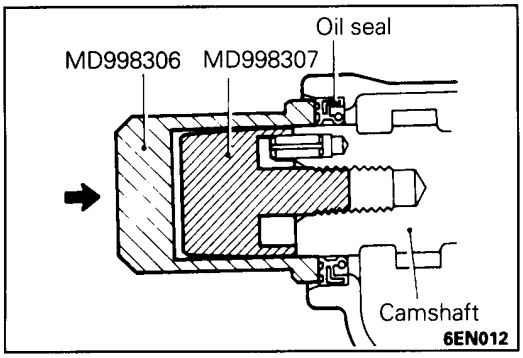


3. REMOVAL OF CAMSHAFT OIL SEAL

(1) Cut out a portion in the camshaft oil seal lip.
(2) Cover the tip of a screwdriver with a cloth and apply it to the cutout in the oil seal to pry off oil seal.

Caution
Take care not to damage the camshaft and cylinder head.



SERVICE POINT OF INSTALLATION E11VCAC

3. INSTALLATION OF CAMSHAFT OIL SEAL

(1) Install special tool (camshaft oil seal guide) to the end of the camshaft and apply engine oil to the outer surface of special tool.
(2) Using special tool (camshaft oil seal installer) press-in the oil seal.

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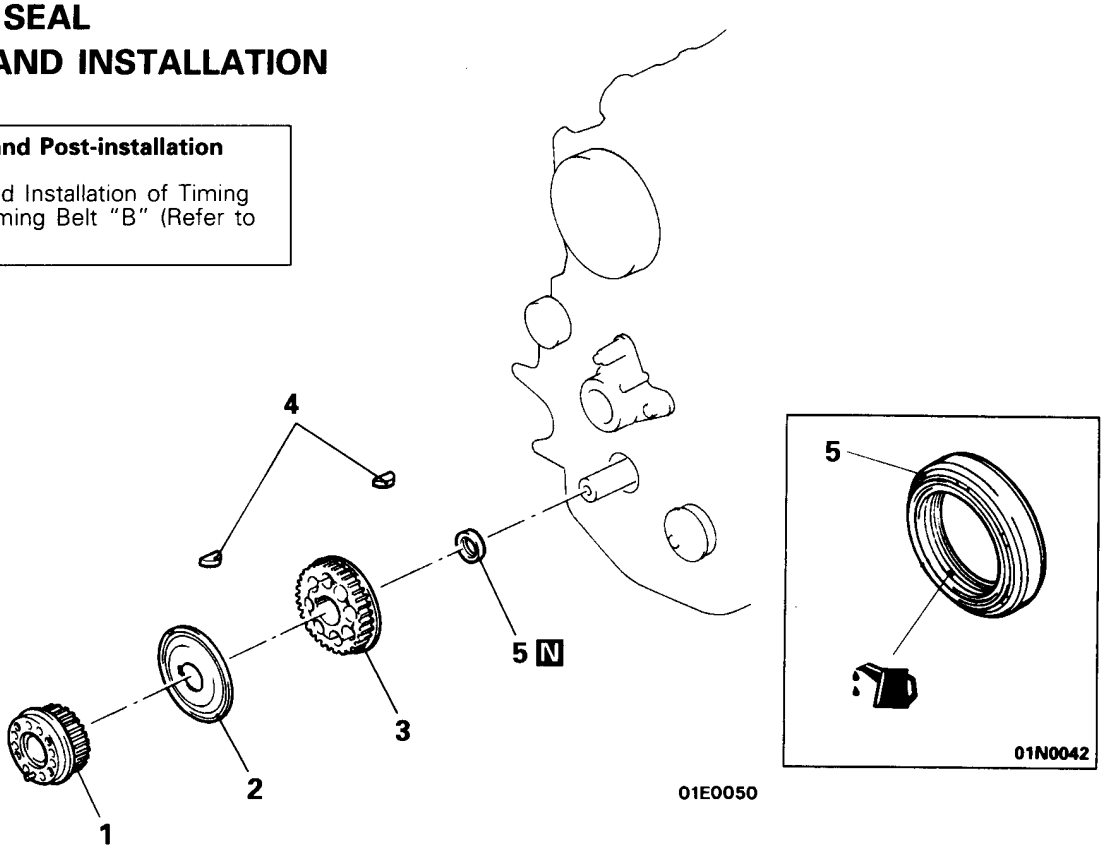
CRANKSHAFT OIL SEALS

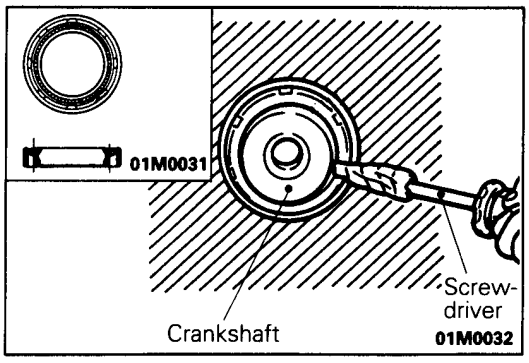
E11UA-A

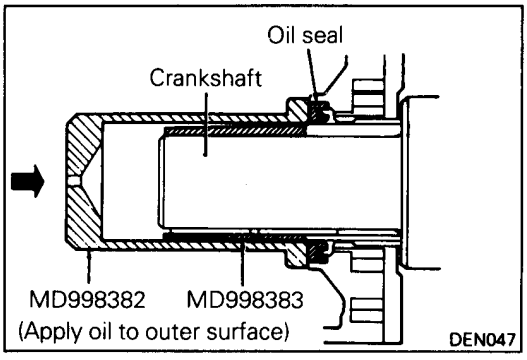
FRONT OIL SEAL
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Removal and Installation of Timing Belt and Timing Belt "B" (Refer to P.11-16.)



Removal steps
1. Crankshaft sprocket
2. Flange
3. Crankshaft sprocket "B"
4. Key
5. Oil seal





SERVICE POINT OF REMOVAL

E11UBAC

5. REMOVAL OF OIL SEAL

(1) Cut out a portion in the crankshaft oil seal lip.
(2) Cover the tip of a screwdriver with a cloth and apply it to the cutout in the oil seal to pry the oil seal.

Caution
Take care not to damage the crankshaft and front case.

SERVICE POINT OF INSTALLATION

E11UCAF

5. INSTALLATION OF OIL SEAL

Apply engine oil to the lip section of the oil seal, and use the special tool to press-fit the oil seal.

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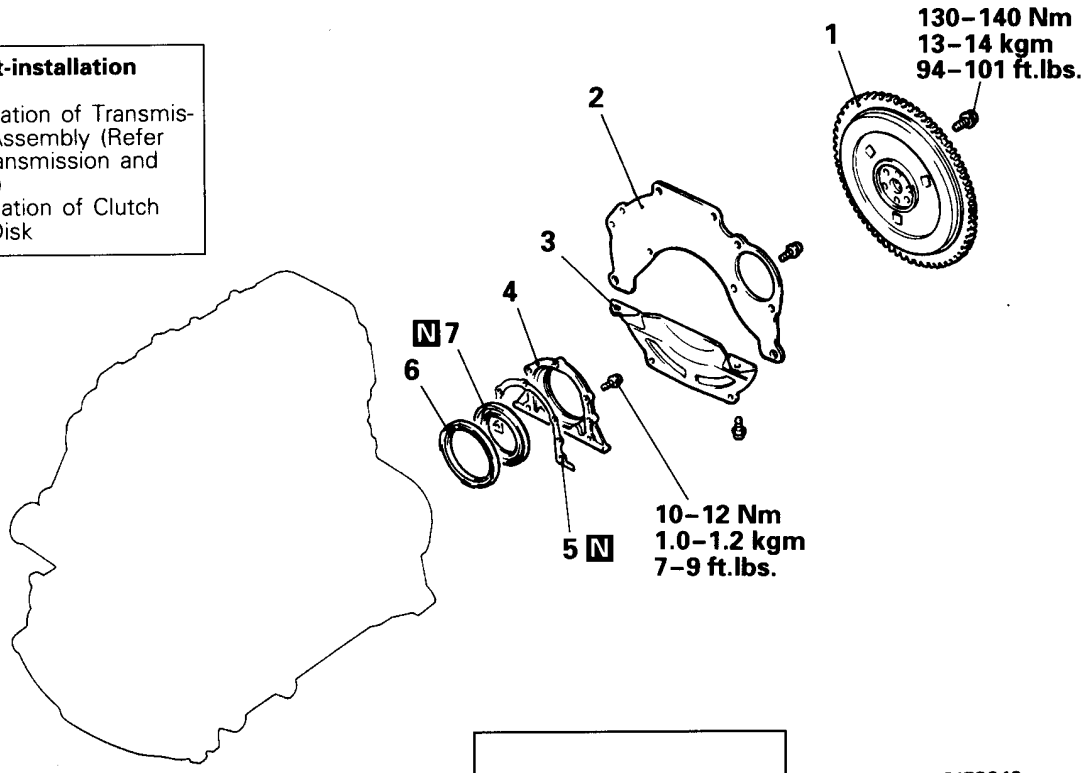
REAR OIL SEAL
REMOVAL AND INSTALLATION

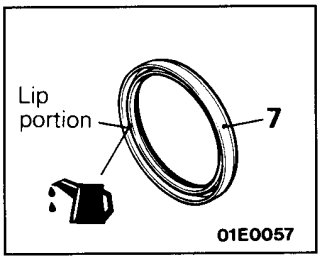
E11UA-D

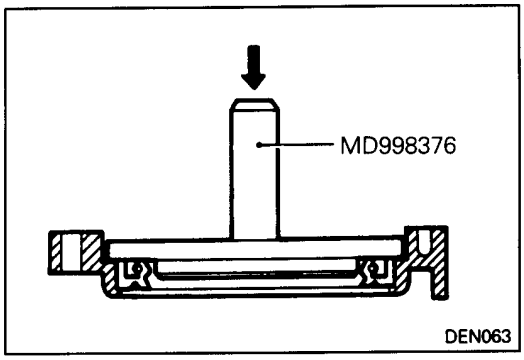
Pre-removal and Post-installation Operation
- Removal and Installation of Transmission and Transfer Assembly (Refer to GROUP 22 – Transmission and Transfer Assembly.)
- Removal and Installation of Clutch Cover and Clutch Disk



01E0049

Removal steps
1. Fly wheel assembly
2. Rear plate
3. Belhousing cover
4. Oil seal case
5. Gasket
- ◆◆ 6. Oil separator
- ◆◆ 7. Oil seal

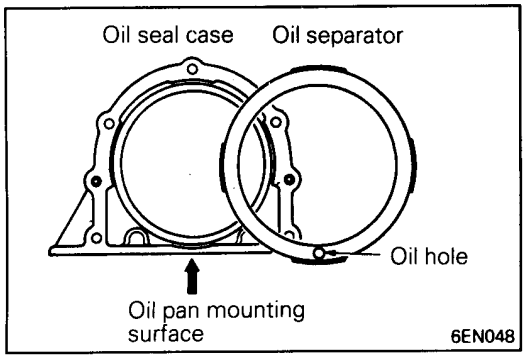




SERVICE POINT OF INSTALLATION

E11UCAG

7. INSTALLATION OF OIL SEAL



6. INSTALLATION OF OIL SEPARATOR

Press the oil separator into the oil seal case. Install it so that the separator oil hole is on the very bottom, as illustrated.

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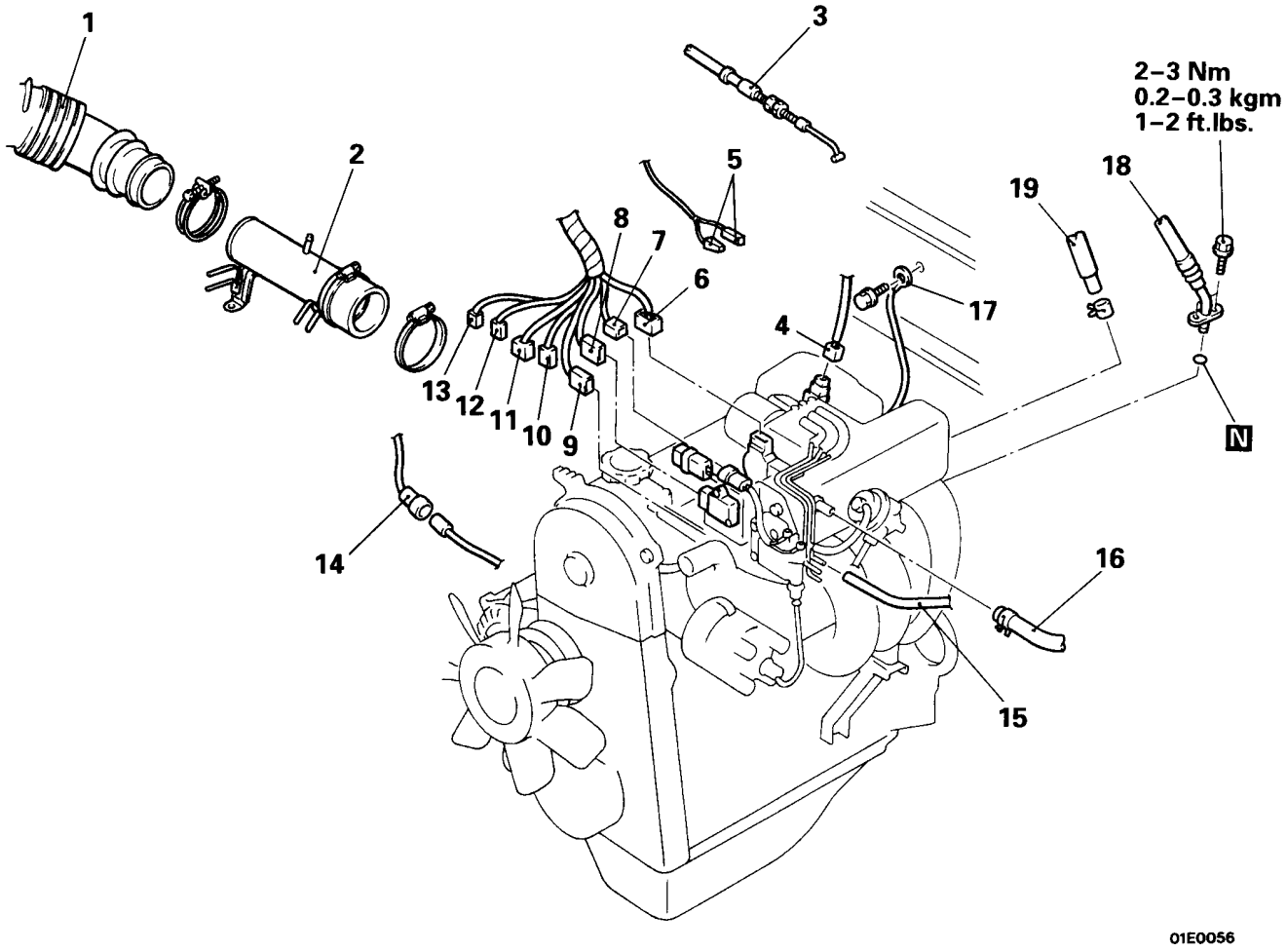
CYLINDER HEAD GASKET

E11JA--

REMOVAL AND INSTALLATION

Pre-removal Operation
- Draining of the Engine Coolant (Refer to GROUP 14 – Service Adjustment Procedure.)

Post-installation Operation
- Filling of the Engine Coolant (Refer to GROUP 14 – Service Adjustment Procedure.)
- Adjustment of Accelerator Cable (Refer to GROUP 13 – Service Adjustment Procedures.)



Removal steps

1. Air intake hose
2. Air inlet pipe
3. Accelerator cable connection
4. ISC motor connector
5. Noise filter
6. TPS connector
7. Injector connector
8. Distributor connector
9. Ignition coil connector
10. Power transistor connector
11. Engine coolant temperature switch connector <A/C>
12. Engine coolant temperature gauge unit connector
13. Engine coolant temperature sensor connector
14. Oxygen sensor connection
15. Purge hose connection
16. Brake booster vacuum hose connection
17. Earth cable
18. High pressure fuel hose connection
19. Fuel return hose connection

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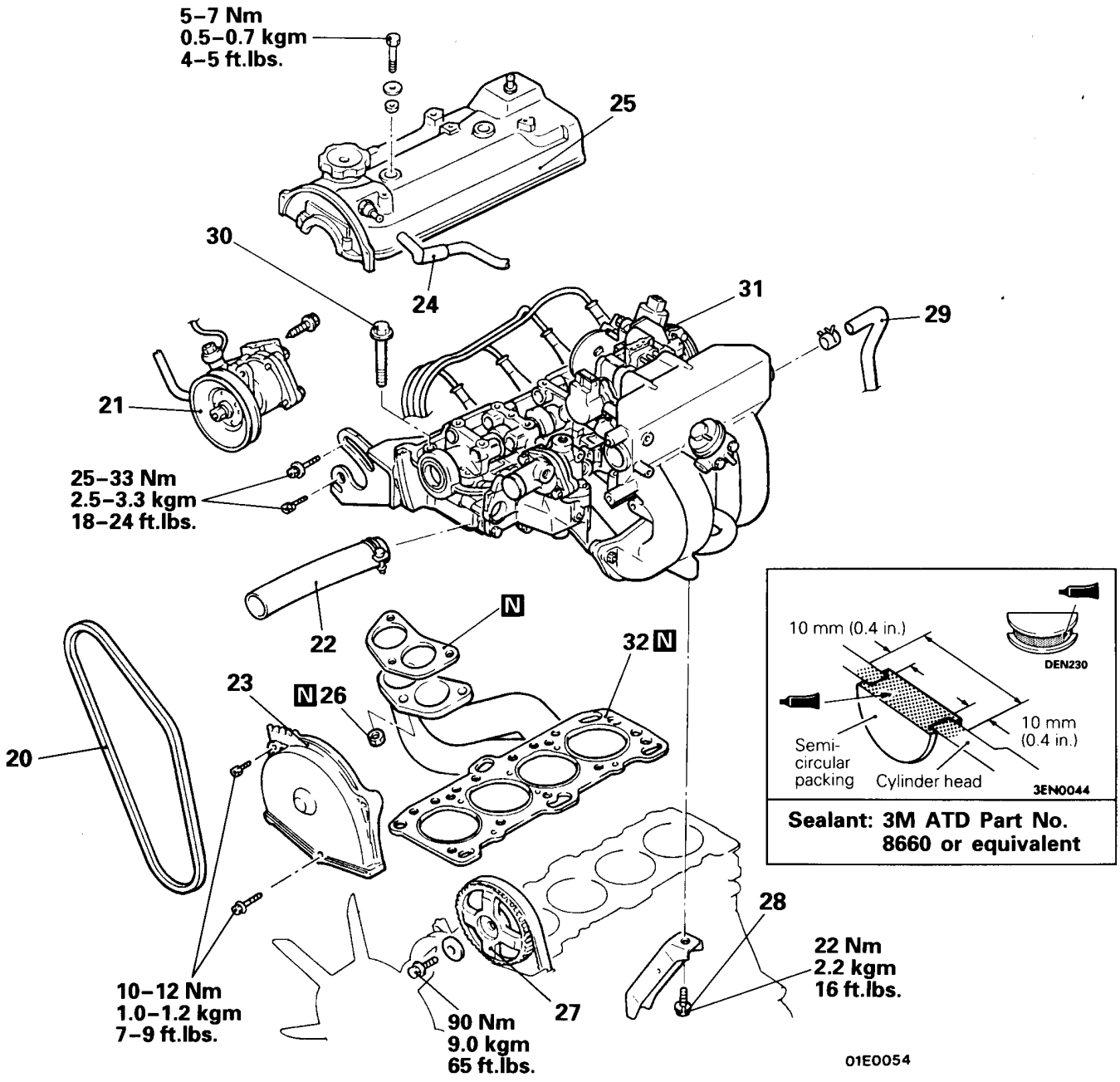

- Adjustment of drive belt tension (Refer to P.11-6.)
20. Drive belt (Power steering)
21. Power steering oil pump
22. Radiator upper hose
23. Timing belt upper cover
24. PCV hose connection
25. Rocker cover
26. Connection for exhaust manifold and front exhaust pipe
27. Camshaft sprocket
28. Intake manifold stay connection
29. Water hose
30. Cylinder head bolt
31. Cylinder head assembly
32. Cylinder head gasket

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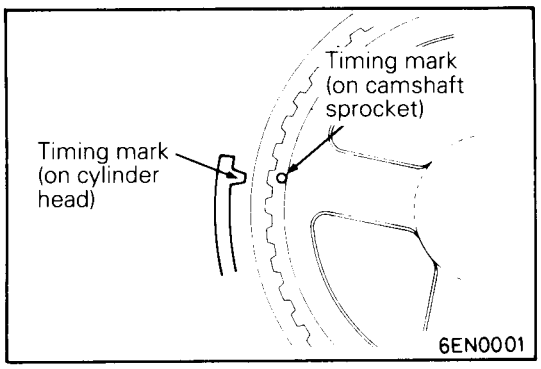
SERVICE POINTS OF REMOVAL E11JBCF

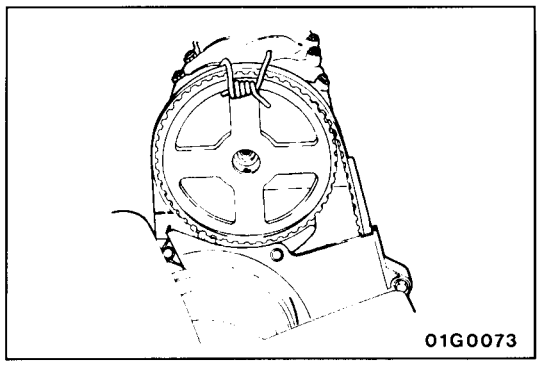
21. REMOVAL OF POWER STEERING OIL PUMP

(1) Remove the power steering oil pump (with the hose attached)
(2) Suspend the removed oil pump (by using wire or similar material) at a place where no damage will be caused during removal/installation of the cylinder head.



27. REMOVAL OF CAMSHAFT SPROCKET

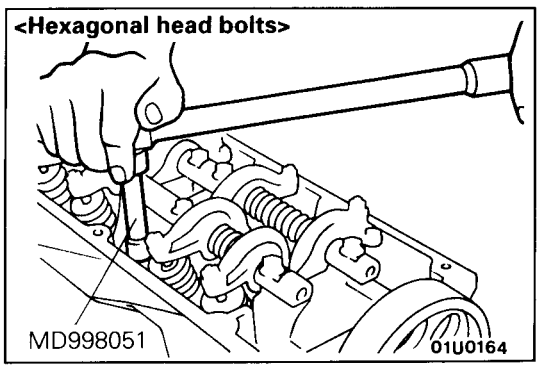
(1) Rotate the crankshaft and align the timing mark.



(2) Pull the camshaft sprocket (with the timing belt attached) out from the camshaft, and place it on top of the timing belt front lower cover.

Caution

1. **The crankshaft must not be rotated after the camshaft sprocket is pulled out from the camshaft.**
2. **Take care that there is no slack in the timing belt.**
3. **Use care so that the camshaft sprocket may not disengage from the belt and drop.**



30. REMOVAL OF CYLINDER HEAD BOLT

<Hexagonal head bolts>

Use the special tool to loosen the bolts in 2 or 3 steps, and remove the cylinder head assembly from the cylinder block.

<12-point head bolts>

Using the 12 mm – 12 points socket wrench, loosen the cylinder head bolts. Loosen evenly, little by little.

SERVICE POINTS OF INSTALLATION E11JDCR

32. INSTALLATION OF CYLINDER HEAD GASKET

(1) Wipe off the oil on the mounting surface of the cylinder head gasket.
(2) Lay the cylinder head gasket on cylinder block with the identification at front top.

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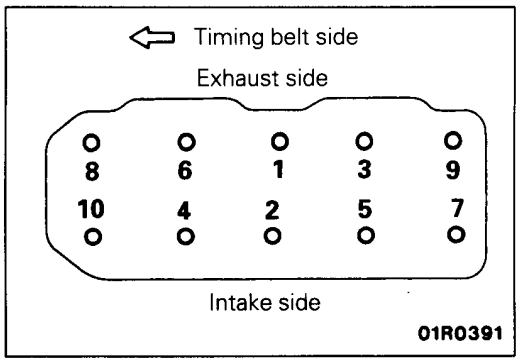
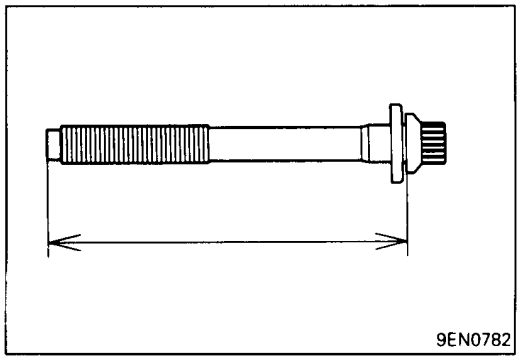
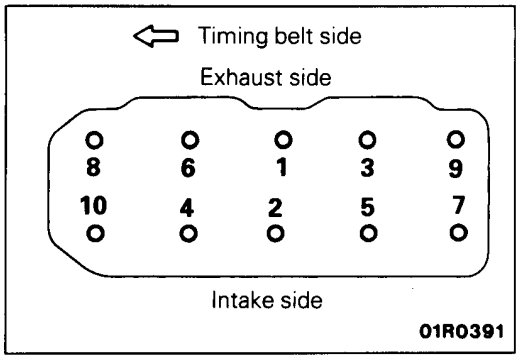
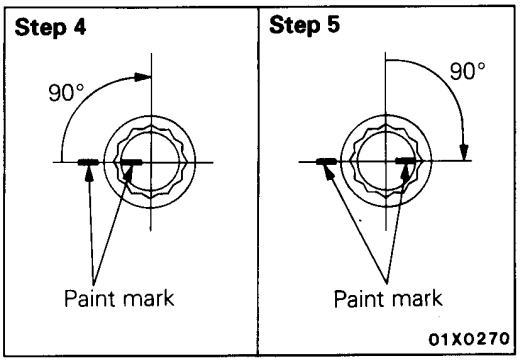








30. INSTALLATION OF CYLINDER HEAD BOLT

<Hexagonal head bolts>

Tighten in the numerical order indicated in the diagram in two or three groups with special tool (MD998051).

Tightening torque (cold engine): 105–115 Nm (10.5–11.5 kgm 76–83 ft.lbs.)

<12-point head bolts>

(1) When installing the cylinder head bolts, check that the shank length of each bolt meets the limit. If the limit is exceeded, replace the bolt.

Limit: Max. 120.4 mm (4.74 in.)

(2) Apply engine oil to the threaded portions of bolts and to the washers.

(3) Tighten the bolts with a 12-mm double hexagon wrench by the following steps (angular tightening method).

Step	Operation	Remarks
1	Tighten to 78 Nm (8.0 kgm, 58 ft.lbs.)	In the order shown in the illustration.
2	Loosen fully.	In the reverse order of that shown in the illustration.
3	Tighten to 20 Nm (2.0 kgm, 15 ft.lbs.)	In the order shown in the illustration.
4	Tighten 90° of a turn.	In the order shown in the illustration. Mark the head of the cylinder head bolt and cylinder head by paint.
5	Tighten 90° of a turn.	In the order shown in the illustration. Check that the painted mark of the head bolt is lined up with that of the cylinder head.

Caution

1. **When the bolt is tightened less than 90°, the bolt will be loosened. Observe the tightening angle strictly.**
2. **When the bolt is tightened more than 90°, remove the bolt and repeat the procedure from the step (1).**

NOTES

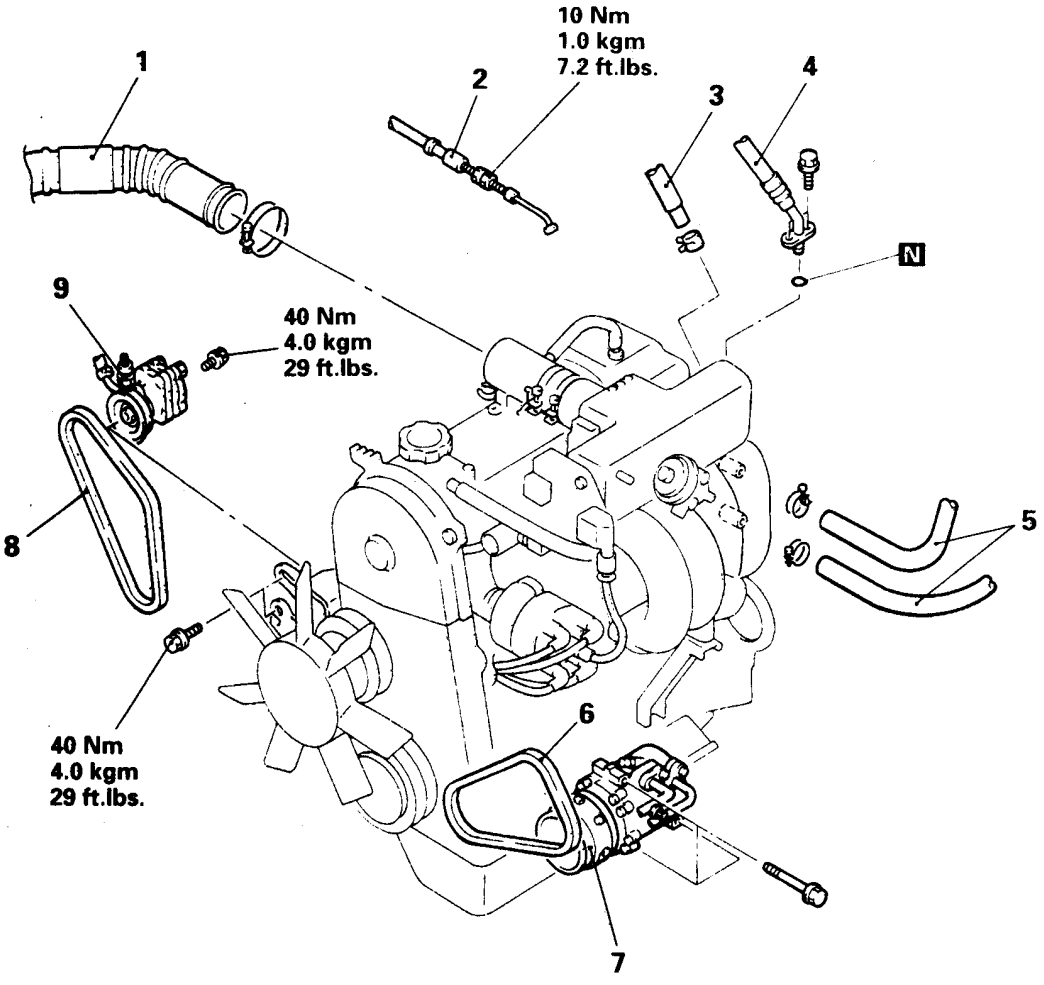
ENGINE ASSEMBLY

E11TA--

REMOVAL AND INSTALLATION

Pre-removal Operation
- Removal of the Hood (Refer to GROUP 42 – Hood.)
- Removal of the Transmission and Transfer Assembly (Refer to GROUP 22, 23 – Transmission Assembly.)
- Removal of the Radiator (Refer to GROUP 14 – Radiator.)
- Removal of Battery and Battery Tray

Post-installation Operation
- Installation of the Radiator (Refer to GROUP 14 – Radiator.)
- Installation of the Transmission and Transfer Assembly (Refer to GROUP 22, 23 – Transmission Assembly.)
- Installation of the Radiator
- Installation of Battery and Battery Tray
- Installation of the Hood
- Adjustment of the Engine (Refer to P.11-6.)



01E0076

Removal steps

1. Air intake hose
2. Accelerator cable connection
3. Fuel return hose connection
4. High pressure fuel hose connection
5. Heater hose connections
6. Drive belt } <A/C>
◆◆ 7. Compressor }
8. Drive belt } (Power Steering)
◆◆ 9. Oil pump }

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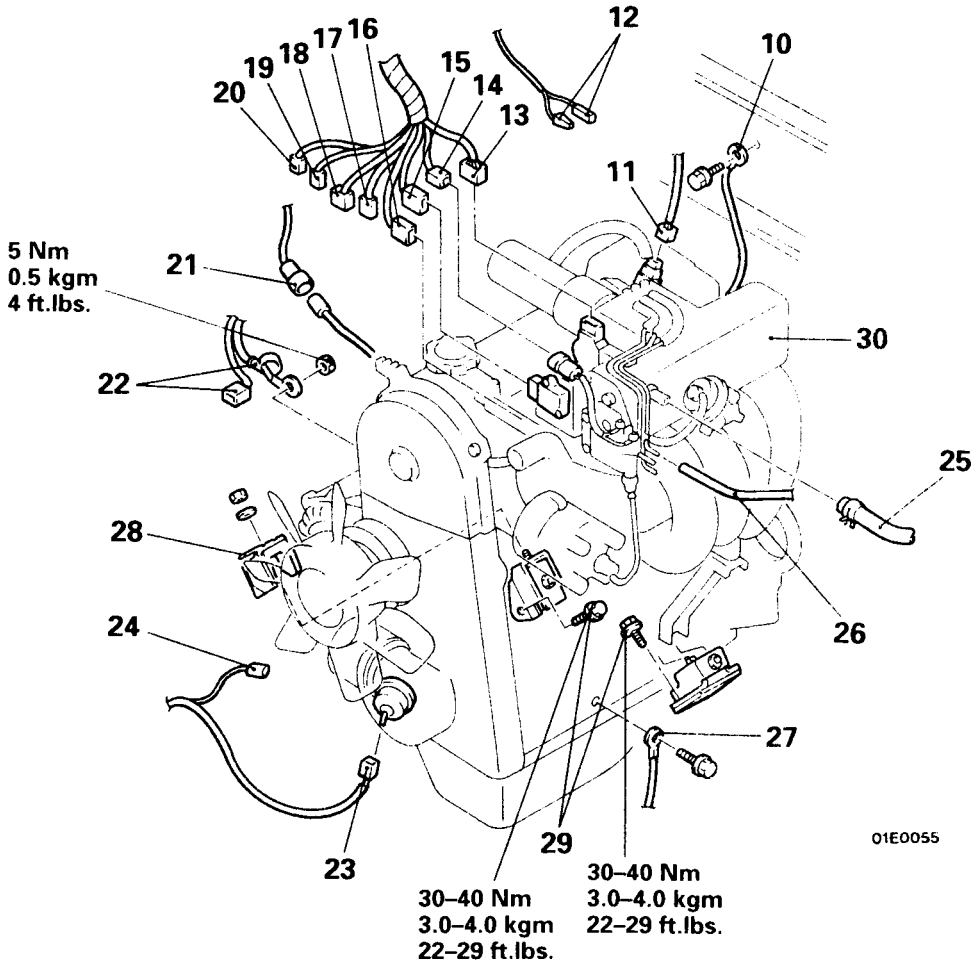

10. Earth cable
11. ISC motor connector
12. Noise filter connector
13. TPS connector
14. Injector harness connector
15. Distributor connector
16. Ignition coil connector
17. Power transistor
18. Engine coolant temperature gauge unit connector
19. Engine coolant temperature sensor connector
20. Engine coolant temperature switch connector <A/C>
21. Oxygen sensor connector
22. Alternator connector
23. Oil pressure gauge unit connector
24. Oil level sensor connector
25. Brake booster vacuum hose connection
26. Purge hose connection
27. Earth cable
28. Heat protector
29. Engine mounting bolt
◆■ ■◆ 30. Engine assembly

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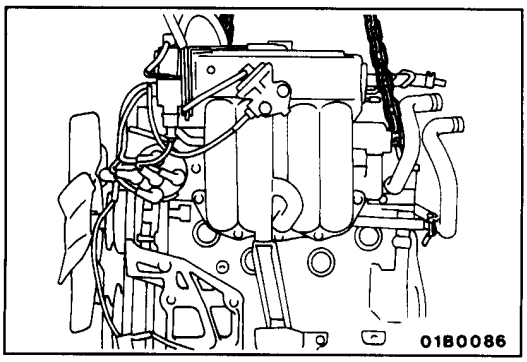
SERVICE POINTS OF REMOVAL E11TBAJ

7. REMOVAL OF COMPRESSOR <A/C>/9. OIL PUMP (POWER STEERING)

(1) Remove the oil pump and air conditioner compressor (with the hose attached)
(2) Suspend the removed oil pump (by using wire or similar material) at a place where no damage will be caused during removal/installation of the engine assembly.



30. REMOVAL OF ENGINE ASSEMBLY

(1) Check that all cables, hoses, harness connectors, etc. are disconnected from the engine.
(2) Lift the chain block slowly to remove the engine assembly upward from the engine compartment.

SERVICE POINTS OF INSTALLATION E11TDAL

30. INSTALLATION OF ENGINE ASSEMBLY

Install the engine assembly. When doing so, check carefully to be sure that all pipes and hoses are connected, and that none are twisted, damaged, etc.

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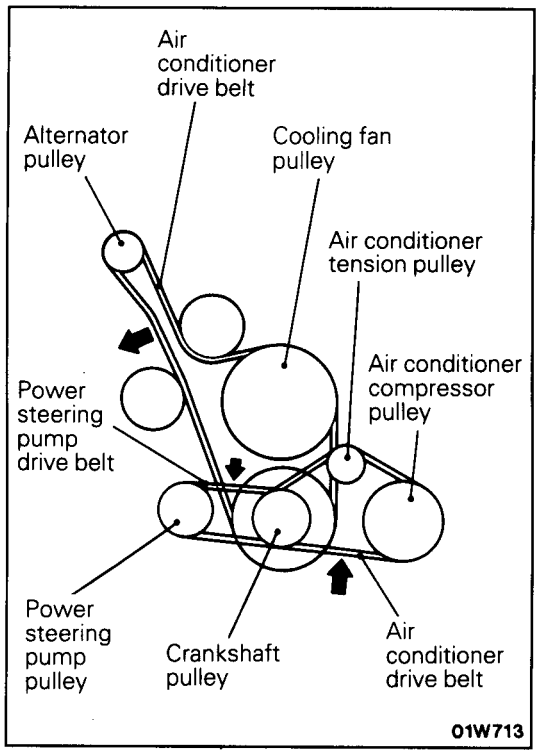


ENGINE <6G72>

SERVICE ADJUSTMENT PROCEDURES

DRIVE BELTS TENSION INSPECTION AND ADJUSTMENT

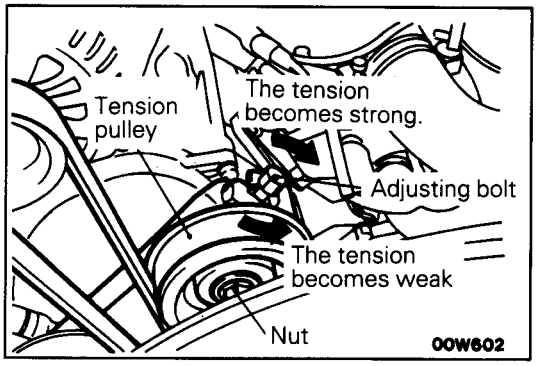
E11FQBE

<SOHC–12 VALVE>

Check the tension by pushing at the centre of the belt between pulleys with a force of 100 N (10 kg, 22 lbs.) as shown in the figure. Measure drive belt flexion.

Standard value:

Alternator	**8–10 mm (0.31–0.39 in.)**
Power steering oil pump	**9–14.5 mm (0.35–0.57 in.)**
Air conditioner compressor	**6.5–7.5 mm (0.26–0.30 in.)**



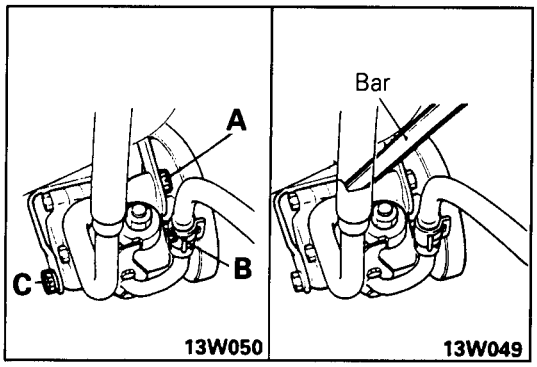
TENSION ADJUSTMENT OF ALTERNATOR DRIVE BELT

(1) Loosen tension pulley fixing nut.
(2) Adjust belt tension with adjusting bolt.

Standard value:

New belt	**6.5–8 mm (0.26–0.31 in.)**
Used belt (with corrected tension)	**9 mm (0.35 in.)**

(3) Tighten fixing nut.



TENSION ADJUSTMENT OF POWER STEERING OIL PUMP DRIVE BELT

(1) Loosen power steering fixing bolts (A), (B) and (C).
(2) Move power steering pump and tension belt moderately and adjust.
(3) Tighten the fixing bolts (A), (B) and (C) in that order.
(4) Crank the engine once or more.
(5) Check the belt tension

Standard value:

Used belt	**10 mm (0.39 in.)**
New belt	**8.0 mm (0.31 in.)**

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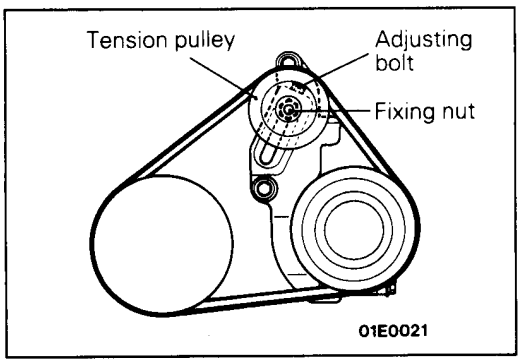


TENSION ADJUSTMENT OF POWER STEERING OIL PUMP DRIVE BELT

(1) Loosen tension pulley fixing nut.
(2) Adjust belt tension with adjusting nut.
(3) Tighten fixing bolt.
(4) Crank the engine once or more.
(5) Check the belt tension.

Standard value:

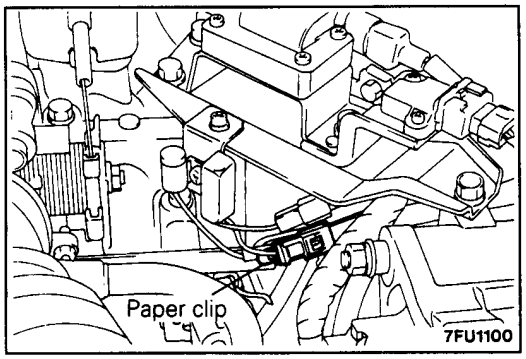
Used belt	**6.5–7.5 mm (0.26–0.30 in.)**
New belt	**5–6 mm (0.20–0.24 in.)**

<SOHC-24 VALVE>

For the inspection and adjustment procedures, refer to P.11-72.

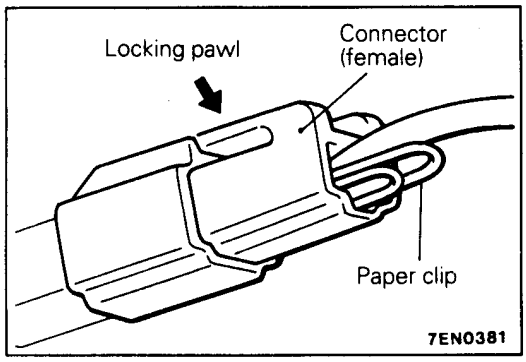
LASH ADJUSTERS INSPECTION E11FBAI

For the inspection procedures, refer to P. 11-7.



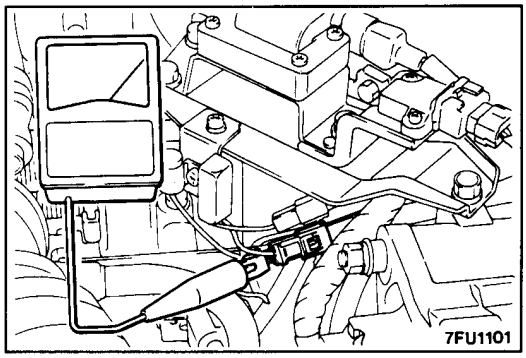
IGNITION TIMING INSPECTION AND ADJUSTMENT <SOHC–12 VALVE> E11FUBD

(1) Perform inspection and adjustment with the vehicle in the following condition.
- Engine coolant temperature: 80–95°C (176–203°F)
- Lights and all accessories: OFF
- Transmission: Neutral (P range for vehicles with an automatic transmission)
- Steering wheel: Straight forward position



(2) Insert a paper clip into the 1-pin connector between the primary side of the ignition coil and the noise filter. The connector should not be disconnected.

Caution
Insert the paper clip along the terminal from the opposite side to the locking pawl of the female connector, as shown in the illustration.



(3) Connect a primary voltage detection-type speedometer to the paper clip.

NOTE
Do not use the multi-use tester (MUT) or MUT-II. When the multi-use tester or MUT-II is connected to the diagnosis connector, the ignition timing will be unchanged, instead of reverting to the standard ignition timing.

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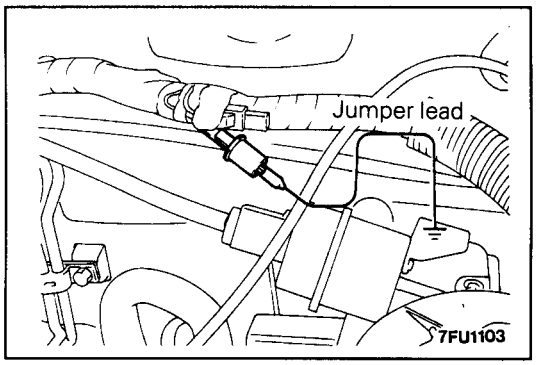
(4) Start the engine and run it at idle speed.
(5) Check that the idle speed is at the standard value.

Standard value: 700±100 r/min

(6) Turn the ignition switch to "OFF".
(7) Install the timing light.
(8) Remove the waterproof female connector from the ignition timing adjustment connector (brown).

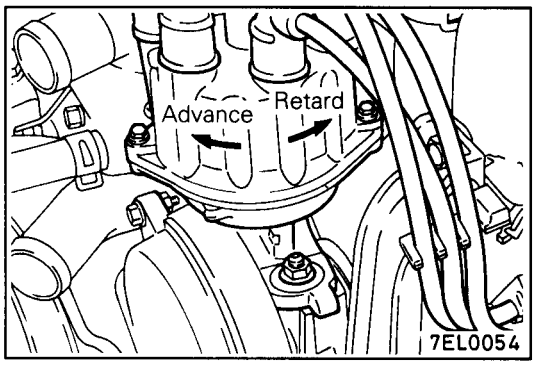


(9) Use a jumper lead to earth the ignition timing adjustment terminal.

NOTE
Earthing the ignition timing adjustment terminal will change the ignition timing to standard.

(10) Start the engine and run it at idle speed.
(11) Inspect the standard ignition timing.

Standard value: 5°BTDC±2°



(12) If the timing is outside the standard value, adjust by turning the distributor.

NOTE
The ignition timing will be advanced if the distributor is turned in a clockwise direction, and retarded if it is turned in an anti-clockwise direction.

(13) After adjusting the ignition timing, tighten the mounting nut, being careful not to move the distributor.
(14) Stop the engine, remove the jumper lead from the ignition timing adjustment connector (brown), and return the connector to its original condition.
(15) Start the engine and check that ignition timing is at the standard value.

Standard value: Approx. 15°BTDC

NOTE
1. Ignition timing is variable within about ±7°, even under normal operating.
2. And it is automatically further advanced by about 5° from 10°BTDC at higher altitudes.

(16) Sealing tape is to be attached to the fitting nut only for vehicles for Switzerland.

NOTE
Sealing tape has been attached at the factory for all other vehicles.

IGNITION TIMING INSPECTION<SOHC–24 VALVE>

For the inspection procedures, refer to P.11-73.

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IDLE SPEED INSPECTION

E11FXCU

<SOHC–12 VALVE>

Refer to P.11-8-2.

Curb idle speed: 700±100 r/min.

<SOHC–24 VALVE>

Refer to P.11-74.

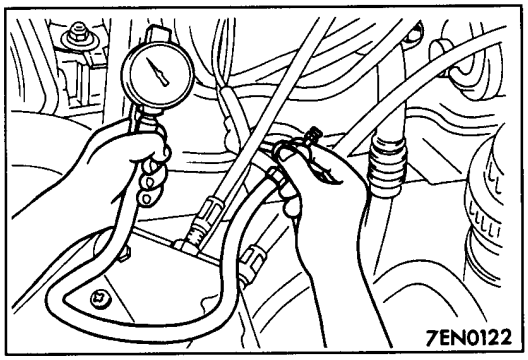
IDLE MIXTURE INSPECTION

<SOHC–12 VALVE>

Refer to P.11-9.

<SOHC–24 VALVE>

Refer to P.11-74.



COMPRESSION PRESSURE INSPECTION

<SOHC–12 VALVE>

Refer to P.11-10.

Standard value:
Compression pressure 1180 kPa (12.0 kg/cm^2, 171 psi)

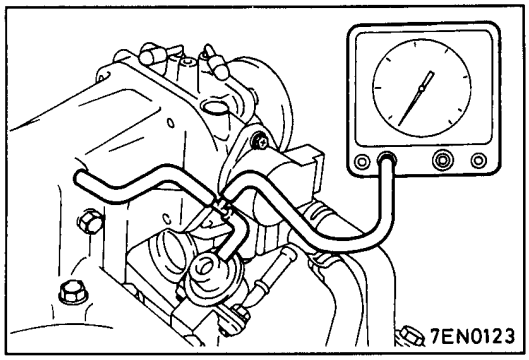
Limit:
Compression pressure min. 870 kPa (8.9 kg/cm^2, 127 psi)
Compression pressure difference between each cylinder max. 98 kPa (1.0 kg/cm^2, 14 psi)

<SOHC–24 VALVE>

Refer to P.11-75.

Standard value:
Compression pressure 1180 kPa (12.0 kg/cm^2, 171 psi)

Limit:
Compression pressure min. 870 kPa (8.9 kg/cm^2, 127 psi)
Compression pressure difference between each cylinder max. 98 kPa (1.0 kg/cm^2, 14 psi)



MANIFOLD VACUUM INSPECTION

Refer to P.11-11.

Standard value: 69 kPa (520 mmHg, 20 in.Hg)

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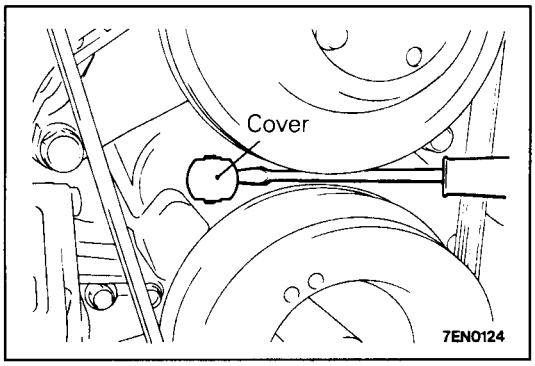
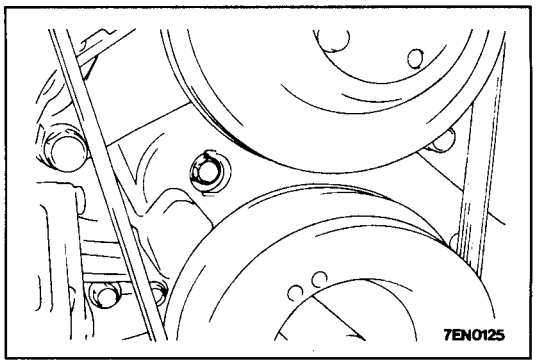


TIMING BELT TENSION ADJUSTMENT <SOHC–12 VALVE>

E11FFDF

(1) Turn the crankshaft so that the No. 1 cylinder is at top dead centre on compression stroke.
(2) Remove the cover from access hole of belt cover.

NOTE
Work will be made easier, if the air conditioning compressor belt is removed.



(3) Loosen the timing belt tensioner mounting bolt 1 or 2 turns.
(4) Turn the crankshaft two turns clockwise.
(5) Tighten the timing belt tensioner mounting bolt to the specified torque.

Tightening torque: 26 Nm (2.6 kgm, 19 ft.lbs.)

(6) Attach the cover to the access hole.

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NOTES

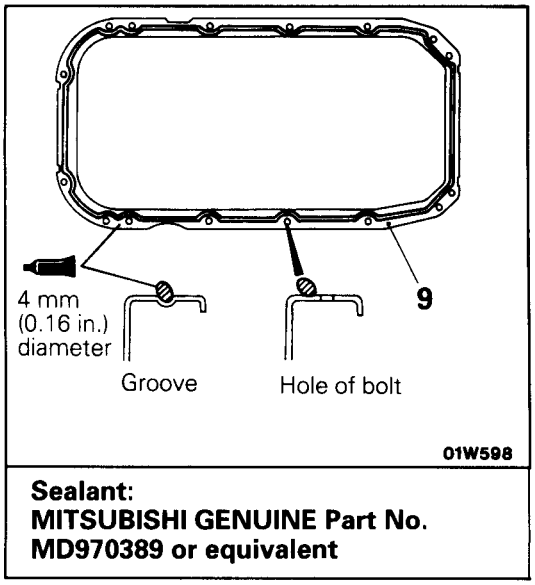
OIL PAN AND OIL SCREEN <SOHC–12 VALVE>

E11KA-B

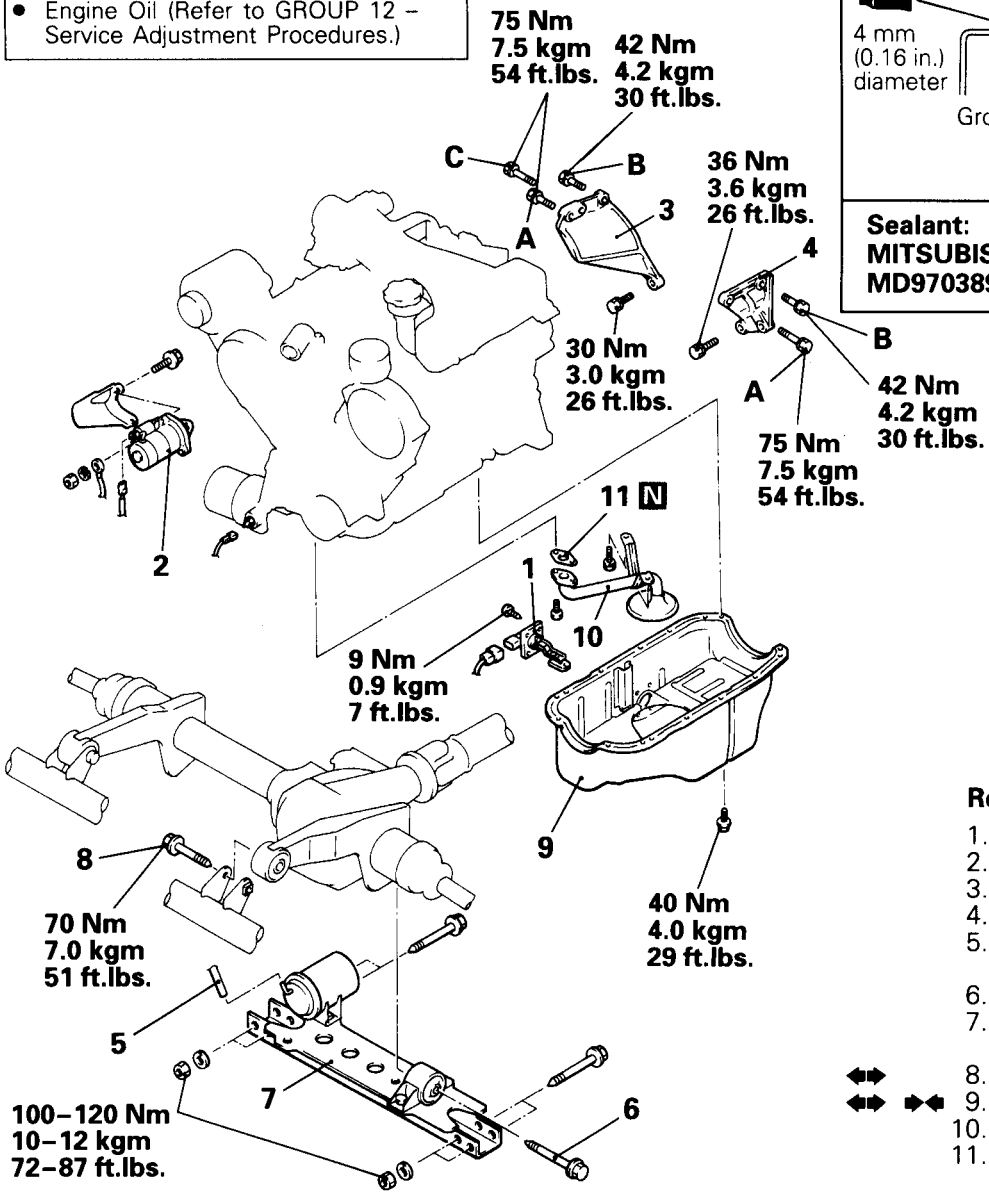
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
Removal and Installation
- Under Skid Plate, Undercover, Air-guide Plate
- Front Exhaust Pipe (Refer to GROUP 15 – Exhaust Pipe and Mufflers.)

Draining and Supplying
- Engine Oil (Refer to GROUP 12 – Service Adjustment Procedures.)

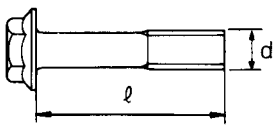


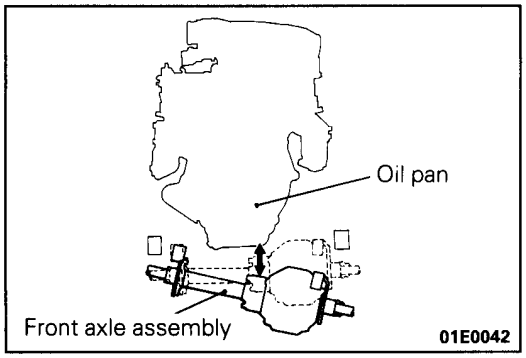
Sealant:
MITSUBISHI GENUINE Part No. MD970389 or equivalent



01E0024

Removal steps
1. Oil level sensor
2. Starter
3. Transmission stay (R.H.)
4. Transmission stay (L.H.)
5. Vacuum hose <Super select 4WD>
6. Bolt
7. Front suspension crossmember
8. Bolt
9. Oil pan
10. Oil screen
11. Oil screen gasket

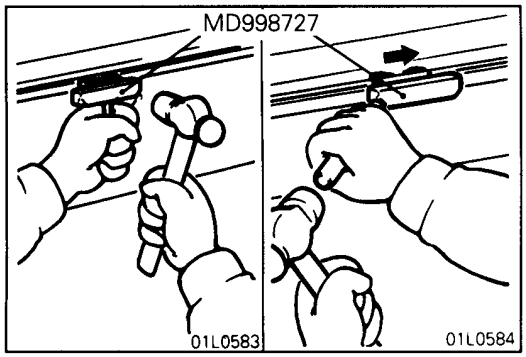
Symbol	d × ℓ mm (in.)	NOTE
A	12 × 35 (0.47 × 1.37)	 04U0025
B	10 × 30 (0.39 × 1.18)	
C	12 × 50 (0.47 × 1.96)	



SERVICE POINTS OF REMOVAL E11KBBK

8. REMOVAL OF BOLT

After removing the mounting bolt, lower the front axle assembly as far as possible and so that there is enough space to remove the oil pan.



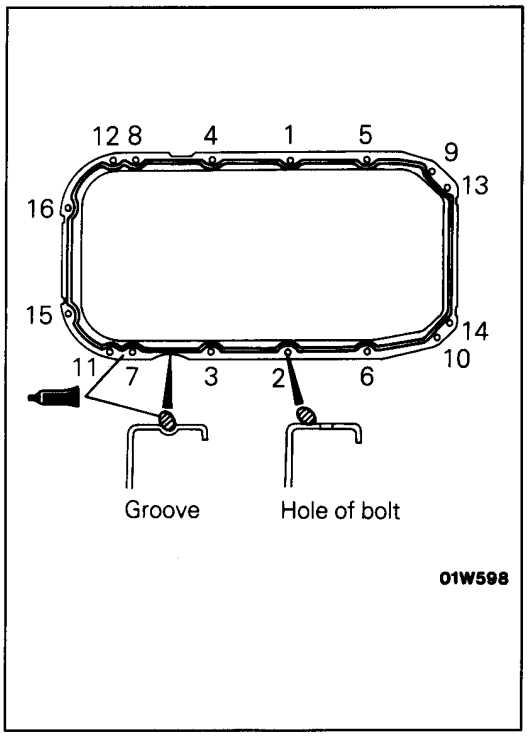
9. REMOVAL OF OIL PAN

(1) Remove oil pan bolts.
(2) Tap the special tool in between the oil pan and cylinder block.
(3) Slide the special tool by tapping it at an angle to remove the oil pan.

Caution
The use of a screwdriver or chisel in place of the special tool can damage the gasket seat surface and cause oil leakage.

INSPECTION E11KEAB2

- Check oil pan for cracks.
- Check oil pan sealant-coated surface for damage and deformation.
- Check oil screen for cracked, clogged or damaged wire net and pipe.



SERVICE POINTS OF INSTALLATION E11KDBK

9. INSTALLATION OF OIL PAN

(1) Remove sealant from oil pan and cylinder block mating surfaces.
(2) Degrease the sealant-coated surface and the engine mating surface.
(3) Apply the specified sealant around the gasket surface of oil pan as specified in illustration.

Specified sealant: MITSUBISHI GENUINE PART No. MD970389 or equivalent

NOTE
The sealant should be applied in a continuous bead approximately 4 mm (0.16 in.) in diameter.

(4) Assemble oil pan to cylinder block within 15 minutes after applying the sealant.

Caution
1. **Tighten the oil pan mounting bolt in the order illustrated.**
2. **After installing the oil pan, wait at least 30 minutes before starting the engine.**

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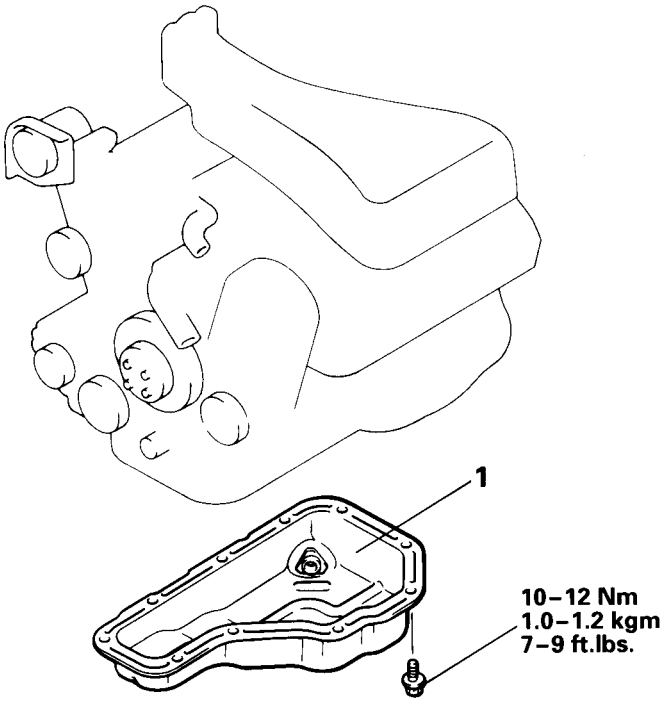
OIL PAN AND OIL SCREEN <SOHC–24 VALVE>

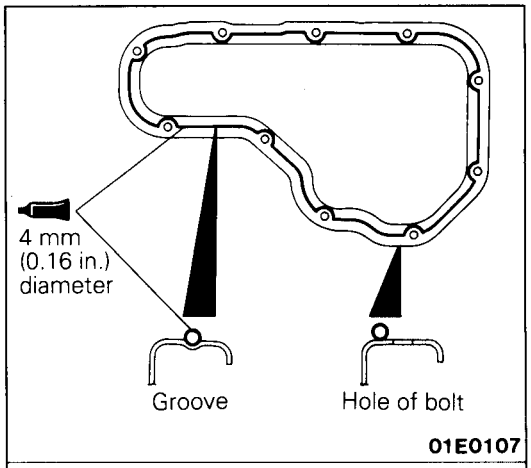
OIL PAN, LOWER
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
Removal and Installation
- Under Skid Plate, Undercover, Air-guide Plate
- Front Exhaust Pipe (Refer to GROUP 15 – Exhaust Pipe, Mufflers.)

Draining and Supplying
- Engine Oil (Refer to GROUP 12 – Service Adjustment Procedures.)



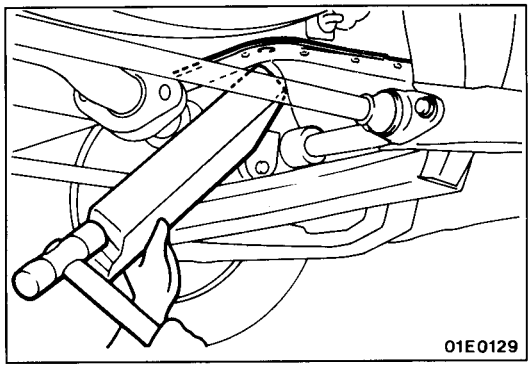
01E0152



01E0107

Sealant:
MITSUBISHI GENUINE Part No. MD970389 or equivalent

◆◆ ◆◆ 1. Oil pan, lower



01E0129

SERVICE POINT OF REMOVAL

1. REMOVAL OF OIL PAN, LOWER

(1) Remove the lower oil pan installation bolt.
(2) Place a wooden block to the oil pan, lower as shown in the figure and remove by tapping with a hammer.

Caution
The use of an oil pan remover (MD998727) can damage the oil pan, upper (aluminum made).

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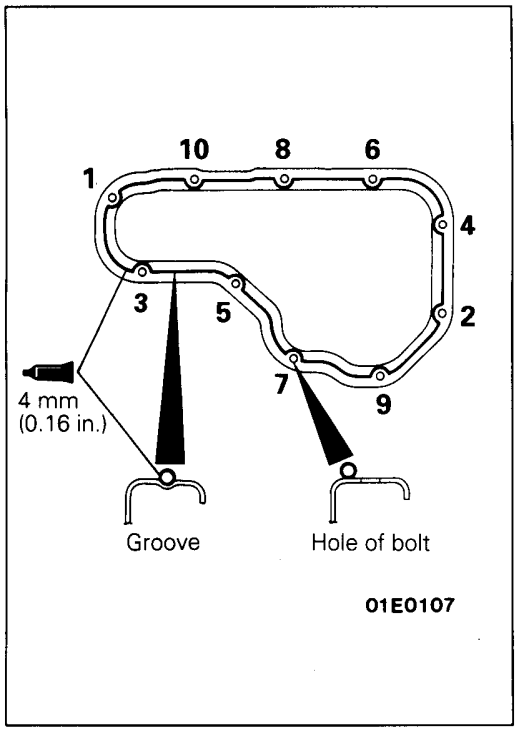
INSPECTION

- Check oil pan for cracks.
- Check oil pan sealant-coated surface for damage and deformation.



SERVICE POINT OF INSTALLATION

1. INSTALLATION OF OIL PAN, LOWER

(1) Remove sealant from oil pan and cylinder block mating surfaces.
(2) Degrease the sealant-coated surface and the engine mating surface.
(3) Apply the specified sealant around the gasket surface of oil pan as specified in illustration.

Specified sealant: MITSUBISHI GENUINE PART No. MD970389 or equivalent

NOTE
The sealant should be applied in a continuous bead approximately 4 mm (0.16 in.) in diameter.

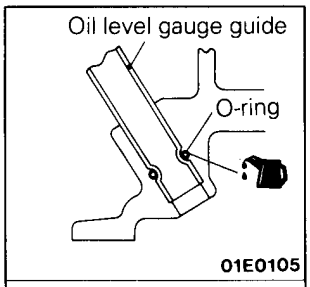
(4) Assemble oil pan to cylinder block within 15 minutes after applying the sealant.
(5) Tighten the oil pan mounting bolt in the order illustrated.

Caution
After installing the oil pan, wait at least 30 minutes before starting the engine.

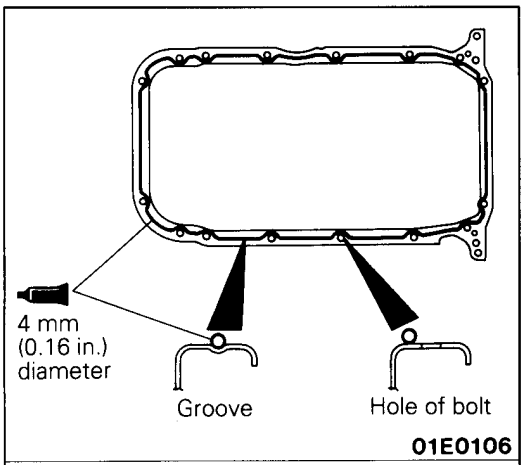
OIL PAN, UPPER AND OIL SCREEN

REMOVAL AND INSTALLATION

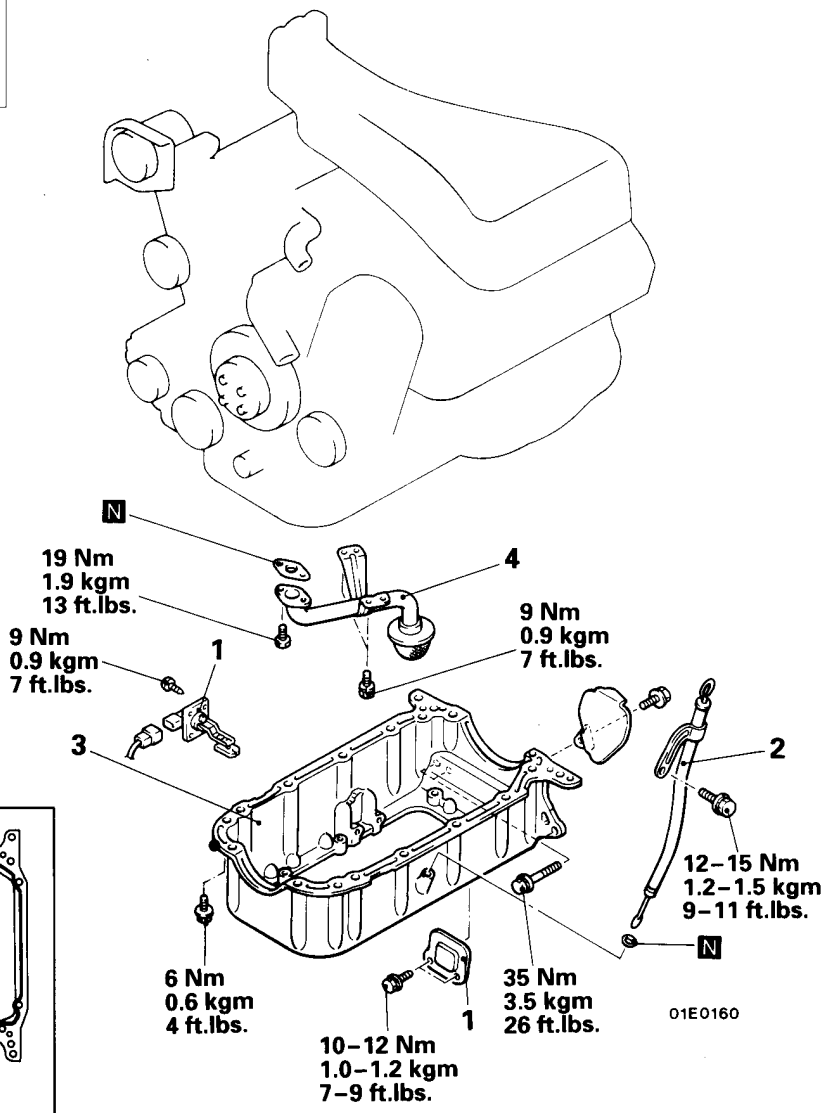
Pre-removal and Post-installation Operation
Removal and Installation
- Oil pan, Lower (Refer to P.11-35-1)
- Front Differential Carrier (Refer to GROUP 26 – Differential Carrier)



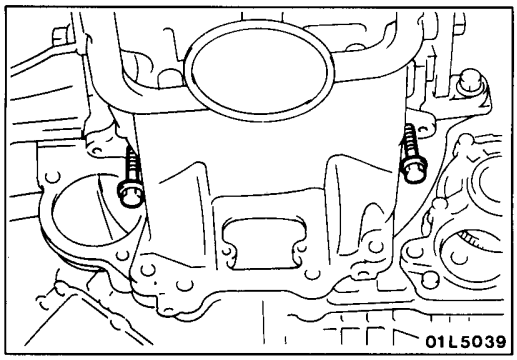
Engine oil



Sealant:
MITSUBISHI GENUINE Part No.
MD970389 or equivalent



Removal steps
1. Oil level sensor
2. Cover
3. Oil level gauge guide
4. Oil pan, upper
5. Oil screen



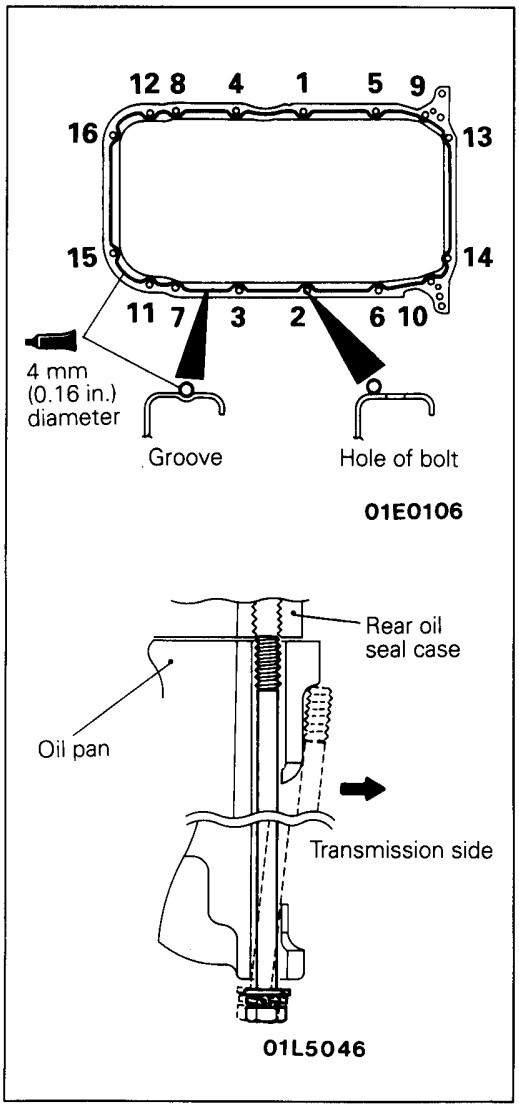
SERVICE POINT OF REMOVAL

4. REMOVAL OF OIL PAN, UPPER

Install a bolt [diameter x length: 10 x 38 mm (0.39 x 1.50 in.)] to link the oil pan, upper with the transmission in the hole of the oil pan, upper as shown in the illustration, and then tighten the bolt to remove the oil pan, upper.

INSPECTION

- Check the oil pan for cracks.
- Check the sealant-coated surface of the oil pan for damage and deformation.
- Check the oil screen for cracked, clogged or damaged wire net and pipe.



SERVICE POINT OF INSTALLATION

4. INSTALLATION OF OIL PAN, UPPER

(1) Remove the sealant from the oil pan and cylinder block mating surfaces.
(2) Degrease the sealant-coated surface and the engine mating surface.
(3) Apply specified sealant around the gasket surface of the oil pan as shown in the illustration.

Specified sealant: MITSUBISHI GENUINE PART No. MD970389 or equivalent

NOTE
The sealant should be applied in a continuous bead approximately 4 mm (0.16 in.) in diameter.

(4) Install the oil pan to the cylinder block within 15 minutes after applying the sealant.
(5) Tighten the oil pan mounting bolts in the order shown in the illustration at left.

Caution
The bolt holes for bolts 13 and 14 in the illustration are cut away on the transmission side, so be careful not to insert these bolts at an angle.

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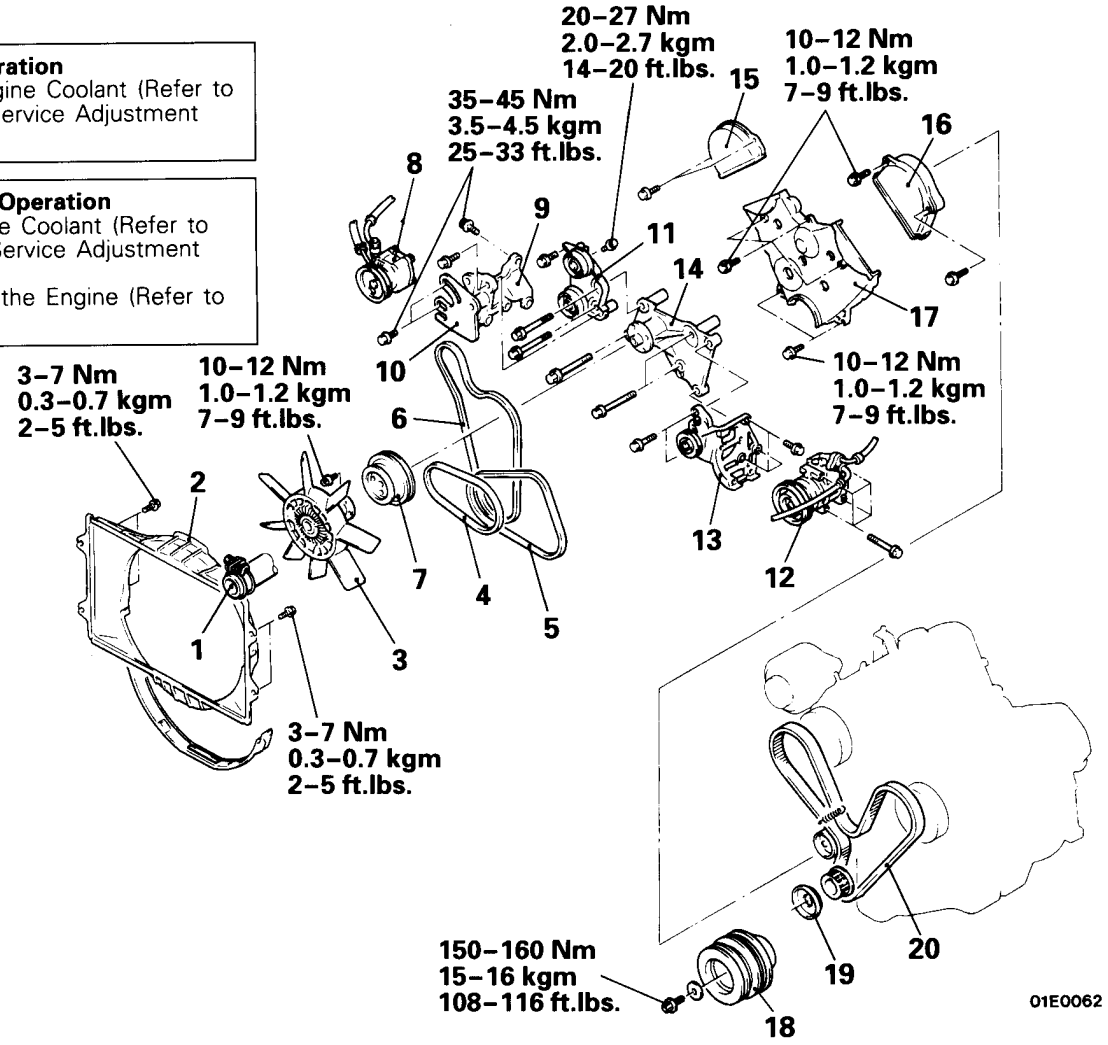
TIMING BELT <SOHC–12 VALVE>

E11GA-B

REMOVAL AND INSTALLATION

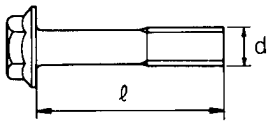
Pre-removal Operation
- Draining of Engine Coolant (Refer to GROUP 14 – Service Adjustment Procedures.)

Post-installation Operation
- Filling of Engine Coolant (Refer to GROUP 14 – Service Adjustment Procedures.)
- Adjustment of the Engine (Refer to P.11-30.)



Removal steps

1. Radiator upper hose connection
2. Radiator shroud
3. Cooling fan clutch assembly
   - Adjustment of drive belt tension (Refer to P.11-30.)
4. Drive belt (Power steering)
5. Drive belt <A/C>
6. Drive belt (Alternator, Cooling fan)
7. Cooling fan pulley
8. Power steering oil pump
9. Oil pump bracket
10. Oil pump mounting bracket
11. Tension pulley bracket
12. Compressor } <A/C>
13. Compressor bracket }
14. Cooling fan bracket assembly
15. Timing belt cover outer (A)
16. Timing belt cover outer (B)
17. Timing belt cover outer (C)
18. Crankshaft pulley
19. Front flange
20. Timing belt

Symbol	Hardness category	d × ℓ mm (in.)	Torque Nm (kgm, ft.lbs.)	Note
A	7T	10 × 85 (0.39 × 3.34)	42 (4.2, 30)	 04U0025
B		10 × 95 (0.39 × 3.74)		
C		12 × 100 (0.47 × 3.93)	75 (7.5, 54)	
D		8 × 20 (0.31 × 0.79)	16 (1.6, 12)	
E	4T	6 × 20 (0.24 × 0.79)	10–20 (1.0–1.2, 7–9)	
F		6 × 55 (0.24 × 2.17)		
G		6 × 60 (0.24 × 2.36)		

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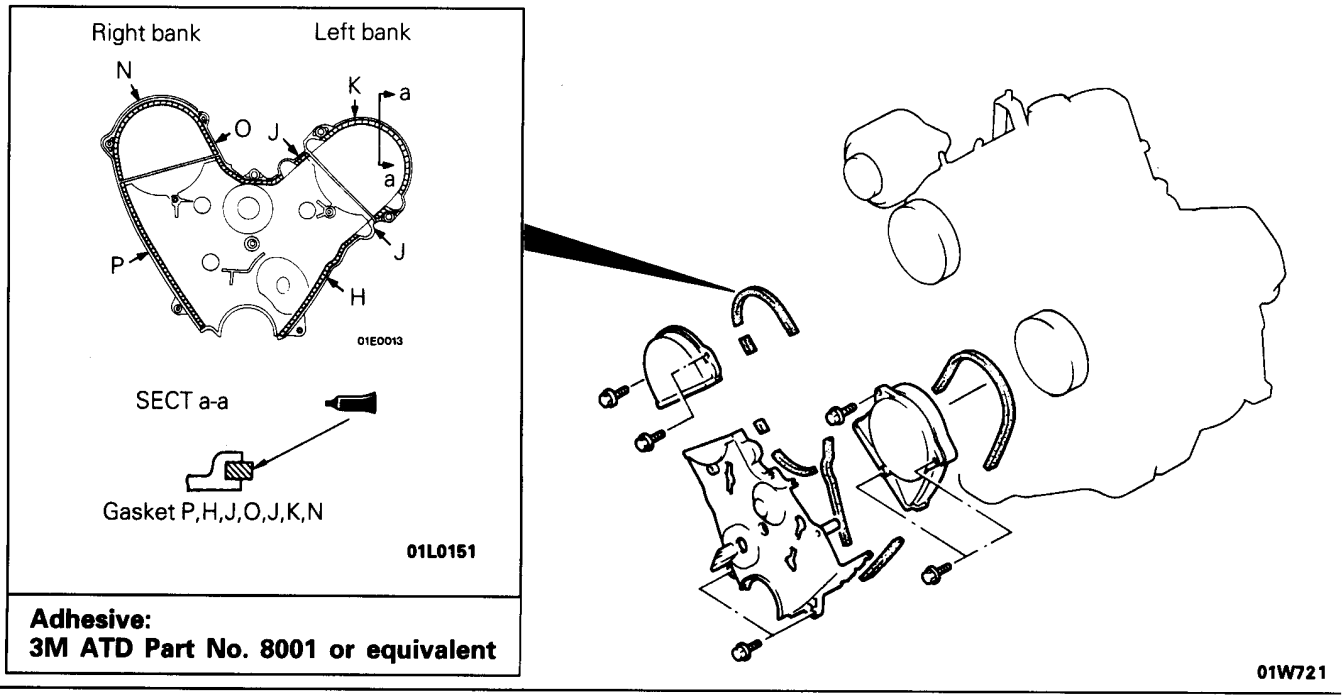
ADHESIVE POINTS



SERVICE POINTS OF REMOVAL E11GBFE

8. REMOVAL OF POWER STEERING OIL PUMP

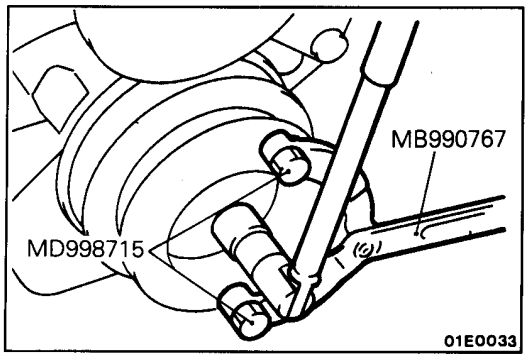
Remove the power steering oil pump from the bracket, and hold toward the body using wire or similar materials.

NOTE
Move the power steering oil pump with the pressure hose and return hose still attached.

12. REMOVAL OF COMPRESSOR <AIR CONDITIONER>

Remove the compressor from the bracket, and hold toward the body using wire or similar materials.

NOTE
Move the compressor with the high pressure hose and low pressure hose still attached.



18. REMOVAL OF CRANKSHAFT PULLEY

Using the special tool, remove the crankshaft pulley from the crankshaft.

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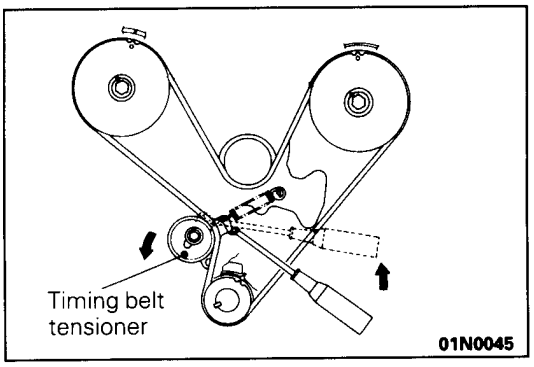
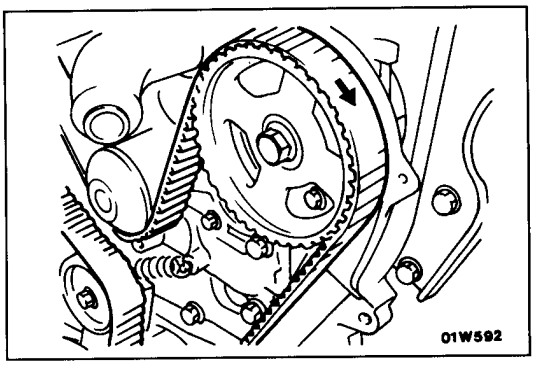


20. REMOVAL OF TIMING BELT

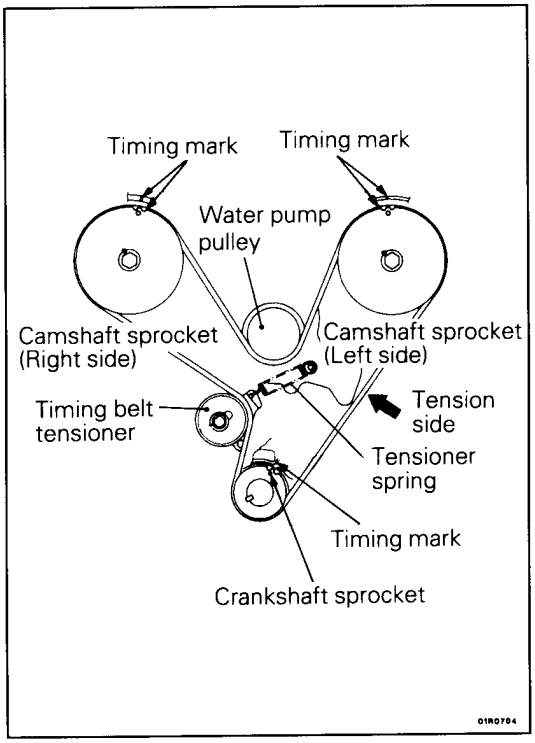
(1) Loosen the timing belt tensioner bolt and turn the timing belt tensioner anticlockwise along the elongated hole.



(2) When the timing belt is to be reused, in order to allow reinstallation of the belt so that it travels in the same direction as before it was removed, mark the direction of travel with an arrow before removing it.

Caution

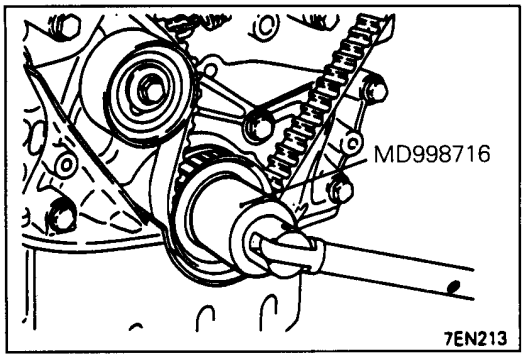
1. **As water or oil on the belt can seriously reduce its usable life, ensure that the timing belt, sprocket, and tensioner stay clean and dry while removed, and never wash them. Parts that have become too dirty should be replaced.**
2. **When any of the parts are oily, check to see whether there are any oil leaks in any of the oil seals or the camshaft oil seal on the front of the engine.**



SERVICE POINTS OF INSTALLATION E11GDFE

20. INSTALLATION OF TIMING BELT

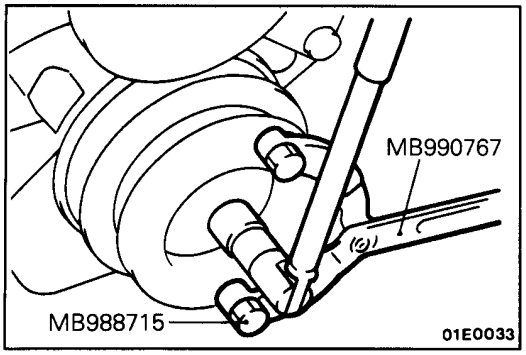
(1) Align the timing marks of the camshaft sprockets (on the right and left sides) and the crankshaft sprocket. (At the top dead point of the No. 1 cylinder compression stroke.)
(2) First, route the timing belt on the crankshaft sprocket, then on the camshaft sprocket on the side without slackness in the tight side.
(3) Next, run the timing belt onto the water pump pulley, the camshaft sprocket on the left side, and the timing belt tensioner.
(4) Apply force anticlockwise to the camshaft sprocket on the right side. When the tight side of the belt is fault, check that the timing marks are all aligned.



(5) Attach the flange.
(6) Back off the fixing bolts of the temporarily tightened tensioner one or two turns and tighten the timing belt with the tensioner spring force.
(7) Using the special tool, turn the crankshaft two turns in the normal rotating direction (clockwise).

NOTE
Turn smoothly, but not in the opposite direction (anticlockwise).

(8) Re-align the sprockets timing marks and tighten the tensioner fixing bolts.



18. INSTALLATION OF CRANKSHAFT PULLEY

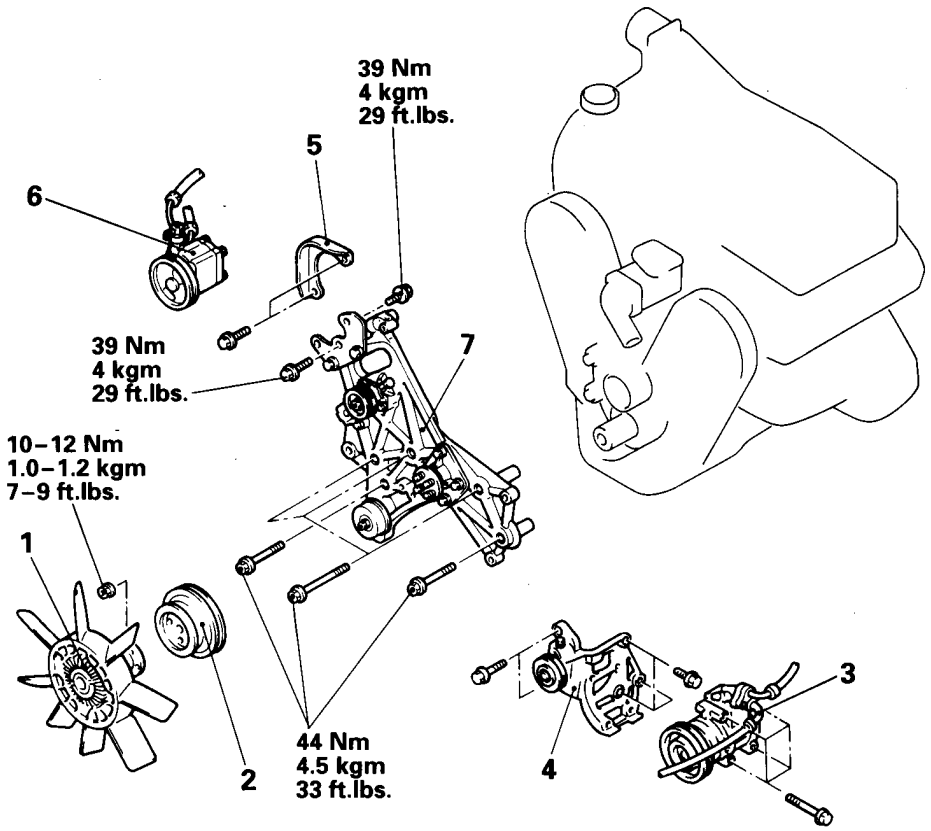
Using the special tool, attach the crankshaft pulley to the crankshaft.

TIMING BELT <SOHC–24 VALVE>

REMOVAL AND INSTALLATION

Pre-removal Operation
- Removal of Radiator (Refer to GROUP 14 – Radiator.)
- Removal of Alternator (Refer to GROUP 16 – Alternator.)

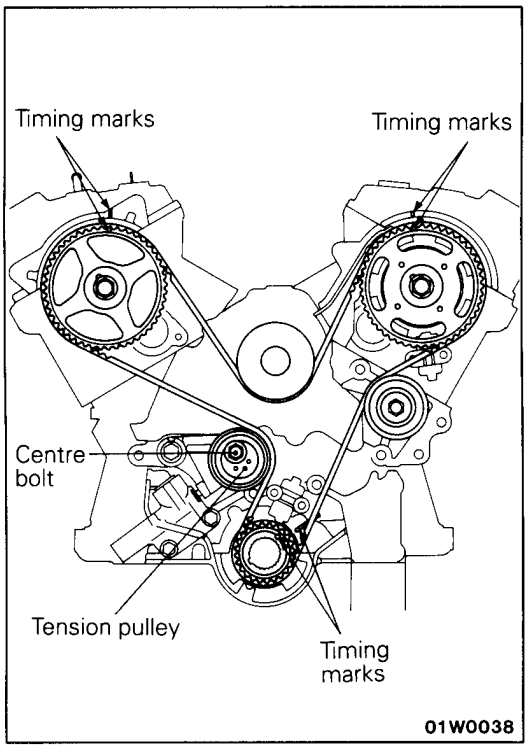
Post-installation Operation
- Installation of Alternator (Refer to GROUP 16 – Alternator.)
- Installation of Radiator (Refer to GROUP 14 – Radiator.)
- Adjustment of Engine (Refer to P.11-30.)



01W0074

Removal steps

1. Cooling fan clutch assembly
2. Water pump pulley
3. Compressor <A/C>
4. Compressor bracket <A/C>
5. Cover
6. Power steering oil pump
7. Accessory mount

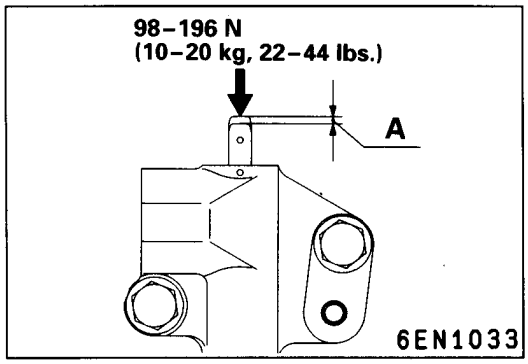


11. REMOVAL OF TIMING BELT

(1) Align the timing marks.
(2) Loosen the centre bolt on the tension pulley to remove the timing belt.

Caution
Make a mark on the back of the timing belt indicating the direction of rotation so it may be reassembled in the same direction if it is to be reused.

(3) When the timing belt is to be reused, in order to allow re-installation of the belt so that it travels in the same direction as before it was removed, mark the direction of travel with an arrow before removing it.



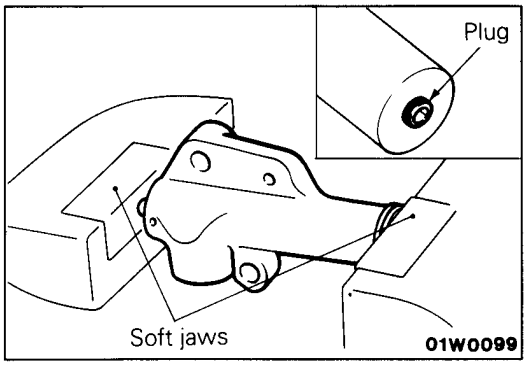
INSPECTION

AUTO TENSIONER

(1) Hold the auto-tensioner by hand. Then measure contraction (A) when pressing the tip of the rod on a steel (cylinder block, etc.) with a force of 98–196 N (10–20 kg, 22–44 lbs.).

Standard value (A):1 mm (0.04 in.) or less

(2) If not within the standard value, replace the auto-tensioner.

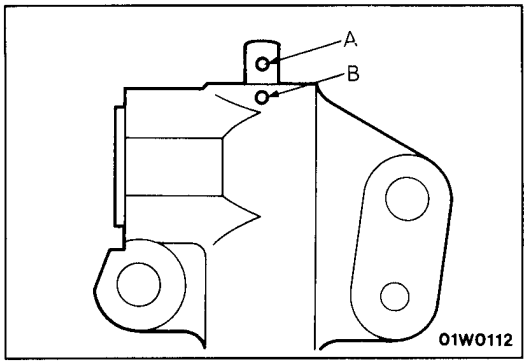


SERVICE POINTS OF INSTALLATION

12. INSTALLATION OF AUTO TENSIONER

(1) If the auto tensioner rod is in its fully extended position, reset it as follows.
  1) Keep the auto tensioner level and, in that position, clamp it in the vice with soft jaws.
  2) Push in the rod little by little with the vice until the set hole A in the rod is aligned with that B in the cylinder.

Caution
1. The auto tensioner must be placed at a right angle to the pressing surface of press or vice.
2. Push in the rod slowly to prevent the push rod from being damaged.



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3) Insert a wire [1.4 mm (0.055 in.) in diameter] into the set holes.

NOTE
The wire should be as stiff as possible (such as piano wire, etc.), and should be bent into the shape of an "L"

4) Unclamp the auto tensioner from the vice.

(2) Install the auto tensioner.

Caution
Leave the wire installed in the auto tensioner.

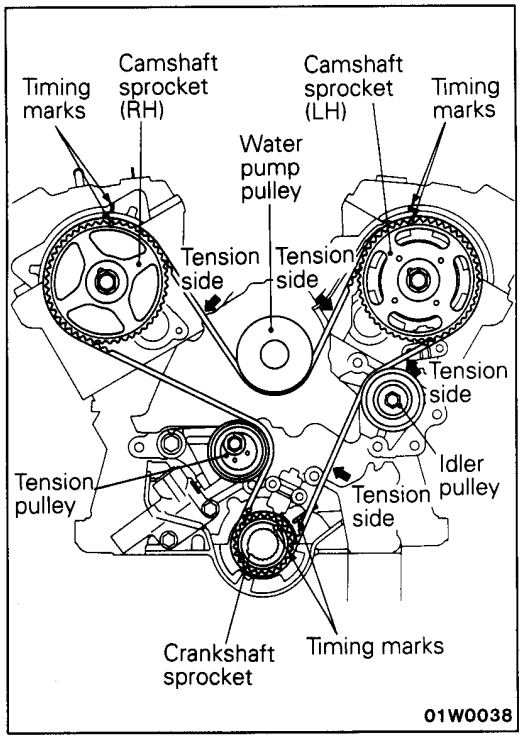
11. INSTALLATION OF TIMING BELT

(1) Align the crankshaft sprocket and camshaft sprocket timing marks.

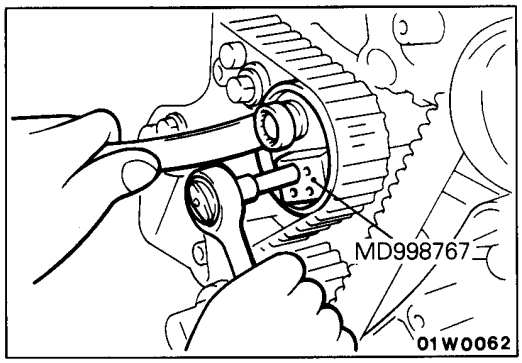
(2) Install the timing belt by the following steps so that the belt is not loosened between the sprockets and pulleys.
1. Crankshaft sprocket
2. Idler pulley
3. Camshaft sprocket (LH)
4. Water pump pulley
5. Camshaft sprocket (RH)
6. Tension pulley

Caution
Be careful not to pinch your finger, as the camshaft sprocket (RH) is turned easily by spring force.

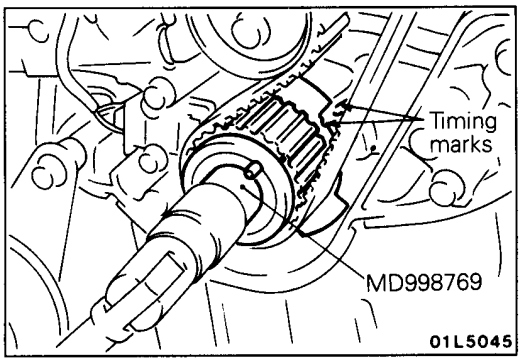
(3) Apply a anticlockwise force to the camshaft sprocket (RH) and recheck that the timing marks are aligned with the timing belt tight.



(4) Press the tension pulley onto the timing belt with the special tool and temporarily tighten the centre bolt.



(5) Turn the crankshaft a 1/4 turn anti-clockwise with the special tool and align the timing mark by turning the crankshaft clockwise.



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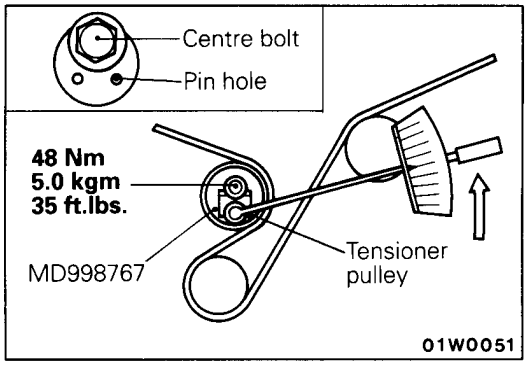
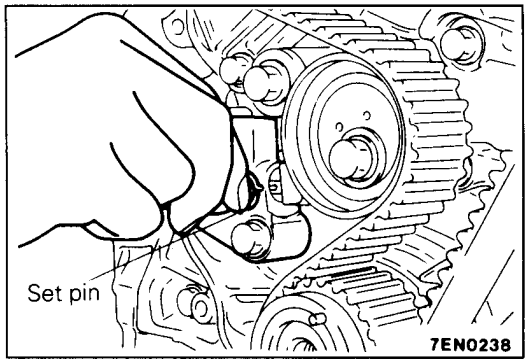
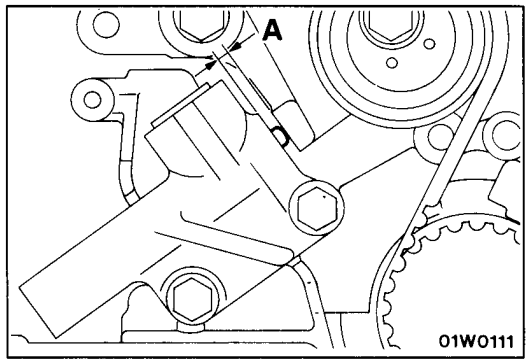


(6) Loosen the centre bolt on the tensioner pulley. Using the special tool and torque wrench, apply tensioning torque to the timing belt and, at the same time, tighten the centre bolt to specification.

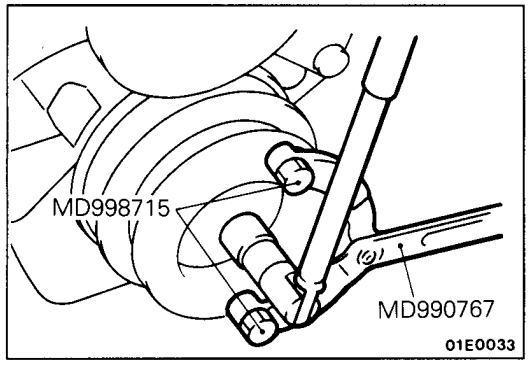
Reference value: 4.4 Nm (0.45 kgm, 3.3 ft.lbs.) (Timing belt tensioning torque)



(7) Remove the set pin which is inserted into the auto-tensioner.
(8) Turn the crankshaft clockwise twice to align the timing marks.



(9) Wait at least five minutes and check that the contraction of the auto-tensioner push rod is within the standard value.
Standard value (A): 3.8 to 4.5 mm (0.149 to 0.177 in.)
(10) If the protrusion is out of specification, repeat steps (5) to (9).
(11) Check again that timing marks on all sprockets are aligned properly.



9. INSTALLATION OF CRANKSHAFT PULLEY

Using the special tool, attach the crankshaft pulley to the crankshaft.

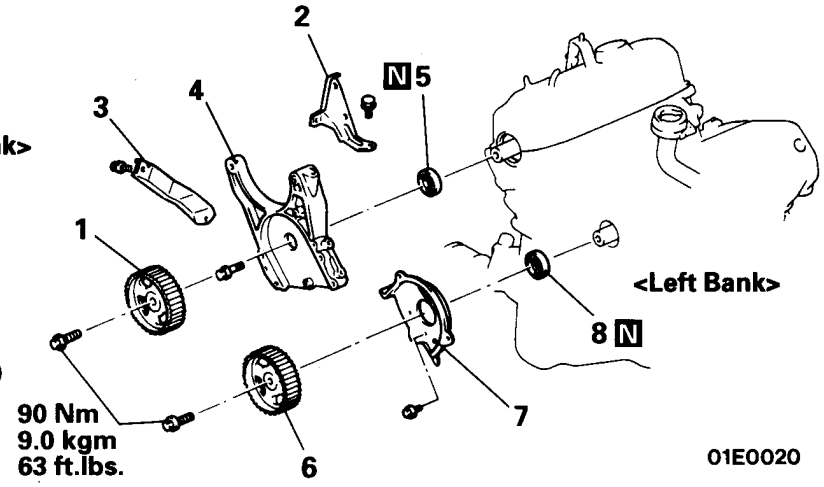
Caution
Use only the specified special tools, or the pulley damper will be damaged.

NOTES

CAMSHAFT OIL SEAL <SOHC–12 VALVE>

E11VA-B

REMOVAL AND INSTALLATION



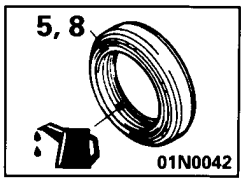
Removal steps <Right Bank>

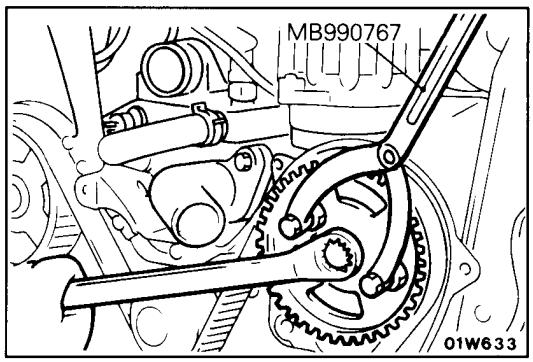
- Alternator (Refer to GROUP 16 – Alternator)
- Timing Belt (Refer to P.11-36.)

1. Camshaft sprocket
2. Cooling fan stay
3. Alternator bracket stay
4. Alternator bracket
5. Oil seal

Removal steps <Left bank>

6. Camshaft sprocket
7. Timing belt rear cover
8. Oil seal

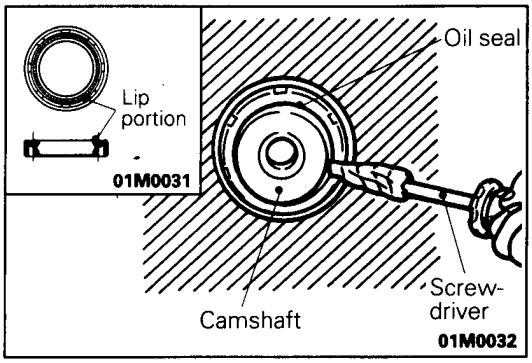




SERVICE POINTS OF REMOVAL

E11VBAP

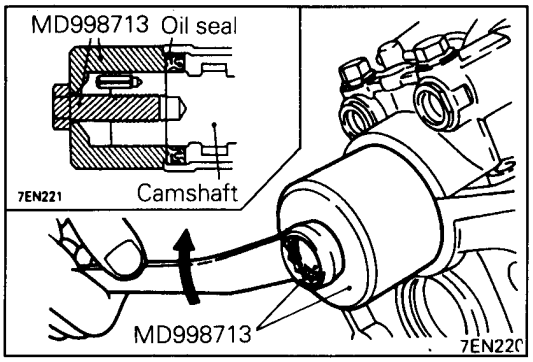
1./6. REMOVAL OF CAMSHAFT SPROCKET



5./8. REMOVAL OF OIL SEAL

(1) Cut out a portion in the camshaft oil seal lip
(2) Cover the tip of a screwdriver with a cloth and apply it to the cutout in the oil seal to pry off the oil seal.

Caution
Take care not to damage the camshaft and cylinder head.



SERVICE POINT OF INSTALLATION

E11VCAD

8./5. INSTALLATION OF OIL SEAL

(1) Apply a slight amount of engine oil all over the circumference of the camshaft oil seal lip section.
(2) Using the special tool, insert the oil seal.

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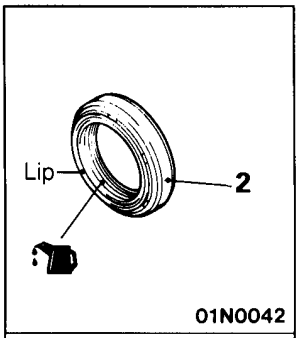
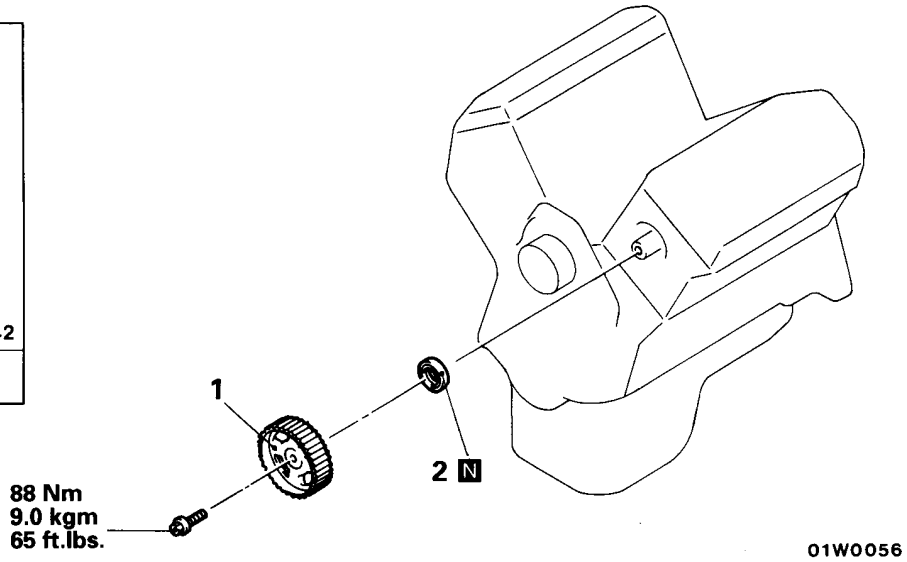
CAMSHAFT OIL SEAL <SOHC–24 VALVE>

REMOVAL AND INSTALLATION

Pre-removal and Post-installation operation
- Removal and Installation of Timing Belt (Refer to GROUP 11-39-1)

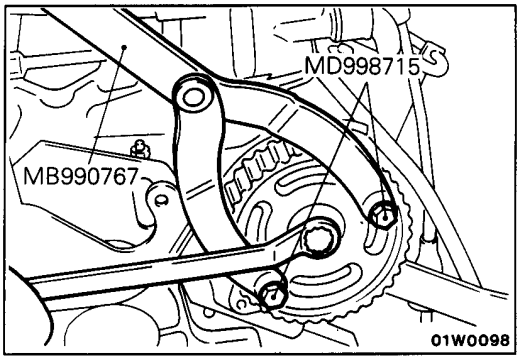


Engine oil



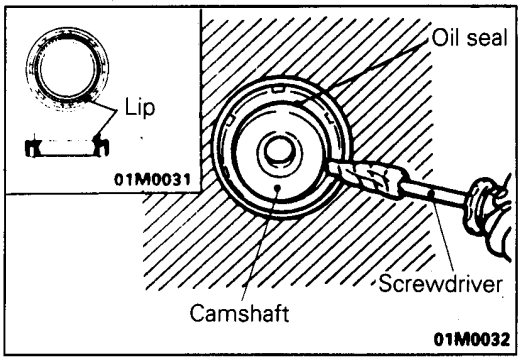
Removal steps

1. Camshaft sprocket
2. Camshaft oil seals



SERVICE POINTS OF REMOVAL

1. REMOVAL OF CAMSHAFT SPROCKET



2. REMOVAL OF CAMSHAFT OIL SEAL

(1) Cut out a portion in the camshaft oil seal lip.
(2) Cover the tip of a screwdriver with a cloth and apply it to the cutout in the oil seal to pry off the oil seal.

Caution
Use care not to damage the camshaft and cylinder head.

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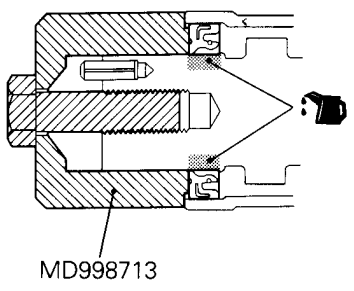
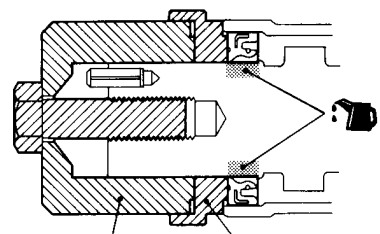
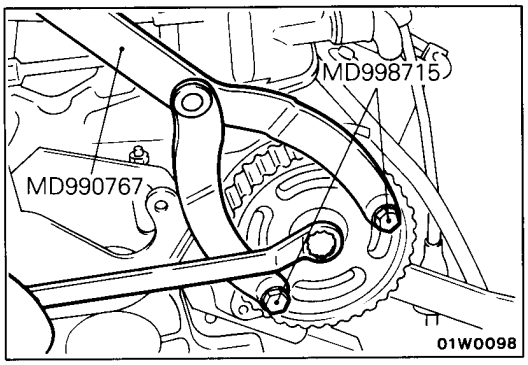
<Right bank side>



<Left bank side>





SERVICE POINTS OF INSTALLATION

2. INSTALLATION OF CAMSHAFT OIL SEAL

Coat engine oil on the whole circumference of the oil seal lip section.
Using the special tool, press-fit the oil seal.

1. INSTALLATION OF CAMSHAFT SPROCKET

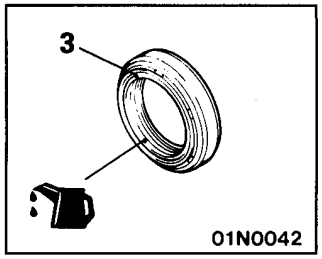
CRANKSHAFT OIL SEALS <SOHC-12 VALVE>

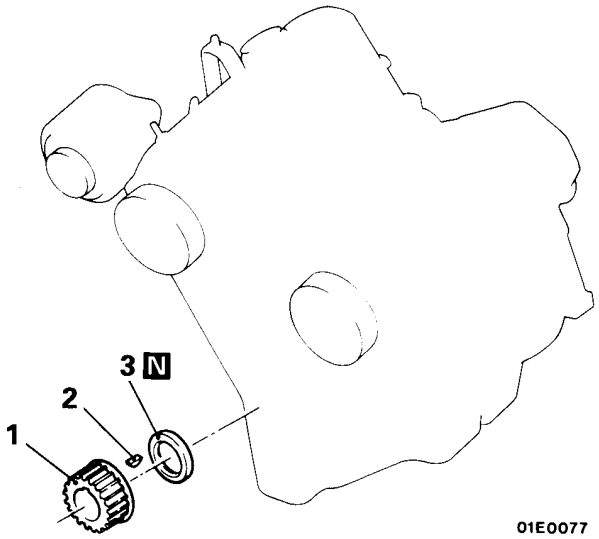
E11UA-B

FRONT OIL SEAL
REMOVAL AND INSTALLATION

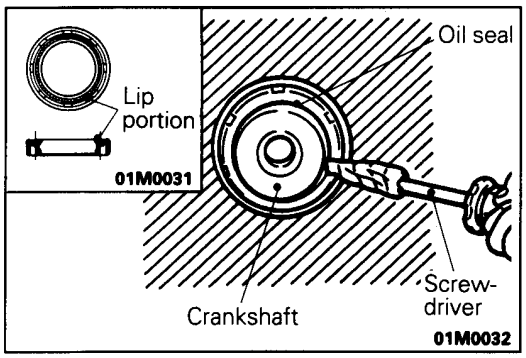
Pre-removal and Post-installation Operation
- Removal of the Timing Belt (Refer to P.11-36.)

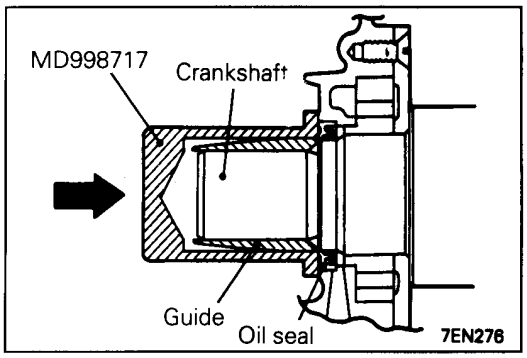
Adjustment
- Engine Adjustment (Refer to P.11-30.)





Removal steps
1. Crankshaft sprocket
2. Key
3. Oil seal





SERVICE POINTS OF REMOVAL

E11UBAD

3. REMOVAL OF OIL SEAL

(1) Cut out a portion in the crankshaft oil seal lip.
(2) Cover the tip of a screwdriver with a cloth and apply it to the cutout in the oil seal to pry off the oil seal.

Caution
Take care not to damage the crankshaft and oil pump case.

SERVICE POINTS OF INSTALLATION

E11UCAH

3. INSTALLATION OF OIL SEAL

Using the special tool, knock the oil seal into the oil pump case.

NOTE
Knock it as far as the surface.

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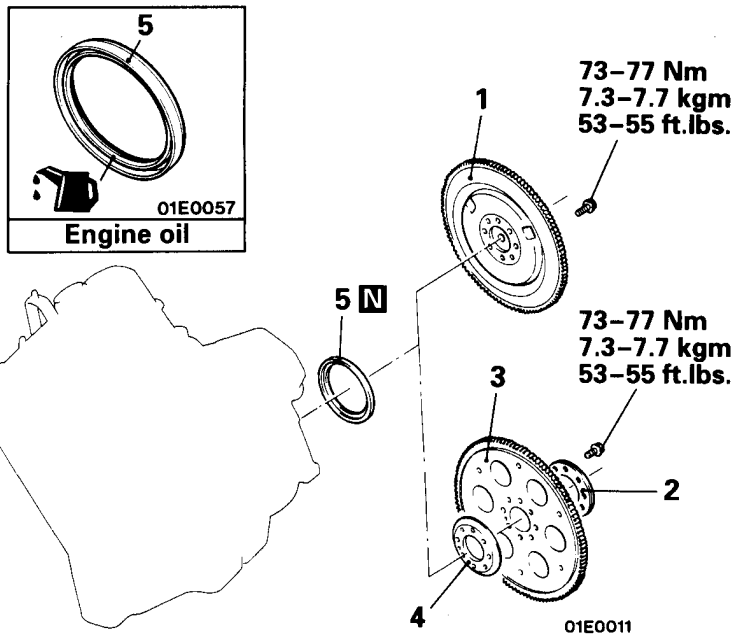
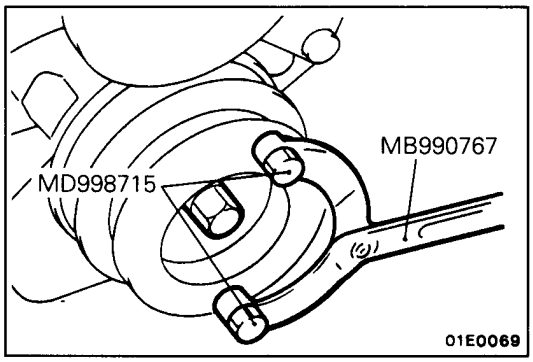
REAR OIL SEAL
REMOVAL AND INSTALLATION

E11UA-E

Pre-removal and Post-installation Operation
Removal and Installation
- Transmission (Refer to GROUP 22, 23 – Transmission and Transfer Assembly.)
- Clutch <M/T>



Removal steps
1. Flywheel assembly <M/T>
2. Adaptor plate A
3. Drive plate <A/T>
4. Adaptor plate B
5. Oil seal

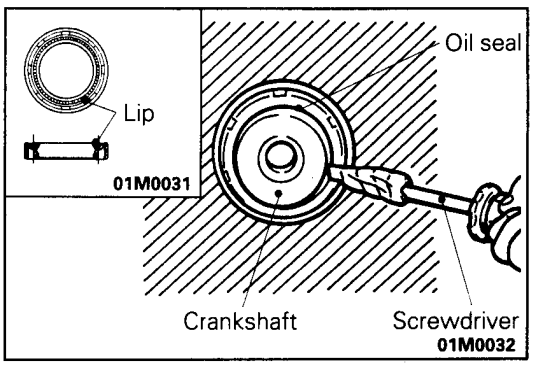


SERVICE POINTS OF REMOVAL

E11UBAE

1. REMOVAL OF FLYWHEEL ASSEMBLY <M/T>/2. ADAPTOR PLATE A <A/T>/3. DRIVE PLATE <A/T>/4. ADAPTOR PLATE B <A/T>

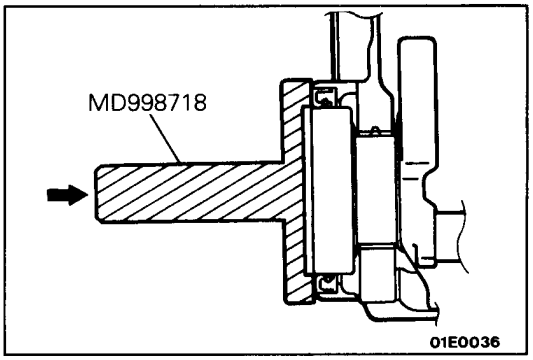
Stop the crankshaft pulley from turning with the special tool, and remove the flywheel, the adaptor plate and the drive plate.



5. REMOVAL OF OIL SEAL

(1) Cut out a portion in the crankshaft oil seal lip.
(2) Cover the tip of a screwdriver with a cloth and apply it to the cutout in the oil seal to pry off the oil seal.

Caution
Take care not to damage the crankshaft and oil seal case.



SERVICE POINTS OF INSTALLATION

E11UCAI

7. INSTALLATION OF OIL SEAL

Using the special tool, press-fit a new crankshaft rear oil seal into the oil seal case.

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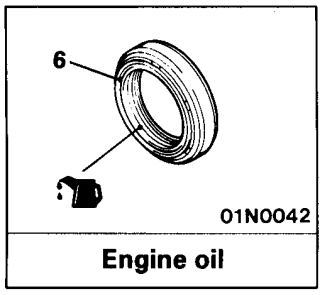
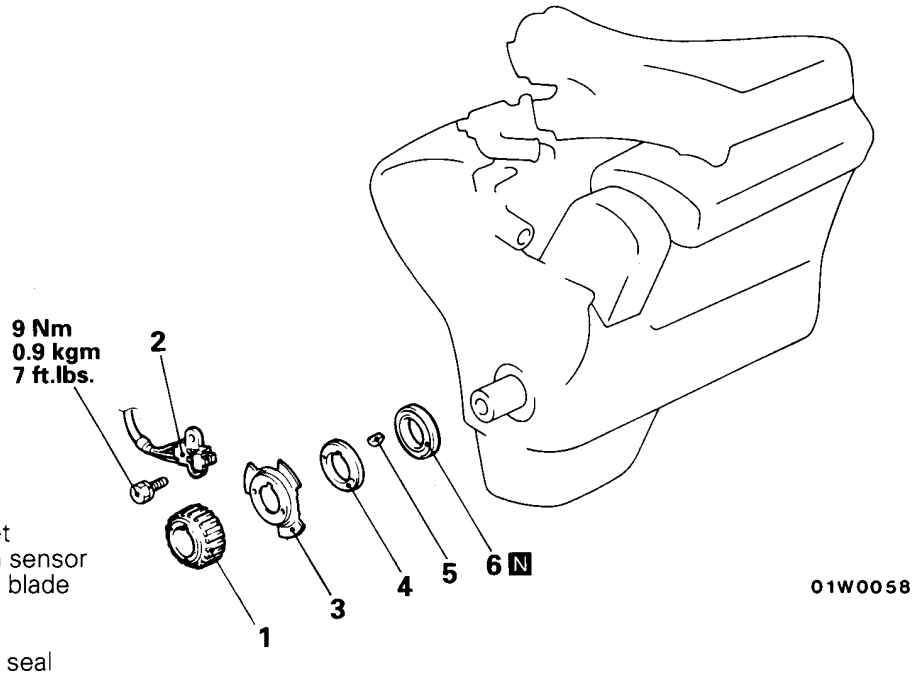
CRANKSHAFT OIL SEALS <SOHC–24 VALVE>

FRONT OIL SEAL REMOVAL AND INSTALLATION

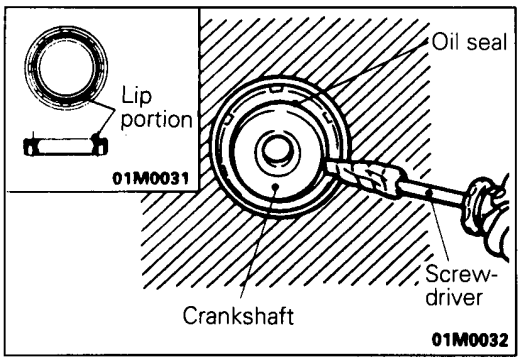
Pre-removal and Post-installation Operation
- Removal and Installation of Timing Belt (Refer to P.11-39-1)

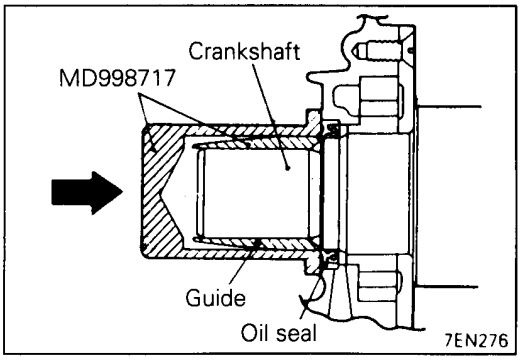
Adjustment
- Engine Adjustment (Refer to P.11-30)





Removal steps
1. Crankshaft sprocket
2. Crankshaft position sensor
3. Crankshaft sensing blade
4. Crankshaft spacer
5. Key
6. Crankshaft front oil seal





SERVICE POINT OF REMOVAL

2. REMOVAL OF OIL SEAL

(1) Cut out a portion in the crankshaft oil seal lip.
(2) Cover the tip of a screwdriver with a cloth and apply it to the cutout in the oil seal to pry off the oil seal.

Caution
Use care not to damage the crankshaft and oil pump case.

SERVICE POINT OF INSTALLATION

6. INSTALLATION OF OIL SEAL

Using the special tool, knock the oil seal into the oil pump case.

NOTE
Knock it as far as the surface.

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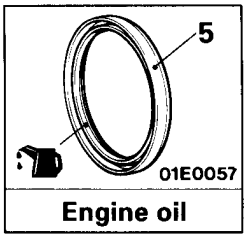
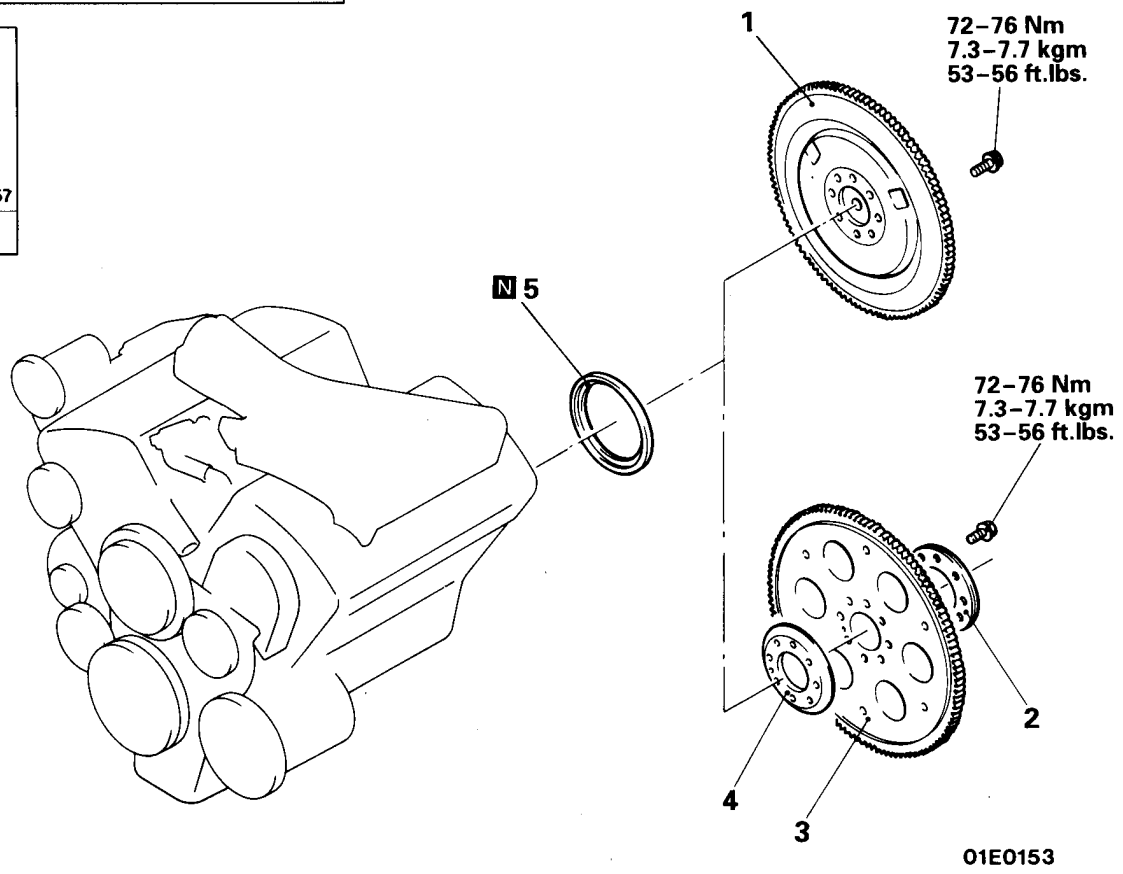
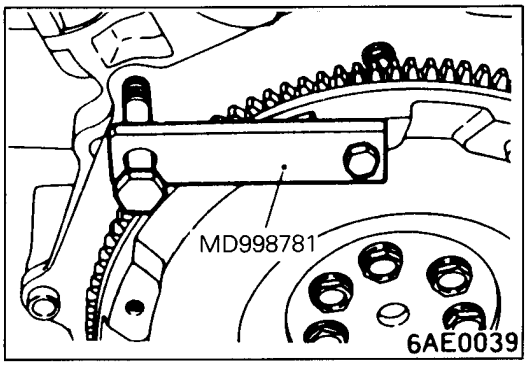
REAR OIL SEAL
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Removal and Installation of Transmission
  (M/T: Refer to GROUP – 22 Transmission and Transfer Assembly)
  (A/T: Refer to GROUP 23 – Transmission and Transfer Assembly)
- Removal and Installation of Clutch <M/T>





Removal steps
1. Flywheel assembly <M/T>
2. Adaptor plate A <A/T>
3. Drive plate <A/T>
4. Adaptor plate B <A/T>
5. Oil seal



SERVICE POINTS OF REMOVAL

1. REMOVAL OF FLYWHEEL ASSEMBLY <M/T>/2. ADAPTOR PLATE A <A/T>/3. DRIVE PLATE <A/T>/4. ADAPTOR PLATE B

Use the special tool to secure the flywheel assembly or drive plate, and remove the bolt.

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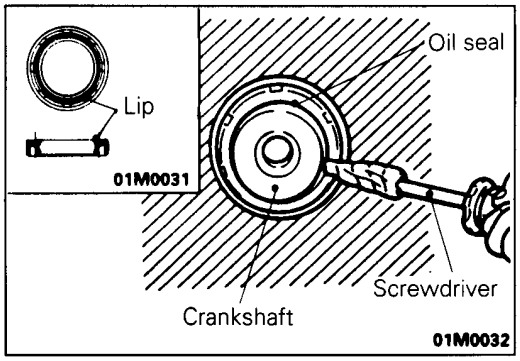
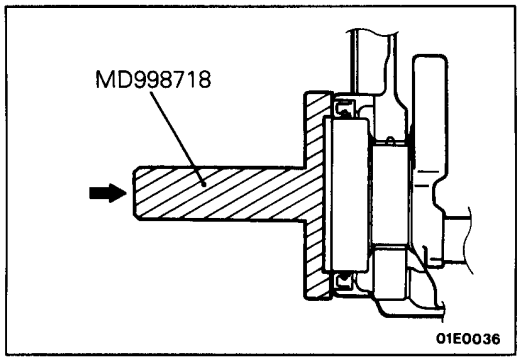


5. REMOVAL OF OIL SEAL

(1) Cut out a portion in the crankshaft oil seal lip.
(2) Cover the tip of a screwdriver with a cloth and apply it to the cutout in the oil seal to pry off the oil seal.

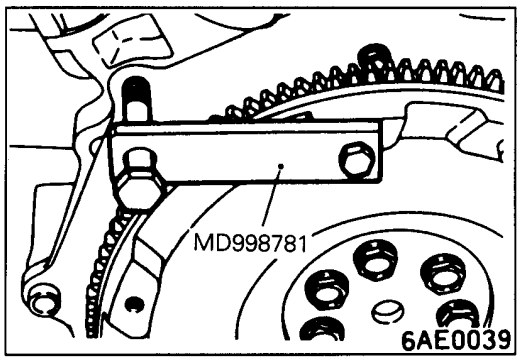
Caution
Take care not to damage the crankshaft and oil seal case.



SERVICE POINTS OF INSTALLATION

5. INSTALLATION OF OIL SEAL

Using the special tool, press-fit a new crankshaft rear oil seal into the oil seal case.



4. INSTALLATION OF ADAPTOR PLATE B <A/T>/3. DRIVE PLATE <A/T>/2. ADAPTOR PLATE A <A/T>/1. FLYWHEEL ASSEMBLY <M/T>

Use the special tool to secure the drive plate, and tighten the bolts.

NOTES

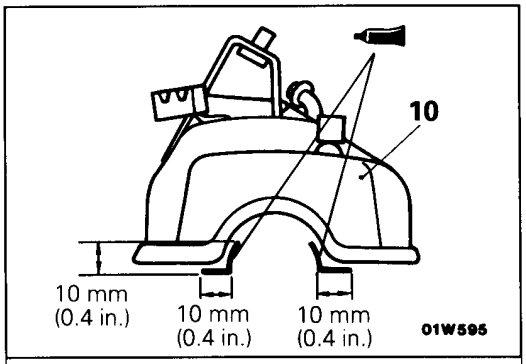
CYLINDER HEAD GASKET <SOHC–12 VALVE>

E11JA-B

REMOVAL AND INSTALLATION

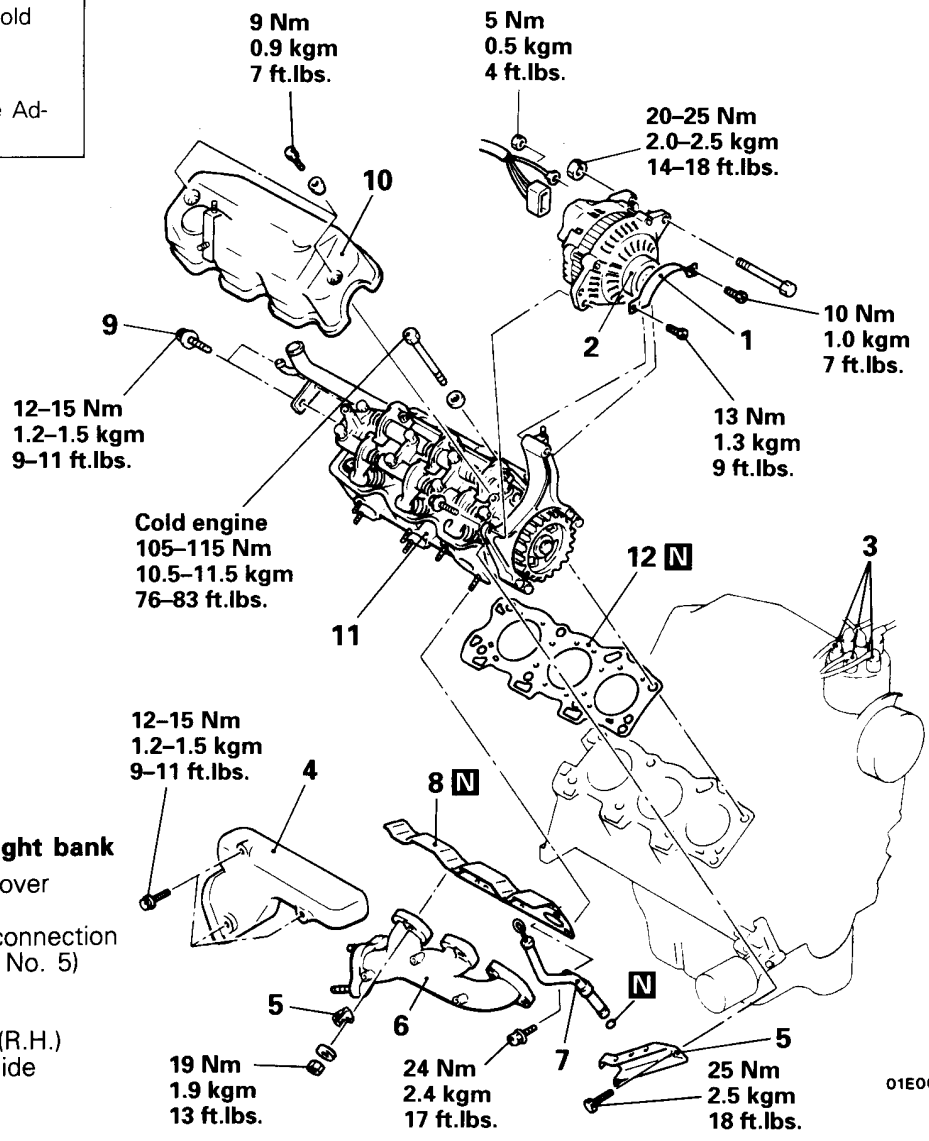
Pre-removal Operation
- Draining of Engine Coolant (Refer to GROUP 14 – Service Adjustment Procedures.)
- Removal of the Timing Belt (Refer to P.11-36.)
- Removal of the Intake Manifold
- Removal of the Under Skid Plate, Undercover, Air Guide Plate and Transfer Case Protector
- Removal of the Front Exhaust Pipe (Refer to GROUP 15 – Exhaust Pipe and Mufflers.)

Post-installation Operation
- Installation of the Front Exhaust Pipe (Refer to GROUP 15 – Exhaust Pipe and Mufflers.)
- Installation of the Under Skid Plate, Undercover, Air Guide Plate and Transfer case Protector
- Installation of the Intake Manifold
- Installation of the Timing Belt (Refer to P.11-36.)
- Supplying of Engine Coolant (Refer to GROUP 14 – Service Adjustment Procedures.)



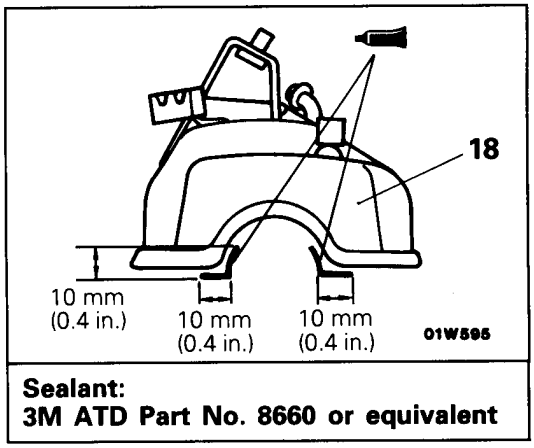
Sealant: 3M ATD Part No. 8660 or equivalent

<Right bank>



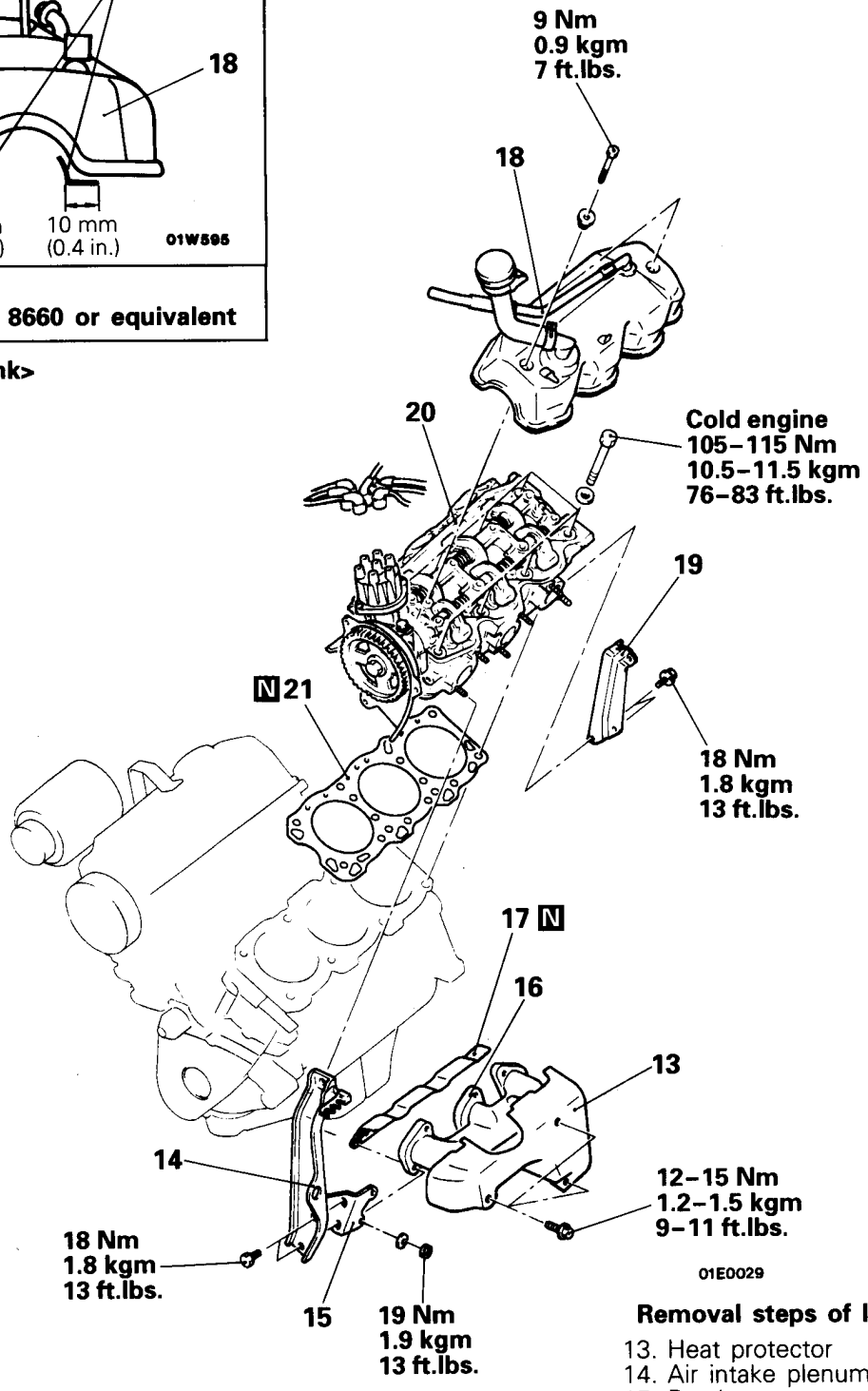
Removal steps of right bank
1. Alternator pulley cover
2. Alternator
3. Spark plug cable connection (No. 1, No. 3 and No. 5)
4. Heat protector
5. Alternator stay
6. Exhaust manifold (R.H.)
7. Oil level gauge guide
8. Gasket
9. Bolt
10. Rocker cover

◀▶ ▶◀ 11. Cylinder head assembly
▶◀ 12. Cylinder head gasket



Sealant:
3M ATD Part No. 8660 or equivalent

<Left bank>



Removal steps of left bank

13. Heat protector
14. Air intake plenum stay (Front)
15. Bracket
16. Exhaust manifold (L.H.)
17. Gasket
18. Rocker cover
19. Air intake plenum stay (Rear)
20. Cylinder head assembly
21. Cylinder head gasket

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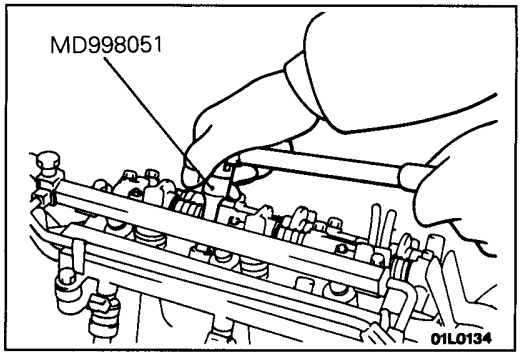
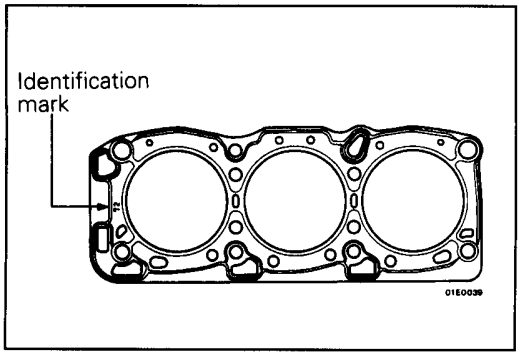


SERVICE POINTS OF REMOVAL E11JBCG

11./20. REMOVAL OF CYLINDER HEAD ASSEMBLY

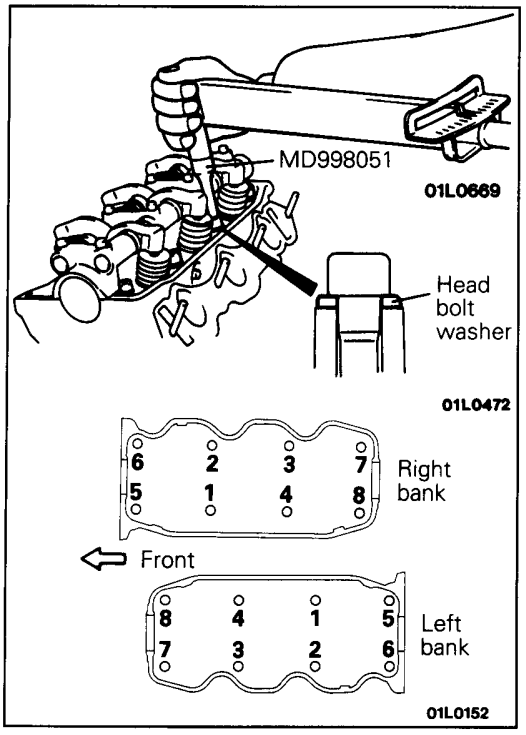
Using the special tool, after loosening the bolts in the order shown in the figure (in 2 or 3 cycles), remove, and then remove the cylinder head assembly.



SERVICE POINTS OF INSTALLATION E11JDCS

21./12. INSTALLATION OF CYLINDER HEAD GASKET

(1) Degrease the mounting surface of the cylinder head gasket.
(2) Lay the cylinder head gasket on cylinder block with the identification mark at front top.



20./11. INSTALLATION OF CYLINDER HEAD ASSEMBLY

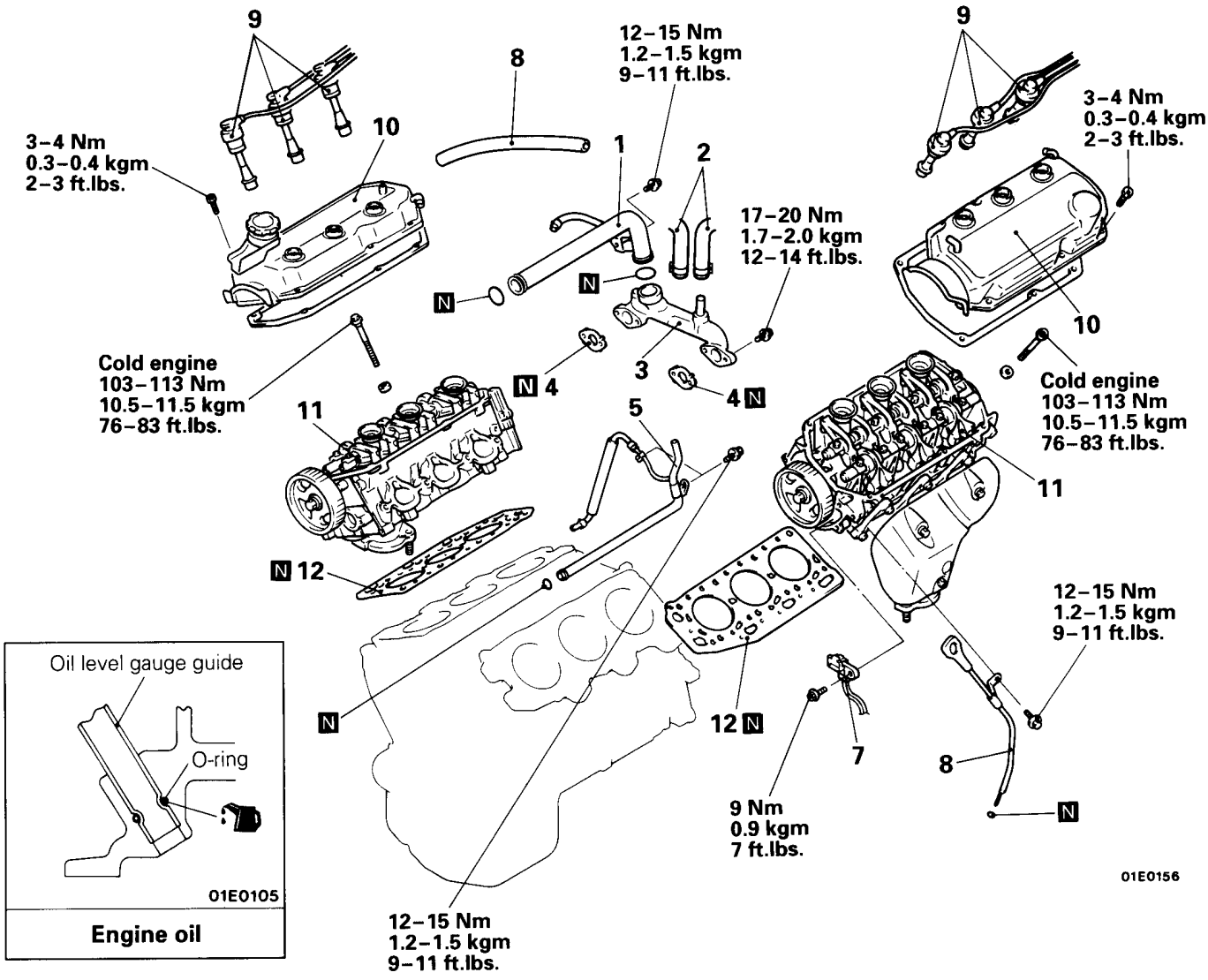
Using the special tool, tighten the bolts in the order shown in two or three steps.

Caution
Attach the head bolt washer in the direction shown in the figure.

CYLINDER HEAD GASKET <SOHC-24 VALVE>

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Engine Coolant Draining and Supplying (Refer to GROUP 14 – Service Adjustment procedures.)
- Removal and Installation of Timing Belt (Refer to P.11-39-1)
- Removal and Installation of Intake Manifold (Refer to GROUP 15 – Intake Manifold.)



Removal steps

- ◆◆ 1. Water outlet pipe
- 2. Heater hose
- ◆◆ 3. Water passage
- ◆◆ 4. Gasket
- ◆◆ 5. Water pipe and hose assembly
- 6. Oil level gauge guide <Only when removing the left side bank>
- 7. Camshaft position sensor <Only when removing the left side bank>
- 8. Ventilation hose
- 9. Spark plug cable
- 10. Rocker cover
- ◆◆ ◆◆ 11. Cylinder head assembly
- ◆◆ 12. Cylinder head gasket

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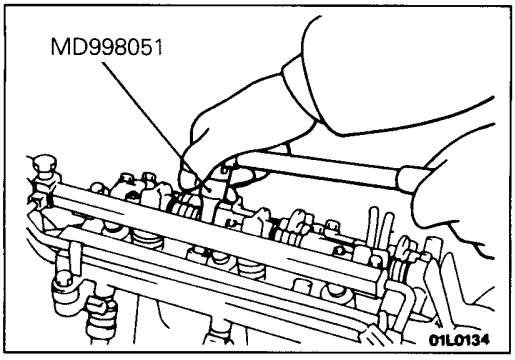
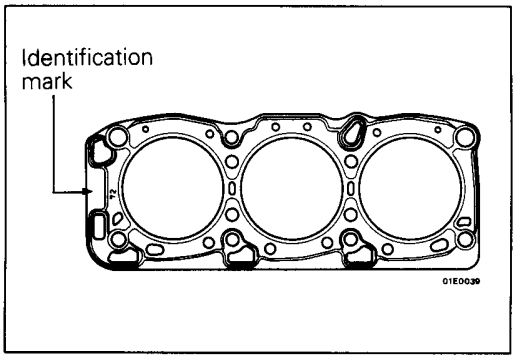


SERVICE POINT OF REMOVAL

11. REMOVAL OF CYLINDER HEAD ASSEMBLY

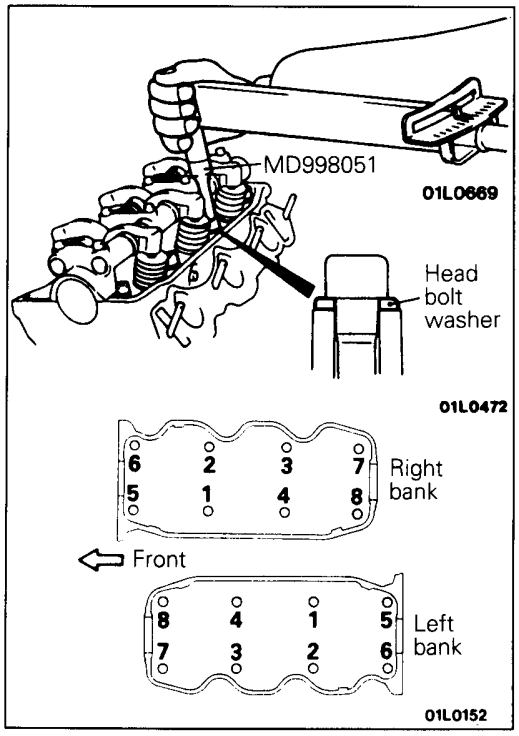
Using the special tool, after loosening the bolts (in 2 or 3 cycles), remove, and then remove the cylinder head assembly.



SERVICE POINTS OF INSTALLATION

12. INSTALLATION OF CYLINDER HEAD GASKET

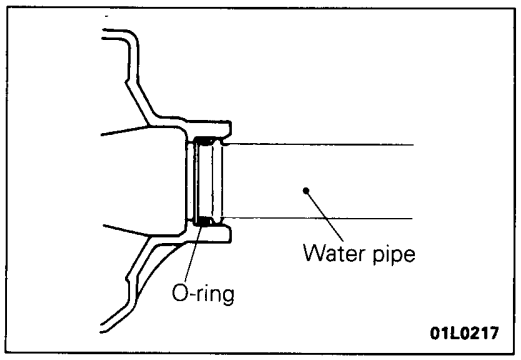
(1) Degrease the mounting surface of the cylinder head gasket.
(2) Lay the cylinder head gasket on cylinder block with the identification mark at front top.



11. INSTALLATION OF CYLINDER HEAD ASSEMBLY

Using the special tool, tighten the bolts in the order shown in two or three steps.

Caution
Attach the head bolt washer in the direction shown in the figure.



5. INSTALLATION OF WATER PIPE AND HOSE ASSEMBLY/1. WATER OUTLET PIPE

Rinse the mounting location of the O-ring and water pipe with water, and install the O-ring and water pipe.

Caution

1. **Do not apply oil and grease to water pipe O-ring.**
2. **Keep the water pipe connections free of stand, dust, etc.**
3. **Insert water pipe until its end bottoms.**

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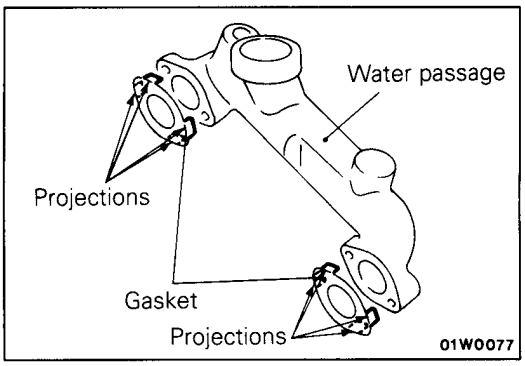


4. INSTALLATION OF GASKET/3. WATER PASSAGE

Hook the gasket projections to the water passage and install the water passage to the cylinder head.

NOTES

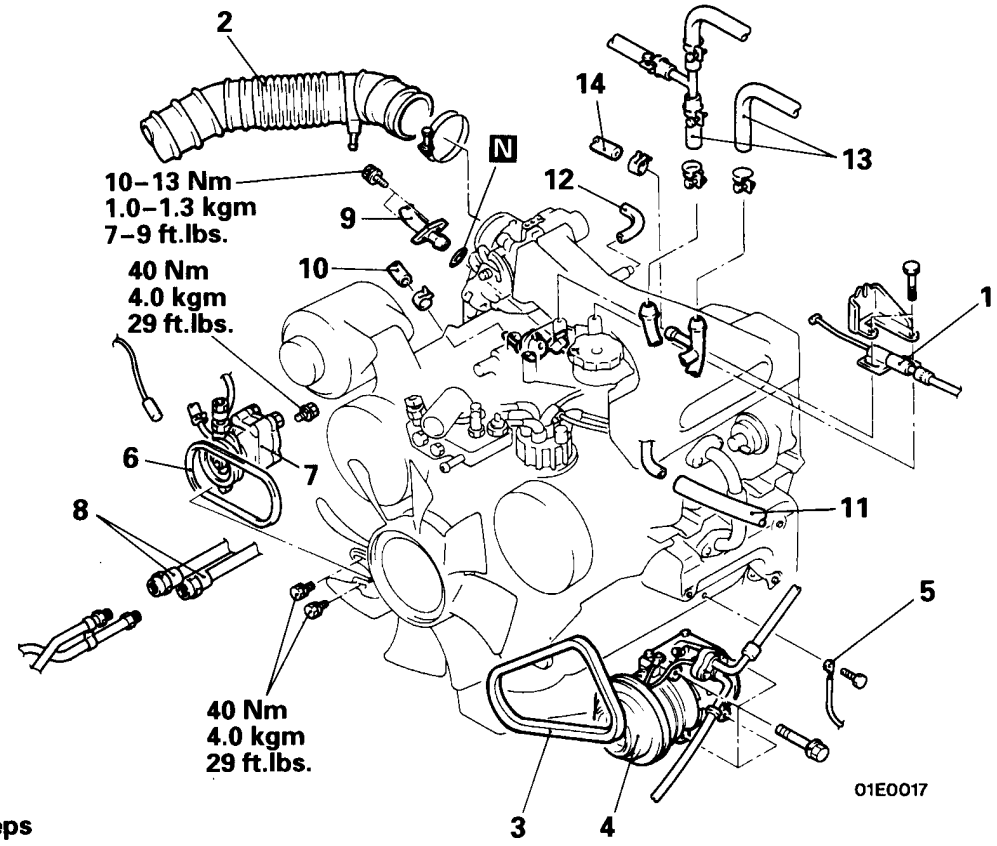
ENGINE ASSEMBLY <SOHC–12 VALVE>

E11TA-B

REMOVAL AND INSTALLATION

Pre-removal Operation
- Removal of the Hood (Refer to GROUP 42 – Hood.)
- Removal of the Radiator (Refer to GROUP 14 – Radiator.)
- Removal of the Under Skid Plate, Undercover, Air guide Plate
- Removal of the Front Exhaust Pipe (Refer to GROUP 15 – Exhaust Pipe and Mufflers.)
- Removal of the Transmission and Transfer Assembly (Refer to GROUP 22, 23 – Transmission and Transfer Assembly.)

Post-installation Operation
- Installation of the Transmission and Transfer Assembly (Refer to GROUP 22, 23 – Transmission and Transfer Assembly.)
- Installation of the Front Exhaust Pipe (Refer to GROUP 15 – Exhaust Pipe and Mufflers.)
- Installation of the Under Skid Plate and Undercover
- Installation of the Radiator (Refer to GROUP 14 – Radiator.)
- Installation of the Hood (Refer to GROUP 42A – Hood.)
- Adjustment of the engine (Refer to P.11-30.)
- Adjustment of Accelerator cable (Refer to GROUP 13 – Service Adjustment Procedures.)



Removal steps

1. Accelerator cable connection
2. Air intake hose
3. Drive belt } <A/C>
4. Compressor } <A/C>
5. Connection for earth cable
6. Drive belt } (Power steering)
7. Oil pump } (Power steering)
8. Oil cooler hose connection
9. High pressure fuel hose connection
10. Fuel return hose connection
11. Vacuum hose connection
12. Brake booster vacuum hose connection
13. Heater hose connections
14. Heater hose connection (Vehicles with rear heater)

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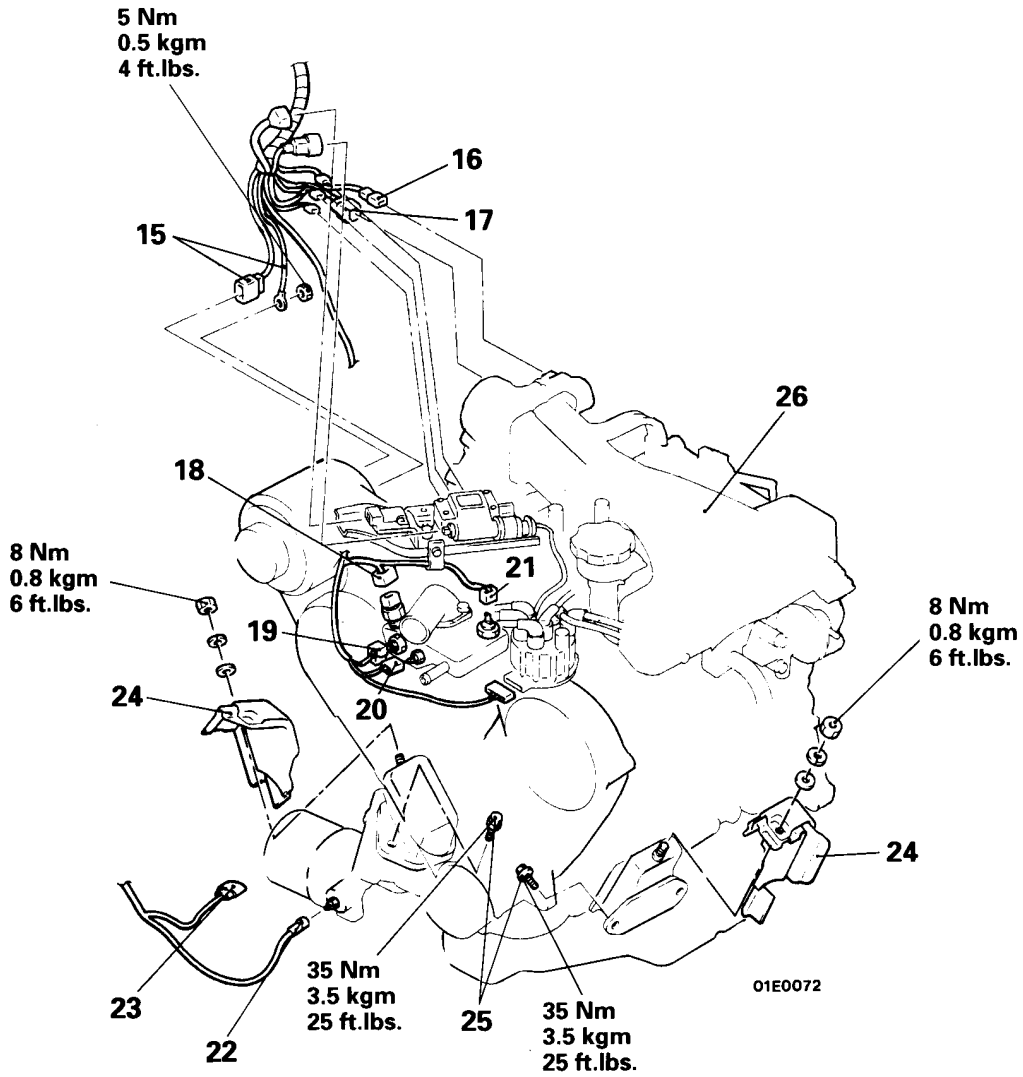


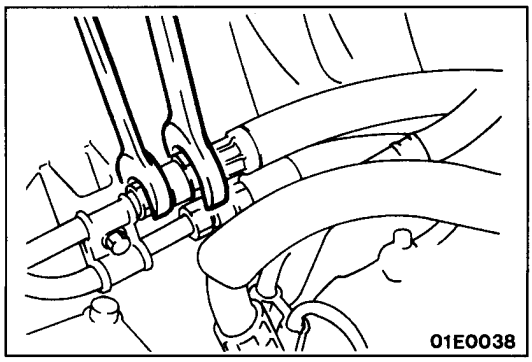
15. Alternator connector
16. ISC motor connector
17. TPS connector
18. Engine coolant temperature switch connector <A/C>
19. Engine coolant temperature sensor connector
20. Thermo switch connector <A/T>
21. Engine coolant temperature gauge unit connector
22. Oil pressure gauge unit connector
23. Oil level sensor connector
24. Heat protectors
25. Engine mounting bolt
26. Engine assembly

SERVICE POINTS OF REMOVAL E11TBAK

4. REMOVAL OF COMPRESSOR <A/C>/7. OIL PUMP (POWER STEERING)

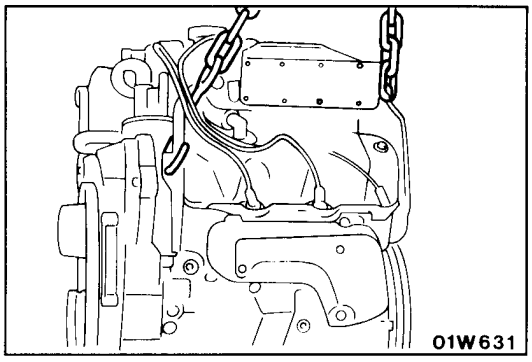
Remove the oil pump and air conditioner compressor (with the hose attached).

NOTE
Suspend the removed oil pump (by using wire or similar material) at a place where no damage will be caused during removal/installation of the engine assembly.



8. REMOVAL OF OIL COOLER HOSE CONNECTION

Use a spanner or similar tool to remove the oil cooler hose connection.



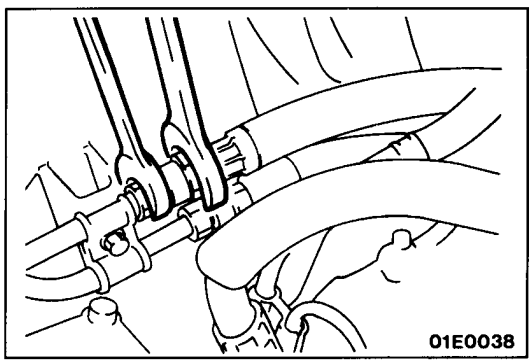
26. REMOVAL OF ENGINE ASSEMBLY

(1) Check that all cables, hoses, harness connectors, etc. are disconnected from the engine.
(2) Lift the chain block slowly to remove the engine assembly upward from the engine compartment.

SERVICE POINTS OF INSTALLATION E11TDAM

26. INSTALLATION OF ENGINE ASSEMBLY

Install the engine assembly. When doing so, check carefully that all pipes and hoses are connected, and that none are twisted, damaged, etc.



8. CONNECTION OF OIL COOLER HOSE

Use a spanner or similar tool to connect the oil cooler hose.

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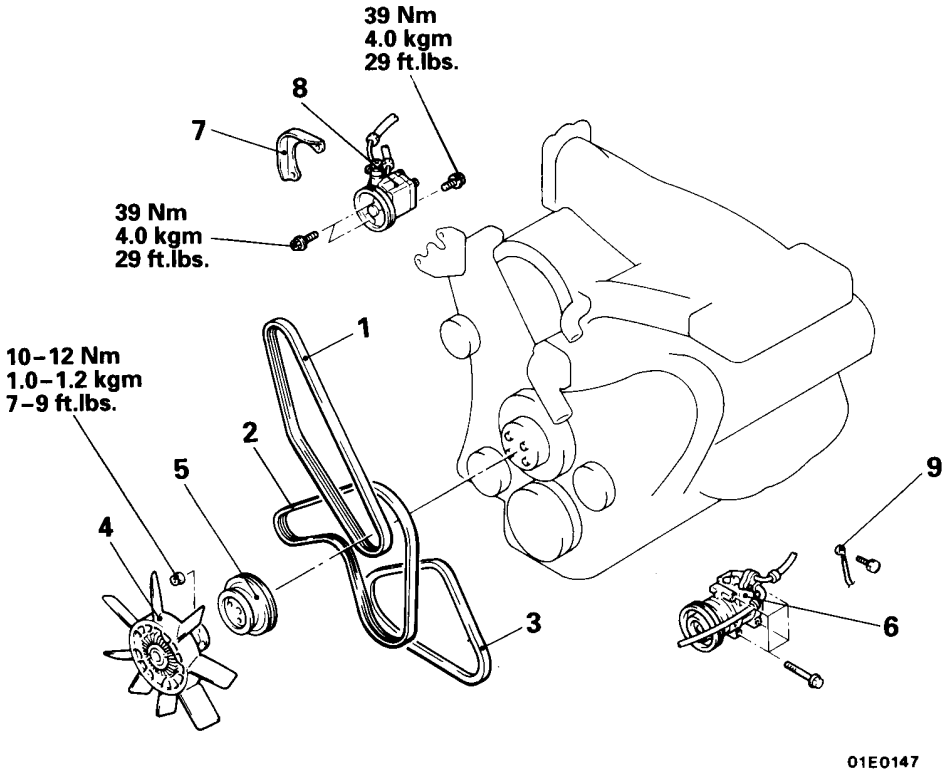
ENGINE ASSEMBLY <SOHC–24 VALVE>

REMOVAL AND INSTALLATION

Pre-removal Operation
- Removal of Hood
  (Refer to GROUP 42 – Hood.)
- Removal of Battery and Battery Tray
- Removal of Auto-Cruise Control Intermediate Link
  (Refer to GROUP 13 – Auto-Cruise Control.)
- Removal of Radiator
  (Refer to GROUP 14 – Radiator.)
- Removal of Front Exhaust Pipe
  (Refer to GROUP 15 – Exhaust Pipe and Muffler.)
- Removal of Transmission and Transfer Assembly
  (M/T: Refer to GROUP 22 – Transmission and Transfer Assembly)
  (A/T: Refer to GROUP 23 – Transmission and Transfer Assembly.)

Post-installation Operation
- Installation of Transmission and Transfer Assembly
  (M/T: Refer to GROUP – 22 Transmission and Transfer Assembly)
  (A/T: Refer to GROUP 23 – Transmission and Transfer Assembly.)
- Installation of Front Exhaust Pipe
  (Refer to GROUP 15 – Exhaust Pipe and Muffler.)
- Installation of Radiator (Refer to GROUP 14 – Radiator.)
- Installation of Battery and Battery Tray
- Installation and Adjustment of Auto-Cruise Control Intermediate Link (Refer to GROUP 13 – Auto-Cruise Control.)
- Installation of Hood (Refer to GROUP 42 – Hood.)
- Adjustment of Engine (Refer to P.11-30.)
- Adjustment of Accelerator Cable
  (Refer to GROUP 13 – Service Adjustment Procedures.)
- Adjustment of Throttle Cable <A/T>
  (Refer to GROUP 23 – Service Adjustment Procedures.)
- Engine Oil Supplying and Checking



Removal steps
1. Power steering drive belt
2. Alternator drive belt
3. A/C drive belt
4. Cooling fan
5. Water pump pulley
6. A/C compressor ◆◆
7. Cover
8. Power steering oil pump ◆◆
9. Earth cable connection

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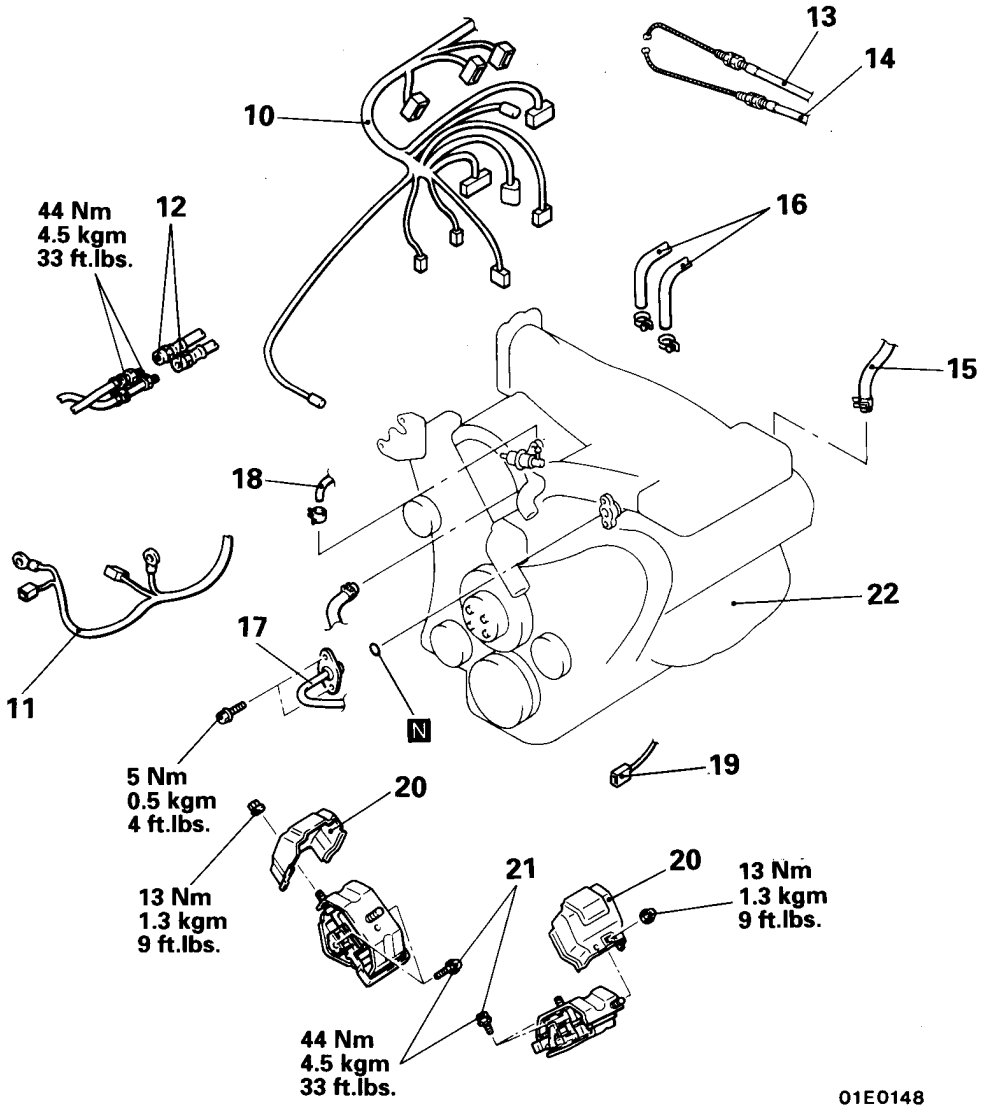


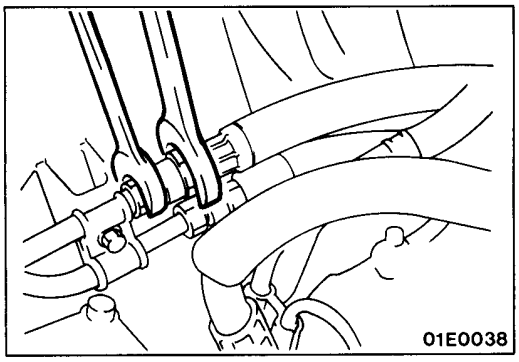
10. Engine control harness connection
11. Alternator and starter harness connection
12. Engine oil cooler hose connection
13. Accelerator cable connection
14. Throttle cable connection
15. Brake booster vacuum hose connection
16. Heater hose connection
17. Fuel hose connection
18. Fuel return hose connection
19. Oil pressure switch harness connection
20. Heat protectors
21. Engine mounting bolt
22. Engine assembly

SERVICE POINTS OF REMOVAL

6. REMOVAL OF COMPRESSOR <A/C>/8. OIL PUMP (POWER STEERING)

Remove the oil pump and air conditioning compressor (with the hose attached).

NOTE
Suspend the removed oil pump (by using wire or similar material) at a place where no damage will be caused during removal/installation of the engine assembly.



12. DISCONNECTION OF OIL COOLER HOSE

Use a spanner or similar tool to disconnect the oil cooler hose.

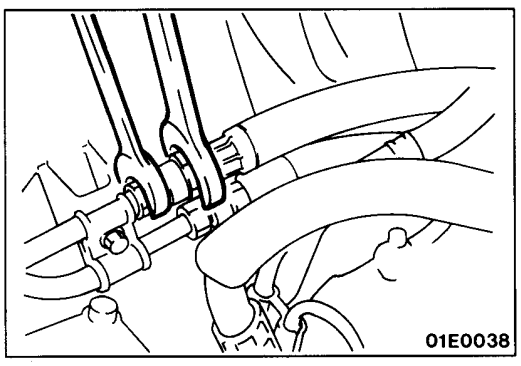
22. REMOVAL OF ENGINE ASSEMBLY

(1) Check that all cables, hoses, harness connectors, etc. are disconnected from the engine.
(2) Lift the chain block slowly to remove the engine assembly upward from the engine compartment.

SERVICE POINTS OF INSTALLATION

22. INSTALLATION OF ENGINE ASSEMBLY

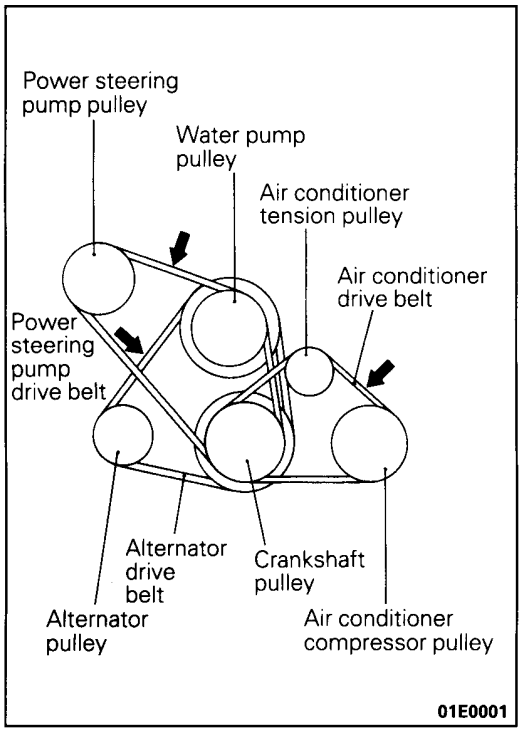
Install the engine assembly. When doing so, check carefully that all pipes and hoses are connected, and that none are twisted, damaged, etc.



12. CONNECTION OF OIL COOLER HOSE

Use a spanner or similar tool to connect the oil cooler hose.

NOTES



ENGINE <4D56>

SERVICE ADJUSTMENT PROCEDURES

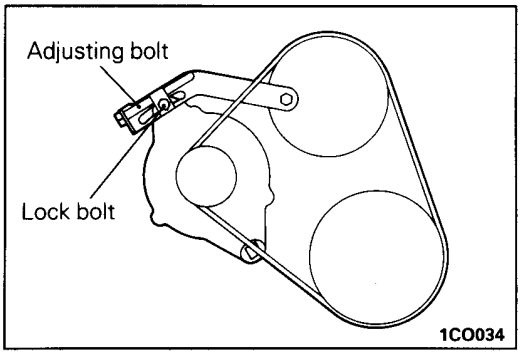
DRIVE BELTS TENSION INSPECTION AND ADJUSTMENT

E11FQBF

Check the tension by pushing at the centre of the belt between pulleys with a force of 100 N (10 kg, 22 lbs.) as shown in the figure. Measure drive belt flexion.

Standard value:

Alternator	
Single belt type	**11–14 mm (0.43–0.55 in.)**
Double belt type	**15–18 mm (0.59–0.71 in.)**
Power steering oil pump	
V type	**8–13.5 mm (0.31–0.53 in.)**
V ribbed type	**8–12 mm (0.31–0.47 in.)**
Air conditioner compressor	**6.5–7.5 mm (0.26–0.30 in.)**



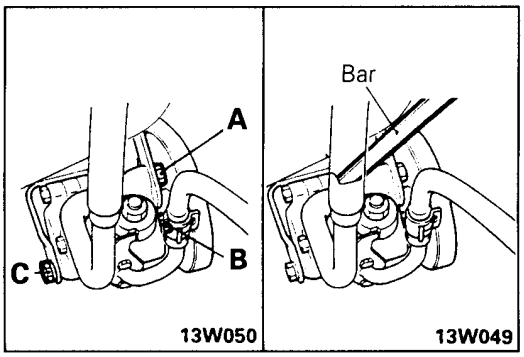
TENSION ADJUSTMENT OF ALTERNATOR DRIVE BELT

(1) Loosen the nut on the alternator pivot bolt.
(2) Loosen the lock bolt.
(3) Turn the adjusting bolt to adjust the belt so that the amount of flexion is at the standard value.

Standard value:

Single belt type
If former belt (with corrected tension) is used
11–14 mm(0.43–0.55 in.)
If a new belt is used 9–12 mm (0.35–0.47 in.)
Double belt type (for each belt)
If former belt (with corrected tension) is used
15–18 mm (0.59–0.71 in.)
If a new belt is used
13–16 mm (0.51–0.63 in.)

(4) Tighten the lock nut.
(5) Tighten the nut on the alternator pivot bolt.



TENSION ADJUSTMENT OF POWER STEERING OIL PUMP DRIVE BELT

(1) Loosen power steering oil pump fixing bolt (A), (B) and (C).
(2) Move power steering oil pump tension belt moderately and adjust belt tension.
(3) Tighten the fixing bolts (A), (B) and (C) in that order.
(4) Crank the engine once or more.
(5) Check the belt tension.

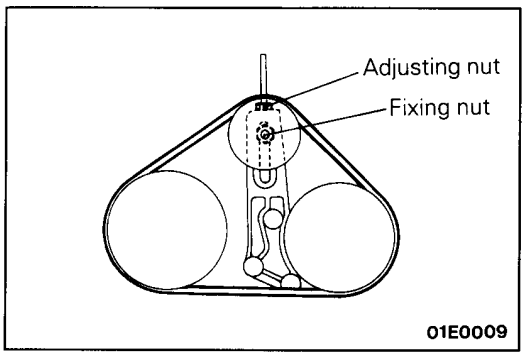
Standard value:

V type

Used belt	**9.5 mm (0.37 in.)**
New belt	**7.0 mm (0.28 in.)**

V ribbed type

Used belt	**9–11 mm (0.35–0.43 in.)**
New belt	**6–8 mm (0.24–0.31 in.)**

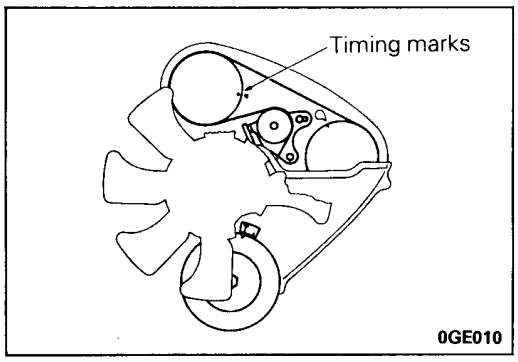


TENSION ADJUSTMENT OF THE AIR CONDITIONER COMPRESSOR DRIVE BELT

(1) Loosen tension pulley fixing nut.
(2) Adjust belt tension with adjusting nut.
(3) Tighten fixing nut.
(4) Crank the engine once or more.
(5) Check the belt tension.

Standard value:

Used belt	**6.5–7.5 mm (0.26–0.30 in.)**
New belt	**5–6 mm (0.20–0.24 in.)**



VALVE CLEARANCE INSPECTION AND ADJUSTMENT

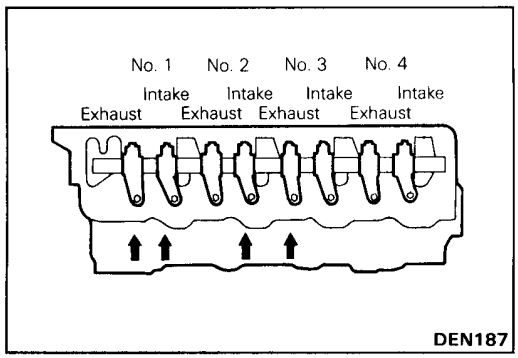
E11FDAV

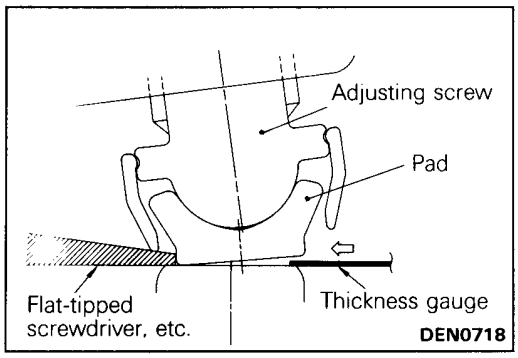
(1) Start the engine and allow it to warm up until the engine coolant temperature reaches 80 to 95°C (176 to 203°F).
(2) Remove the timing belt upper cover.
(3) Remove the rocker cover.
(4) Align the camshaft sprocket timing marks and set the No.1 cylinder at top dead centre.

Caution
The crankshaft should always be turned in a clockwise direction.

(5) Measure the valve clearance at the places indicated by arrows in the illustration.

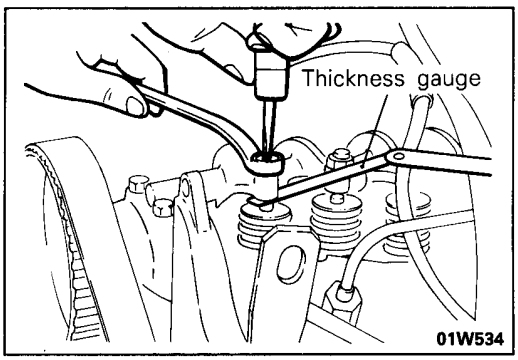
Standard value: 0.25 mm (0.010 in.)



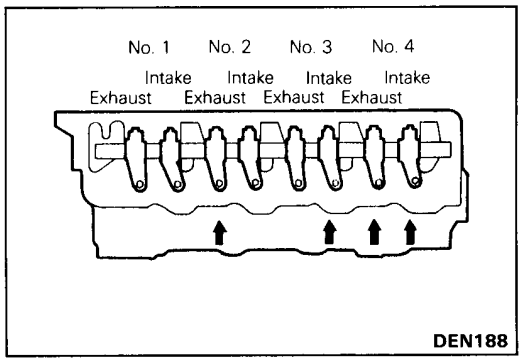


(6) If the clearance is outside the standard value, loosen the lock nut of the rocker arm and adjust by turning the adjusting screw while using a thickness gauge to measure the clearance.

NOTE
<Vehicles with supercharging pressure relief solenoid valve>
When inserting the thickness gauge, push the pad from the opposite side from the thickness gauge insertion side with a flat-tipped screwdrive or similar tool to make a gap, and then insert the thickness gauge.



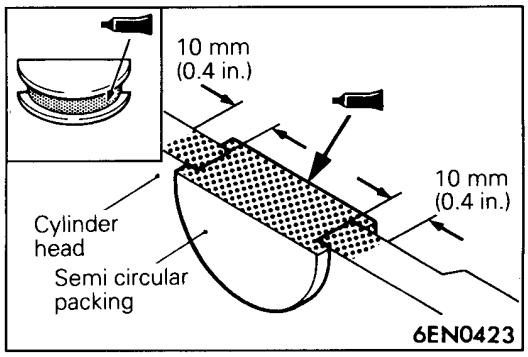
(7) Tighten the lock nut while holding the adjusting screw with a screwdriver so that it doesn't turn.
(8) Turn the crankshaft 360° to bring No.4 cylinder to the top dead centre position.



(9) Measure the valve clearance at the place indicated by the arrow in the illustration.

Standard value: 0.25 mm (0.010 in.)

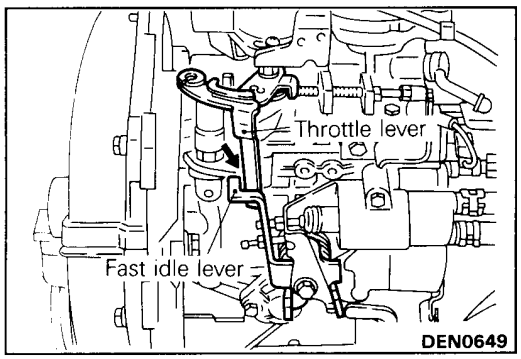
(10) If the clearance is outside the standard value, adjust by following steps (6)–(7) above.



(11) Apply specified sealant to the section of the semi-circular packing shown in the illustration.

Specified sealant: 3M ATD Part No. 8660 or equivalent

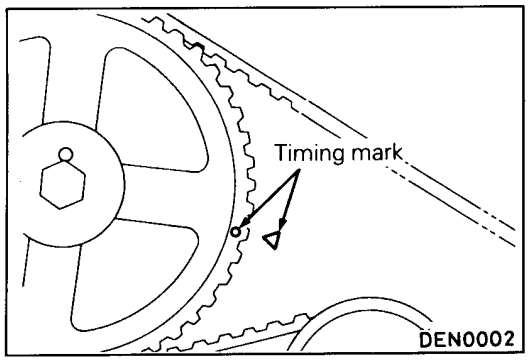
(12) Install the rocker cover.
(13) Install the timing belt upper cover.



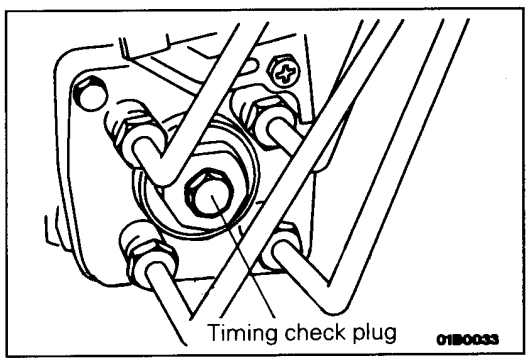
INJECTION TIMING INSPECTION AND ADJUSTMENT

E11FUAJ

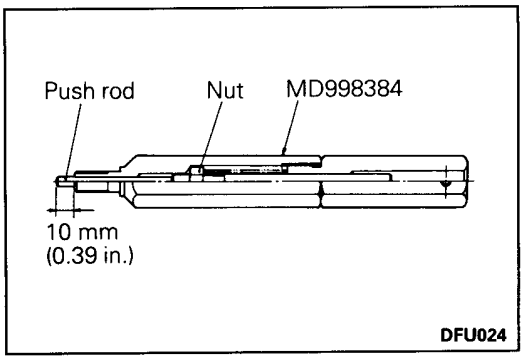
(1) Warm up the engine and then check to be sure that the fast idle lever is separated from the throttle lever. <Vehicles with cold start device>
(2) Remove all of the glow plugs.
(3) Remove the timing belt upper cover.



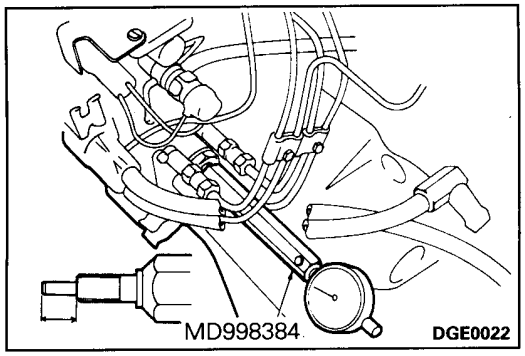
(4) Align the timing marks of the camshaft sprocket and set the No. 1 cylinder to the top dead centre position.



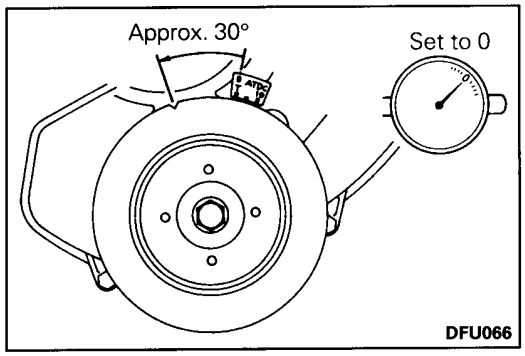
(5) Remove the timing check plug at the rear of the injection pump.



(6) Before installation of special tool, make sure that push rod is protruding by 10 mm (0.39 in.). Protrusion of push rod can be adjusted with an inner nut.
(7) Connect the dial gauge to the special tool.

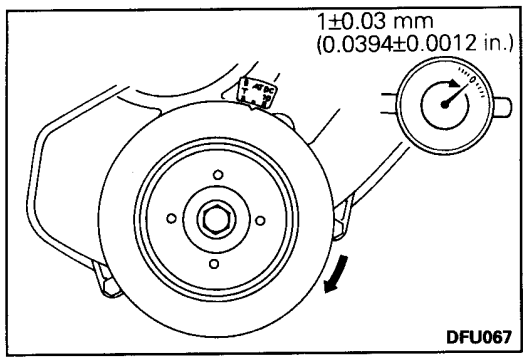


(8) Install the special tool to the check plug at the rear of the injection pump.



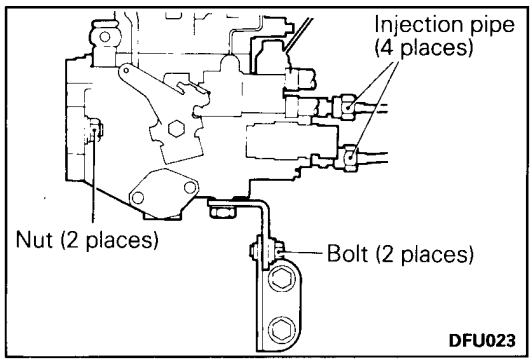
(9) Turn the crankshaft clockwise to move the No.1 cylinder approximately 30° before compression top dead centre.
(10) Set the needle of the dial gauge to 0.
(11) Check that the needle doesn't move even if the crankshaft is turned slightly (2–3°) both clockwise and anti-clockwise.

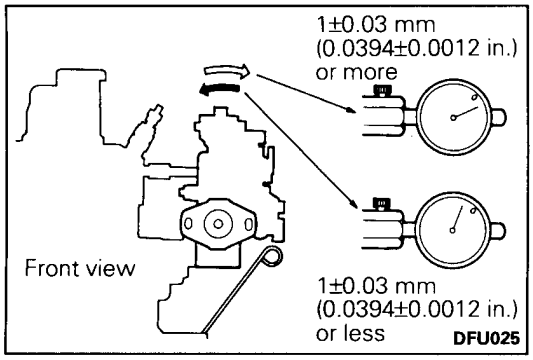
NOTE
If the needle moves, the notch is not positioned properly, so once more move the No.1 cylinder approximately 30° before compression top dead centre.

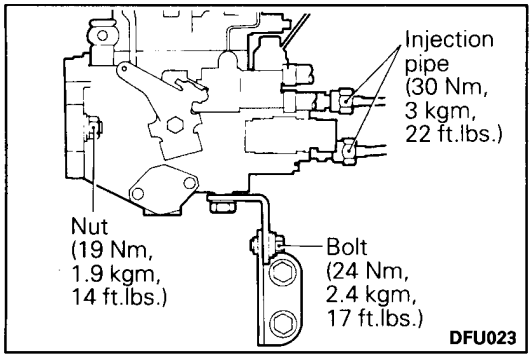


(12) Turn the crankshaft clockwise to align the No.1 cylinder to 7° ATDC (for the vehicles with oil cooled turbocharger) or to 9° ATDC (for the vehicles with water cooled turbocahrger).
(13) Check that the needle of the dial gauge is displaying the standard value.

Standard value: 1 ± 0.03 mm (0.0394 ± 0.0012 in.)







(14) If the needle is outside the standard value, adjust the injection timing by the following procedure.

① Loosen the injection pipe union nuts (4 places) on the injection pump. (Do not remove the union nuts.)

Caution
When loosening the nuts, hold the delivery valve holders with a spanner so that they don't turn at the same time.

② Loosen the upper mounting nut and the lower mounting bolt of the injection pump. (Do not remove the nut and bolt.)

③ Tilt the injection pump to the left and right and adjust the needle on the dial gauge so that the display value is uniform.

④ Provisionally tighten the mounting nut and bolt of the injection pump.

⑤ Repeat steps (9)–(13) to check if the adjustment has been made correctly.

⑥ Tighten the mounting nut and bolt to the specified torque.

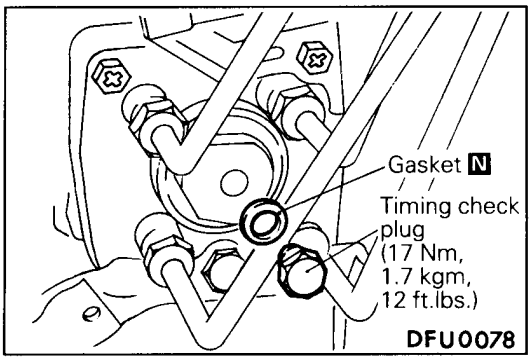
Specified torque:
Injection pump mounting bolt
24 Nm (2.4 kgm, 17 ft.lbs.)
Injection pump mounting nut
19 Nm (1.9 kgm, 14 ft.lbs.)

⑦ Tighten the injection pump union nuts to the specified torque.

Specified torque: 30 Nm (3 kgm, 22 ft.lbs.)

Caution
When tightening the nuts, hold the delivery valve holders with a spanner so that they don't turn at the same time.

(15) Remove the special tool.



(16) Install a new gasket to the timing check plug.
(17) Tighten the timing check plug to the specified torque.

Specified torque: 17 Nm (1.7 kgm, 12 ft.lbs.)

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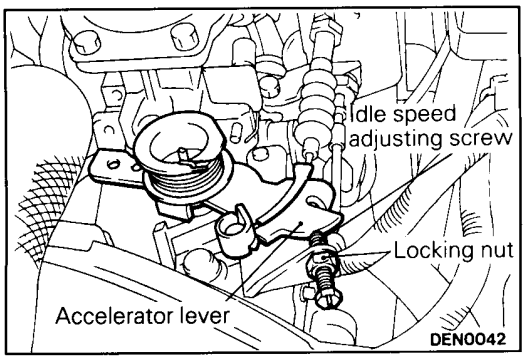
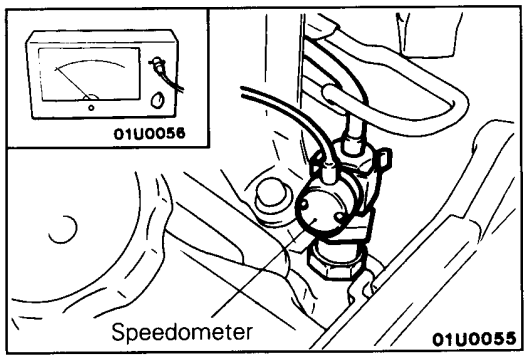
IDLE SPEED INSPECTION AND ADJUSTMENT
E11FXCV

NOTE
Carry out inspection and adjustment of the idle speed after checking that the ignition and injection timing are normal.



(1) Carry out inspection and adjustment with the vehicle in the following condition.
- Engine coolant temperature: 80–95°C (176–203°F)
- Lights and all accessories: OFF
- Transmission: Neutral (P range for vehicles with automatic transmission)
- Steering wheel: Straight forward position



(2) Connect the speedometer to the injection nozzle or the injection pipe.

Caution
When the speedometer is connected to the injection pipe, the pipe mounting clamps should all be removed.

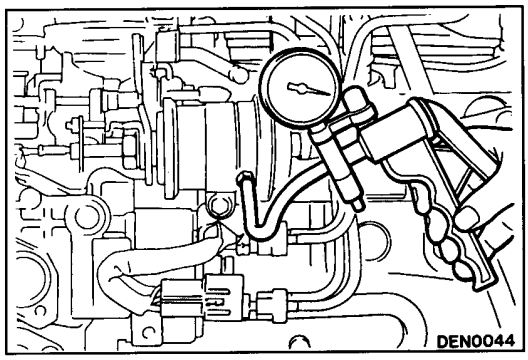
(3) Start the engine and run it at idle speed.
(4) Check engine idle speed.

Cub idle speed: 750±100 r/min.

(5) If not within the standard value, loosen idle adjusting screw lock nut and adjust the idle speed by rotating adjusting screw. And after adjustment, tighten locking nut.

THROTTLE OPENER INSPECTION AND ADJUSTMENT — FOR ABS
E11FCAA

(1) Perform inspection and adjustment with the vehicles in the following condition.
- Engine coolant temperature: 80–95°C (176–203°F)
- Lights and all accessories: OFF
- Transmission: Neutral (P range for vehicles with an automatic transmission)
- Steering wheel: Straight forward position



(2) Inspect and adjust the idle speed.
(3) Remove the vacuum hose (for anti-skid brake: blue) from the idle-up actuator.
(4) Connect a hand vacuum pump to the nipple of the removed vacuum hose.
(5) Connect the speedometer.
(6) Start the engine and run it at idle speed.

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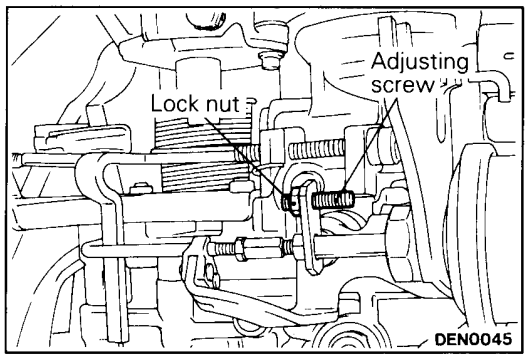


(7) Check the engine speed when a negative pressure of 87 kPa (650 mmHg, 26 in.Hg) is applied.

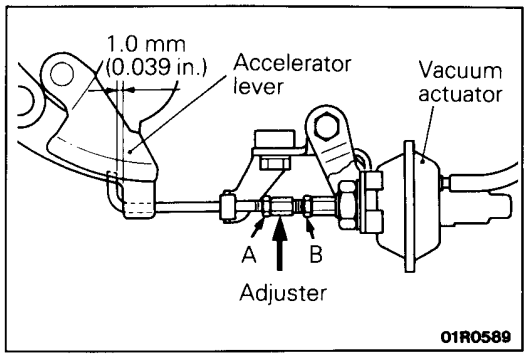
Standard value: 1900±100 r/min

(8) If the engine speed is outside the standard value, loosen the lock nut on the actuator rod and adjust by turning the adjusting screw.
(9) Tighten the lock nut while making sure that the adjusting screw doesn't turn.

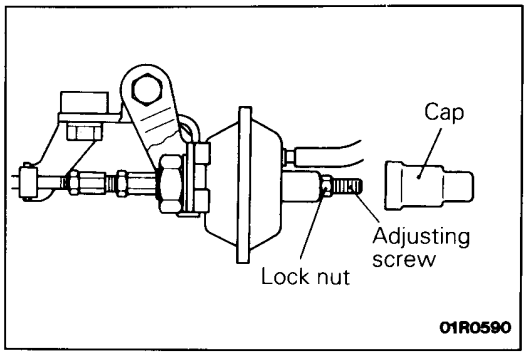
THROTTLE OPENER INSPECTION AND ADJUSTMENT — FOR A/C E11FCAB

1. Place the vehicle in the following condition before inspecting and adjusting.
   (1) Coolant temperature: 80–95°C (176–203°F)
   (2) Lights and all accessories: OFF
   (3) Transmission: Neutral. (A/T: P)
2. Inspect and adjust the idling speed.
3. Connect a tachometer.
4. Turn on the air-conditioner switch and check whether or no the engine speed is the standard value.

   Standard value: 900±50 rpm
5. When the engine speed is not the standard value, adjust using the following procedure.



<Vehicles without ABS, Vehicles with ABS–A/T>
(1) Loosen lock nuts A and B of the vacuum actuator.
(2) Adjust the adjuster so that the gap between the tip of the vacuum actuator rod and the accelerator lever is approximately 1.0 mm (0.04 in.).
(3) Tighten lock nuts A and B.
(4) Start the engine and make sure that the rod contacts the accelerator lever when the air-conditioner switch is on and does not contact the accelerator lever when the air-conditioner switch is turned off.



(5) Remove the vacuum actuator cap and loosen the lock nut.
(6) Turn the adjusting screw and adjust the engine speed to the standard value.

Caution
Do not push the adjusting screw deeper than the surface of the lock nut.

(7) Tighten the lock nut and install the cap.

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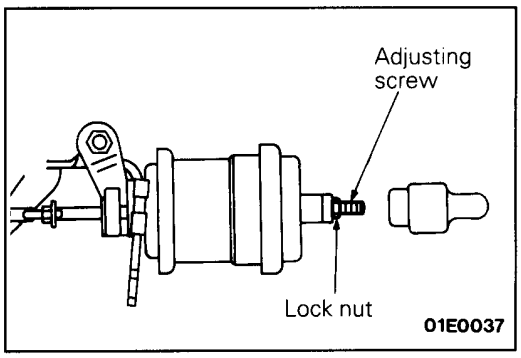


<Vehicles with ABS-M/T>

(1) Loosen the lock nut.
(2) Turn the adjusting screw and adjust the engine speed to the standard value.

Caution
Do not push the adjusting screw deeper than the surface of the lock nut.

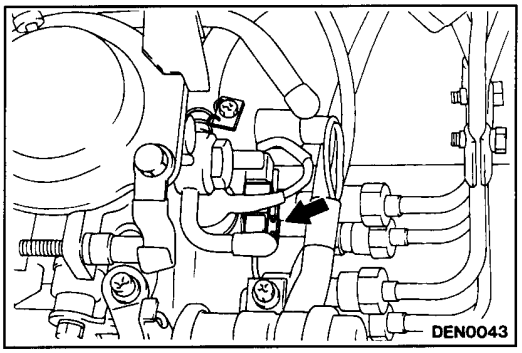
(3) Tighten the lock nut.

COMPRESSION PRESSURE INSPECTION E11FGAK

(1) Perform inspection and adjustment with the vehicle in the following condition.
- Engine coolant temperature: 80–95°C (176–203°F)
- Lights and all accessories: OFF
- Transmission: Neutral (P range for vehicles with an automatic transmission)

(2) Remove all of the glow plugs.

Caution
Be careful not to subject the glow plugs to any shock.

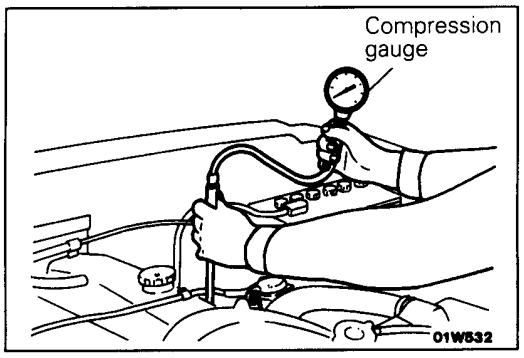


(3) Disconnect the fuel cut solenoid valve connector.

NOTE
Doing this will stop carrying out ignition and fuel injection.

(4) Cover the glow plug holes with a rag etc., and after the engine has been cranked, check that no foreign material is adhering to the rag.

Caution
1. **Keep away from the glow plug holes when cranking.**
2. **If compression is measured while water, oil, fuel, etc., that has come from cracks is inside the cylinder, these materials will become heated and will gush out from the glow plug hole, which is dangerous.**



(5) Set the compression gauge to one of the glow plug holes.
(6) Crank the engine and measure the compression pressure.

Standard value:
2650 kPa (27.0 kg/cm², 384 psi.)
<Vehicles with oil cooled turbocharger>
3040 kPa (31.0 kg/cm², 441 psi.)
<Vehicles with water cooled turbocharger>

Limit: 1880 kPa (19.2 kg/cm², 273 psi.) minimum
<Vehicles with oil cooled turbocharger>
2200 kPa (22.4 kg/cm², 319 psi.) minimum
<Vehicles with water cooled turbocharger>

(7) Measure the compression for all the cylinders, and check that the pressure differences of the cylinders are below the limit.

Limit: 290 kPa (3.0 kg/cm^2, 43 psi.)

(8) If there is a cylinder with compression or a compression difference that is outside the limit, pour a small amount of engine oil through the glow plug hole, and repeat the operations in steps (6) and (7).

① If the compression increases after oil is added, the cause of the malfunction is a worn or damaged piston ring and/or cylinder inner surface.

② If the compression does not rise after oil is added, the cause is a burnt or defective valve or pressure is leaking from the gasket.

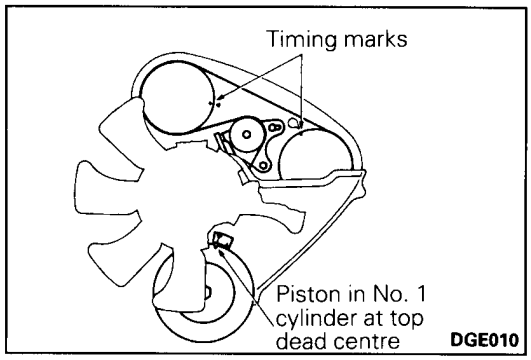
(9) Connect the fuel cut solenoid valve connector.

(10)Install the glow plugs.

TIMING BELT TENSION ADJUSTMENT E11FFDG

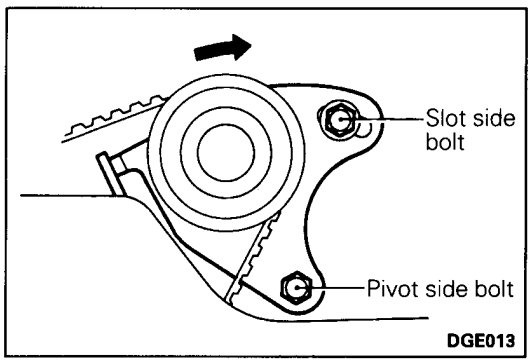
(1) Remove timing belt upper cover.

(2) Turn the crankshaft in the clockwise direction and check the timing belt around its entire circumference for abnormalities.

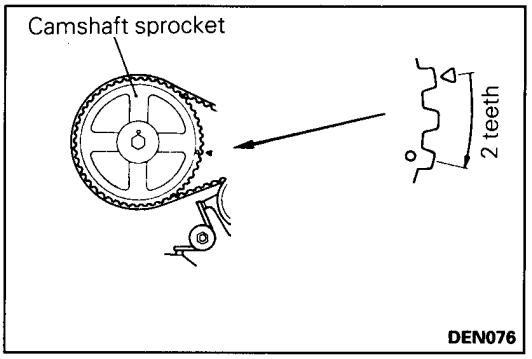


(3) Align the timing mark on the sprockets with the timing mark on the front upper case.

Caution
When aligning the timing mark, be sure not to turn the crankshaft in the counterclockwise direction as this can cause improper belt tension.



(4) Loosen the tensioner pivot side bolt 1 turn and slot side bolt 1 or 2 turns.



(5) Turn the crankshaft and the camshaft sprocket clockwise two teeth.

(6) first tighten tensioner slot side bolt, and then tighten pivot side bolt to specified torque.

Tightening torque: 26 Nm (2.6 kgm, 19 ft.lbs.)

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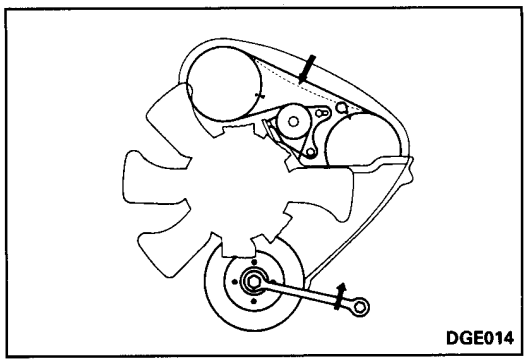
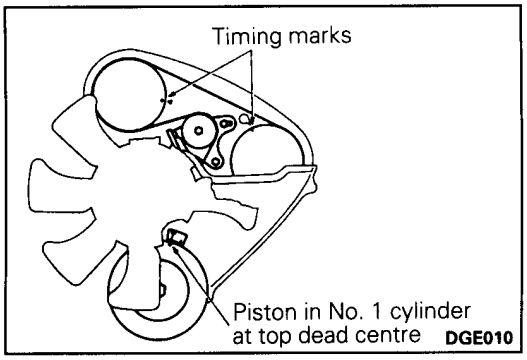

DGE014

(7) Turn the crankshaft anti-clockwise to align the timing marks.
(8) Push down belt at a point halfway with forefinger to check that tension of belt is up to standard value.

Standard value: 4–5 mm (0.16–0.20 in.)

(9) Mount the timing belt upper cover.

TIMING BELT "B" TENSION ADJUSTMENT E11FFBF

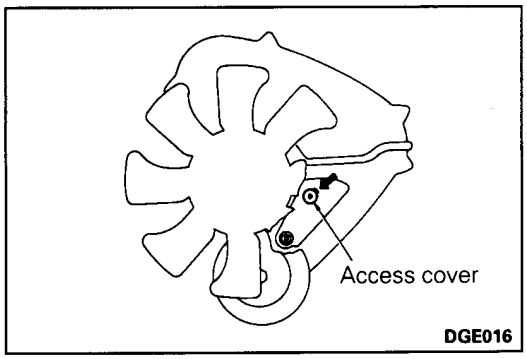


DGE010

(1) Remove timing belt upper cover.
(2) Turn the crankshaft in the clockwise direction and check the timing belt around its entire circumference for abnormalities.
(3) Align the timing mark on the sprockets with the timing mark on the front upper case.

Caution
When aligning the timing mark, be sure not to turn the crankshaft in the counterclockwise direction as this can cause improper belt tension.

(4) Remove the access cover.

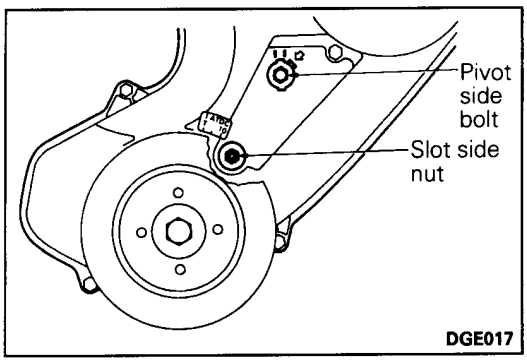


DGE016

(5) Loosen the tensioner pivot side bolt 1 turn and slot side nut 1 or 2 turns.
(6) First tighten tensioner slot side nut, and then tighten pivot side bolt to specified torque.

Tightening torque:

Bolt	**24 Nm (2.4 kgm, 17 ft.lbs.)**
Nut	**26 Nm (2.6 kgm, 19 ft.lbs.)**



DGE017

(7) Mount the access cover.
(8) Mount the timing belt upper cover.

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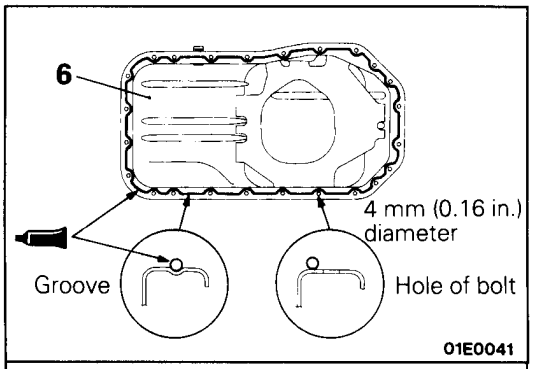
OIL PAN AND OIL SCREEN

E11KA-C

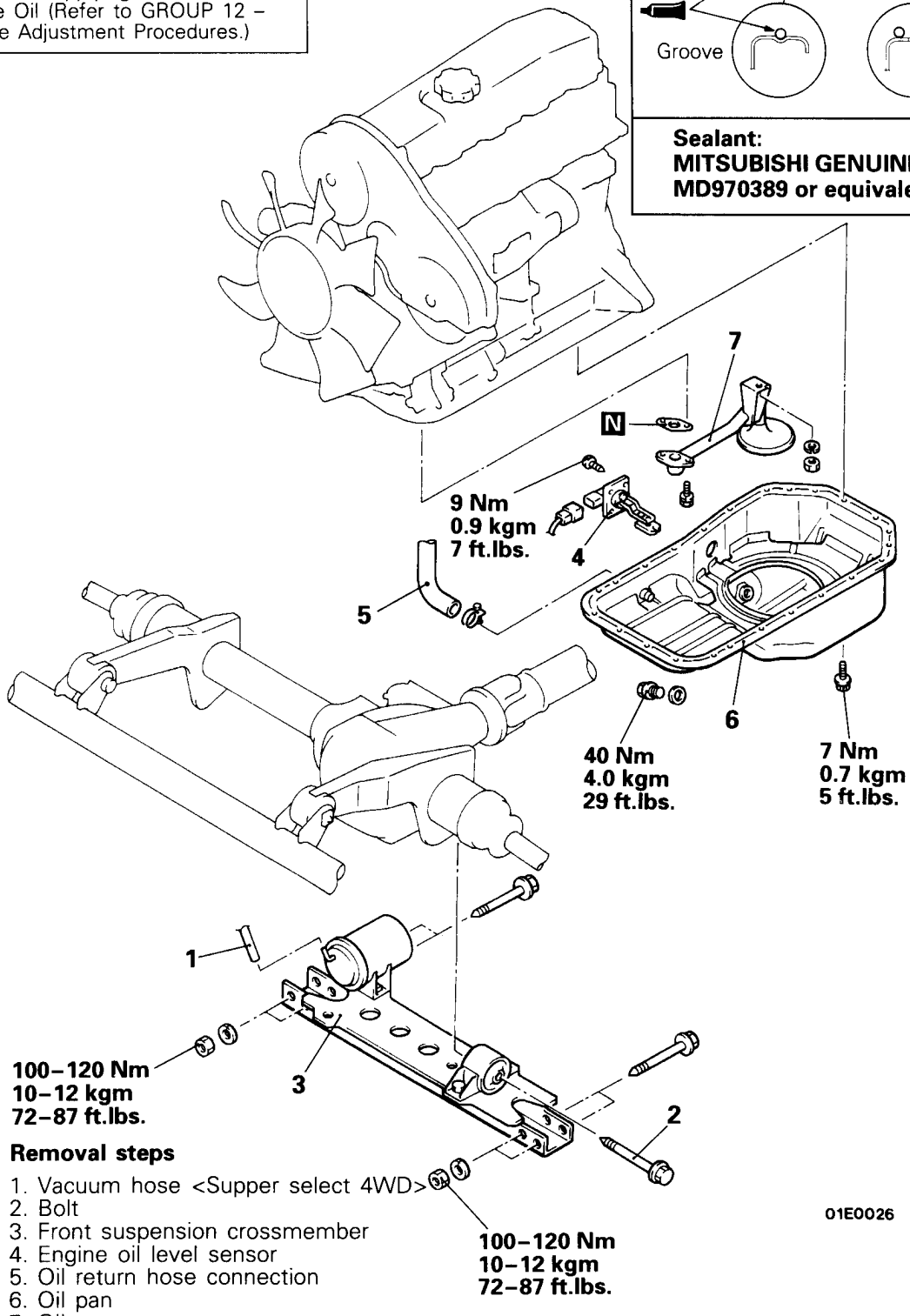
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
Removal and Installation
- Under Skid Plate, Undercover
- Front Exhaust Pipe (Refer to GROUP 15 – Exhaust Pipe and Mufflers.)

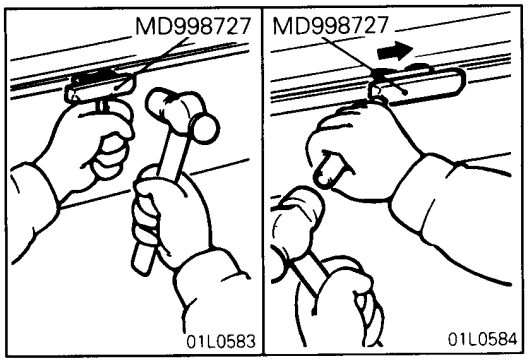
Draining and Supplying
- Engine Oil (Refer to GROUP 12 – Service Adjustment Procedures.)



Sealant:
MITSUBISHI GENUINE Part No. MD970389 or equivalent



Removal steps
1. Vacuum hose <Supper select 4WD>
2. Bolt
3. Front suspension crossmember
4. Engine oil level sensor
5. Oil return hose connection
6. Oil pan
7. Oil screen



SERVICE POINTS OF REMOVAL E11KBCB

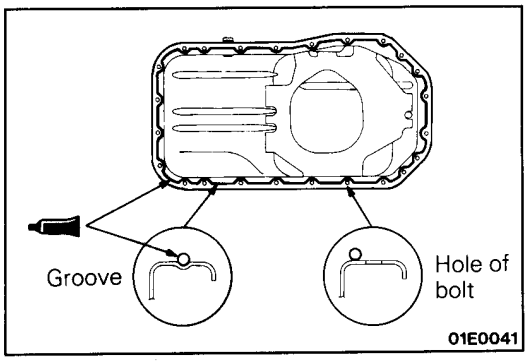
6. REMOVAL OF OIL PAN

(1) Remove oil pan bolts.
(2) Tap the special tool in between the oil pan and cylinder block.
(3) Slide the special tool by tapping it at an angle to remove the oil pan.

Caution
The use of a screwdriver or chisel in place of the special tool can damage the gasket seat surface and cause oil leakage.

INSPECTION E11KEAB3

- Check oil pan for cracks.
- Check oil pan sealant-coated surface for damage and deformation.
- Check oil screen for cracked, clogged or damaged wire net and pipe.



SERVICE POINTS OF INSTALLATION E11KDCA

6. INSTALLATION OF OIL PAN

(1) Remove sealant from oil pan and cylinder block mating surfaces.
(2) Degrease the sealant-coated surface and the engine mating surface.
(3) Apply the specified sealant around the gasket surface of oil pan as specified in illustration.

Specified sealant: MITSUBISHI GENUINE PART No. MD970389 or equivalent

NOTE
The sealant should be applied in a continuous bead approximately 4 mm (0.16 in.) in diameter.

(4) Assemble oil pan to cylinder block within 15 minutes after applying the sealant.

Caution
After installing the oil pan, wait at least 30 minutes before starting the engine.

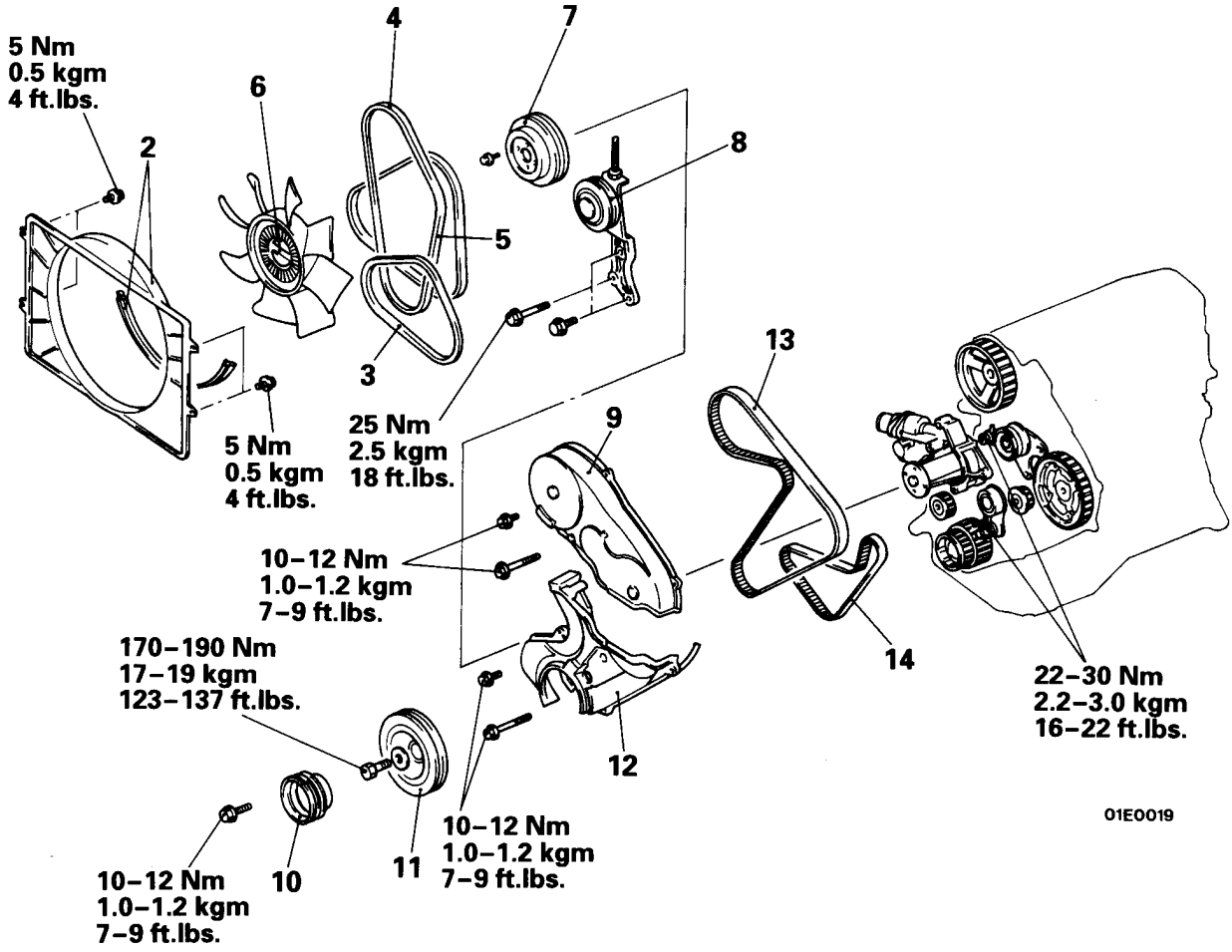
TIMING BELT AND TIMING BELT "B"

E11GA-C

REMOVAL AND INSTALLATION

Pre-removal Operation
- Removal of the Intercooler (Refer to GROUP 15 – Intercooler.)
- Removal of the Under Skid Plate and Undercover
- Draining of the Engine Coolant (Refer to GROUP 14 – Service Adjustment Procedures.)

Post-installation Operation
- Installation of the Intercooler (Refer to GROUP 15 – Intercooler.)
- Installation of the Under Skid Plate and Undercover
- Filling of the Engine Coolant (Refer to GROUP 14 – Service Adjustment Procedure.)
- Adjustment of the Engine (Refer to P.11-49.)



Removal steps

1. Radiator upper hose
2. Radiator fan shroud
- Adjustment of drive belt (Refer to P.11-49.)
3. Drive belt <A/C>
4. Drive belt (Power steering)
5. Drive belt (Alternator)
6. Cooling fan and fan clutch
7. Cooling fan pulley
8. Tension pulley bracket
9. Timing belt front upper cover
10. Crankshaft pulley (A/C /Power steering)
◀▶ 11. Crankshaft pulley
12. Timing belt front lower cover
◀▶ ▶◀ 13. Timing belt
◀▶ ▶◀ 14. Timing belt B

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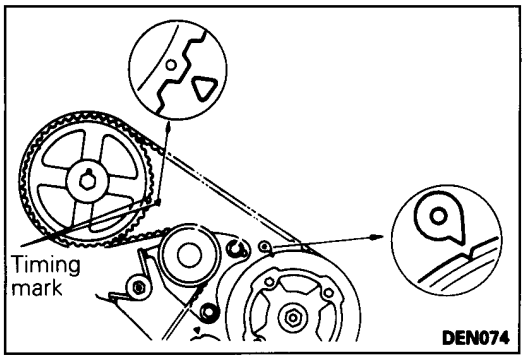
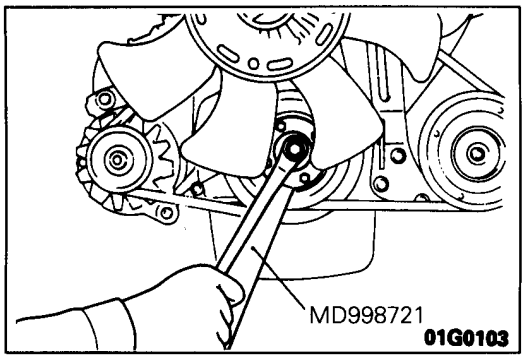


SERVICE POINTS OF REMOVAL E11GBDN

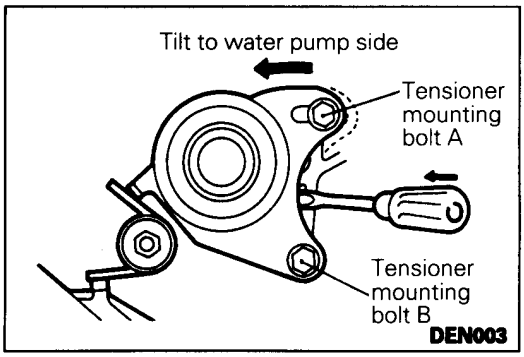
11. REMOVAL OF CRANKSHAFT PULLEY

(1) Position the No. 1 cylinder at compression TDC and remove the crankshaft pulley.

NOTE
The No. 1 cylinder is at compression TDC when the marks are aligned as shown in the figure.

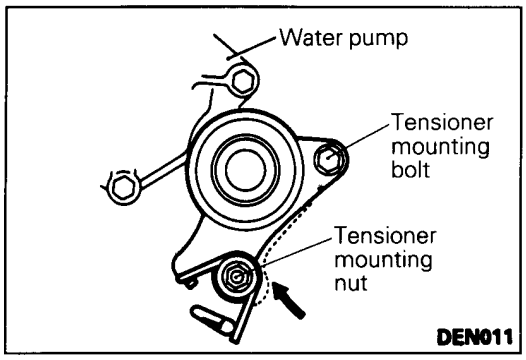


(2) Use the special tool to keep crankshaft from turning and remove the bolts.



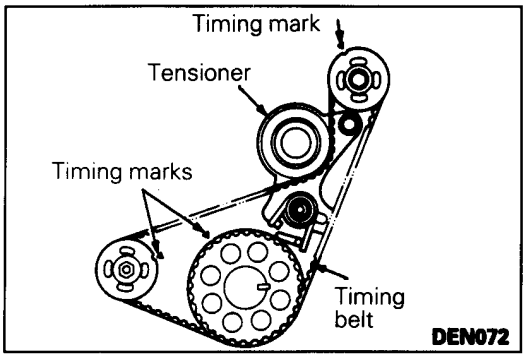
13. REMOVAL OF TIMING BELT

(1) When reinstalling timing belt, mark an arrow at the belt to show rotation direction.
(2) Loosen the tensioner mounting bolt A and B.
(3) Push timing belt tensioner to water pump side and tighten the tensioner mounting bolt A and B. Secure so that tensioner will not move back.



14. REMOVAL OF TIMING BELT "B"

(1) When reinstalling timing belt "B", mark an arrow at the belt to show rotation direction.
(2) Loosen the tensioner mounting bolt and nut.
(3) Push timing belt tensioner to water pump side and tighten the tensioner mounting bolt and nut. Secure so that tensioner will not move back.



SERVICE POINTS OF INSTALLATION E11GDDL

14. INSTALLATION OF TIMING BELT "B"

(1) Align the timing marks of the 3 sprockets.
(2) When reusing timing belt "B", make sure the arrow mark is pointing in the same direction as when the belt was removed.

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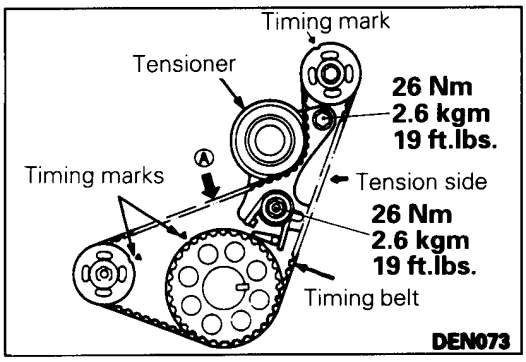
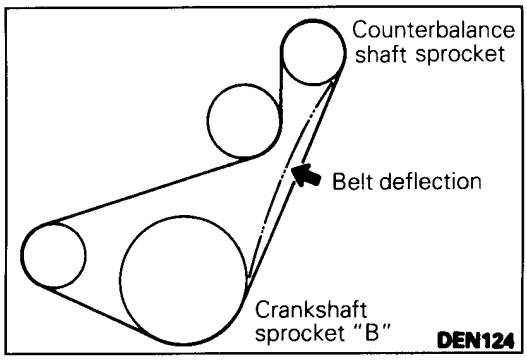
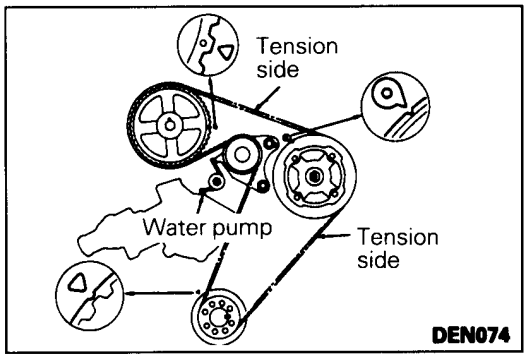






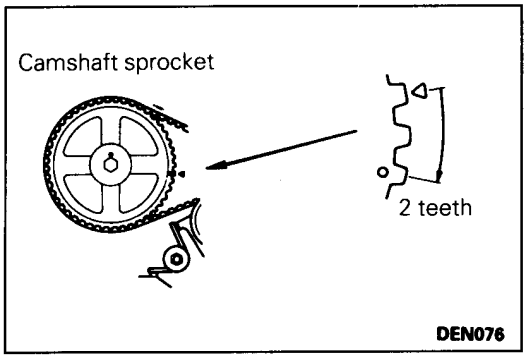
(3) Install timing belt B and make sure there is no deflection on the tension side.
(4) Press the deflection side of timing belt B (indicated by arrow (A)) with the hand and fully stretch the tensioner side.
(5) Make sure that the timing marks are aligned.
(6) Loosen the tensioner mounting bolt and nut so that only the pressure of the spring is applied to timing belt B.
(7) Tighten the tensioner mounting bolt and nut, tightening the nut first. If the bolt is tightened first, the tensioner will move and tension the belt.
(8) Press in the direction of the arrow in the figure with the index finger to check the amount of deflection.

Standard value: 4–5 mm (0.16–0.20 in.)

13. INSTALLATION OF TIMING BELT

(1) Align the timing marks of the 3 sprockets.
(2) When reusing timing belt, make sure the arrow mark is pointing in the same direction as when the belt was removed.
(3) Install the timing belt to the crankshaft sprocket, to injection pump sprocket, to tensioner and to camshaft sprocket in that order, using care not to allow defection on the tension side of the timing belt.

Caution
1. **Engage the belt on the various sprockets while maintaining tension on the belt of tension side.**
2. **Align the injection pump sprocket with the timing mark, hold the sprocket so that it does not turn and engage the belt.**



(4) Loosen the tensioner mounting bolts and apply tension with the spring.
(5) Turn the crankshaft clockwise and stop at the second lobe of the camshaft sprocket.

Caution
1. **When turning the crankshaft in item (5), strictly observe the specified amount of rotation (2 teeth on the camshaft sprocket) in order to apply a constant force to the tension side of the belt.**
2. **Do not turn the crankshaft counterclockwise.**
3. **Do not touch the belt during adjustment.**

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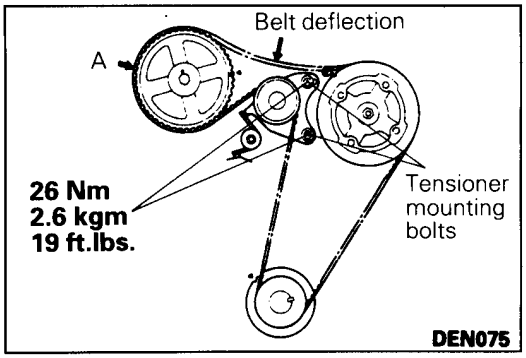
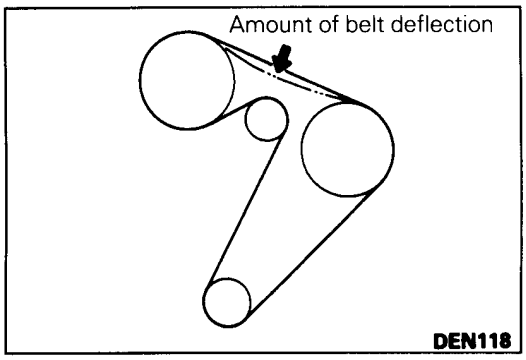


(6) Inspect to make sure that the part indicated by arrow A does not float upward.
(7) Tighten the tensioner mounting bolts, starting with the bolt in the elongated hole. If the lower bolt is tightened first, belt tension will become too tight.

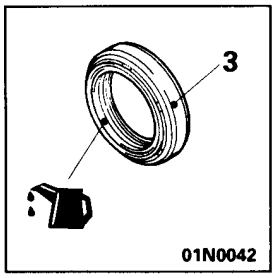


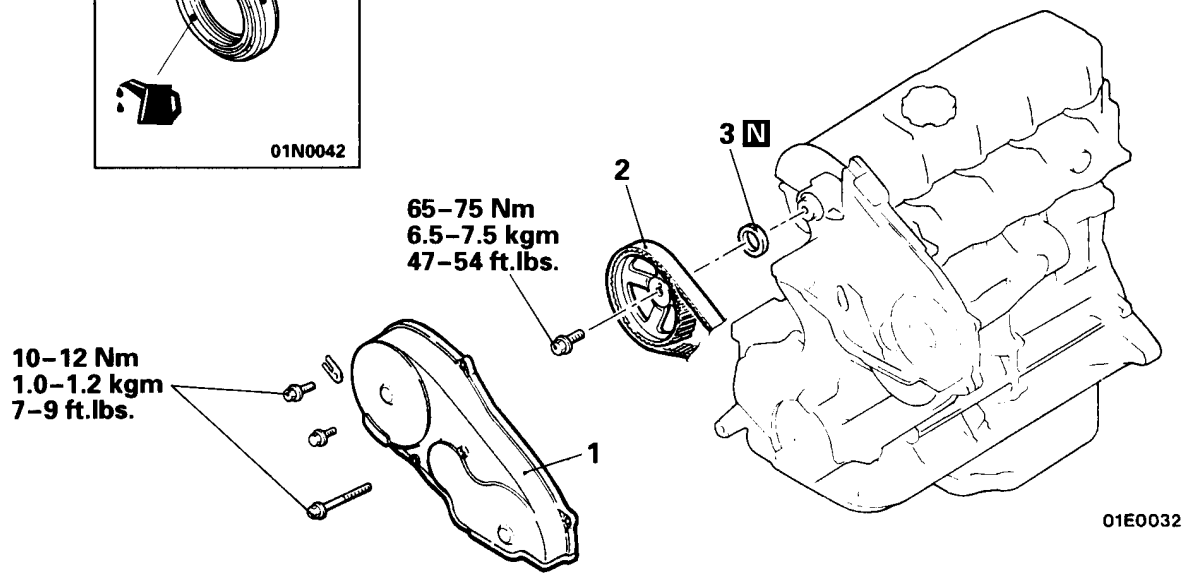
(8) Turn the crankshaft anticlockwise and align the timing mark. Next, make sure that the timing marks of all sprockets are aligned.
(9) Press on the centre of the belt with an index finger to check the amount of deflection.
Standard value: 4–5 mm (0.16–0.20 in.)

CAMSHAFT OIL SEAL

E11VA-C

REMOVAL AND INSTALLATION





1. Timing belt upper cover
2. Camshaft sprocket
3. Oil seal

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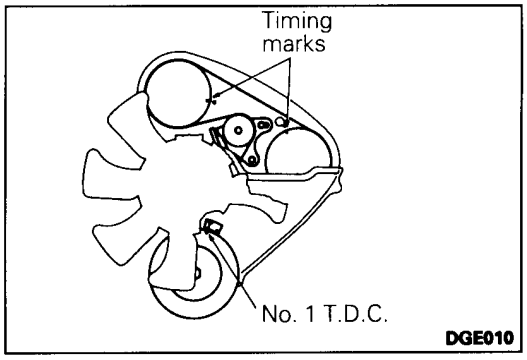
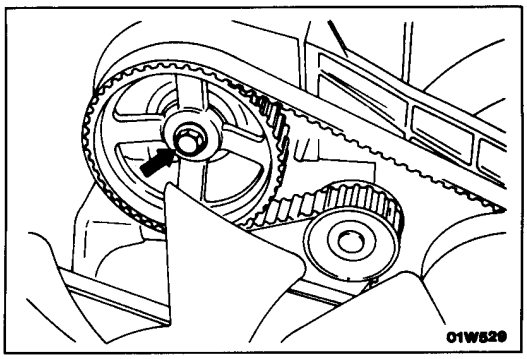


SERVICE POINT OF REMOVAL E11VBBA

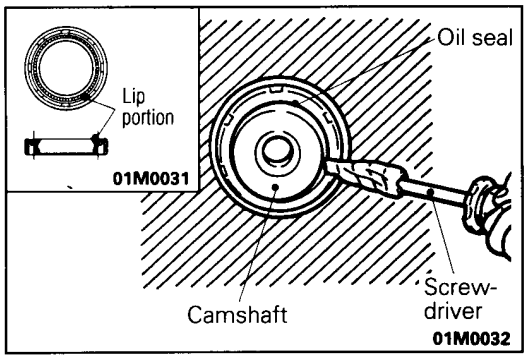
2. REMOVAL OF CAMSHAFT SPROCKET

(1) Rotate crankshaft clockwise (to the right) and align timing marks.



(2) Remove camshaft sprocket with timing belt and place it on timing belt front lower cover.

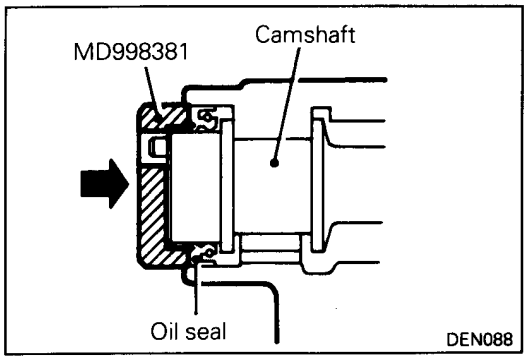
NOTE
1. Secure timing belt to sprocket with wire etc., to prevent them from slipping out of place.
2. Do not rotate crankshaft after removing camshaft sprocket.



3. REMOVAL OF OIL SEAL

(1) Cut out a portion in the camshaft oil seal lip.
(2) Cover the tip of a screwdriver with a cloth and apply it to the cutout in the oil seal to pry off the oil seal.

Caution
Take care not to damage the camshaft and cylinder head.



SERVICE POINT OF INSTALLATION E11VCBA

3. INSTALLATION OF OIL SEAL

(1) Apply oil to the oil seal lips.
(2) Using special tool, press-fit a new camshaft oil seal into the front bearing cap.

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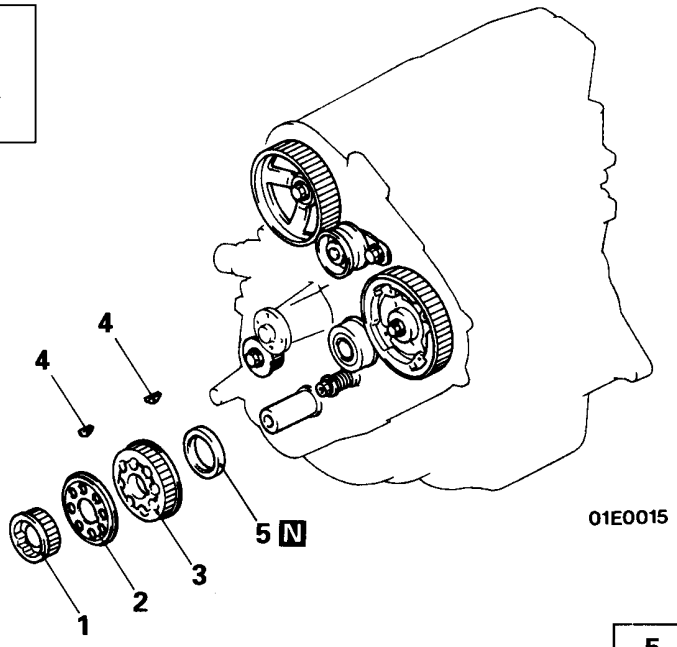
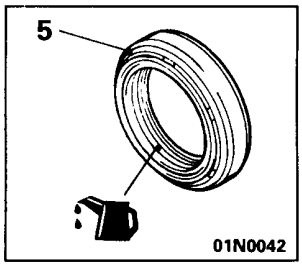
CRANKSHAFT OIL SEALS

E11UA-C

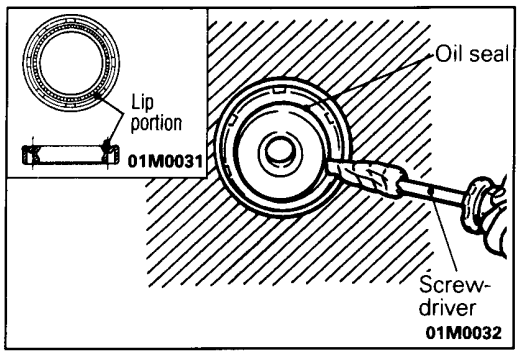
FRONT OIL SEAL
REMOVAL AND INSTALLATION

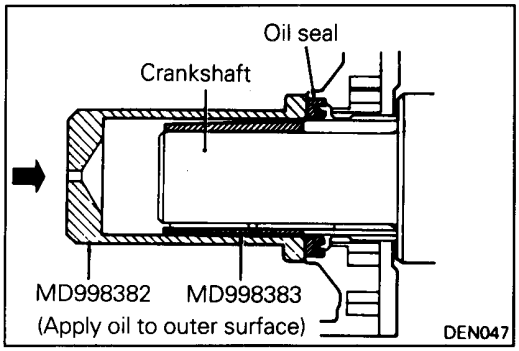
Pre-removal and Post-installation Operation
- Removal and installation of Timing Belt and Timing Belt "B" (Refer to P.11-60.)





Removal steps
1. Crankshaft sprocket
2. Flange
3. Crankshaft sprocket "B"
4. Key
5. Oil seal





SERVICE POINT OF REMOVAL

E11UBBA

5. REMOVAL OF OIL SEAL

(1) Cutout of a portion in the crankshaft oil seal lip.
(2) Cover the tip of a screwdriver with a cloth and apply it to the cutout in the oil seal to pry off the oil seal.

Caution
Take care not to damage the crankshaft and front case.

SERVICE POINT OF INSTALLATION

E11UCBB

5. INSTALLATION OF OIL SEAL

Apply engine oil to the outside of the special tool (MD998283) and to the oil seal lip, and use the special tool to press-fit the oil seal.

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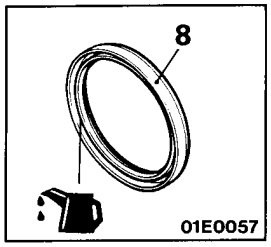
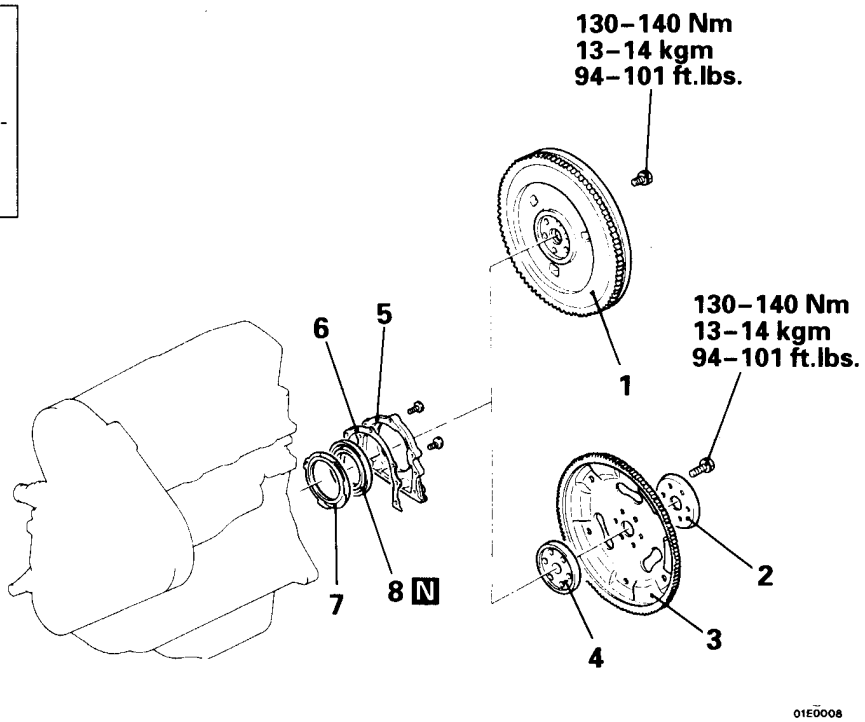
REAR OIL SEAL
REMOVAL AND INSTALLATION

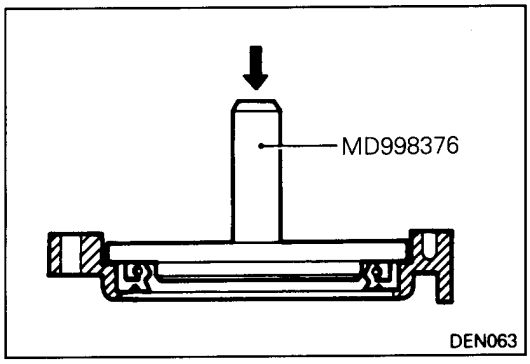
E11UA-F

Pre-removal and Post-installation Operation
- Removal and Installation of Oil Pan (Refer to P.11-58.)
- Removal and Installation of Transmission and Transfer Assembly (Refer to GROUP 22, 23 – Transmission and Transfer Assembly.)





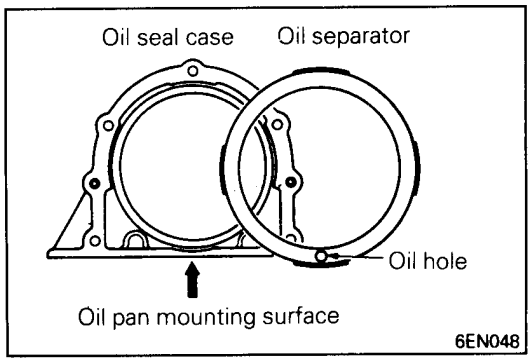
Removal steps
1. Flywheel assembly <M/T>
2. Adaptor plate
3. Drive plate <A/T>
4. Crankshaft adaptor
5. Oil seal case
6. Gasket
7. Oil separator
8. Oil seal



SERVICE POINTS OF INSTALLATION

E11UCBO

8. INSTALLATION OF OIL SEAL



7. INSTALLATION OF OIL SEPARATOR

Install the oil separator in such a way that its oil hole come at the case bottom (indicated by an arrow in illustration).

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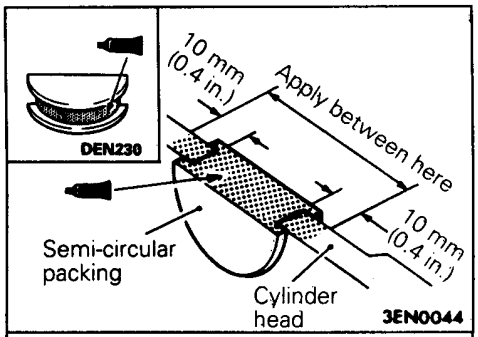
CYLINDER HEAD GASKET

E11JA-C

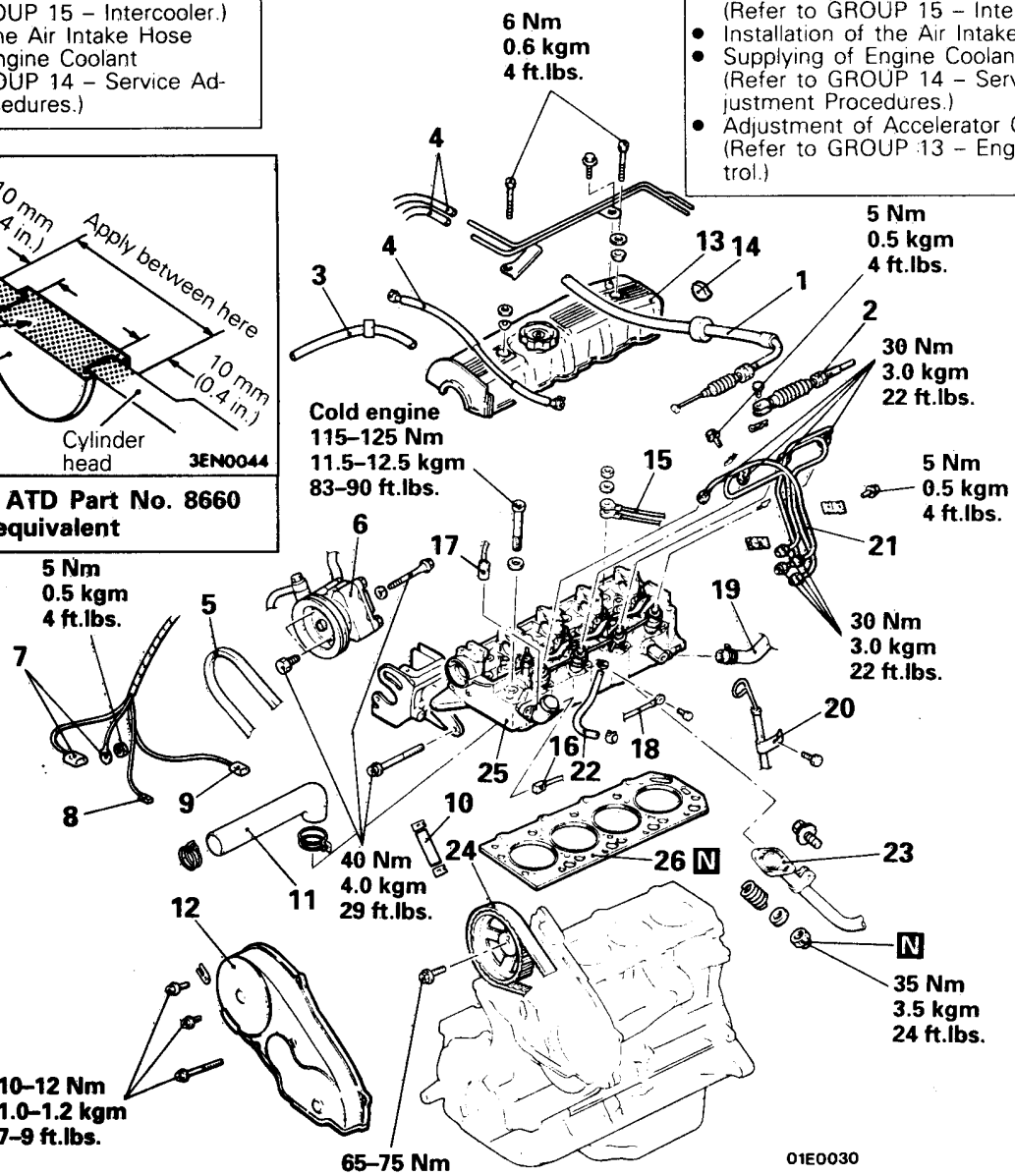
REMOVAL AND INSTALLATION

Pre-removal Operation
- Removal of the Intercooler (Refer to GROUP 15 – Intercooler.)
- Removal of the Air Intake Hose
- Draining of Engine Coolant (Refer to GROUP 14 – Service Adjustment Procedures.)

Post-installation Operation
- Installation of the Intercooler (Refer to GROUP 15 – Intercooler.)
- Installation of the Air Intake Hose
- Supplying of Engine Coolant (Refer to GROUP 14 – Service Adjustment Procedures.)
- Adjustment of Accelerator Cable (Refer to GROUP 13 – Engine Control.)



Sealant: 3M ATD Part No. 8660 or equivalent



Removal steps

1. Accelerator cable connection
2. Kick down cable connection
3. Breather hose connection
4. Vacuum hose connection
   - Adjustment of drive belt tension (Refer to P.11-49)
5. Drive belt } <Power steering>
6. Oil pump } <Power steering>
7. Alternator harness connector
8. Oil pressure gauge unit connector
9. Oil level sensor connector
10. Oil return hose connection
11. Radiator upper hose
12. Timing belt front upper cover
13. Rocker cover
14. Semi-circular packing
15. Glow plug harness connector
16. Engine coolant temperature switch connector <A/C>
17. Engine coolant temperature sensor connector
18. Earth cable connection
19. Heater hose
20. Oil level gauge and gauge guide
21. Injection pipes
22. Fuel return hose
23. Front exhaust pipe connection
24. Camshaft sprocket
25. Cylinder head assembly
26. Cylinder head gasket

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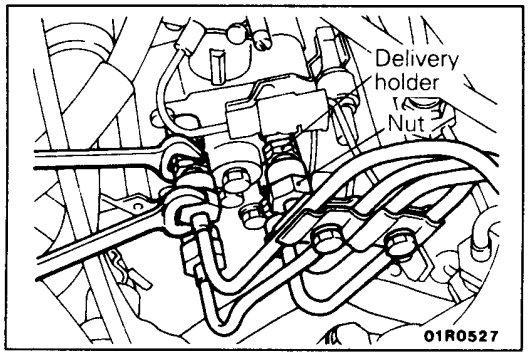
SERVICE POINTS OF REMOVAL E11JBBH

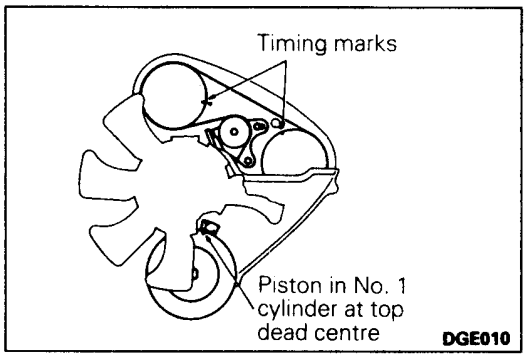
6. REMOVAL OF OIL PUMP <POWER STEERING>

(1) Remove the power steering oil pump. (with the hose attached)
(2) Suspend the remove oil pump (by using wire or similar material) at a place where no damaged will be caused during removal/installation of the cylinder head.



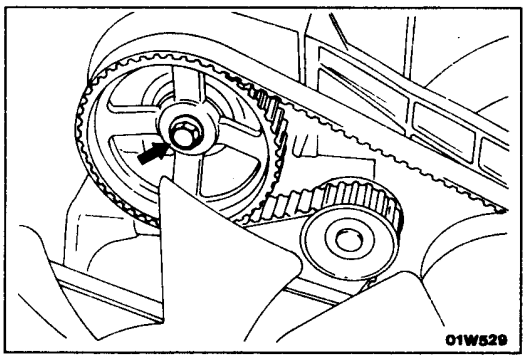
21. DISCONNECTION OF INJECTION PIPE

When loosening nuts at both ends of injection pipe, hold the other side (pump side-delivery holder, nozzle side-nozzle holder) with wrench and loosen nut.



24. REMOVAL OF CAMSHAFT SPROCKET

(1) Rotate the crankshaft clockwise and check that the camshaft sprocket's timing mark and the injection sprocket's timing mark are aligned.

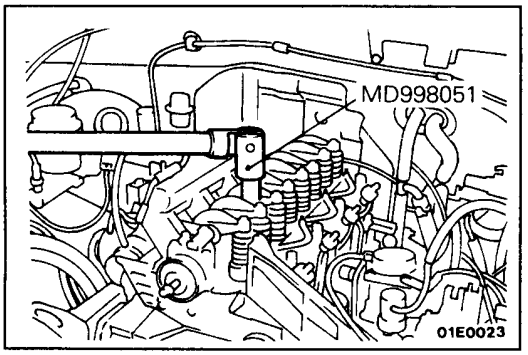


(2) Pull the camshaft sprocket (with the timing belt attached) out from the camshaft, and place it on top of the timing belt front lower cover.

Caution
1. **The crankshaft must not be rotated after the camshaft sprocket is pulled out from the camshaft.**
2. **Take care that there is no slack in the timing belt.**
3. **Use care so that the camshaft sprocket may not disengage from the belt and drop.**

25. REMOVAL OF CYLINDER HEAD ASSEMBLY

(1) Using the special tool, loosen the bolts in 2 or 3 steps, and then remove them.
(2) Suspend the chain block-and-tackle from a hanger, and remove the cylinder head assembly from the cylinder block.



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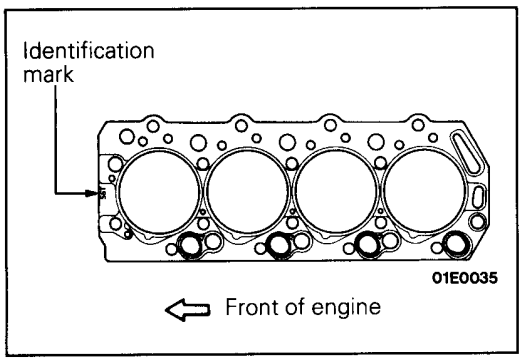

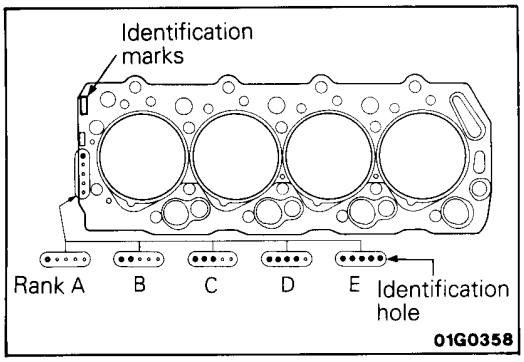

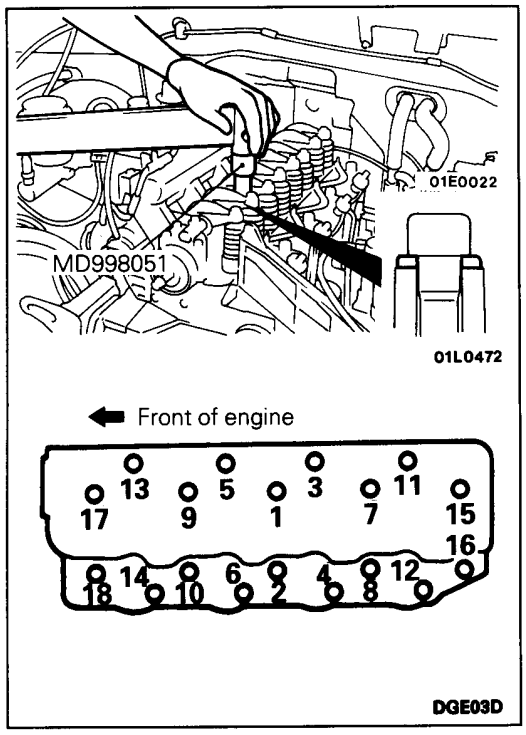

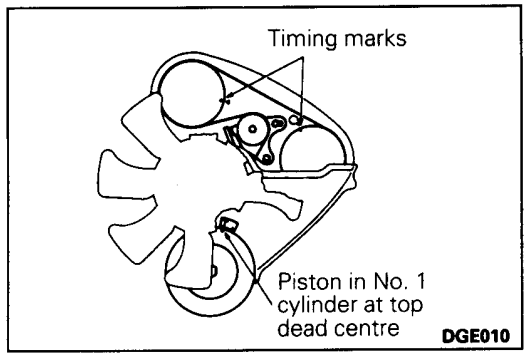

SERVICE POINTS OF INSTALLATION E11JDBI

26. INSTALLATION OF CYLINDER HEAD GASKET

<Without identification hole>

(1) Clean both gasket surfaces of cylinder head and cylinder block.
(2) Lay the cylinder head gasket on cylinder block with the identification mark at front top.

<With identification hole>

(1) Wipe off any oil or grease from the gasket mounting surface.
(2) Identify a rank by the number of the identification hole and select a gasket having the same rank.

NOTE
The ranks are described in "PARTS CATALOGUE".

(3) Place the cylinder head gasket on top of the cylinder block so that the identification mark is facing upwards as in the illustration.

25. INSTALLATION OF CYLINDER HEAD ASSEMBLY

(1) Using the special tool, tighten the bolts (in the order indicated in the figure) in 2 or 3 steps, and finally tighten at the specified torque.

Caution
Install the head bolt washers as shown with shear drop upward.

24. INSTALLATION OF CAMSHAFT SPROCKET

Install the camshaft sprocket to the camshaft. Check that the camshaft sprocket's timing mark and the injection sprocket's timing mark are aligned.

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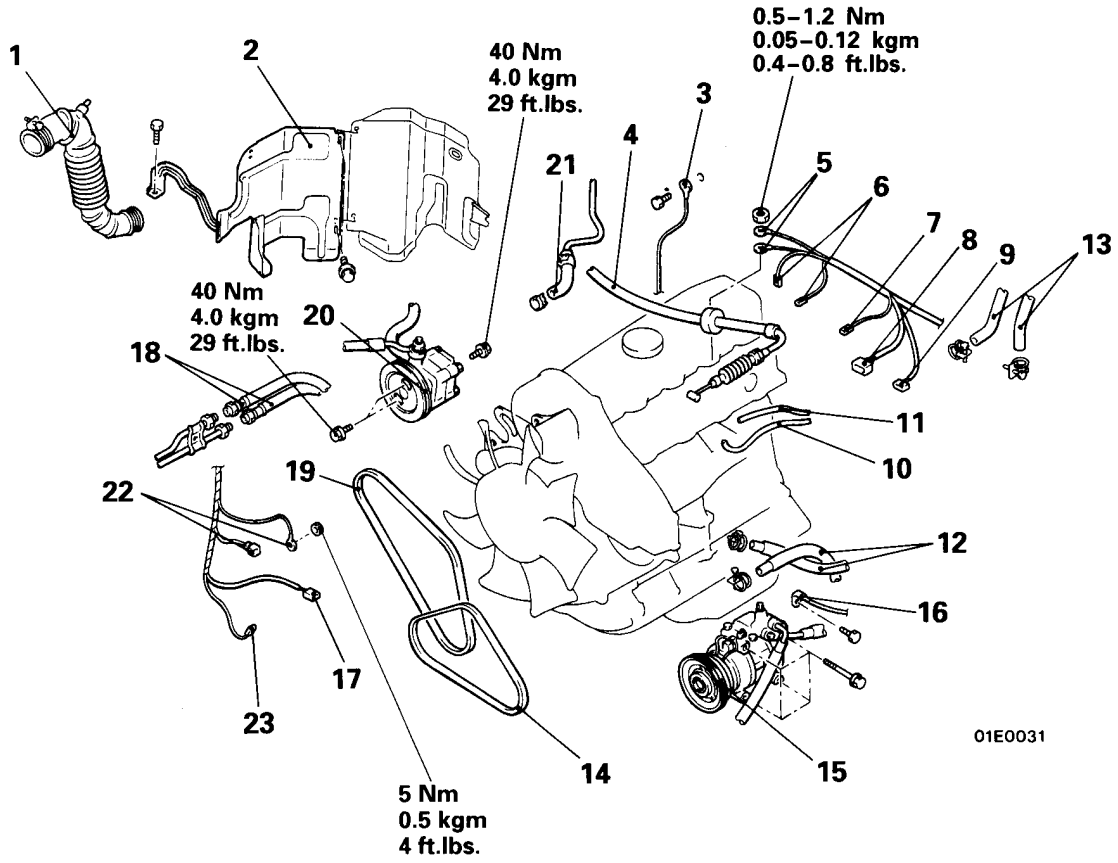
ENGINE ASSEMBLY

E11TA-C

REMOVAL AND INSTALLATION

Pre-removal Operation
- Removal of the Hood (Refer to GROUP 42 – Hood.)
- Removal of the Transmission and Transfer Assembly (Refer to GROUP 22, 23 – Transmission Assembly.)
- Removal of the Intercooler (Refer to GROUP 15 – Intercooler.)
- Removal of the Radiator (Refer to GROUP 14 – Radiator.)
- Removal of Battery and Battery Tray

Post-installation Operation
- Installation of the Transmission and Transfer Assembly (Refer to GROUP 22, 23 – Transmission Assembly.)
- Installation of the Radiator
- Installation of the Intercooler (Refer to GROUP 15 – Intercooler.)
- Installation of Battery and Battery Tray
- Installation of the Hood (Refer to GROUP 42 – Hood.)
- Air bleeding of Fuel System (Refer to GROUP 13 – Service Adjustment Procedures.)
- Adjustment of Drive Belt Tension (Refer to P.11-49.)



Removal steps

1. Air cleaner cover and air intake hose assembly
2. Heat protector
3. Earth cable
4. Accelerator cable connection
5. Glow plug harness connector
6. Engine coolant temperature switch connectors <A/C>
7. Lever position switch connector <A/T-A/C>
8. Lever position sensor connector
9. Sensor connector
10. Vacuum hose <ABS>
11. Vacuum hose <A/C>
12. Fuel hose connections
13. Heater hose connections
14. Drive belt
15. Compressor } <A/C>
16. Earth cable
17. Oil level sensor connector
18. Engine oil cooler hose connection
19. Drive belt
20. Oil pump } <Power steering>
21. Brake booster vacuum hose connection
22. Alternator connector
23. Oil pressure gauge unit connector

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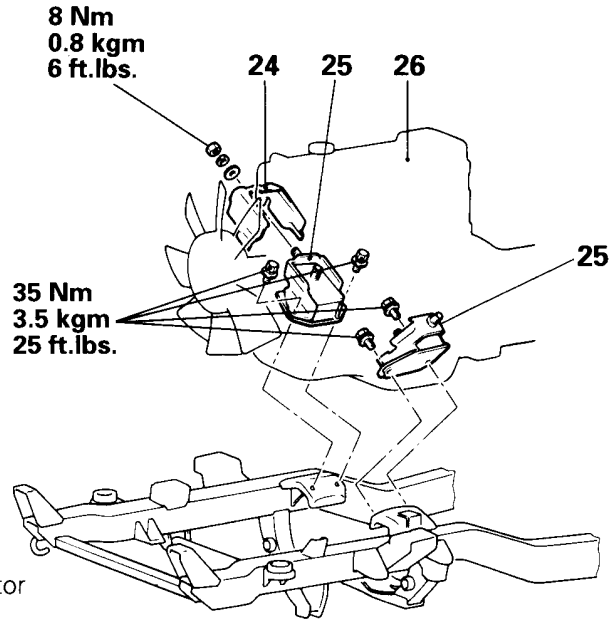

24. Heat protector
25. Engine mounting front insulator attaching bolt
◀■▶ ▶■◀ 26. Engine assembly

SERVICE POINTS OF REMOVAL E11TBAL

15. REMOVAL OF COMPRESSOR <A/C>/20. OIL PUMP (POWER STEERING)

(1) Remove the oil pump and air conditioner compressor (with the hose attached).
(2) Suspend the removed oil pump (by using wire or similar material) at a place where no damage will be caused during removal/installation of the engine assembly.

26. REMOVAL OF ENGINE ASSEMBLY

(1) Check that all cables, hoses, harness connectors, etc. are disconnected from the engine.
(2) Lift the chain block slowly to remove the engine assembly upward from the engine compartment.

SERVICE POINTS OF INSTALLATION E11TDAN

26. INSTALLATION OF ENGINE ASSEMBLY

Install the engine assembly. When doing so, check carefully that all pipes and hoses are connected, and that none are twisted, damaged, etc.

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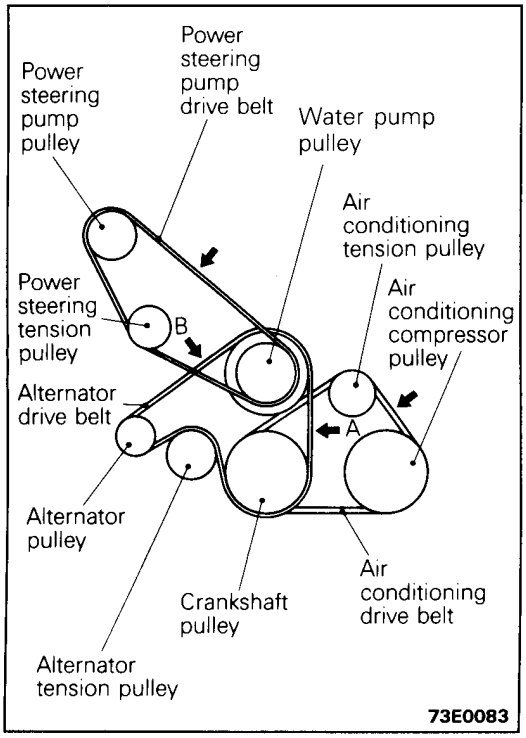

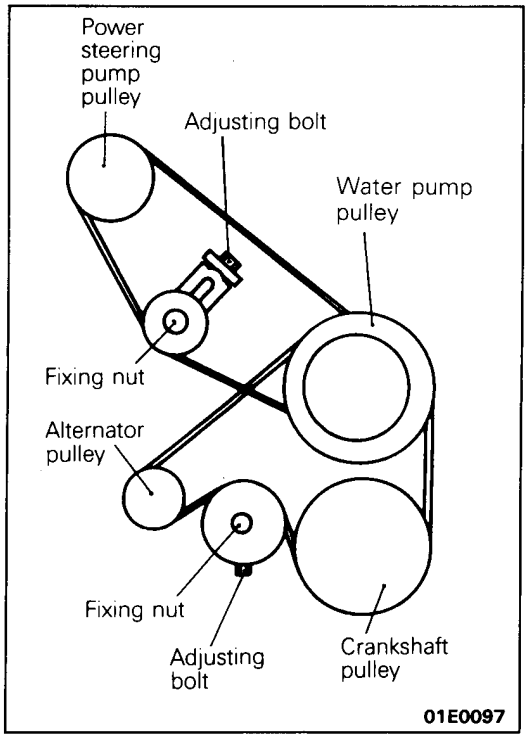

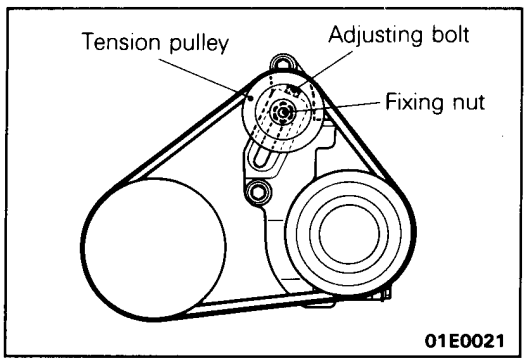

ENGINE <6G74>

SERVICE ADJUSTMENT PROCEDURES

DRIVE BELTS TENSION INSPECTION AND ADJUSTMENT

Apply 100 N force to the belt back midway between the pulleys as shown in the illustration, and use a belt-tension gauge to measure the deflection or the belt tension.

Standard value:

Item		Check value	Adjustment value	
			Used belt	New belt
For alternator	A mm (in.)	5.0–7.0 (0.20–0.28)	6.0 (0.23)	4.0–5.0 (0.16–0.20)
	B mm (in.)	8.5–10.5 (0.33–0.41)	8.5 (0.33)	5.5–7.5 (0.22–0.30)
For power steering	Deflection mm (in.)	13.0–17.0 (0.51–0.67)	14.0–16.0 (0.55–0.67)	11.0–13.0 (0.55–0.63)
For A/C	Deflection mm (in.)	6.5–7.5 (0.26–0.30)	6.5–7.5 (0.26–0.30)	5.0–6.0 (0.20–0.24)

A: Between the water pump pulley and the crankshaft pulley
B: Between the water pump pulley and the alternator pulley

TENSION ADJUSTMENT OF ALTERNATOR DRIVE BELT AND POWER STEERING OIL PUMP DRIVE BELT

(1) Loosen the tension pulley fixing nut.
(2) Adjust belt tension with the adjusting bolt.
(3) Tighten the fixing nut.
(4) Crank the engine once or more.
(5) Check the belt tension.

TENSION ADJUSTMENT OF AIR CONDITIONING COMPRESSOR DRIVE BELT

(1) Loosen the tension pulley fixing nut.
(2) Adjust belt tension with the adjusting bolt.
(3) Tighten the fixing nut.
(4) Crank the engine once or more.
(5) Check the belt tension.

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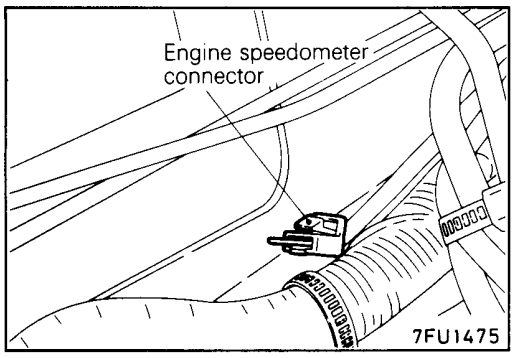


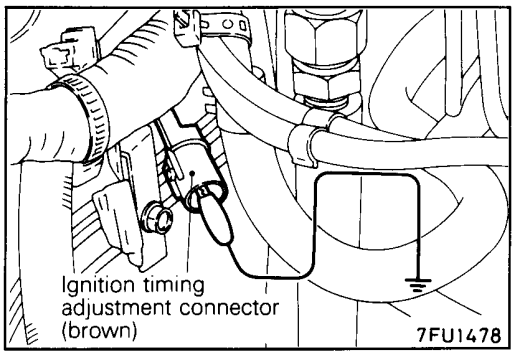
IGNITION TIMING INSPECTION

(1) Before inspection and adjustment, set the vehicle to the following condition.
- Engine coolant temperature: 80–95°C (176–203°F)
- Lights and all accessories: OFF
- Transmission: Neutral (A/T: P range)

(2) Insert a paper clip into the 1-pin connector (blue) as shown in the illustration at left.
(3) Connect a primary voltage detection type tachometer to the paper clip.

NOTE
Do not use the MUT-II. When the MUT-II is connected to the diagnosis connector, the ignition timing will be unchanged instead of reverting to the basic ignition timing.

(4) Install the timing light.
(5) Start the engine and run it at idle.
(6) Check to be sure that the idle speed is approximately 700 ± 100 r/min.
(7) Turn the ignition switch to OFF.



(8) Disconnect the waterproof female connector from the ignition timing adjustment connector (brown).
(9) Use jumper leads to earth the ignition timing adjustment terminal.

NOTE
Earthing the ignition timing adjustment terminal will change the ignition timing to basic ignition timing.

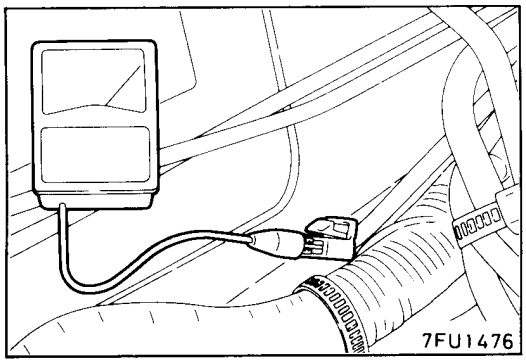
(10) Check the basic ignition timing.

Standard value: 5°BTDC ± 3°

(11) If the ignition timing is outside the standard value, check the MPI System while referring to GROUP 13 – Service Adjustment Procedures.
(12) Disconnect the jumper lead from the ignition timing adjustment connector (brown), and return the connector to its original condition.
(13) Check that the ignition timing is at the standard value.

Standard value: Approx. 15°BTDC

NOTE
1. Ignition timing is variable within about ±7°, even under normal operating.
2. And it is automatically further advanced by about 5° from 10°BTDC at higher altitudes.



IDLE SPEED INSPECTION

(1) Perform inspection and adjustment with the vehicles in the following condition.
- Engine coolant temperature: 80–95°C (176–203°F)
- Lights and all accessories: OFF
- Transmission: Neutral (For A/T: P range)

(2) Check that the standard ignition timing is at the standard value.

Standard value: 5°BTDC ± 3°

(3) After turning the ignition switch to OFF, connect the MUT-II to the diagnosis connector (white).
(4) Start the engine and run it at idle speed.
(5) Let it idle for 2 minutes.
(6) Check idling speed.

Curb idle speed: 700 ± 100 r/min

NOTE
Idle speed is automatically controlled by the idle speed control (ISC) system.

(7) If it is outside the standard value, refer to GROUP 13 – Check Chart Classified by Problem Symptoms and check the MPI components.

IDLE MIXTURE INSPECTION

(1) Before inspection, set the vehicle to the following condition.
- Engine coolant temperature: 80–95°C (176–203°F)
- Lights, power cooling fan and all accessories: OFF
- Transmission: Neutral (A/T: P range)

(2) Check that the basic ignition timing is at the standard value.

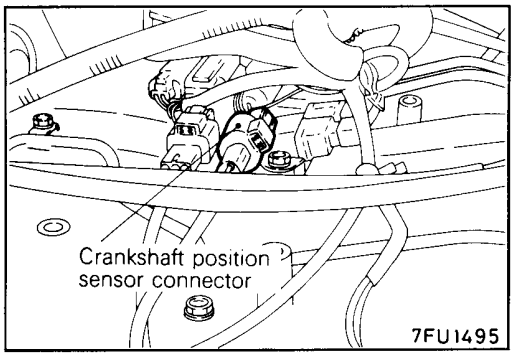
Standard value: 5°BTDC ± 3°

(3) After turning the ignition switch to OFF, connect a tachometer, or connect the MUT-II to the diagnosis connector (white).

NOTE
For the connection procedure for the tachometer, refer to P.11-73.

(4) Start the engine and race it at an engine speed of 2,500 r/min for two minutes.
(5) Connect a CO and HC tester.
(6) Check the CO concentration and the HC concentration while the engine is idling.

Standard value:
CO concentration: 0.5% or less
HC concentration: 100 ppm or less



COMPRESSION . PRESSURE INSPECTION

(1) Before inspection, check that the engine oil, starter and battery are normal. Also, set the vehicle to the following condition:
- Engine coolant temperature: 80–95°C (176–203°F)
- Lights and all accessories: OFF
- Transmission: Neutral (P range for vehicles with automatic transmission)

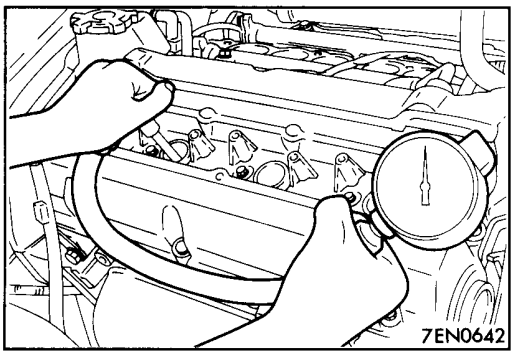
(2) Remove all of the spark plugs.

(3) Disconnect the crankshaft position sensor connector.

NOTE
Doing this will prevent the engine control unit from carrying out ignition and fuel injection.

(4) Cover the spark plug hole with a rag etc., and after the engine has been cranked, check that no foreign material is adhering to the rag.

Caution
1. **Keep away from the spark plug hole when cranking.**
2. **If compression is measured with water, oil, fuel, etc., that has come from cracks inside the cylinder, these materials will become heated and will gush out from the spark plug hole, which is dangerous.**



(5) Set compression gauge to one of the spark plug holes.

(6) Crank the engine with the throttle valve fully open and measure the compression pressure.

Standard value:
1270 kPa (13.0 kg/cm^2, 185 psi) – [250–400 r/min.]
Limit:
min. 900 kPa (9.2 kg/cm^2, 131 psi) – [250–400 r/min.]

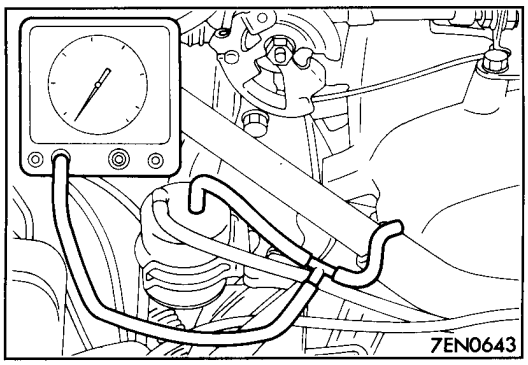
(7) Measure the compression pressure for all the cylinders, and check that the pressure differences of the cylinders are below the limit.

Limit: max. 98.0 kPa (1.0 kg/cm^2, 14 psi)

(8) If there is a cylinder with compression or a compression difference that is outside the limit, pour a small amount of engine oil through the spark plug hole, and repeat the operations in steps (6) and (7).
- ① If the compression increases after oil is added, the cause of the malfunction is a worn or damaged piston ring and/or cylinder inner surface.
- ② If the compression does not rise after oil is added, the cause is a burnt or defective valve seat, or pressure is leaking from the gasket.

(9) Connect the crankshaft position sensor.
(10) Install all spark plugs.
(11) Use the MUT-II to erase the self-diagnosis codes or reconnect the minus (–) cable of the battery after disconnecting it more than 10 seconds.

NOTE
This makes malfunction codes caused by disconnecting the crankshaft position sensor be erased.



MANIFOLD VACUUM INSPECTION

(1) Perform inspection and adjustment with the vehicle in the following condition.
- Engine coolant temperature: 80–95°C (176–203°F)
- Lights and all accessories: OFF
- Transmission: Neutral (P range for vehicles with an automatic transmission)

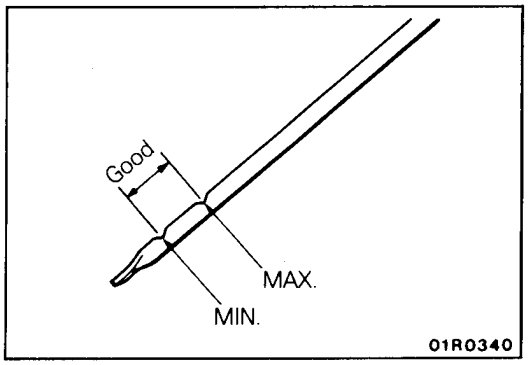
(2) Check to be sure that the idle speed is at the standard value.

Standard value: 700 ± 100 r/min.

(3) Install a T-joint to the vacuum hose between the air intake plenum and the vacuum motor, and then connect a vacuum gauge.
(4) Inspect the vacuum (negative pressure) when the engine is idling.

Limit: min. 69 kPa (515 mmHg, 20 in.Hg)

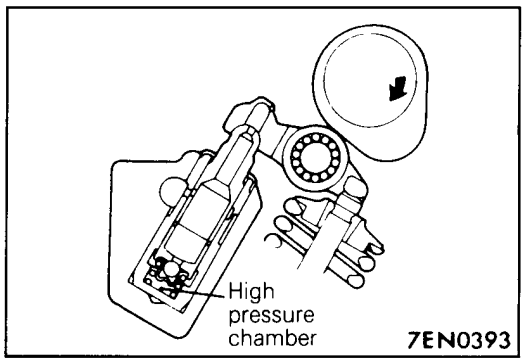
(5) If the idle speed is outside the standard value, refer to the following chart for cause and repair.



LASH ADJUSTER INSPECTION

NOTE
Directly after starting the engine or while the engine is running, if an abnormal sound (clattering) that seems to be coming from the auto-lash adjuster is heard and doesn't stop, carry out the following inspection.
(1) Check the engine oil and refill or replace the oil if necessary.

NOTE
1. If there is a small amount of oil, air is being sucked in through the oil strainer and is getting into the oil passage.
2. If the amount of oil is greater than specified then the oil is mixed by the crankshaft and a large amount of air is mixed into the oil.
3. Air and oil will not separate easily in oil that has degenerated, and the amount of air mixed into the oil will increase.

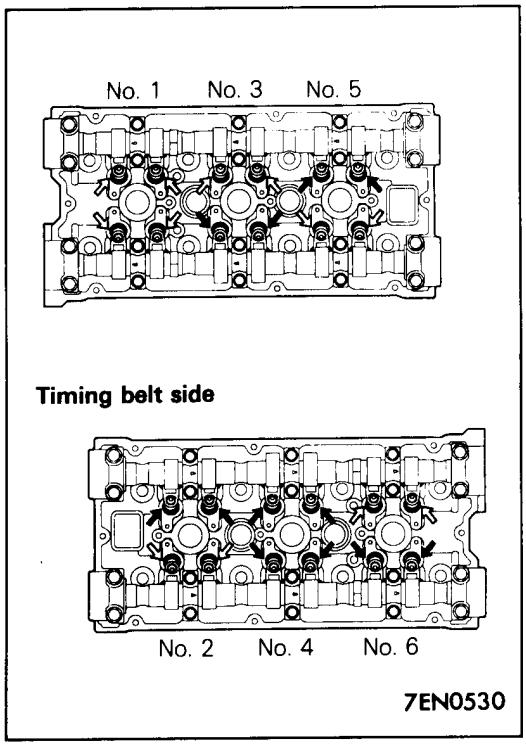


If the air mixed in with the oil due to the above reasons gets into the high pressure chamber of the auto-lash adjuster, the air inside the high pressure chamber will be compressed when the valve is open and the auto-lash adjuster will over-compress, resulting in an abnormal noise when the valve closes. This is the same effect as if the valve clearance is adjusted to be too large by mistake.
In this case, when the air that has got into the auto-lash adjuster is expelled, the condition will return to normal.

(2) Start the engine and gently race* the engine several times (10 times or less).
If the abnormal noise is stopped by the racing, air has been released from the high pressure chamber, and the functioning of the auto-lash adjuster has returned to normal.

* After gradually increasing the engine speed from idle speed to 3,000 r/min (in 30 seconds), gradually reduce the engine speed back to idle speed (in 30 seconds).

NOTE
1. If the vehicle is parked on a slope for a long time, the oil will be sometimes reduced in the auto-lash adjuster, and air will enter the high-pressure chamber when the engine is started.
2. After the vehicle is parked for a long time, the oil will go out of the oil passage. Since it takes a little time to supply oil to the auto-lash adjuster, air sometimes enters the high-pressure chamber.



(3) If the abnormal noise is not stopped by the racing, check the auto-lash adjuster by the following procedure.
1. Stop the engine.
2. Set the engine No.1 cylinder to the compressing top dead centre position.
3. Push the rocker arm in the locations indicated by ⇦ in the illustration at left to check if the rocker arm moves down or not.
4. Slowly turn the crankshaft 360° clockwise.
5. Check the rocker arm in the locations indicated by ⬅ in the illustration at left using the same procedure in step 3.

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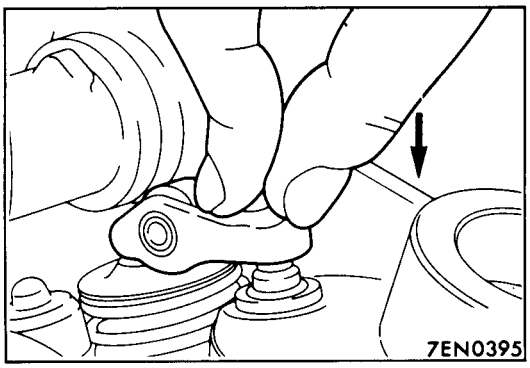
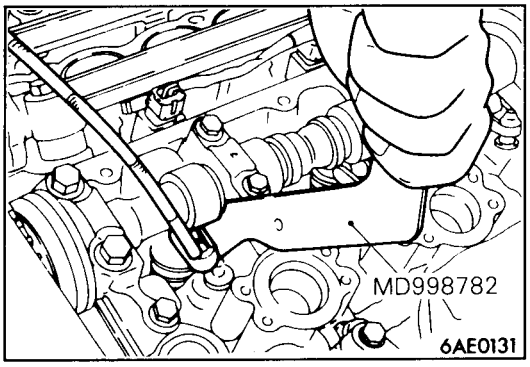


6. If the rocker arm moves down when it is pushed, replace the auto-lash adjuster.
   When replacing the auto-lash adjuster, install after bleeding the air from all of the auto-lash adjusters, and then carry out the checks in steps 1 to 5.
   In addition, if the rocker arm feels extremely stiff when it is pushed and does not move down, the auto-lash adjuster is normal, so investigate for some other cause of the abnormality.

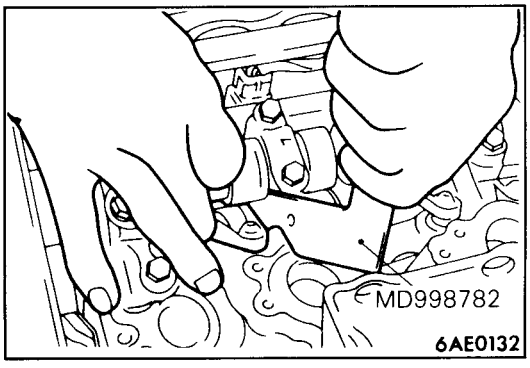
   NOTE
   For the procedure for bleeding the air from the auto-lash adjusters, refer to the Engine Workshop Manual.

(4) Lash adjuster replacement procedure

Caution
In the cylinders which are being removed, the valves will touch the pistons when the valves are pushed down, so the crankshaft should be turned to lower the piston positions.
In addition, places where the rocker arms are lifted by the cams cannot be removed. In these cases, the crankshaft should be turned so that the rocker arms are not lifted.



① Use the special tool to push down the valve, and then remove the roller rocker arm.
② Remove the lash adjuster from the cylinder head.
③ Install a new lash adjuster from which the air has been bled to the cylinder head.



④ Use the special tool to push down the valve, and then install the roller rocker arm.

NOTE
When installing the roller rocker arm, first set the pivot side of the rocker arm onto the top of the lash adjuster, and then after pushing down the valve, set the slipper side of the rocker arm on the end of the valve stem.

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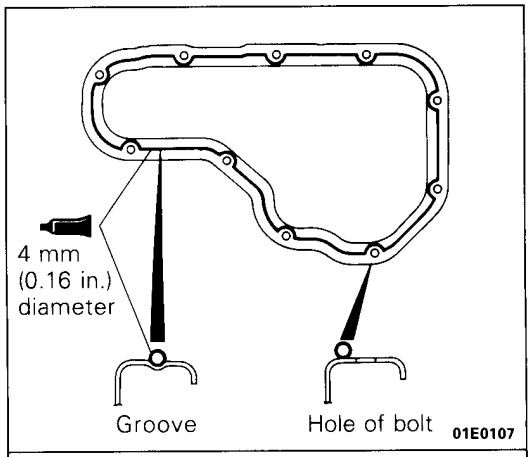
OIL PAN AND OIL SCREEN

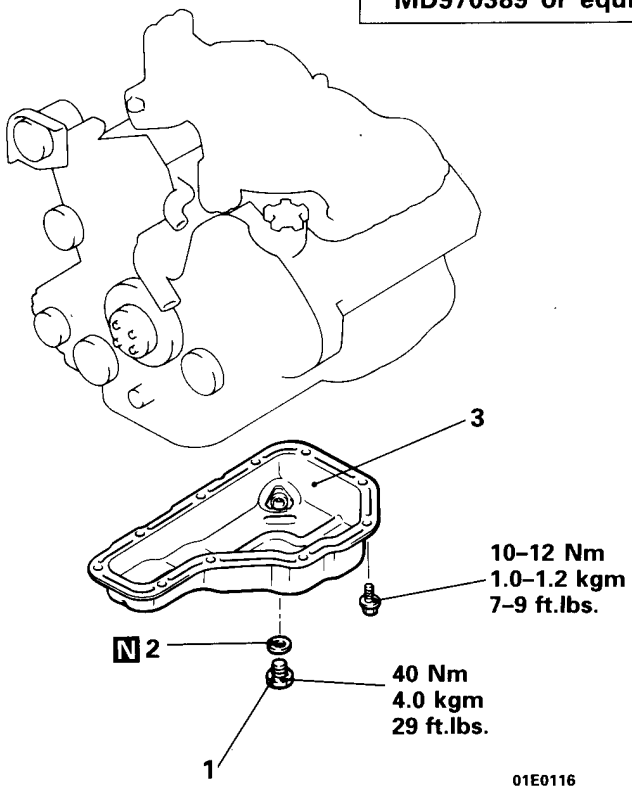
OIL PAN, LOWER
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
Removal and Installation
- Under Skid Plate, Undercover, Air Guide Plate
- Front Exhaust Pipe (Refer to GROUP 15 – Exhaust Pipe, Mufflers and Catalytic Converter.)

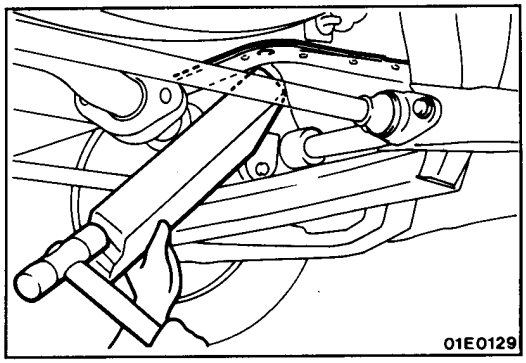
Draining and Supplying
- Engine Oil (Refer to GROUP 12 – Service Adjustment Procedures.)



Sealant:
MITSUBISHI GENUINE PART NO. MD970389 or equivalent



Removal steps
1. Drain plug
2. Gasket
3. Oil pan, lower



SERVICE POINTS OF REMOVAL

3. REMOVAL OF OIL PAN, LOWER

(1) Remove the oil pan, lower installation bolt.
(2) Place a wooden block to the oil pan, lower as shown in the figure and remove by tapping with a hammer.

Caution
The use of an oil pan remover (MD998727) can damage the oil pan, upper (aluminum made).

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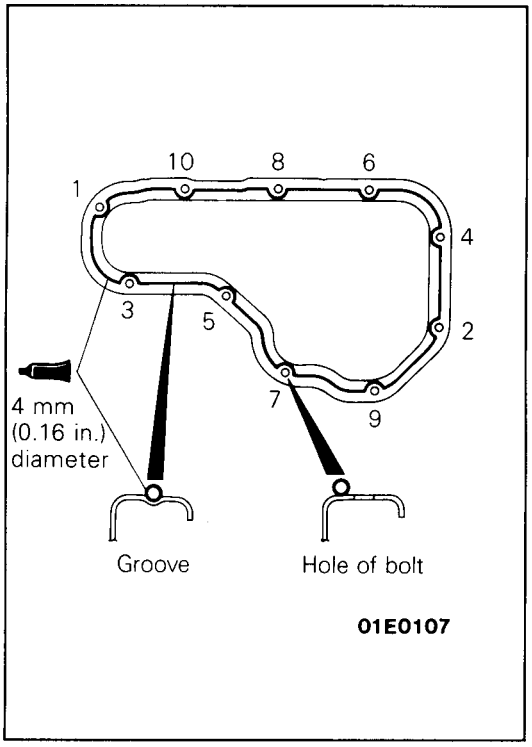
INSPECTION

- Check oil pan for cracks.
- Check oil pan sealant-coated surface for damage and deformation.



SERVICE POINTS OF INSTALLATION

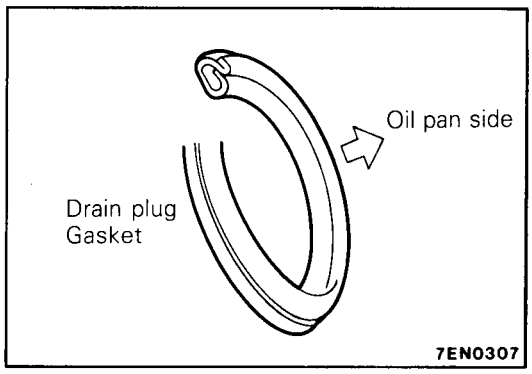
3. INSTALLATION OF OIL PAN, LOWER

(1) Remove sealant from oil pan and cylinder block mating surfaces.
(2) Degrease the sealant-coated surface and the engine mating surface.
(3) Apply the specified sealant around the gasket surface of oil pan as specified in illustration.

Specified sealant: MITSUBISHI GENUINE PART No. MD970389 or equivalent

NOTE
The sealant should be applied in a continuous bead approximately 4 mm (0.16 in.) in diameter.

(4) Assemble oil pan to cylinder block within 30 minutes after applying the sealant.
(5) Tighten the oil pan mounting bolt in the order illustrated (left).



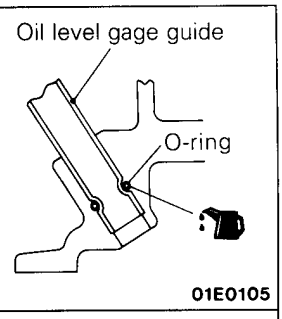
2. INSTALLATION OF GASKET

Replace the gasket with a new gasket, and install it in the direction shown in the illustration.

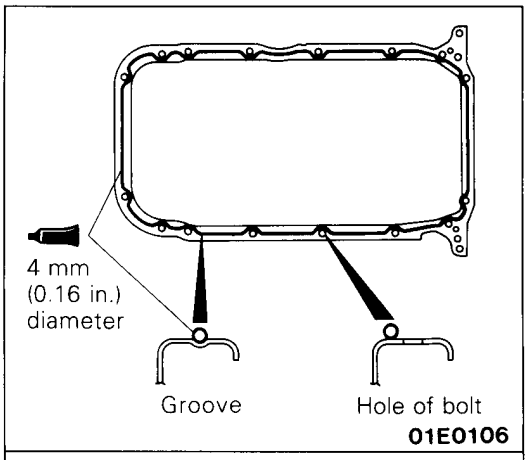
OIL PAN, UPPER AND OIL SCREEN

REMOVAL AND INSTALLATION

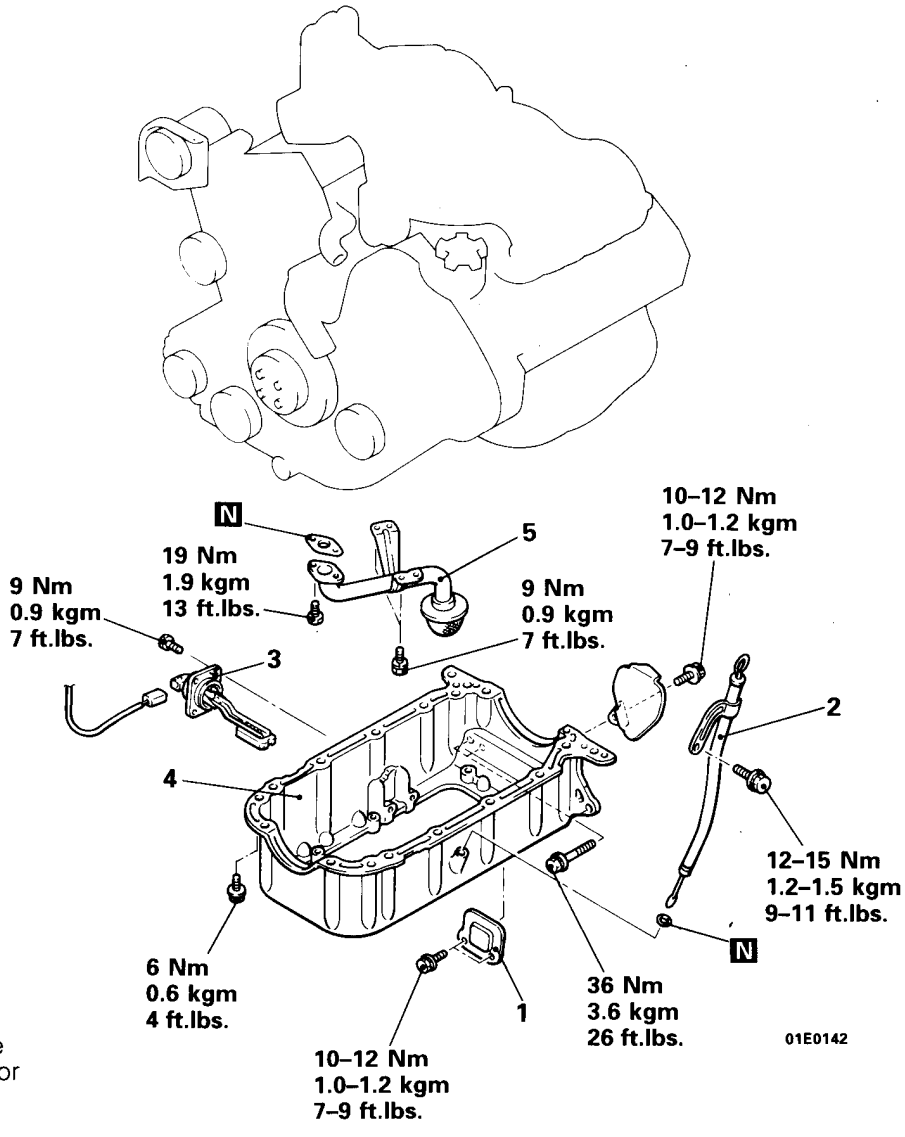
Pre-removal and Post-installation Operation
Removal and Installation
- Oil pan, Lower (Refer to P.11-79.)
- Front Differential Carrier (Refer to GROUP 26 – Differential Carrier)



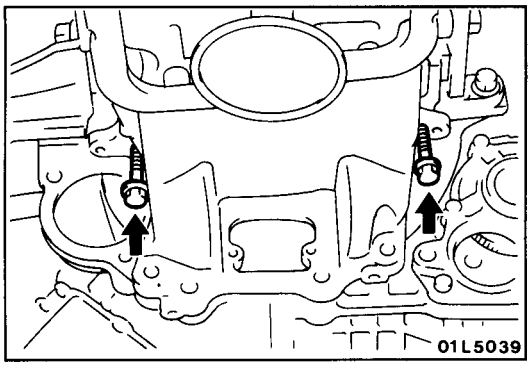
Engine oil



Sealant:
MITSUBISHI GENUINE PART NO. MD970389 or equivalent



Removal steps
1. Cover
2. Oil level gauge guide
3. Engine oil level sensor
◆◆ ◆◆ 4. Oil pan, upper
5. Oil screen



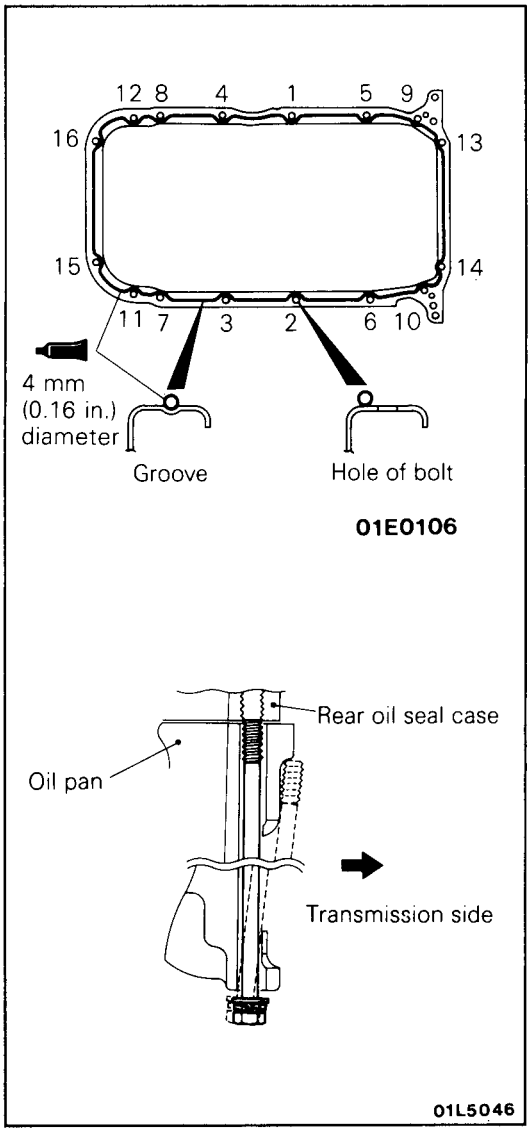
SERVICE POINTS OF REMOVAL

4. REMOVAL OF OIL PAN, UPPER

Install the bolt [bolt diameter × length : 10 × 38 mm (0.39 × 1.50 in.)] that links the oil pan, upper with the transmission in the hole of the oil pan, upper as shown in the figure and tighten the bolt to remove the oil pan, upper.

INSPECTION M11HCAG

- Check oil pan for cracks.
- Check oil pan sealant-coated surface for damage and deformation.



SERVICE POINTS OF INSTALLATION

4. INSTALLATION OF OIL PAN, UPPER

(1) Remove sealant from oil pan and cylinder block mating surfaces.
(2) Degrease the sealant-coated surface and the engine mating surface.
(3) Apply the specified sealant around the gasket surface of oil pan as specified in illustration.

Specified sealant: MITSUBISHI GENUINE PART No. MD970389 or equivalent

NOTE
The sealant should be applied in a continuous bead approximately 4 mm (0.16 in.) in diameter.

(4) Assemble oil pan to cylinder block within 30 minutes after applying the sealant.
(5) Tighten the oil pan mounting bolt in the order illustrated (left).

Caution
Insert the bolts Nos. (13) and (14) to the holes adequately, or the edge of the transmission may be damaged.

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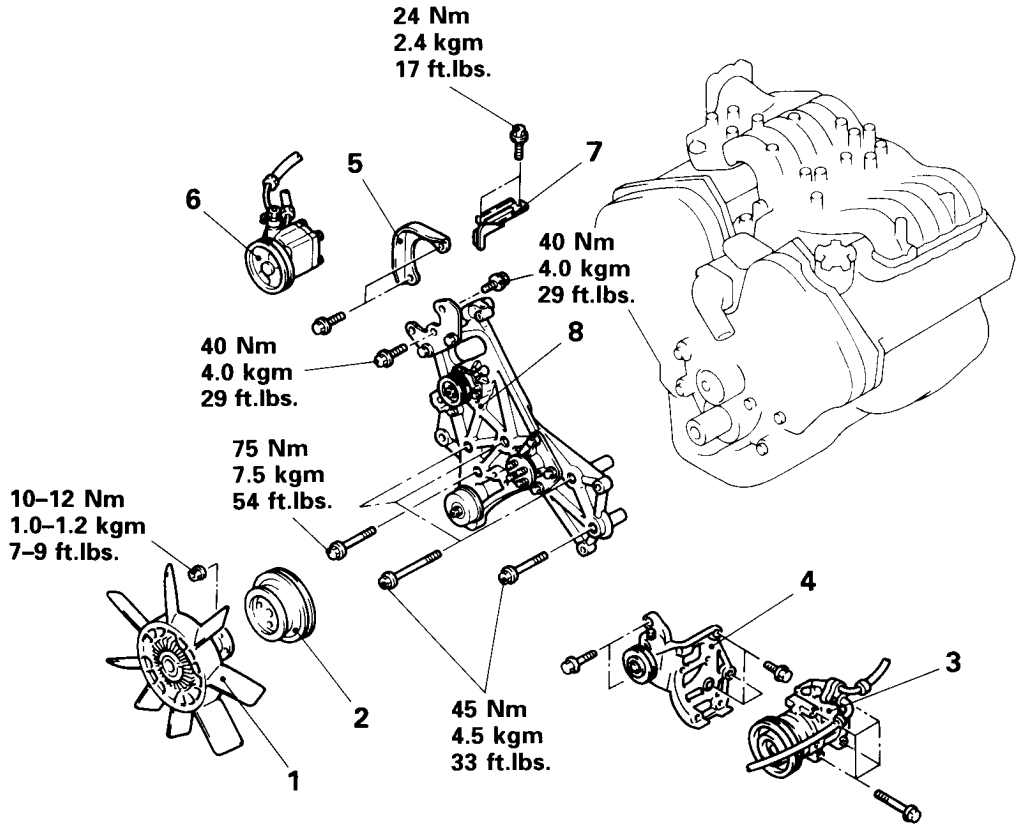
TIMING BELT

REMOVAL AND INSTALLATION

Pre-removal Operation
- Removal of Radiator (Refer to GROUP 14 – Radiator.)
- Removal of Alternator (Refer to GROUP 16 – Alternator.)
- Removal of Battery and Battery Tray
- Removal of the Under Skid Plate, Undercover, Air Guide Plate

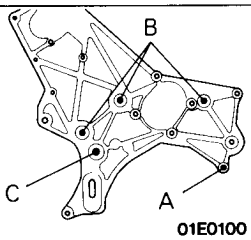
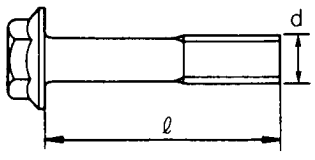
Post-installation Operation
- Installation of the Under Skid Plate, Undercover, Air Guide Plate
- Installation of Battery and Battery Tray
- Installation of Alternator (Refer to GROUP 16 – Alternator.)
- Installation of the Radiator (Refer to GROUP 14 – Radiator.)
- Adjustment of the Engine (Refer to P.11-72.)

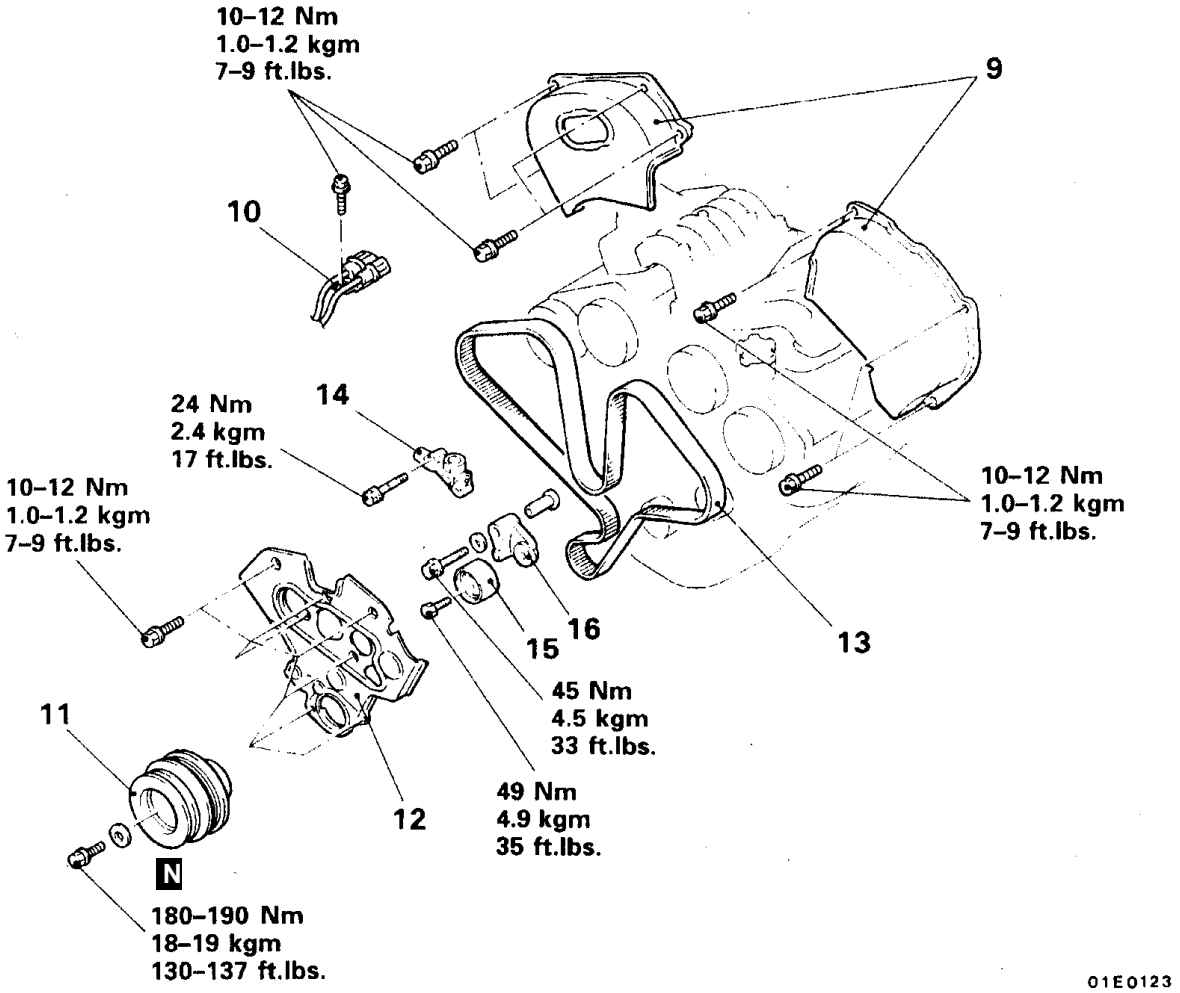


01E0124

Removal steps

1. Cooling fan clutch assembly
2. Water pump pulley
- ◆◆ 3. Compressor } <A/C>
4. Compressor bracket } <A/C>
5. Cover
- ◆◆ 6. Power steering oil pump
7. Accessory mount stay
8. Accessory mount

Symbol	Hardness category	d x ℓ mm	NOTE
A	7T	10 × 80 (0.39 × 3.15)	 01E0100  04U0025
B		10 × 100 (0.39 × 3.93)	
C		12 × 100 (0.47 × 3.93)	



9. Timing belt upper cover
10. Crankshaft position sensor connector

10a! Crankshaft pulley bolt – Заменяйте его на новый при каждом снятии!!! (Информационное письмо ИР-01-003Т)

11. Crankshaft pulley
12. Timing belt lower cover
    • Adjustment of timing belt tension
13. Timing belt
14. Auto tensioner
15. Tension pulley
16. Tension arm assembly

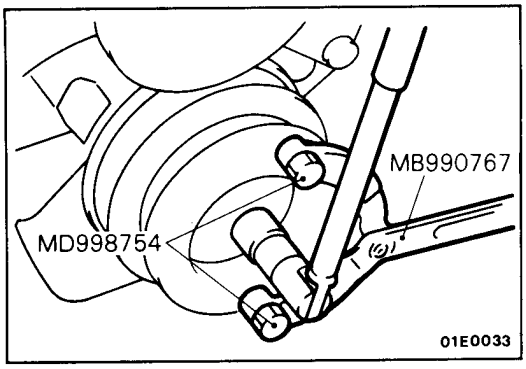
SERVICE POINTS OF REMOVAL

3. REMOVAL OF COMPRESSOR <A/C>/6. OIL PUMP (POWER STEERING)

Remove the oil pump and air conditioning compressor (with the hose attached)

NOTE

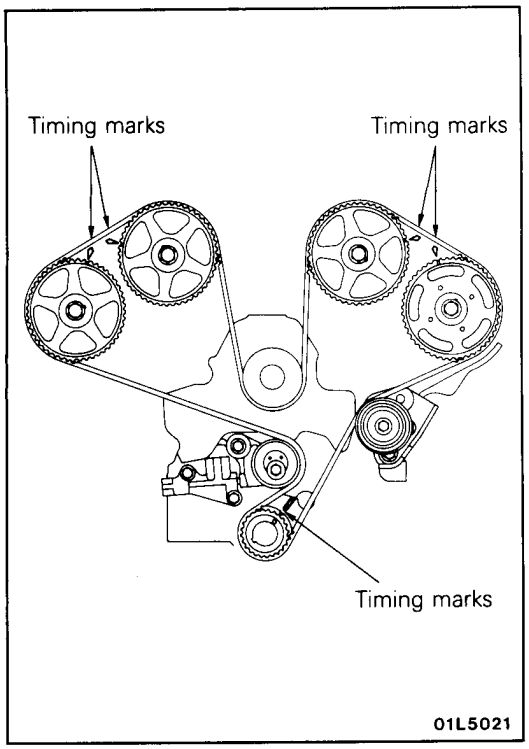
Suspend the removed oil pump (by using wire or similar material) at a place where no damage will be caused during removal/installation of the engine assembly.



11. REMOVAL OF CRANKSHAFT PULLEY

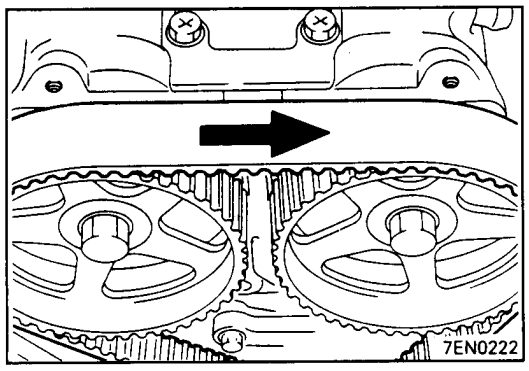
Using special tools, remove the crankshaft pulley from the crankshaft.

Caution
Use only the specified special tools, or a damaged pulley damper could result.



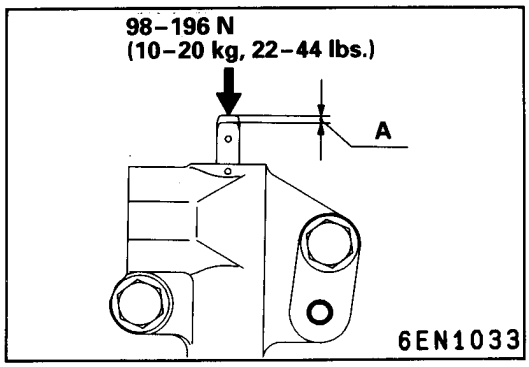
13. REMOVAL OF TIMING BELT

(1) Align the timing marks.



(2) Loosen the center bolt on the tensioner pulley to remove the timing belt.

Caution
1. **Make a mark on the back of the timing belt indicating the direction of rotation so it may be reassembled in the same direction if it is to be reused.**
2. **The cam of the front bank camshaft lifts the valve by means of the rocker arm, the spring force of the valve will easily turn the sprocket, so be careful not to insert your fingers, etc.**



INSPECTION

AUTO TENSIONER

(1) Hold the auto-tensioner by hand and measure contraction (A) when pressing the tip of the rod on a steel (cylinder block, etc.) with a force of 98–196 N (10–20 kg, 22–44 lbs.).

Standard value (A): 1 mm (0.04 in.) or less

(2) If not within the standard value, replace the auto-tensioner.

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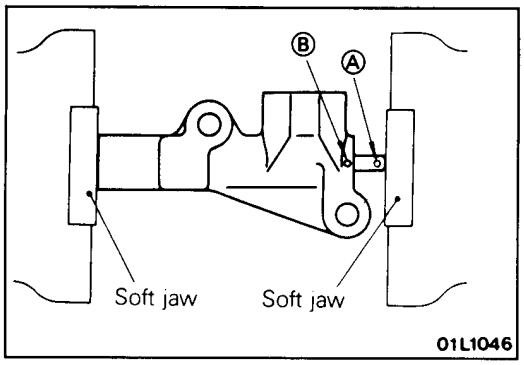


SERVICE POINTS OF INSTALLATION

14.INSTALLATION OF AUTO TENSIONER

(1) If the auto tensioner rod is in its fully extended position, reset it as follows.

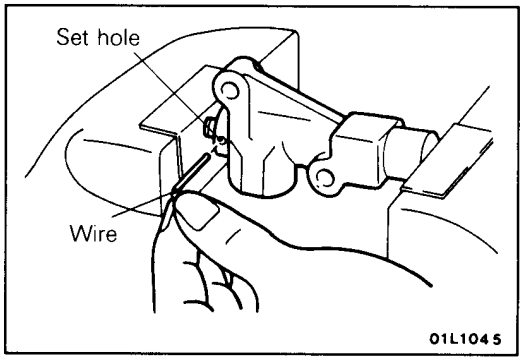
① Keep the auto tensioner level and, in that position, clamp it in the vise with soft jaws.

② Push in the rod little by little with the vise until the set hole Ⓐ in the rod is aligned with that Ⓑ in the cylinder.

Caution

1. The auto tensioner must be placed at a right angle to the pressing surface of press or vise.

2. Push in the rod slowly to prevent the push rod from being damaged.



③ Insert a wire [1.4 mm (0.055 in.) in diameter] into the set holes.

NOTE

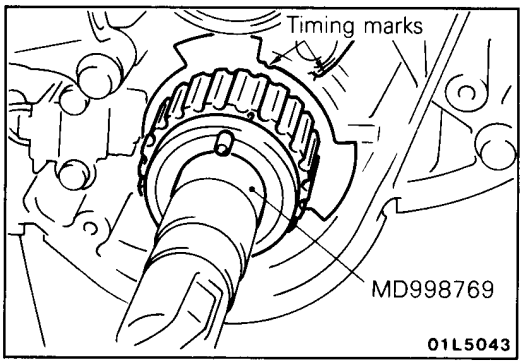
The wire should be as stiff as possible (such as piano wire, etc.), and should be bent into the shape of an "L".

④ Unclamp the auto tensioner from the vise.

(2) Install the auto tensioner.

Caution

Leave the wire installed in the auto tensioner.

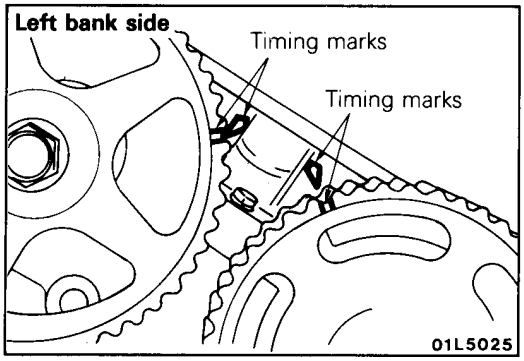


13.INSTALLATION OF TIMING BELT

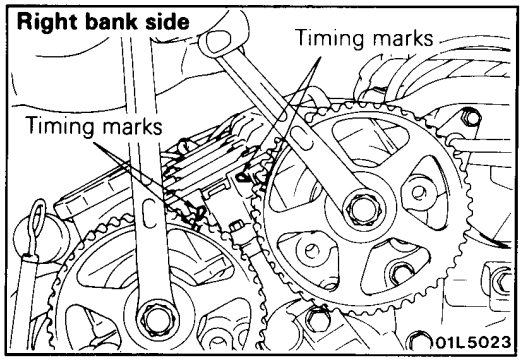
(1) Install the crankshaft pulley and turn the crankshaft sprocket timing mark forward 3 teeth to move the piston slightly past No.1 cylinder top dead centre.

Caution

When the camshaft sprocket is turned with No.1 cylinder top dead centre, there is a danger that the valve and piston will interfere.



(2) Align the timing mark of the left bank side camshaft sprocket.

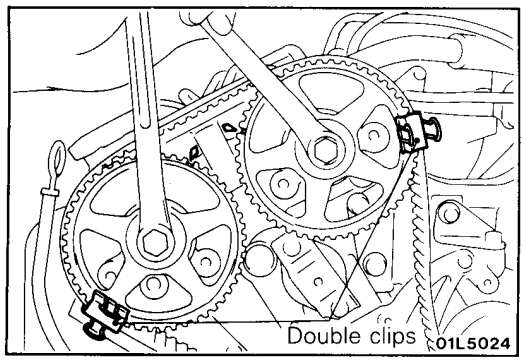


(3) Align the timing mark of the right bank side camshaft sprocket and .support it not to rotate with a closed wrench.

Caution

1. The camshaft sprocket will easily turn because of the valve spring force, so be careful not to insert your fingers, etc.

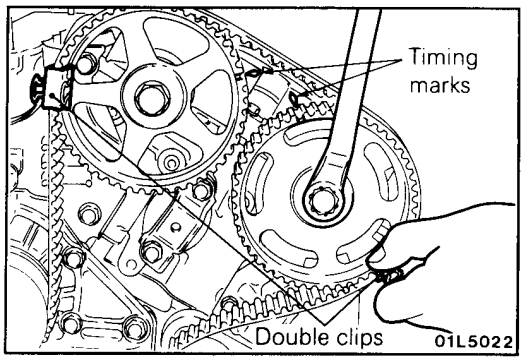
2. If the sprocket on one side of the right bank is turned one full revolution while the sprocket timing marks on the opposite side of the right bank are aligned, the intake and exhaust valves may cause interference.



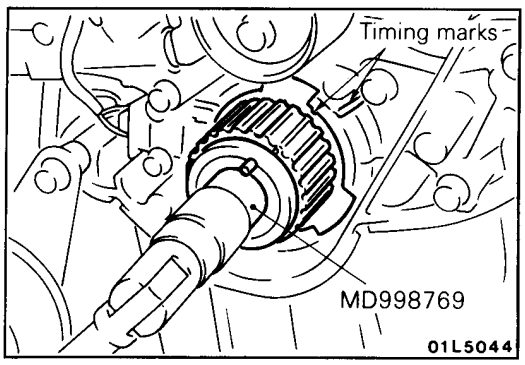
(4) Check that the camshaft sprocket timing mark of the right bank side is aligned and clamp timing belt with double clips.

Caution

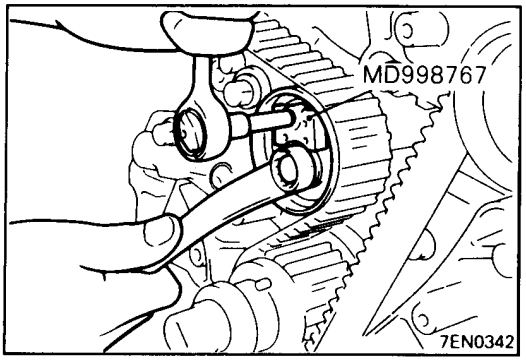
If the timing belt is reused, install so that the arrow marked on it at the time of removal is pointing in the clockwise direction.



(5) Set the timing belt onto the water pump pulley.
(6) Check that the camshaft sprocket timing mark of the left bank side is aligned and clamp the timing belt with double clips.
(7) Set the timing belt onto the idler pulley.



(8) After aligning the crankshaft sprocket timing marks, turn the crankshaft one touch anticlockwise.
(9) Set the timing belt onto the crankshaft sprocket.
(10) Set the timing belt onto the tensioner pulley.



(11) Place the tensioner pulley pin hole so that it is towards the top. Press the tensioner pulley onto the timing belt, .and provisionally tighten the fixing bolt.
(12) Align the crankshaft sprocket timing marks.
(13) Check that each of the sprocket timing mark is aligned.
(14) Remove the 4 double clips.

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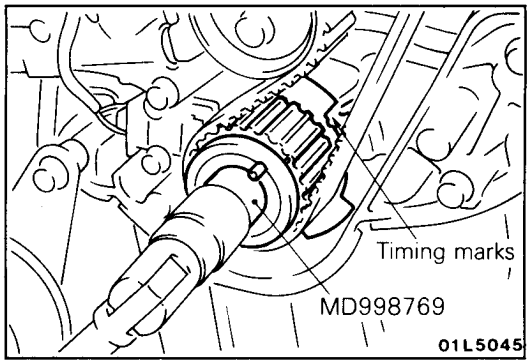
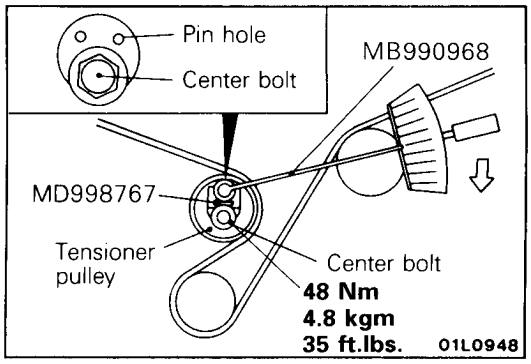


• ADJUSTMENT OF TIMING BELT TENSION

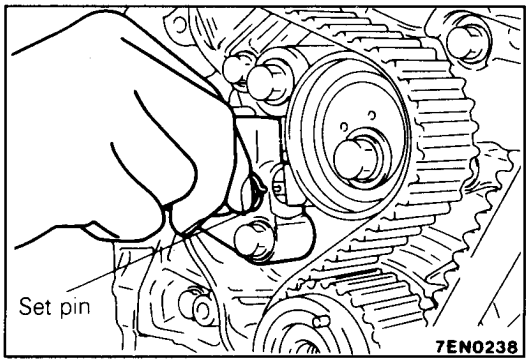
(1) After turning the crankshaft a 1/4 turn anticlockwise, turn it clockwise to the position where the timing marks are aligned.



(2) Loosen the center bolt on the tensioner pulley. Using the special tool and torque wrench, apply tensioning torque to the timing belt and, at the same time, tighten the center bolt to specification.

Reference value: 9.4 Nm (0.96 kgm, 7 ft.lbs.)
(Timing belt tensioning torque)

Caution
When tightening the center bolt, make sure that the tensioner pulley is not rotated together.



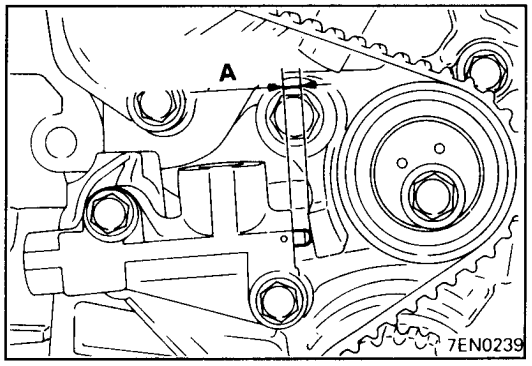
(3) Remove the set pin from the auto tensioner. At this time, make sure that the set pin can be easily removed.
(4) Rotate the crankshaft two turns clockwise and leave it as is for five minutes or more. Then, check again that the set pin can be easily removed from, and installed to, the auto tensioner.

NOTE
Even if the set pin cannot be easily inserted, the auto tensioner is normal if its rod protrusion is within specification.

Standard value (A): 3.8–4.5 mm (0.149–0.177 in.)

If the protrusion is out of specification, repeat steps (1) to (4).

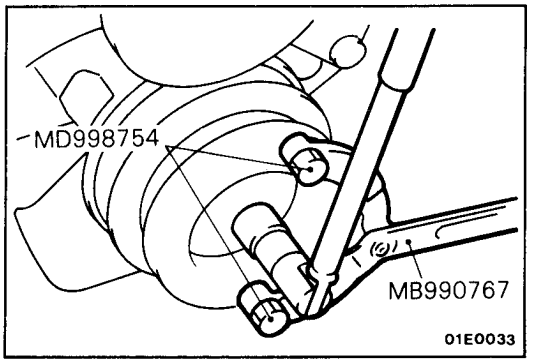
(5) Check again that timing marks on all sprockets are aligned properly.



11. INSTALLATION OF CRANKSHAFT PULLEY

Using the special tool, attach the crankshaft pulley to the crankshaft.

Caution
Use only the specified special tools, otherwise a damaged pulley damper could result.



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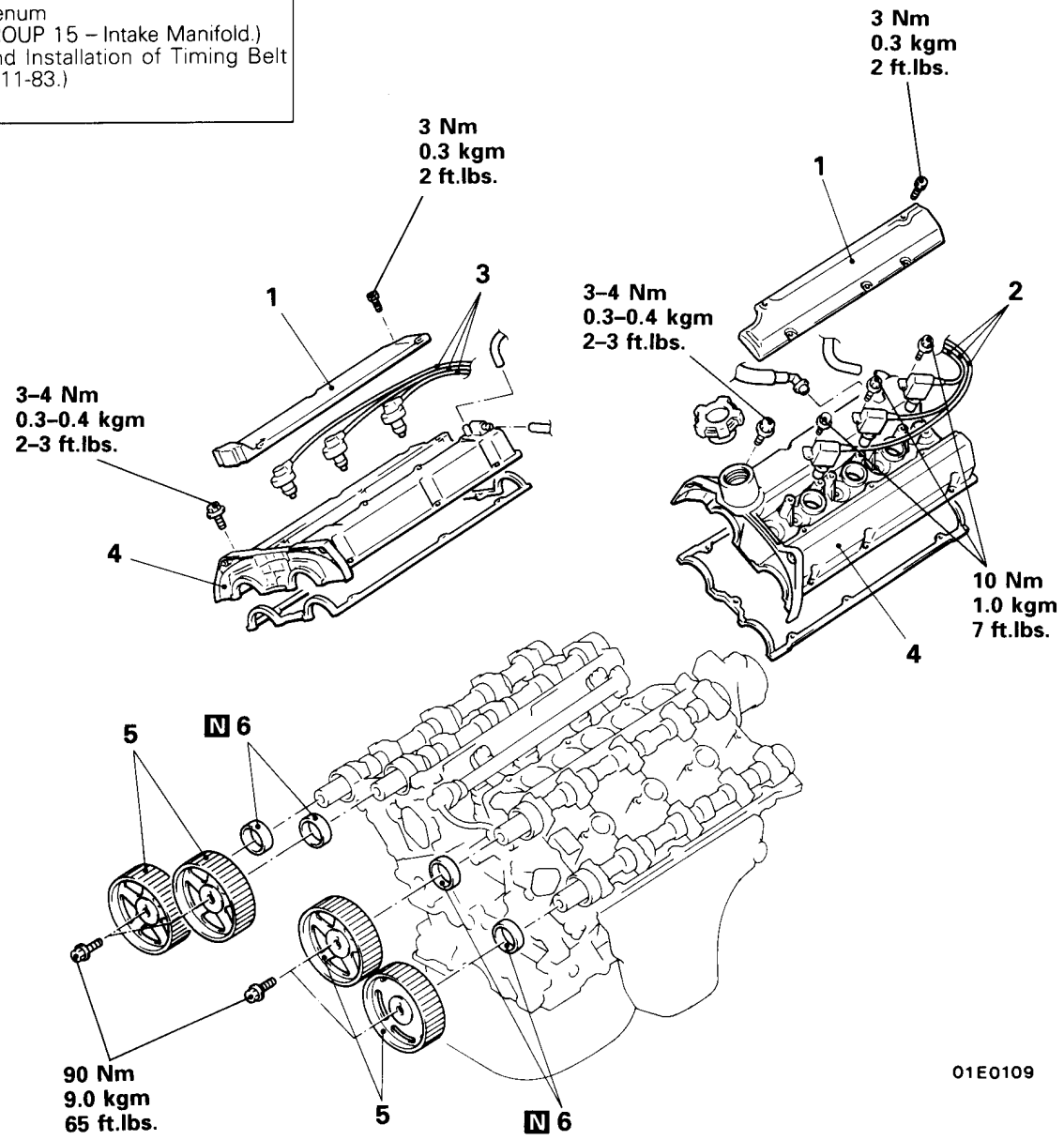
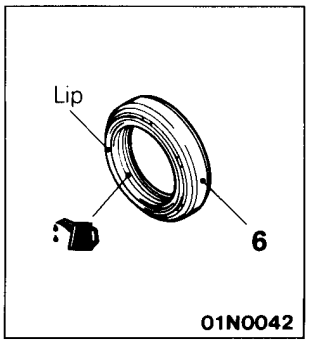
CAMSHAFT OIL SEAL

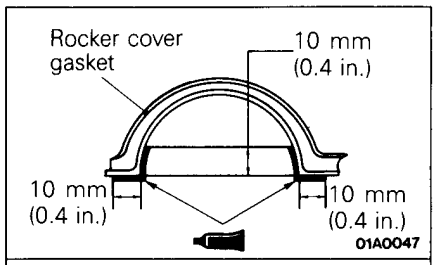
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Removal and Installation of the Intake Manifold Plenum (Refer to GROUP 15 – Intake Manifold.)
- Removal and Installation of Timing Belt (Refer to P.11-83.)

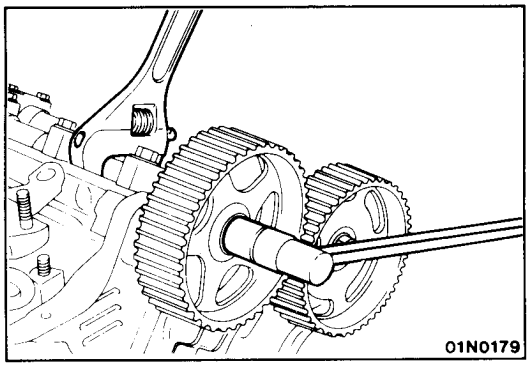


Removal steps
1. Center cover
2. Ignition coil
3. Spark plug cable
4. Rocker cover
5. Camshaft sprocket
6. Camshaft oil seals





Sealant: 3M ATD Part No. 8660 or equivalent

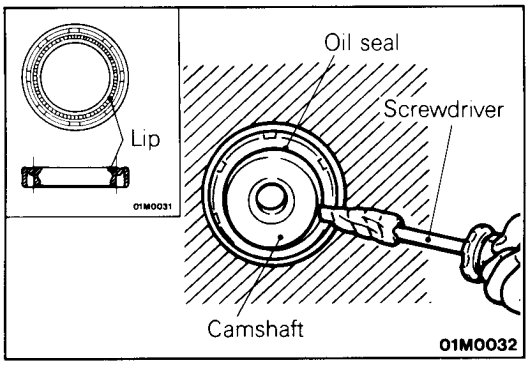


SERVICE POINTS OF REMOVAL

5. REMOVAL OF CAMSHAFT SPROCKET

Using a wrench at the hexagonal part of the camshaft (to prevent the crankshaft from turning), loosen the camshaft sprocket bolt.

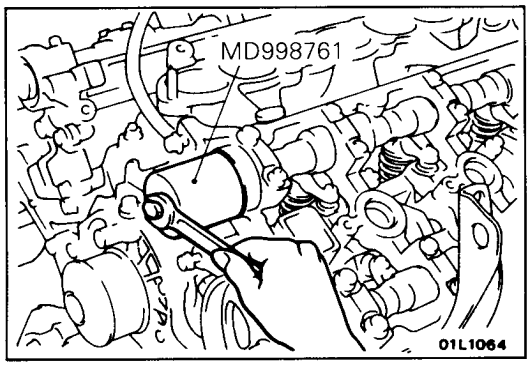
Caution
Do not hold the camshaft sprocket with a tool, or a damaged sprocket could result.



6. REMOVAL OF CAMSHAFT OIL SEAL

(1) Cut out a portion in the camshaft oil seal lip.
(2) Cover the tip of a screwdriver with a cloth and apply it to the cutout in the oil seal to pry off the oil seal.

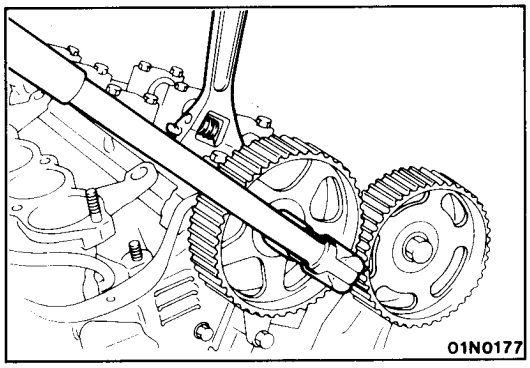
Caution
Use care not to damage the camshaft and cylinder head.



SERVICE POINTS OF INSTALLATION

6. INSTALLATION OF CAMSHAFT OIL SEAL

Coat engine oil on the whole circumference of the oil seal lip section.
Use the special tool to press-fit the oil seal.



5. INSTALLATION OF CAMSHAFT SPROCKET

Using a wrench at the hexagonal part of the camshaft (to prevent the crankshaft from turning), tighten the camshaft sprocket bolt.

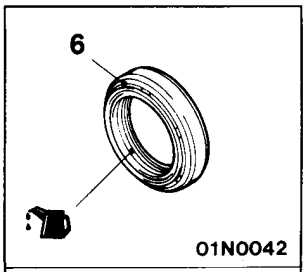
Caution
Do not hold the camshaft sprocket with a tool, or a damaged sprocket could result.

CRANKSHAFT OIL SEALS

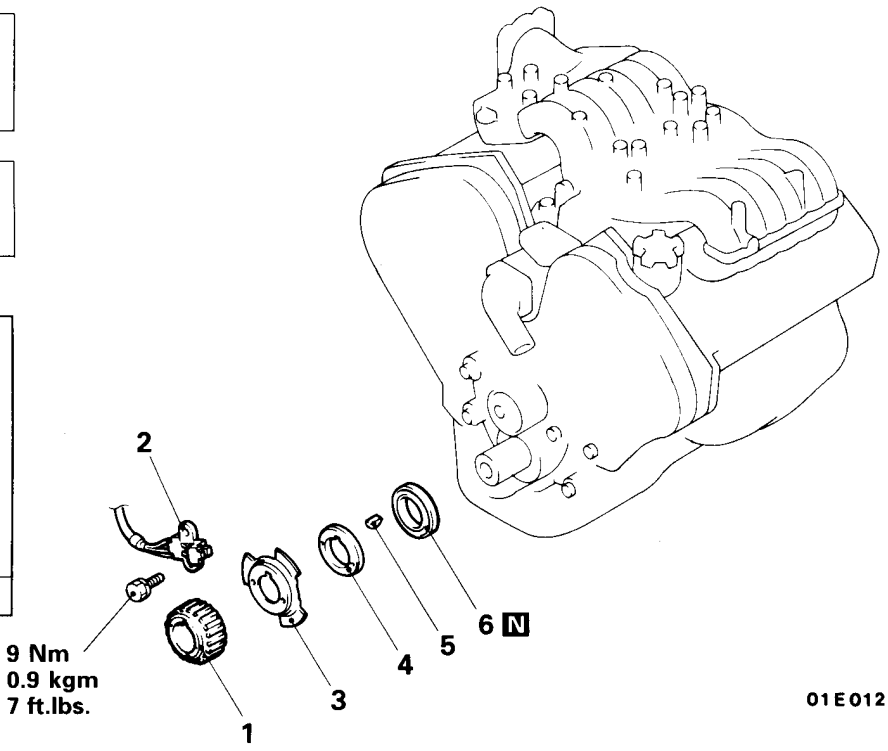
FRONT OIL SEAL
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Removal and Installation of Timing Belt (Refer to P.11-83.)

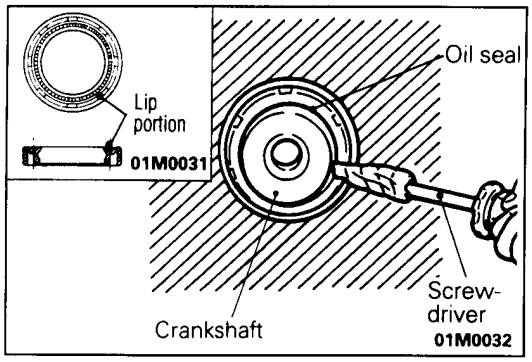
Adjustment
- Engine Adjustment (Refer to P.11-72.)



Engine oil



Removal steps
1. Crankshaft sprocket
2. Crankshaft position sensor
3. Crankshaft sensing blade
4. Crankshaft spacer
5. Key
◀■▶ ▶■◀ 6. Crankshaft front oil seal

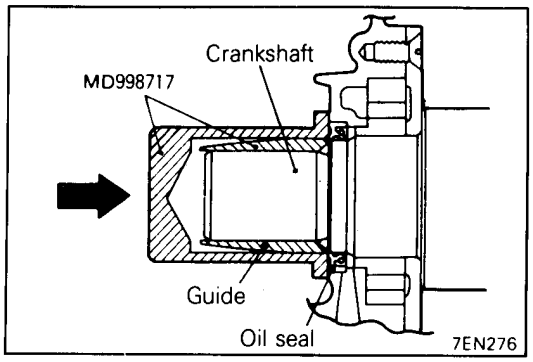


SERVICE POINT OF REMOVAL M11ZLAC

6. REMOVAL OF OIL SEAL

(1) Cut out a portion in the crankshaft oil seal lip.
(2) Cover the tip of a screwdriver with a cloth and apply it to the cutout in the oil seal to pry off the oil seal.

Caution
Take care not to damage the crankshaft and oil pump case.



SERVICE POINTS OF INSTALLATION M11ZNAC

6. INSTALLATION OF OIL SEAL

Using the special tool, knock the oil seal into the oil pump case.

NOTE
Knock it as far as the surface.

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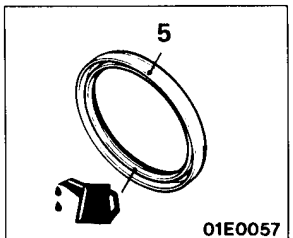
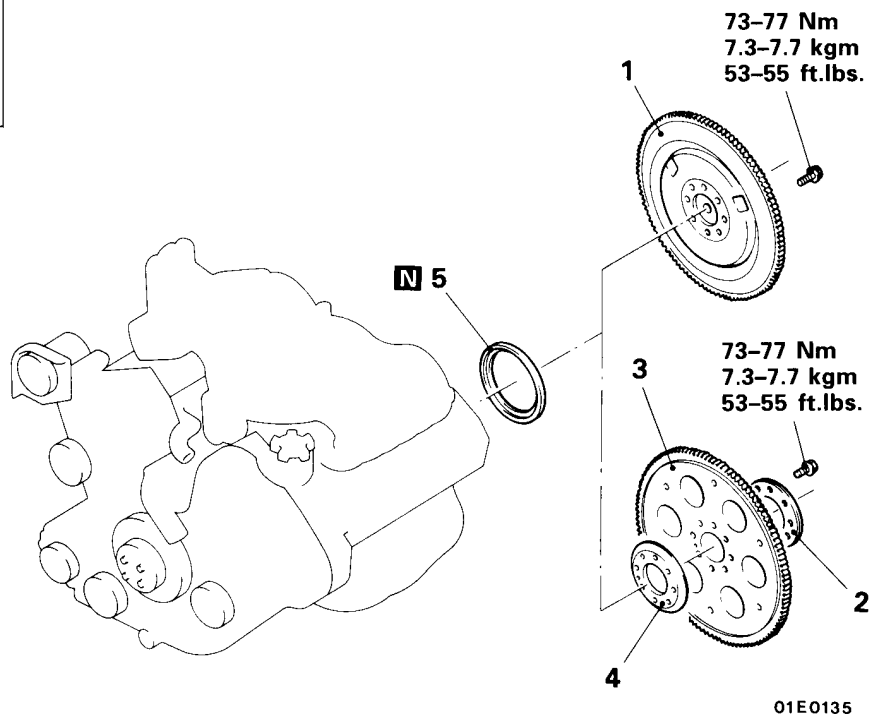
REAR OIL SEAL
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
Removal and Installation
- Transmission
  (Refer to GROUP 22, 23 – Transmission and Transfer Assembly.)
- Clutch <M/T>

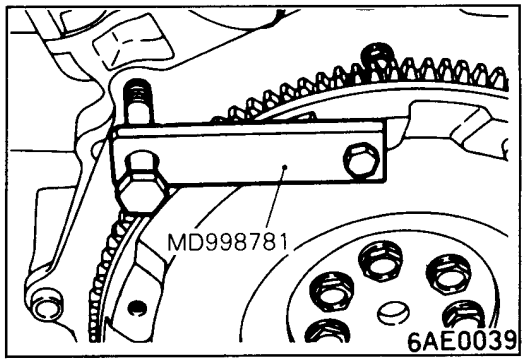


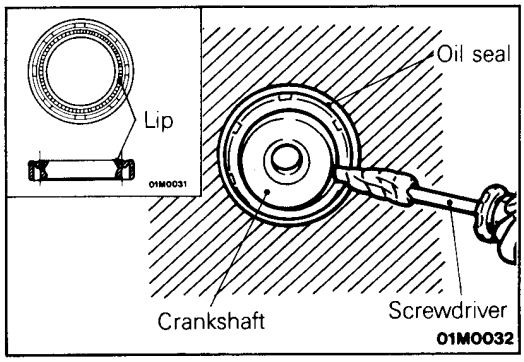
Engine oil



Removal steps

◆◆ ◆◆ 1. Flywheel assembly <M/T>
◆◆ ◆◆ 2. Adaptor plate A } <A/T>
◆◆ ◆◆ 3. Drive plate } <A/T>
◆◆ ◆◆ 4. Adaptor plate B } <A/T>
◆◆ ◆◆ 5. Oil seal





SERVICE POINTS OF REMOVAL

1. REMOVAL OF FLYWHEEL ASSEMBLY <M/T>/3. DRIVE PLATE <A/T>

Use the special tool to secure the drive plate, and remove the bolt.

5. REMOVAL OF OIL SEAL

(1) Cut out a portion in the crankshaft oil seal lip.
(2) Cover the tip of a screwdriver with a cloth and apply it to the cutout in the oil seal to pry off the oil seal.

Caution
Take care not to damage the crankshaft and oil seal case.

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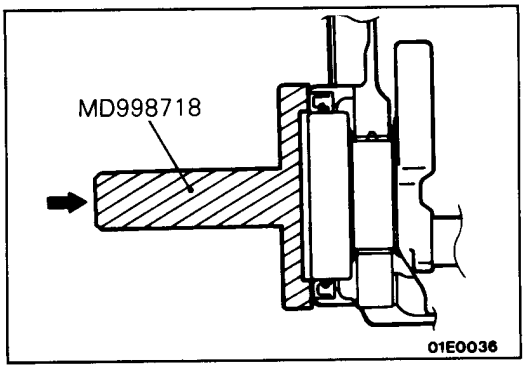
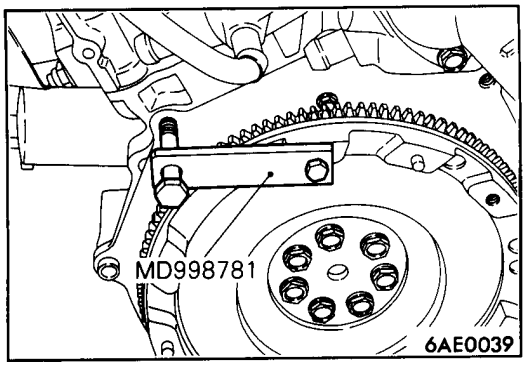


SERVICE POINTS OF INSTALLATION

5. INSTALLATION OF OIL SEAL

Using the special tool, press-fit a new crankshaft rear oil seal into the oil seal case.



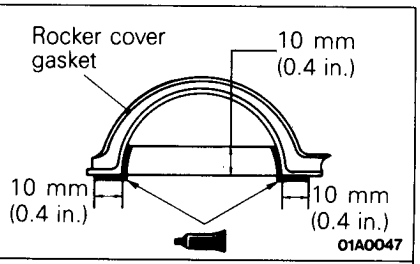
3. INSTALLATION OF DRIVE PLATE <A/T> / 1. FLYWHEEL ASSEMBLY <M/T>

Use the special tool to secure the flywheel or drive plate, and then tighten the bolt to the specified torque.

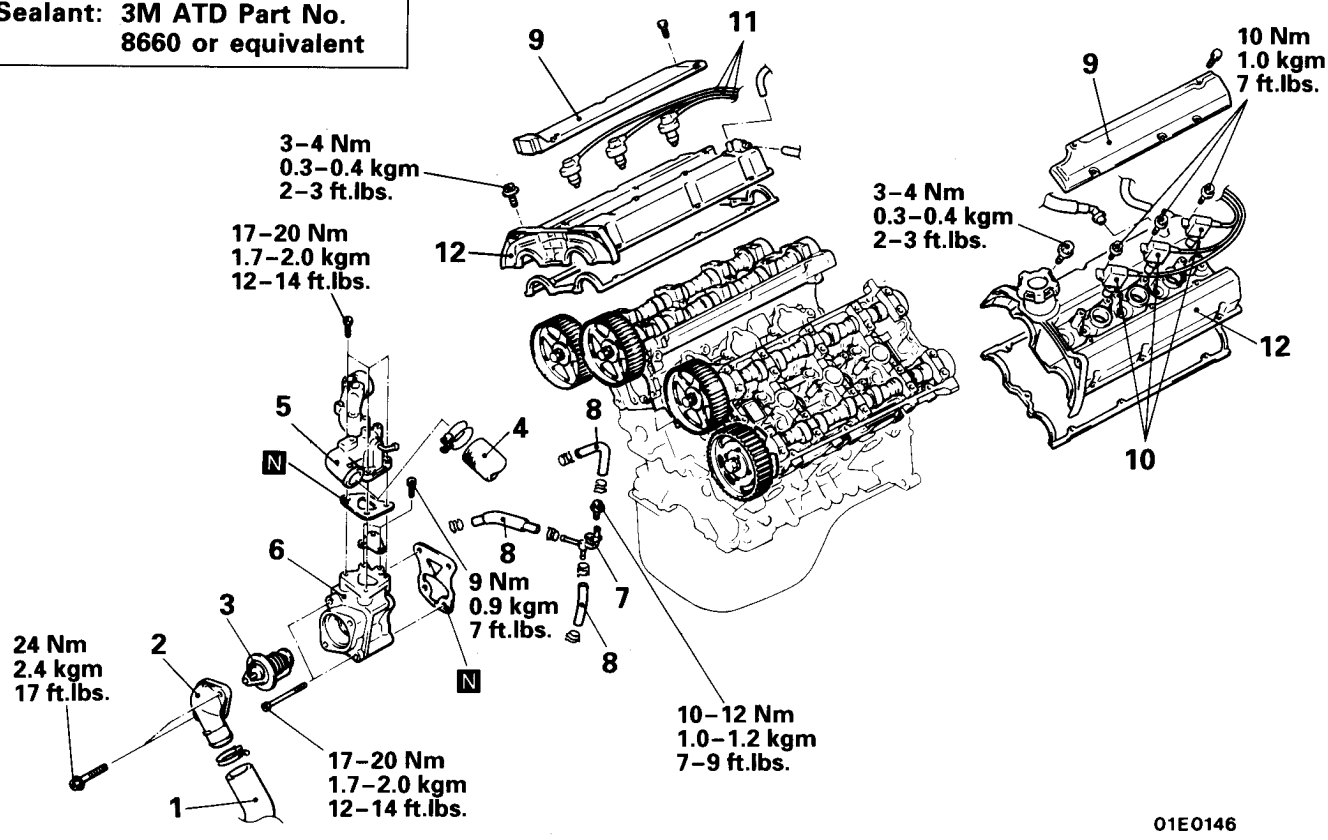
CYLINDER HEAD GASKET

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Engine Coolant Draining and Supplying (Refer to GROUP 14 – Service Adjustment procedures.)
- Removal and Installation of Timing Belt (Refer to P.11-83)
- Removal and Installation of Intake Manifold (Refer to GROUP 15 – Intake Manifold.)
- Removal and Installation of Exhaust Manifold (Refer to GROUP 15 – Exhaust Manifold.)



Sealant: 3M ATD Part No. 8660 or equivalent



Removal steps

1. Radiator lower hose connection
2. Water inlet fitting
3. ◆◆ Thermostat
4. Radiator upper hose connection
5. Water outlet fitting
6. Thermostat case
7. Water line joint
8. Water hose
9. Centre cover
10. Ignition coil
11. Spark plug cable
12. Rocker cover

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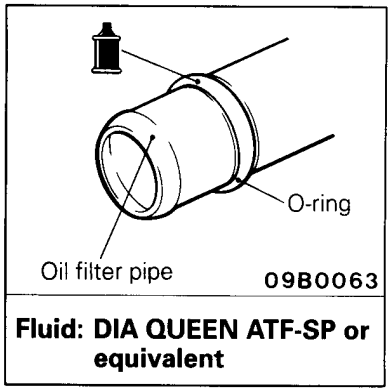
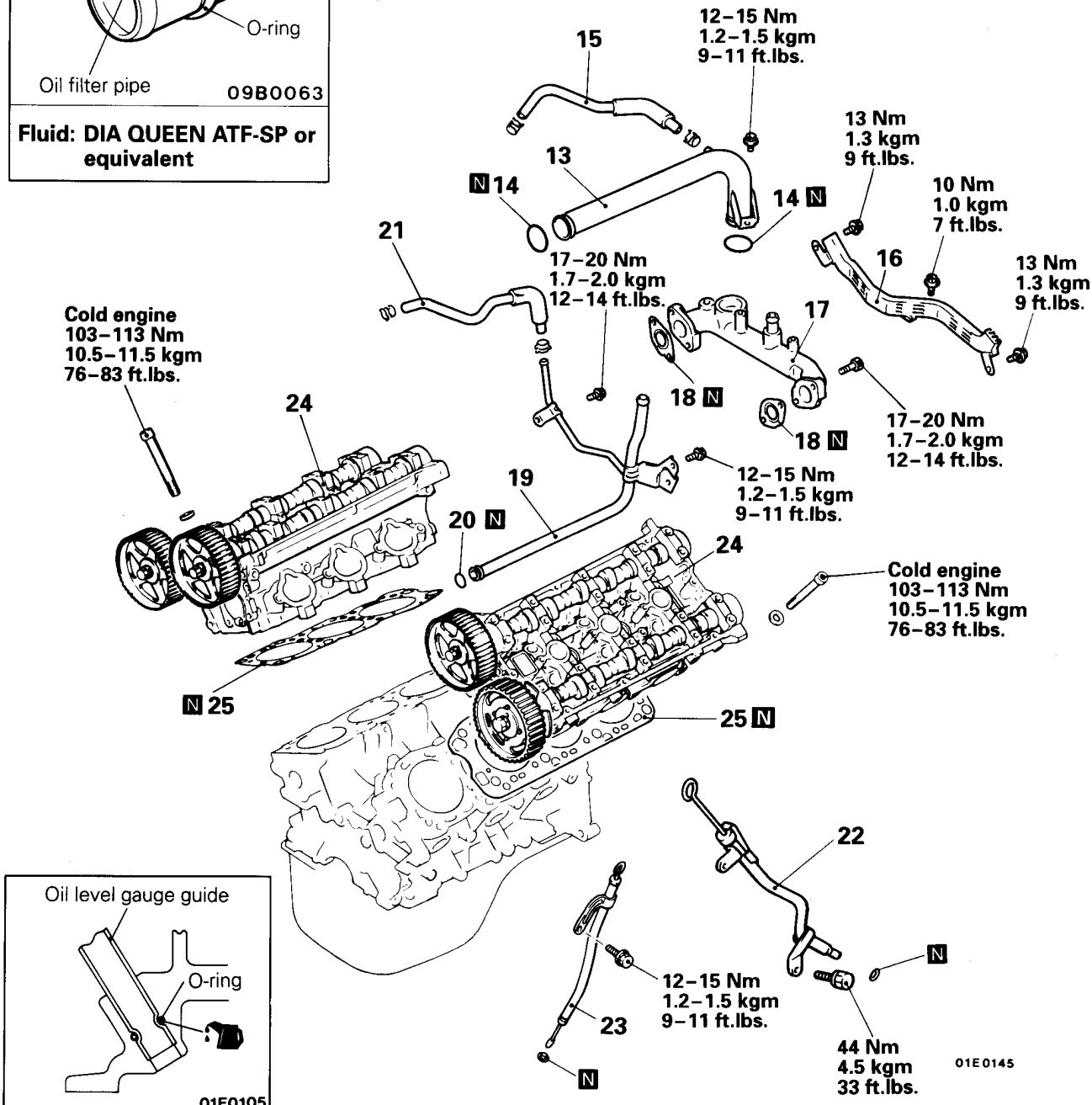
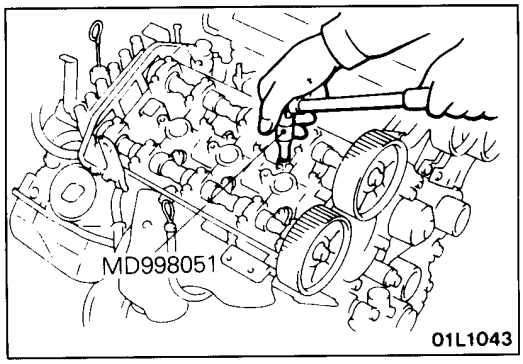


Fluid: DIA QUEEN ATF-SP or equivalent



Engine oil

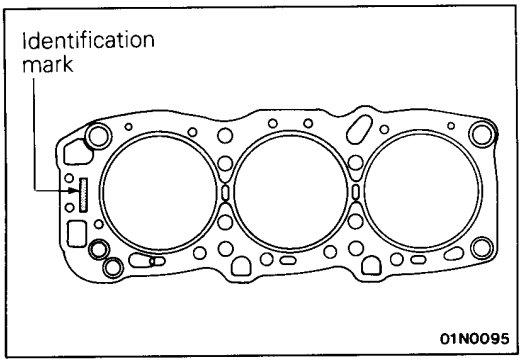
13. Water outlet pipe
◆◆ 14. O-ring
15. Water hose
16. Spark plug cable support
◆◆ 17. Water passage
◆◆ 18. Gasket
19. Water pipe assembly
◆◆ 20. O-ring
21. Water hose
22. Oil filler pipe
23. Oil level gauge guide
◆◆ ◆◆ 24. Cylinder head assembly
◆◆ 25. Cylinder head gasket



SERVICE POINTS OF REMOVAL

24. REMOVAL OF CYLINDER HEAD ASSEMBLY

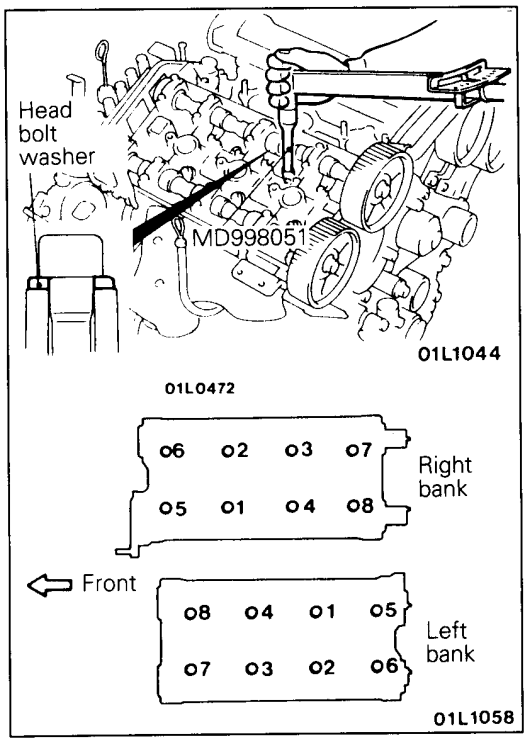
Using the special tool, after loosening the bolts (in 2 or 3 cycles), remove, and then remove the cylinder head assembly.



SERVICE POINTS OF INSTALLATION

25. INSTALLATION OF CYLINDER HEAD GASKET

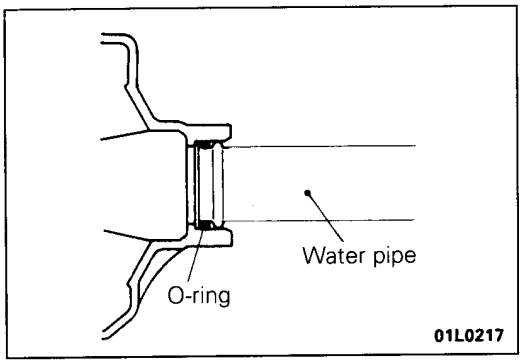
(1) Degrease the mounting surface of the cylinder head gasket.
(2) Lay the cylinder head gasket on cylinder block with the identification mark at front top.



24. INSTALLATION OF CYLINDER HEAD ASSEMBLY

Using the special tool, tighten the bolts in the order shown in two or three steps.

Caution
Attach the head bolt washer in the direction shown in the figure.



20./14. INSTALLATION OF O-RINGS

Rinse the mounting location of the O-ring and water pipe with water, and install the O-ring and water pipe.

Caution
1. **Do not apply oil and grease to water pipe O-ring.**
2. **Keep the water pipe connections free of stand, dust, etc.**
3. **Insert water pipe until its end bottoms.**

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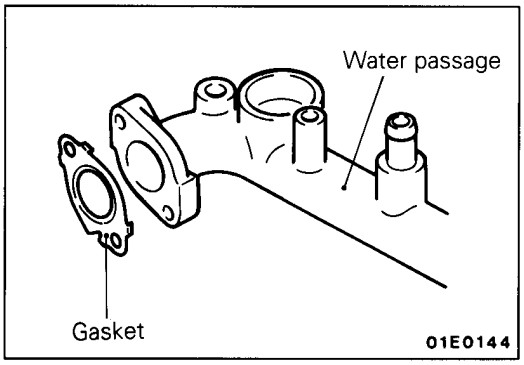
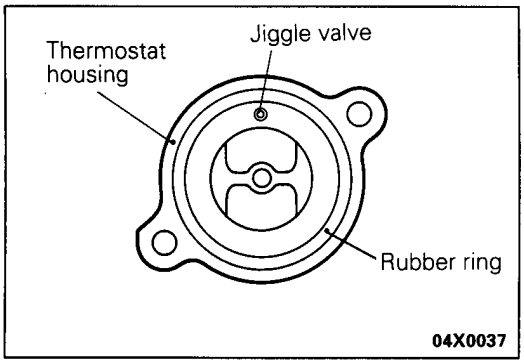


18. INSTALLATION OF GASKET/17. WATER PASSAGE

(1) Install the gasket to the cylinder head as shown in the figure.
(2) Install the water passage to the cylinder head.



3. INSTALLATION OF THERMOSTAT

Install the thermostat so that the jiggle valve is facing straight up and is aligned with the mark on the thermostat case as shown in the illustration.

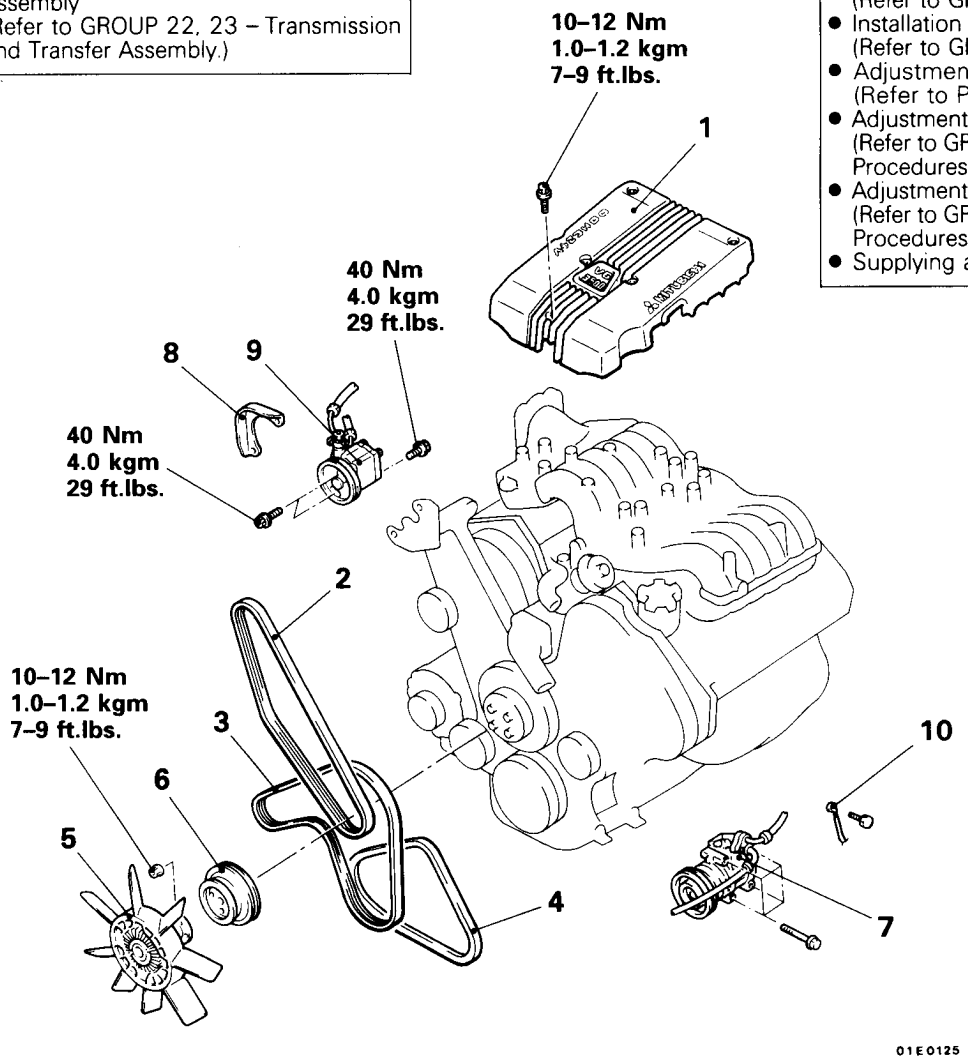
Caution
Make absolutely sure that no oil is adhering to the rubber ring of the thermostat. In addition, be careful not to fold over or scratch the rubber ring when inserting.

ENGINE ASSEMBLY

REMOVAL AND INSTALLATION

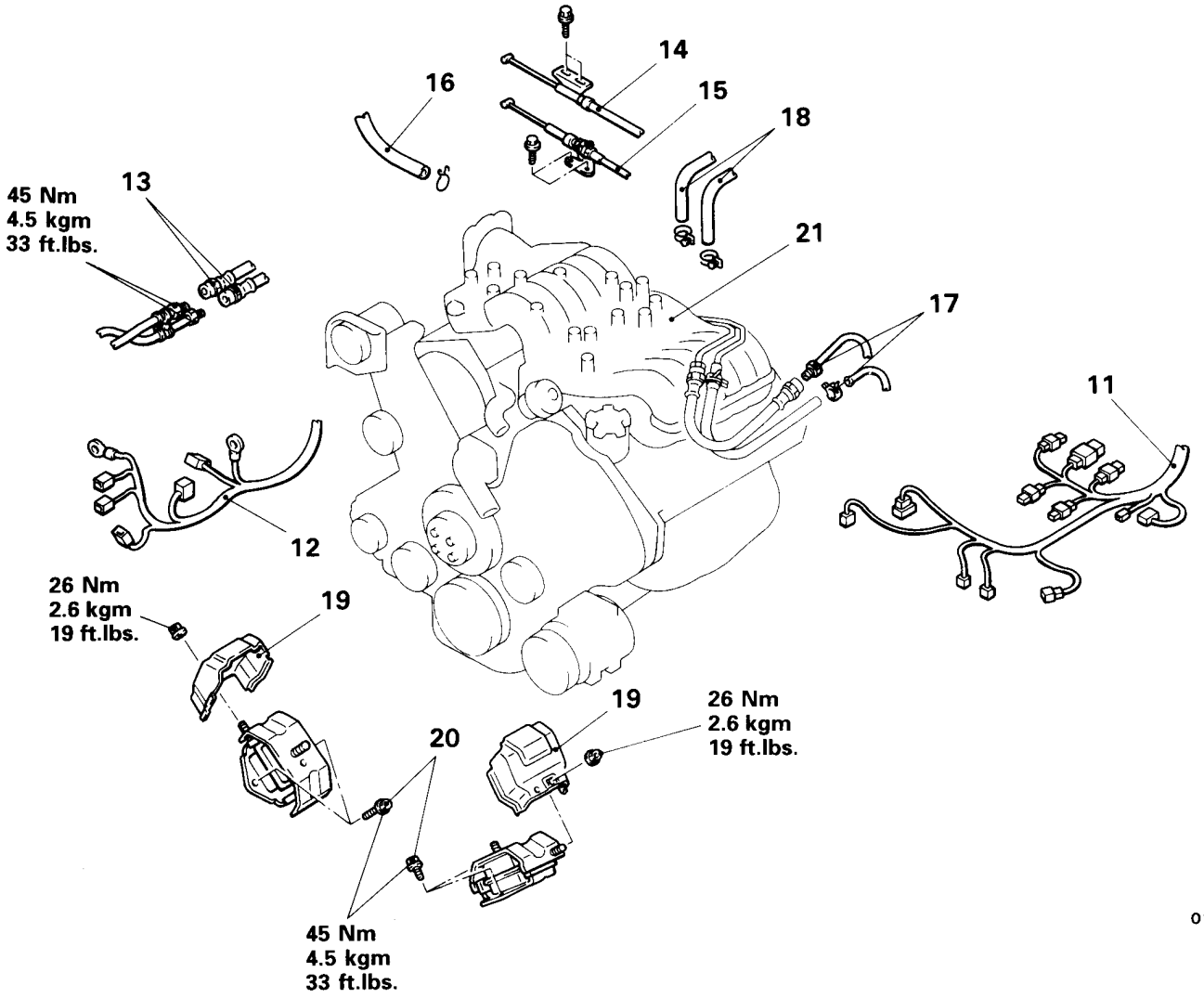
Pre-removal Operation
- Removal of Hood
  (Refer to GROUP 42 – Hood.)
- Removal of Battery and Battery Tray
- Removal of Cruise Control Intermediate Link
  (Refer to GROUP 13 – Cruise Control.)
- Removal of Radiator
  (Refer to GROUP 14 – Radiator.)
- Removal of the Under Skid Plate, Undercover, Air Guide Plate
- Removal of Front Exhaust Pipe
  (Refer to GROUP 15 – Exhaust Pipe, Muffler and Catalytic Converter.)
- Removal of Transmission and Transfer Assembly
  (Refer to GROUP 22, 23 – Transmission and Transfer Assembly.)

Post-installation Operation
- Installation of Transmission and Transfer Assembly
  (Refer to GROUP 22, 23 – Transmission and Transfer Assembly.)
- Installation of Front Exhaust Pipe
  (Refer to GROUP 15 – Exhaust Pipe, Muffler and Catalytic Converter.)
- Installation of the Under Skid Plate, Undercover, Air Guide Plate
- Installation of Radiator
  (Refer to GROUP 14 – Radiator.)
- Installation of Battery and Battery Tray
- Installation and Adjustment of Cruise-Control Intermediate Link
  (Refer to GROUP 13 – Cruise Control.)
- Installation of Hood
  (Refer to GROUP 42 – Hood.)
- Adjustment of Engine
  (Refer to P.11-72)
- Adjustment of Accelerator Cable
  (Refer to GROUP 13 – Service Adjustment Procedures.)
- Adjustment of Throttle Cable
  (Refer to GROUP 23 – Service Adjustment Procedures.)
- Supplying and Checking of Engine Oil



Removal steps

1. Intake air plenum cover
2. Power steering drive belt
3. Alternator drive belt
4. Air conditioner drive belt
5. Cooling fan
6. Water pump pulley
7. Air conditioner compressor
8. Cover
9. Power steering oil pump
10. Earth cable connection



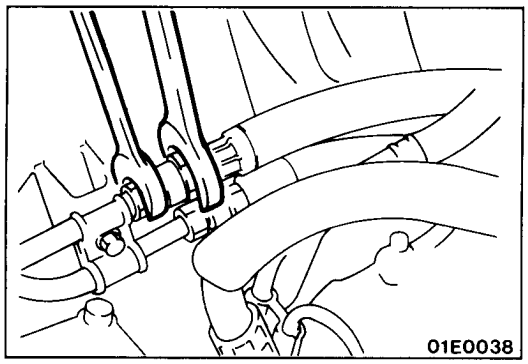
11. Engine control harness connection
12. Alternator & starter harness connection
13. Engine oil cooler hose connection
14. Accelerator cable connection
15. Throttle cable connection
16. Brake booster vacuum hose connection
17. Fuel hose connection
18. Heater hose connection
19. Heat protectors
20. Engine mounting bolts
21. Engine assembly

SERVICE POINTS OF REMOVAL

7. REMOVAL OF COMPRESSOR <A/C>/9. OIL PUMP (POWER STEERING)

Remove the oil pump and air conditioner compressor (with the hose attached).

NOTE
Suspend the removed oil pump (by using wire or similar material) at a place where no damage will be caused during removal/installation of the engine assembly.



13. REMOVAL OF OIL COOLER HOSE CONNECTION

Use a spanner or similar tool to remove the oil cooler hose connection.

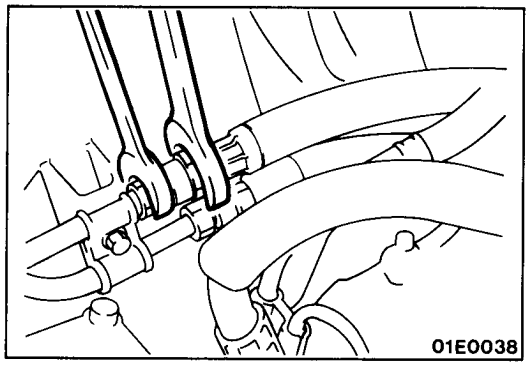
21. REMOVAL OF ENGINE ASSEMBLY

(1) Check that all cables, hoses, harness connectors, etc. are disconnected from the engine.
(2) Lift the chain block slowly to remove the engine assembly upward from the engine compartment.

SERVICE POINTS OF INSTALLATION M11SDBE

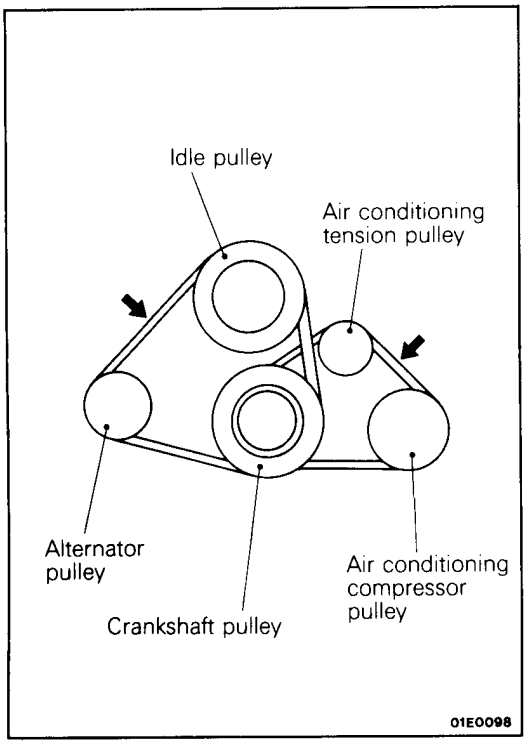
21. INSTALLATION OF ENGINE ASSEMBLY

Install the engine assembly. When doing so, check carefully that all pipes and hoses are connected, and that none are twisted, damaged, etc.



13. CONNECTION OF OIL COOLER HOSE

Use a spanner or similar tool to connect the oil cooler hose.



ENGINE <4M40>

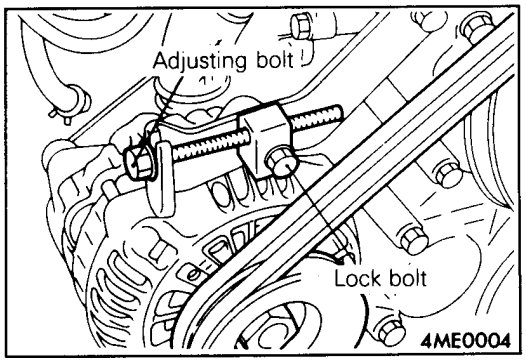
SERVICE ADJUSTMENT PROCEDURES

DRIVE BELTS TENSION INSPECTION AND ADJUSTMENT

Check the tension by pushing at the centre of the belt between pulleys with a force of 100 N (10 kg, 22 lbs.) as shown in the figure. Measure drive belt flexion.

Standard value:

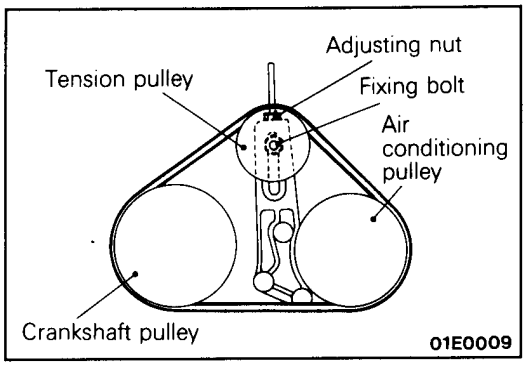
Item	Check value	Adjustment value	
		Used belt	New belt
For alternator	8.0–11.0 mm (0.31–0.43 in.)	9.0–11.0 mm (0.35–0.43 in.)	8.0–9.0 mm (0.31–0.35 in.)
For A/C	6.0–8.0 mm (0.24–0.31 in.)	6.0–8.0 mm (0.24–0.31 in.)	5.0–6.0 mm (0.20–0.24 in.)



ALTERNATOR DRIVE BELT TENSION ADJUSTMENT

(1) Loosen the nut on the alternator pivot bolt.
(2) Loosen the lock bolt.
(3) Turn the adjusting bolt to adjust the belt so that the amount of flexion is at the standard value.
(4) Tighten the lock nut and pivot nut to the specified torques.
(5) Crank the engine one or more turns in the clockwise direction, and then check the amount of belt deflection.

Caution
Always replace the two V-belts together as a set, and do not apply any oil to the belts.

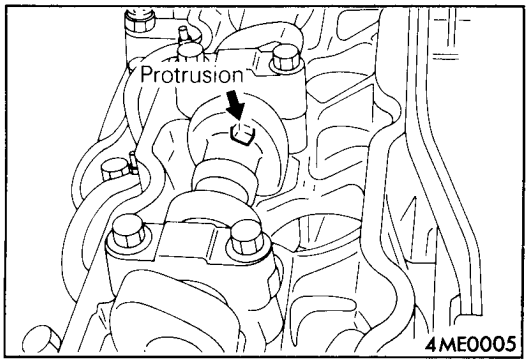


A/C COMPRESSOR DRIVE BELT TENSION ADJUSTMENT

(1) Loosen the tension pulley fixing bolt.
(2) Adjust belt tension with the adjusting nut.
(3) Tighten the fixing bolt.
(4) Crank the engine once or more.
(5) Check the belt tension.

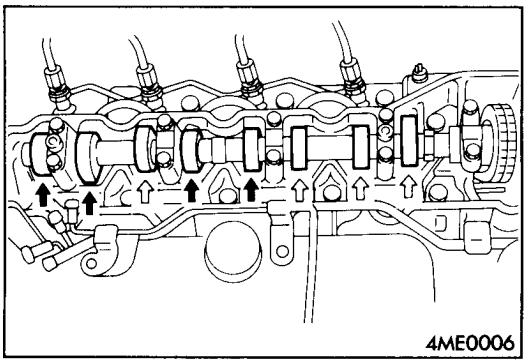
VALVE CLEARANCE INSPECTION AND ADJUSTMENT

(1) Warm up the engine until the engine coolant temperature is 80–95°C. (176–203°F)
(2) Remove the rocker cover.
(3) Remove the glow plug plate and all of the glow plugs from the cylinder head.



(4) Align the notch of the crankshaft pulley with the "0" timing mark to set the No. 1 or No. 4 cylinder to the compression top dead centre position.

NOTE
If the protrusion on the camshaft is pointing directly upwards, the No. 1 cylinder will be at the compression top dead centre position. If the crankshaft is then turned once, the No. 4 cylinder will then be at the compression top dead centre position.



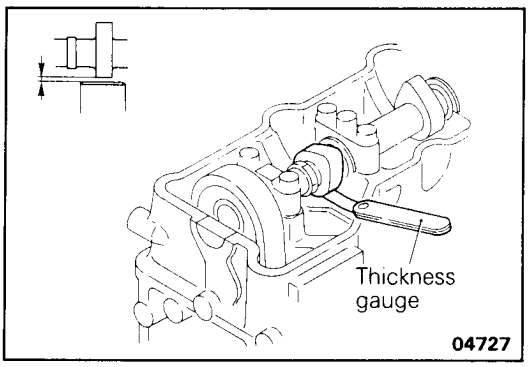
(5) Check the valve clearances at the places indicated by arrows in the illustration by the following procedure.

⇦ : When No. 1 cylinder is at compression top dead centre position
⇦ : When No. 4 cylinder is at compression top dead centre position

① Use a thickness gauge to measure the valve clearance.

Standard value
Intake side: 0.25 mm (0.010 in.)
Exhaust side: 0.35 mm (0.014 in.)

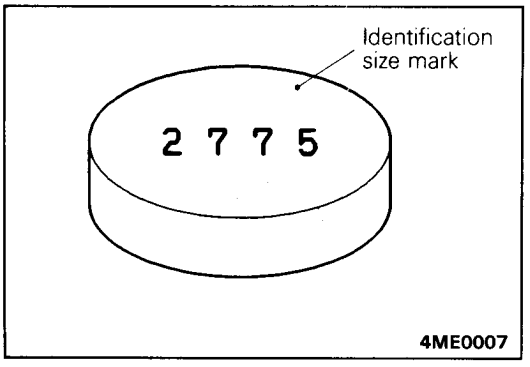
NOTE
There should be a certain amount of resistance against the thickness gauge when taking the measurements.
If the thickness gauge is moving too smoothly, a correct measurement cannot be obtained.



② Re-measure places which are outside the standard value, and make a note of these measurements.
③ Use the measured values as a reference for selecting adjustment/shims which will bring the incorrect valve clearances to the standard value.

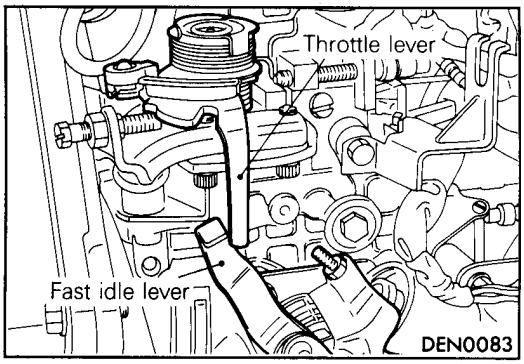
Adjustment shim thickness = Thickness of installed shims + (measured value – Standard value)

NOTE
- The thicknesses of the adjustment shims are between 2.250–3.150 mm (0.089–0.124 in.) (37 types which increase in thickness by 0.025 mm (0.001 in.))
- Size identification mark. "2775" = 2.775 mm (0.109 in.) thickness



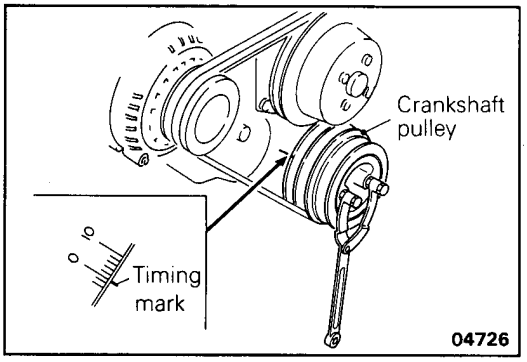
④ Remove the camshaft and install the shim which was selected in step ③.
⑤ Re-measure the valve clearances and check that they are all at the standard value.

(6) Turn the crankshaft once to align the notch of the crankshaft pulley with the timing mark "0".
(7) Check and adjust the other valve clearances according to the step (5).

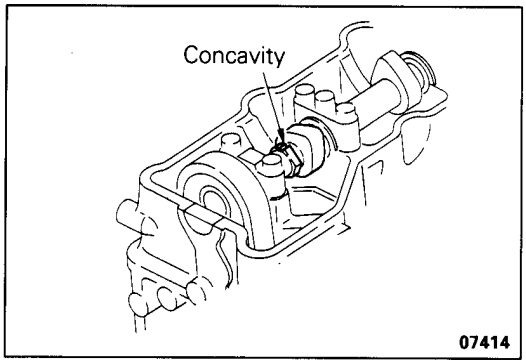


INJECTION TIMING INSPECTION AND ADJUSTMENT

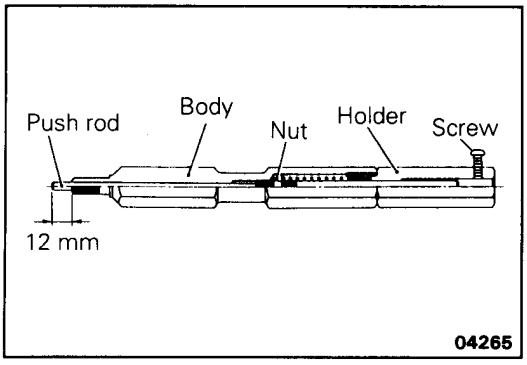
(1) Warm up the engine and then check that the fast idle lever is separated from the throttle lever.
(2) Remove all of the glow plugs.



(3) Align the notch of the crankshaft pulley with the "0" timing mark to set the No. 1 cylinder to the compression top dead centre position.



Caution
When the concavity of the camshaft hexagonal part faces upward, the No. 1 piston is at compression dead top centre.
Never turn the crankshaft counterclockwise, or the timing chain adjusting tensioner will be damaged. If the crankshaft turns anticlockwise, remove the tensioner and install again by the procedure.



(4) Check that the push rod of the special tool is protruding 12 mm (0.472 in.) from the edge of the body of the special tool.

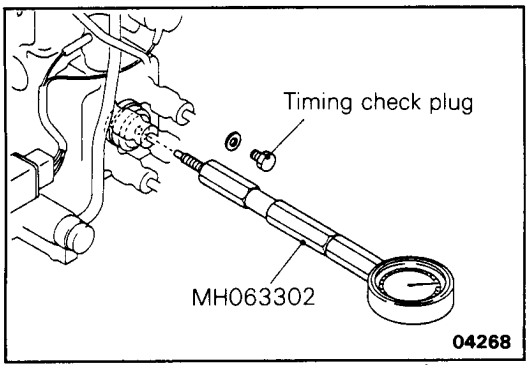
NOTE
If the amount of protrusion is outside the standard value, adjust by turning the nut inside the body of the special tool.

(5) Insert a dial gauge into the holder.

NOTE
Do not insert the dial gauge more than 5 mm. The diameter of the dial gauge should be less than 45 mm.

(6) Hold the dial gauge by its screw at the position where the dial gauge touches the push rod and its needle starts moving.

NOTE
The needle should not move more than 0.5 mm.

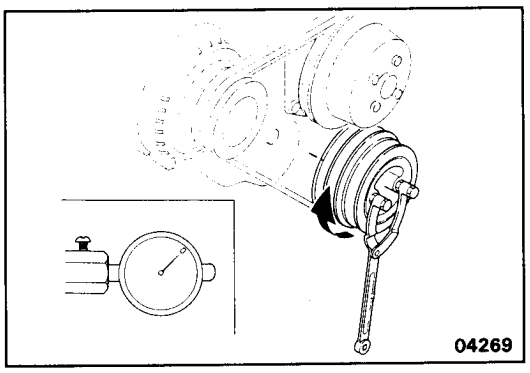


(7) Remove the timing check plug of the injection pump and the gasket, and then install the special tool.

NOTE
- Check that the timing check plug is attached to the gasket which was removed.
- If it is not attached, it may have fallen down or still be attached to the pump, so it should be checked.

(8) Hold the special tool at the position where the needle of the dial gauge starts moving.

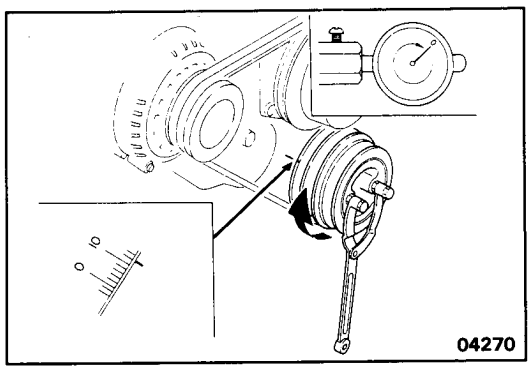
NOTE
If the dial gauge is hard to read, hold the special tool at the position where the special tool is screwed in less than one turn after the needle of the dial gauge starts moving.



(9) Turn the crankshaft once more clockwise to set the No. 1 cylinder 30° before the compression top dead centre position.

(10) Set the needle of the dial gauge to 0.

(11) Check that the needle doesn't move even if the crankshaft is turned slightly (2°–3°) both clockwise and anti-clockwise.



(12) Turn the crankshaft clockwise to align the crankshaft notch to 12° ATDC (vehicles without supercharging pressure control system) or 6° ATDC (vehicles with supercharging pressure control system).

(13) Take a reading of the value displayed on the dial gauge and check that it is within the standard value.

Standard value: 1±0.03 mm (0.0394±0.0012 in.)

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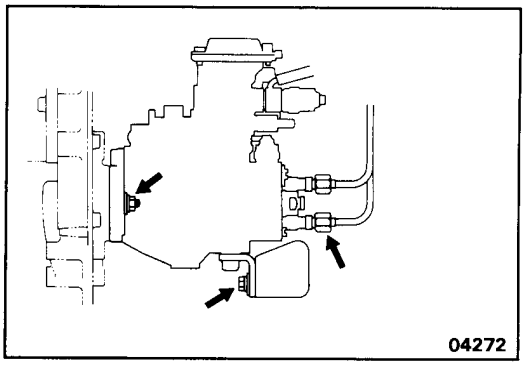

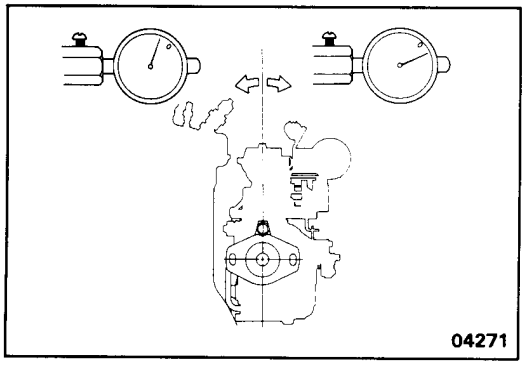

(14) If the value is outside the standard value, adjust the injection timing by the following procedure.
① Loosen the injection pipe union nuts and the injection pump fixing bolts and nuts in that order.

NOTE
- When loosening the union nuts, hold the delivery valve holders with a spanner so that they don't turn at the same time.
- The nuts or bolts should only be loosened, not removed.

② Tilt the injection pump to the left and right to adjust its position so that the value displayed on the dial gauge is at the standard value.

③ Temporarily tighten the injection pump mounting nuts and bolts.
④ Repeat steps (9) – (13) to check if the adjustment has been made correctly.
⑤ Securely tighten the injection pump mounting nuts and bolts.
⑥ Securely tighten the injection pipe union nuts.

NOTE
When tightening the nuts, hold the delivery valve holders with a spanner so that they don't turn at the same time.

(15) Remove the special tool.
(16) Replace the gasket with a new gasket.
(17) Securely tighten the timing check plug.

IDLE SPEED INSPECTION AND ADJUSTMENT

Refer to P.11-53. 750

Standard value: ~~800~~ ± 100 r/min

THROTTLE OPENER INSPECTION AND ADJUSTMENT <A/C>

Services and maintenances are the same as those for 4D56 engine.

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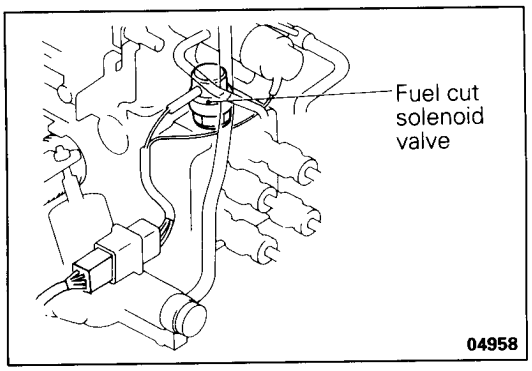
COMPRESSION PRESSURE CHECK

(1) Before check, ensure that oil, starter, motor, battery are normal and set the vehicle to the following condition:
Engine coolant temperature: 80–95°C (176–203°F)
Lamps and accessories: OFF
Transmission: Neutral (for A/T, P range)
Steering wheel: Neutral

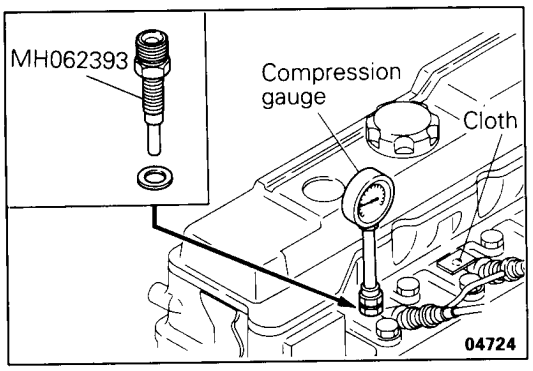
(2) Remove the glow plugs.
(3) Disconnect the fuel cut solenoid valve connector.



NOTE
Doing this will prevent the injection nozzle from injecting fuel.

(4) Cover the glow plug installation hole with a cloth and check that no foreign material adhere to the cloth after cranking the engine.

Caution
1. **Keep away from the glow plug installation hole when cranking.**
2. **If the cylinder is cracked, water, oil or fuel will gush out from the cracks when measuring compression. This leads to a serious injury.**



(5) Insert the special tool to the glow plug installation hole and install the compression gauge.
(6) Open the accelerator lever fully and measure compression pressure by cranking the engine.

Standard value:	**2,840 kPa (29 kg/cm^2, 422 psi) at 280 r/min.**
Limit:	**minimum 2,260 kPa (23 kg/cm^2, 327 psi) at 280 r/min.**

(7) Measure the compression pressure of all the cylinders and check that the pressure differences among the cylinders are within the limit.
Limit: maximum 290 kPa (3 kg/cm^2, 43 psi)

(8) If the compression pressure or pressure difference exceeds the limit, pour a small amount of engine oil from the glow plug installation hole and repeat the above steps (6) and (7).
① If the compression rises, the piston ring and/or cylinder wall may be worn or damaged.
② If the compression does not rise, the valve or valve set may be burned or defective, or pressure may be leaking from the gasket.

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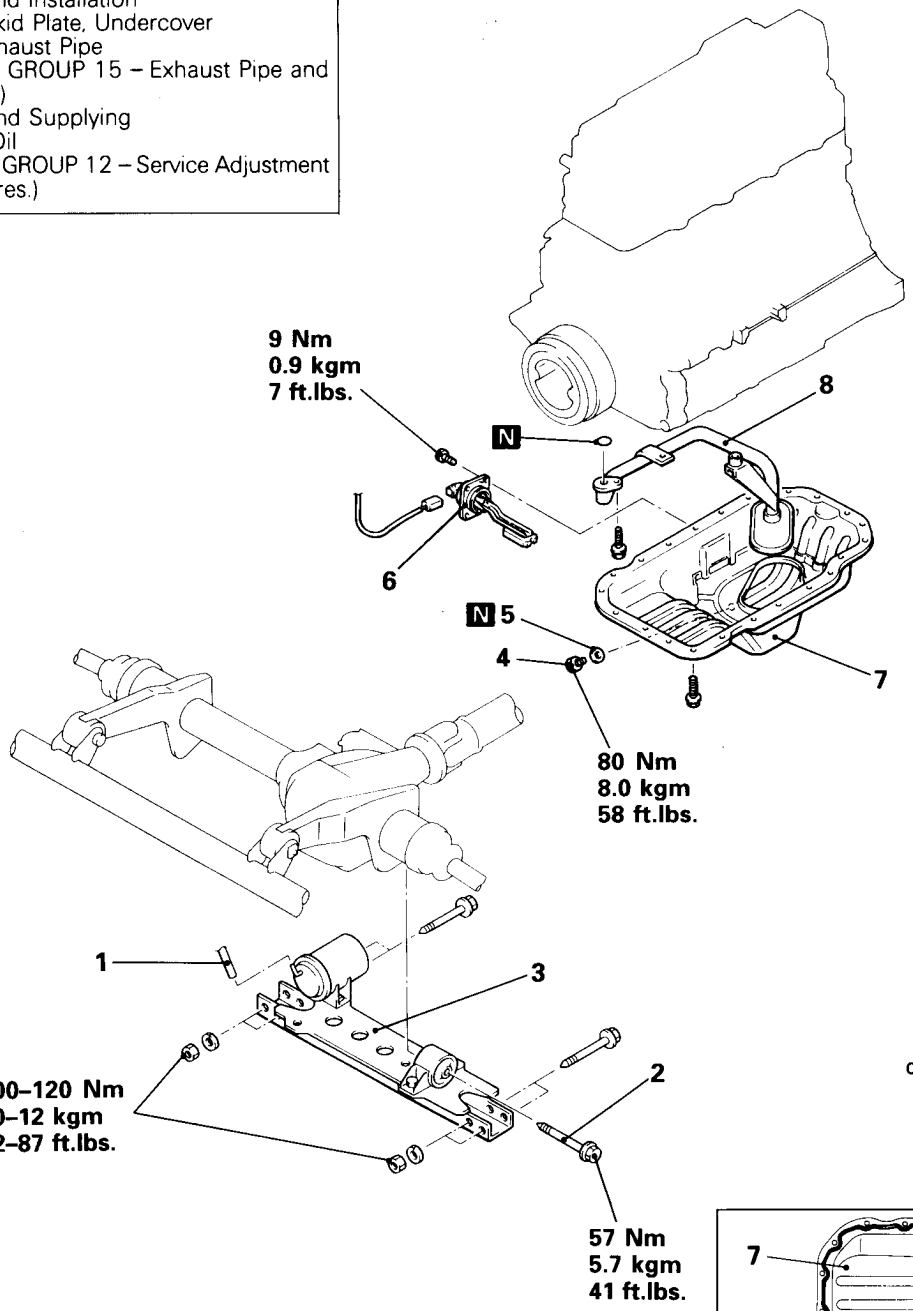
NOTES

OIL PAN AND OIL SCREEN

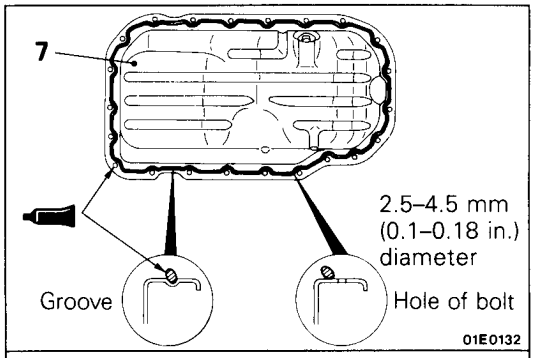
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
Removal and Installation
- Under Skid Plate, Undercover
- Front Exhaust Pipe
  (Refer to GROUP 15 – Exhaust Pipe and Mufflers.)

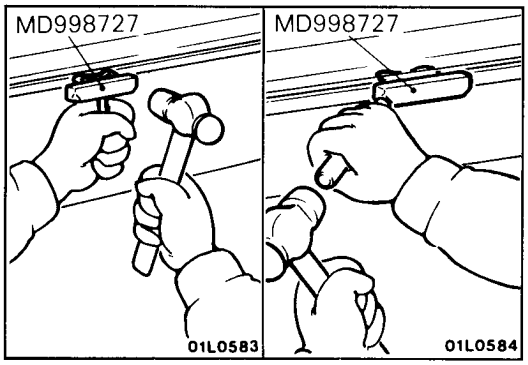
Draining and Supplying
- Engine Oil
  (Refer to GROUP 12 – Service Adjustment Procedures.)



Removal steps
1. Vacuum hose <Super Select 4WD>
2. Bolt
3. Front suspension crossmember
4. Drain plug
◆◆ 5. Gasket
6. Engine oil level sensor
◆◆ ◆◆ 7. Oil pan
8. Oil screen



Sealant:
MITSUBISHI GENUINE Part No. MD970389 or equivalent



SERVICE POINTS OF REMOVAL

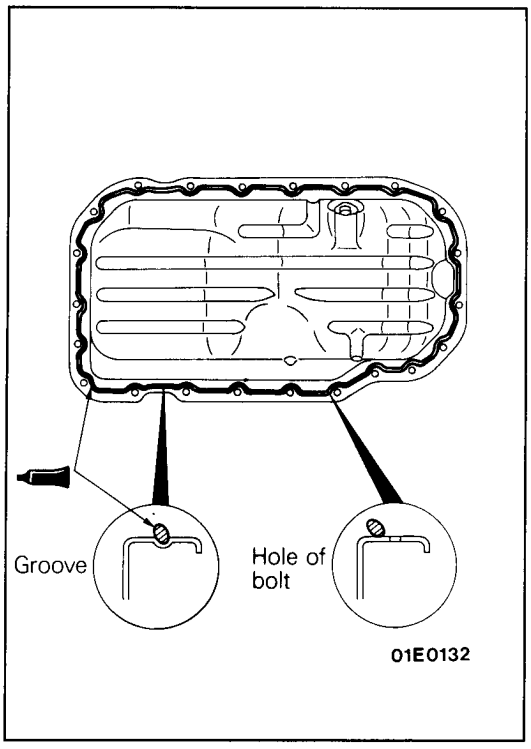
7. REMOVAL OF OIL PAN

(1) Remove oil pan bolts.
(2) Tap the special tool in between the oil pan and cylinder block.
(3) Slide the special tool by tapping it at an angle to remove the oil pan.

Caution
The use of a screwdriver or chisel in place of the special tool can damage the gasket seat surface and cause oil leakage.

INSPECTION

- Check oil pan for cracks.
- Check oil pan sealant-coated surface for damage and deformation.
- Check oil screen for cracked, clogged or damaged wire net and pipe.



SERVICE POINTS OF INSTALLATION

7. INSTALLATION OF OIL PAN

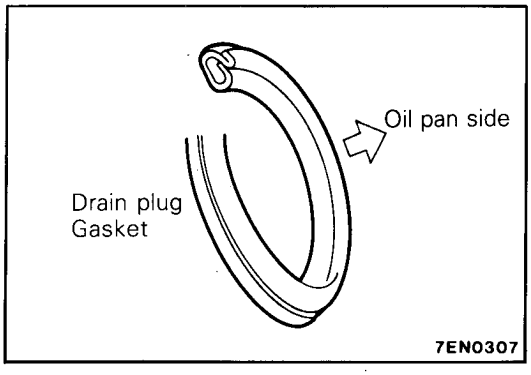
(1) Remove sealant from oil pan and cylinder block mating surfaces.
(2) Degrease the sealant-coated surface and the engine mating surface.
(3) Apply the specified sealant around the gasket surface of oil pan as specified in illustration.

Specified sealant: MITSUBISHI GENUINE PART No. MD970389 or equivalent

NOTE
The sealant should be applied in a continuous bead approximately 2.5–4.5 mm (0.10–0.18 in.) in diameter.

(4) Assemble oil pan to cylinder block within 3 minutes after applying the sealant.

Caution
After installing the oil pan, wait at least 1 hour before starting the engine.



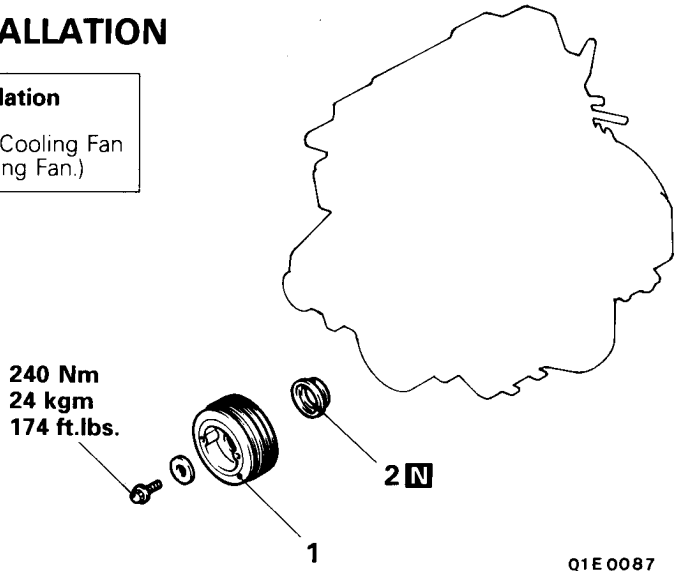
5. INSTALLATION OF GASKET

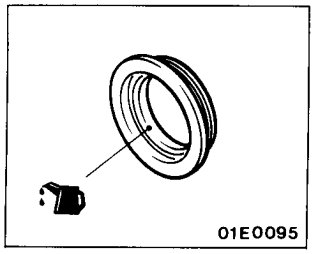
Replace the gasket with a new gasket, and install it in the direction shown in the illustration.

CRANKSHAFT OIL SEALS

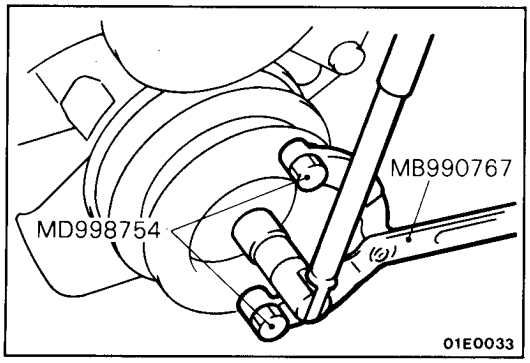
FRONT OIL SEAL
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Removal and Installation of Cooling Fan (Refer to GROUP 14 – Cooling Fan.)





Removal steps
1. Crankshaft pulley
2. Oil seal

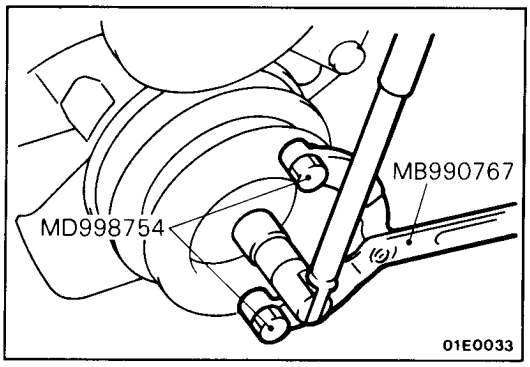


SERVICE POINTS OF REMOVAL

1. REMOVAL OF CRANKSHAFT PULLEY

Using special tools, remove the crankshaft pulley from the crankshaft.

Caution
Use only the specified special tools, or a damaged pulley damper could result.



SERVICE POINTS OF INSTALLATION

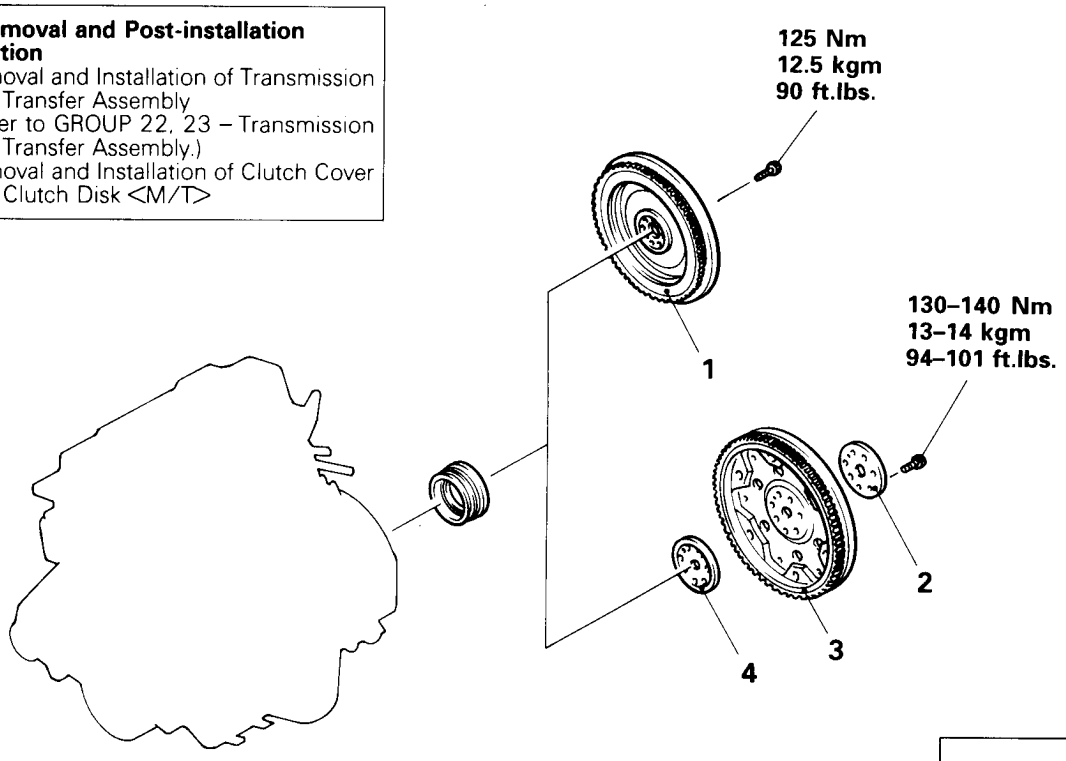
1. INSTALLATION OF CRANKSHAFT PULLEY

Using the special tool, attach the crankshaft pulley to the crankshaft.

Caution
Use only the specified special tools, otherwise a damaged pulley damper could result.

REAR OIL SEAL
REMOVAL AND INSTALLATION

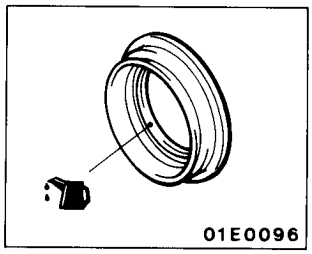
Pre-removal and Post-installation Operation
- Removal and Installation of Transmission and Transfer Assembly (Refer to GROUP 22, 23 – Transmission and Transfer Assembly.)
- Removal and Installation of Clutch Cover and Clutch Disk <M/T>

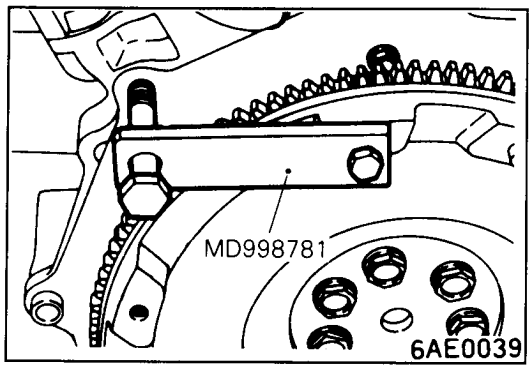


Removal steps

1. Flywheel assembly <M/T>
2. Adaptor plate
3. Drive plate <A/T>
4. Crankshaft adaptor <A/T>
5. Oil seal

01E0086

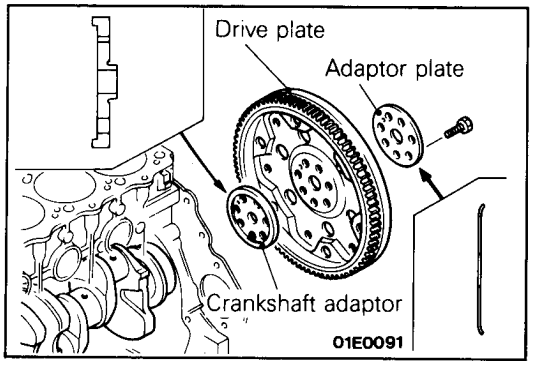




SERVICE POINTS OF REMOVAL

1. REMOVAL OF FLYWHEEL ASSEMBLY <M/T>/3. DRIVE PLATE <A/T>

Use the special tool to secure the flywheel or drive plate, and then remove the bolt.



SERVICE POINTS OF INSTALLATION

4. INSTALLATION OF CRANKSHAFT ADAPTOR / 2. ADAPTOR PLATE

Install the crankshaft adaptor and adaptor plate so that they face as shown in the illustration.

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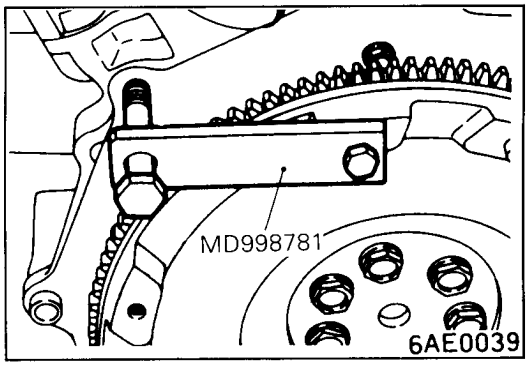


3. INSTALLATION OF DRIVE PLATE <A/T>/1. FLYWHEEL ASSEMBLY <M/T>

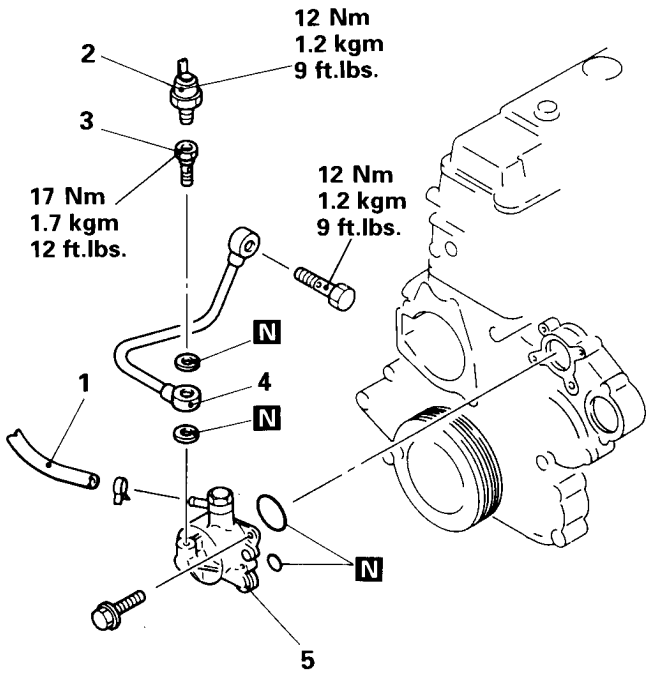
Use the special tool to secure the flywheel or drive plate, and then tighten the bolt to the specified torque.

VACUUM PUMP

REMOVAL AND INSTALLATION

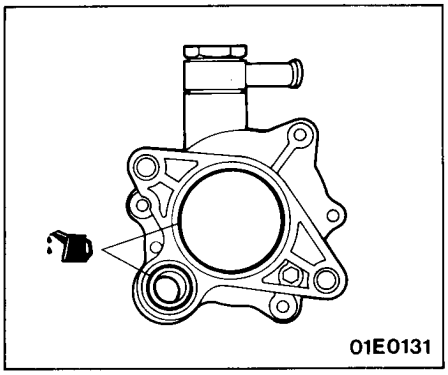
Pre-removal Operation
- Removal of Intercooler

Post-installation Operation
- Installation of Intercooler
- Inspection and Filling of Engine Oil



01E0139

Removal steps
1. Vacuum hose
2. Oil pressure switch
3. Connector
4. Oil pipe
5. Vacuum pump

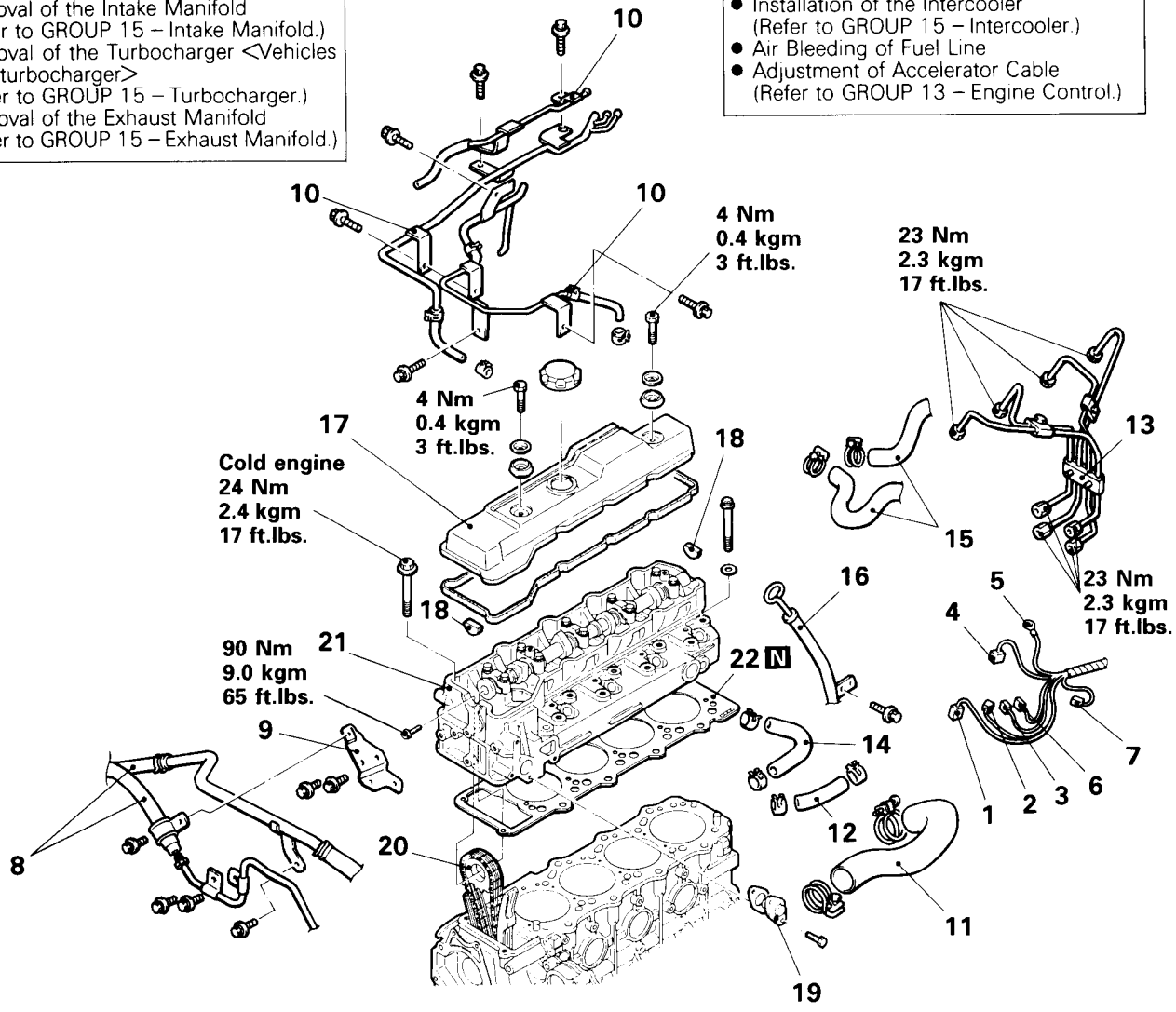


CYLINDER HEAD GASKET

REMOVAL AND INSTALLATION

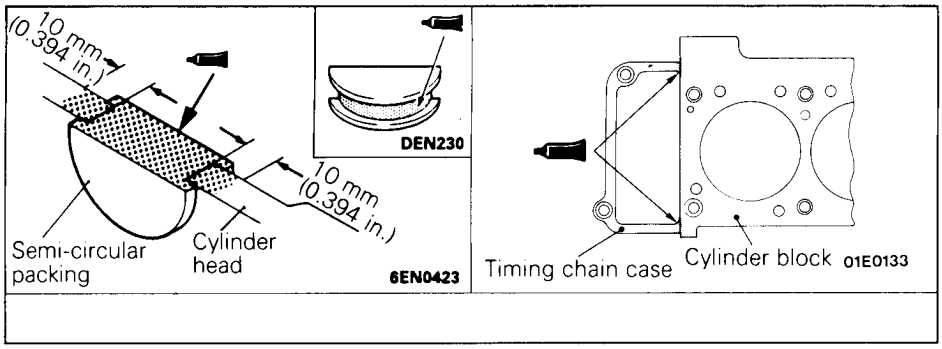
Pre-removal Operation
- Draining of Engine Coolant (Refer to GROUP 14 – Service Adjustment Procedures.)
- Removal of the Intercooler <Vehicles with turbocharger> (Refer to GROUP 15 – Intercooler.)
- Removal of the Intake Manifold (Refer to GROUP 15 – Intake Manifold.)
- Removal of the Turbocharger <Vehicles with turbocharger> (Refer to GROUP 15 – Turbocharger.)
- Removal of the Exhaust Manifold (Refer to GROUP 15 – Exhaust Manifold.)

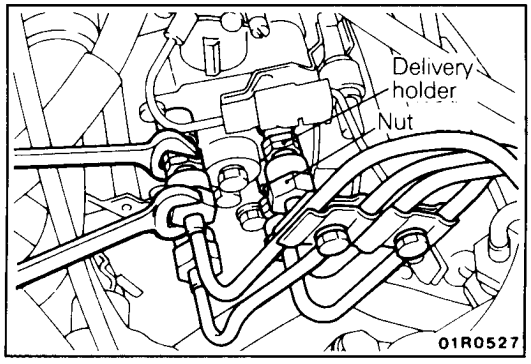
Post-installation Operation
- Installation of the Exhaust Manifold (Refer to GROUP 15 – Exhaust Manifold.)
- Installation of the Turbocharger (Refer to GROUP 15 – Turbocharger.)
- Installation of the Intake Manifold (Refer to GROUP 15 – Intake Manifold.)
- Installation of the Intercooler (Refer to GROUP 15 – Intercooler.)
- Air Bleeding of Fuel Line
- Adjustment of Accelerator Cable (Refer to GROUP 13 – Engine Control.)



Removal steps

1. Oil pressure switch or oil pressure gauge unit connector
2. Engine coolant temperature switch connector <A/C>
3. Thermo switch connector <A/C>
4. Engine coolant temperature sensor and gauge unit connector
5. Glow plug terminal
6. Lever position switch connector <A/T>
7. Lever position sensor
8. Power steering pipe
9. Bracket
10. Vacuum pipe and boost pipe
11. Radiator upper hose
12. Water hose
13. Injection pipe
14. Fuel hose
15. Heater hose
16. Oil level gauge guide
17. Rocker cover
18. Semi-circular packing
19. Timing chain tensioner
20. Camshaft sprocket
21. Cylinder head assembly
22. Cylinder head gasket

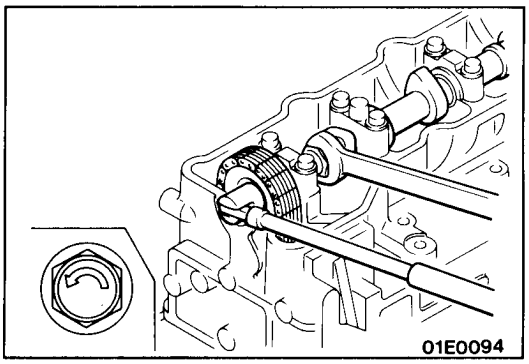




SERVICE POINTS OF REMOVAL

13. DISCONNECTION OF INJECTION PIPE

When loosening nuts at both ends of injection pipe, hold the other side (pump side-delivery holder, nozzle side-nozzle holder) with wrench and loosen nut.



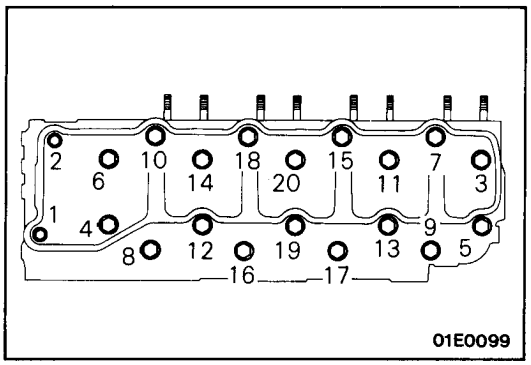
20. REMOVAL OF CAMSHAFT SPROCKET

Loosen the camshaft sprocket bolt while holding the hexagonal section of the camshaft with a wrench, and then remove the camshaft sprocket with the timing chain still around it.

Caution

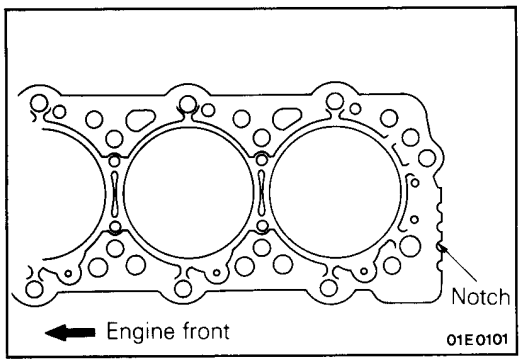
(1) The sprocket bolt is a left-hand thread, and the head of the bolt is marked with an arrow which indicates the direction to turn the bolt during installation. Because of this, turn the bolt in the opposite direction to the direction of the arrow during removal.

(2) The timing chain should not be used to stop the camshaft from turning.



21. REMOVAL OF CYLINDER HEAD ASSEMBLY

Loosen the bolts in 2 or 3 steps in order of the numbers shown in the illustration, and then remove the cylinder head assembly.

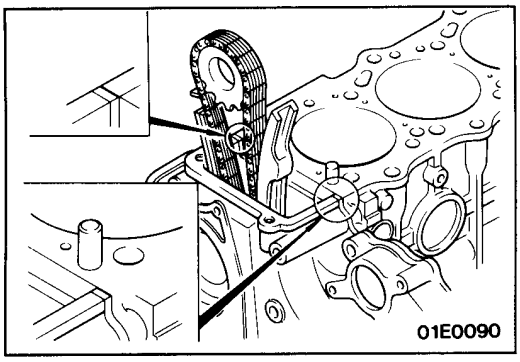


SERVICE POINTS OF INSTALLATION

22. INSTALLATION OF CYLINDER HEAD GASKET/21. CYLINDER HEAD ASSEMBLY

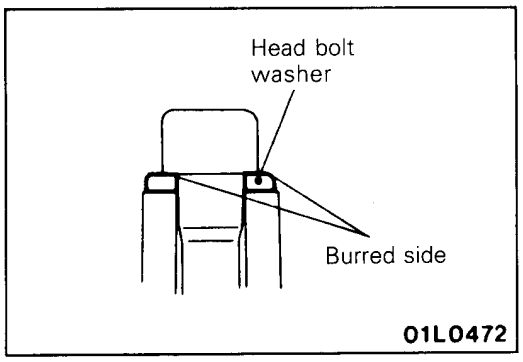
(1) Count the number of notches on the cylinder head gasket which was removed and select a new cylinder head gasket which has the same number of notches.

(2) Wipe off any oil or grease from the gasket mounting surface.

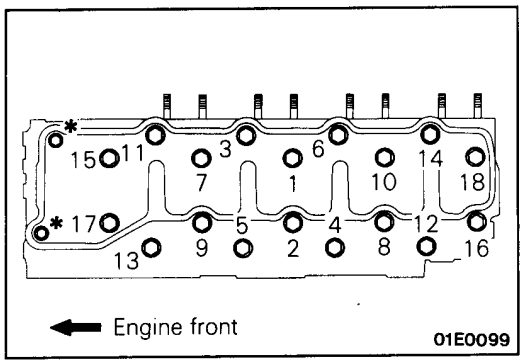


(3) Apply sealant to the mating surfaces of the timing gear case and cylinder block as shown in the illustration, and then install the cylinder head assembly to the cylinder block together with the cylinder head gasket within three minutes of applying the sealant.

Sealant: 3M ATD Part No. 8660 or equivalent

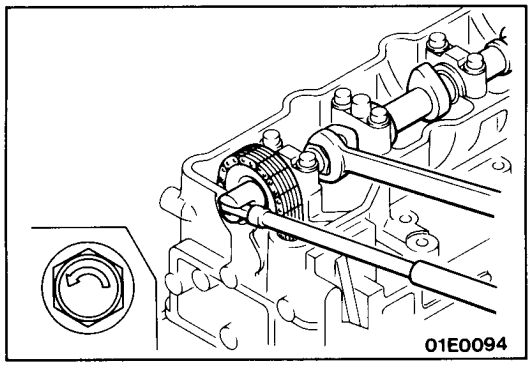


(4) The head bolt washer should be installed so that the burred side resulting from the tapping out is facing upwards.



(5) Install the bolts in the following order.

Procedure	Operation
①	Tighten the bolts to 100 Nm (10 kgm, 72 ft.lbs) in the order shown in the illustration.
②	Fully loosen the bolts in the reverse order to that shown in the illustration.
③	Tighten the bolts to 50 Nm (5.0 kgm, 36 ft.lbs.) in the order shown in the illustration.
④	Tighten by 1 / 4 turn (90°) in the order shown in the illustration.
⑤	Tighten by 1 / 4 turn (90°) in the order shown in the illustration.
⑥	Tighten the bolts marked with * to 24 Nm (2.4 kgm, 17 ft.lbs.).



20. INSTALLATION OF CAMSHAFT SPROCKET

Install the camshaft sprocket with the timing chain still around it, and then tighten the camshaft sprocket bolt while holding the hexagonal section of the camshaft with a wrench.

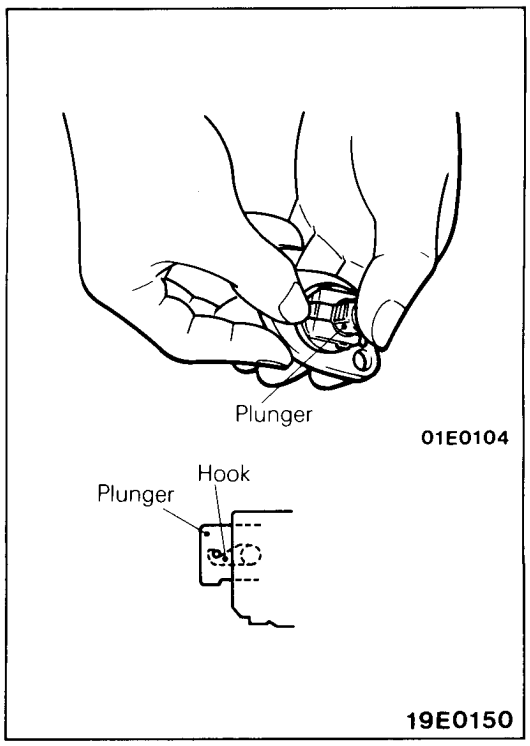
Caution

(1) The sprocket bolt is a left-hand thread, and the head of the bolt is marked with an arrow which indicates the direction to turn the bolt during installation.

(2) The timing chain should not be used to stop the camshaft from turning.

19. INSTALLATION OF TIMING CHAIN TENSIONER

(1) Raise up the pawl, and then push in the plunger and lock it with the hook as shown in the illustration.



(2) Install the tensioner to the cylinder head assembly.

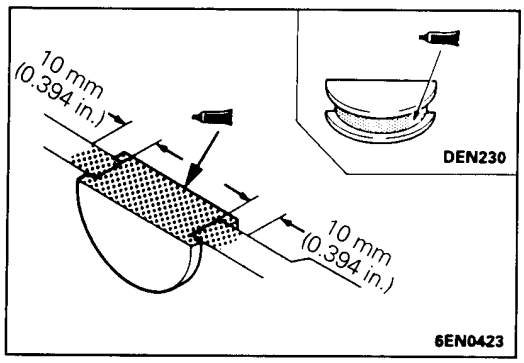
(3) Turn the crankshaft in the clockwise direction.

NOTE

If the engine is cranked in the clockwise direction after the tensioner has been installed, the hook will automatically release and the tension of the timing chain will be determined by the internal ratchet mechanism.

Caution

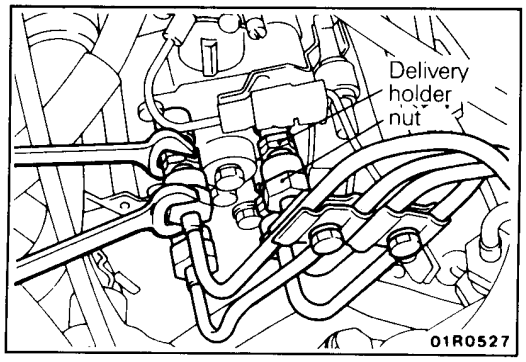
- **Be careful not to install the tensioner without first pushing in the plunger, as to do so will cause excessive tension to be applied to the timing chain, which could cause damage.**
- **If the engine is cranked in an anti-clockwise direction after the tensioner has been installed, it will cause excessive pressure to be applied to the plunger. This will cause the plunger to overrun the ratchet mechanism, resulting in a malfunction.**



18. INSTALLATION OF SEMI-CIRCULAR PACKING

Apply sealant to the semi-circular packing as shown in the illustration, install the semi-circular packing, and then install the rocker cover to the cylinder head assembly within three minutes after applying the sealant.

Caution
Do not start the engine for 1 hour after installing the rocker cover.



13. INSTALLATION OF INJECTION PIPE

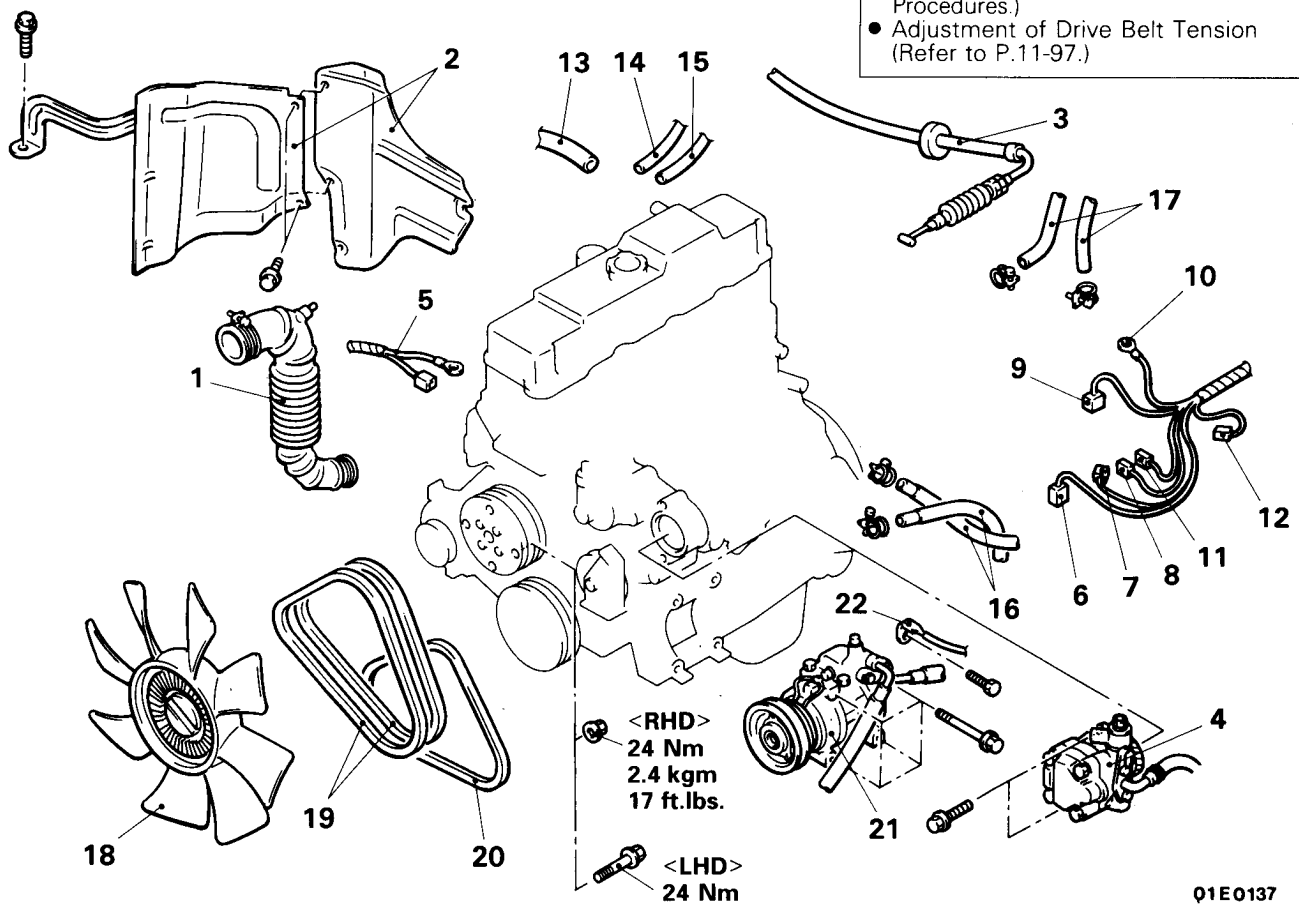
When tightening the nuts at both ends of the injection pipe, tighten the nuts to the specified torque while holding the nuts on the other side (delivery holder on pump side, nozzle holder on nozzle side) with a spanner to stop them from turning.

ENGINE ASSEMBLY

REMOVAL AND INSTALLATION

Pre-removal Operation
- Removal of the Hood
  (Refer to GROUP 42 – Hood.)
- Removal of the Transmission and Transfer Assembly
  (Refer to GROUP 22, 23 – Transmission Assembly.)
- Removal of the Intercooler
  (Refer to GROUP 15 – Intercooler.)
- Removal of the Radiator
  (Refer to GROUP 14 – Radiator.)
- Removal of Battery and Battery Tray
- Removal of Cruise-Control Intermediate Link
  <Vehicles with cruise-control.>

Post-installation Operation
- Installation of the Transmission and Transfer Assembly
  (Refer to GROUP 22, 23 – Transmission Assembly.)
- Installation of the Radiator
- Installation of the Intercooler
  (Refer to GROUP 15 – Intercooler.)
- Installation of Battery and Battery Tray
- Installation of the Cruise-Control Intermediate Link <Vehicles with cruise-control>
- Installation of the Hood
  (Refer to GROUP 42 – Hood.)
- Adjustment of the Accelerator Cable
- Air Bleeding of Fuel System
  (Refer to GROUP 13 – Service Adjustment Procedures.)
- Adjustment of Drive Belt Tension
  (Refer to P.11-97.)



Removal steps

1. Air cleaner cover and air intake hose assembly
2. Heat protector
3. Accelerator cable connection
4. ◆◆ Power steering oil pump <Power steering>
5. Alternator connector
6. Oil pressure switch or oil pressure gauge unit connector
7. Engine coolant temperature switch connector <A/C>
8. Thermo switch <A/T>
9. Engine coolant temperature switch and gauge unit connector
10. Glow plug terminal
11. Lever position switch connector <A/T–A/C>
12. Lever position sensor connector
13. Breather hose
14. Vacuum hose
15. Vacuum hose
16. Fuel hose connections
17. Heater hose connections
18. ◆◆ ◆◆ Cooling fan
19. Alternator drive belt
20. A/C drive belt
21. ◆◆ A/C compressor
22. Earth cable

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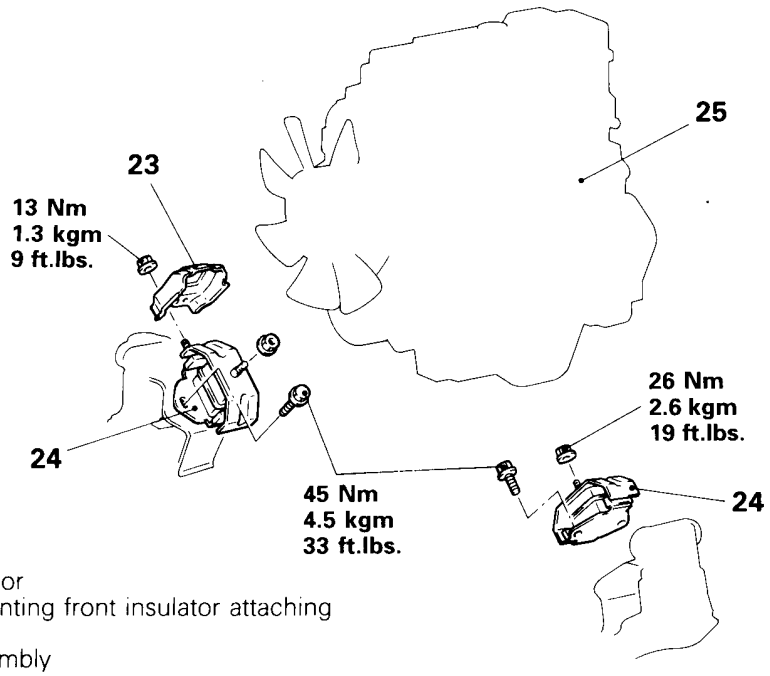

23. Heat protector
24. Engine mounting front insulator attaching bolt
◆◆ ◆◆ 25. Engine assembly

01E0118

SERVICE POINTS OF REMOVAL

4. REMOVAL OF POWER STEERING OIL PUMP/21. A/C COMPRESSOR

(1) Remove the oil pump and air conditioner compressor (with the hose attached).
(2) Suspend the removed oil pump (by using wire or similar material) at a place where no damage will be caused during removal/installation of the engine assembly.

18. REMOVAL OF COOLING FAN <R.H. DRIVE VEHICLES>

Loosen the cooling fan mounting nut while holding the fan clutch of the cooling fan with a spanner or similar tool.

25. REMOVAL OF ENGINE ASSEMBLY

(1) Check that all cables, hoses, harness connectors, etc. are disconnected from the engine.
(2) Lift the chain block slowly to remove the engine assembly upward from the engine compartment.

SERVICE POINTS OF INSTALLATION

25. INSTALLATION OF ENGINE ASSEMBLY

Install the engine assembly. When doing so, check carefully that all pipes and hoses are connected, and that none are twisted, damaged, etc.

18. INSTALLATION OF COOLING FAN

Tighten the cooling fan mounting nut while holding the fan clutch of the cooling fan with a spanner or similar tool.

LUBRICATION

CONTENTS

E12AA--

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- Lubricants 3

SPECIAL TOOL 3

SERVICE ADJUSTMENT PROCEDURES 3
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- Engine Oil Replacement 4
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- Oil Level Warning System Inspection 5

ENGINE OIL COOLER <6G72-12 VALVE> 6

ENGINE OIL COOLER <6G74> 6-1

ENGINE OIL COOLER <4M40> 6-2

ENGINE OIL COOLER <4D56> 7

ENGINE OIL COOLER <6G72-24 VALVE> 9

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GENERAL INFORMATION

ENGINE OILS

Health Warning

Prolonged and repeated contact with mineral oil will result in the removal of natural fats from the skin, leading to dryness, irritation and dermatitis. In addition, used engine oil contains potentially harmful contaminants which may cause skin cancer. Adequate means of skin protection and washing facilities must be provided.

Recommended Precautions

The most effective precaution is to adapt working practices which prevent, as far as practicable, the risk of skin contact with mineral oils, for example by using enclosed systems for handling used engine oil and by degreasing components, where practicable, before handling them.

Other precautions:

- Avoid prolonged and repeated contact with oils, particularly used engine oils.
- Wear protective clothing, including impervious gloves where practicable.
- Avoid contaminating clothes, particularly underpants, with oil.
- Do not put oily rags in pockets, the use of overalls without pockets will avoid this.
- Do not wear heavily soiled clothing and oil-impegnated footwear. Overalls must be cleaned regularly and kept separate from personal clothing.
- Where there is a risk of eye contact, eye protection should be worn, for example, chemical goggles or face shields; in addition an eye wash facility should be provided.
- Obtain First Aid treatment immediately for open cuts and wounds.
- Wash regularly with soap and water to ensure all oil is removed, especially before meals (skin cleansers and nail brushes will help). After cleaning, the application of preparations containing lanolin to replace the natural skin oils is advised.
- Do not use petrol, kerosine, diesel fuel, gas oil, thinners or solvents for cleaning skin.
- Use barrier creams, applying them before each work period, to help the removal of oil from the skin after work.
- If skin disorders develop, obtain medical advice without delay.

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SPECIFICATIONS

GENERAL SPECIFICATIONS

E12CA--

Items	6G72	6G74, 4D56
Engine oil cooler Performance J/h (kcal/h, BTU/h)	12,976 × 10^3 (3,100, 12,301)	26,790 × 10^3 (6,400, 25,396)

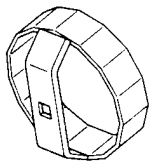
LUBRICANTS

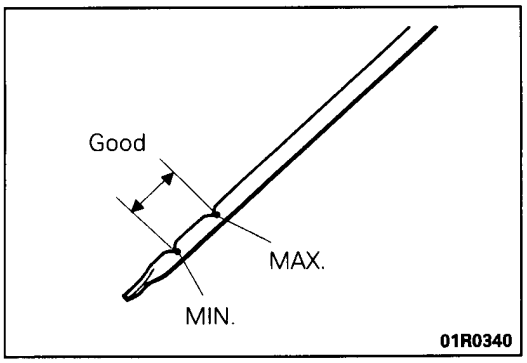
E12CD--

Items	Recommended lubricant	Quantity dm^3 (U.S.qts., Imp.qts.) (including volume inside oil filter and oil cooler)
Engine oil (API classification)		
<4G64, 6G72, 6G74>	SG or higher	4.9 (5.2, 4.3)
<4D56>	CD or higher	6.7 (7.1, 5.9)
<4M40>	CD or higher	7.8 (8.2, 6.9)

SPECIAL TOOL

E11DA--

Tool	Number	Name	Use
	MH061590	Oil filter wrench	Replacement of oil filter <4M40>



SERVICE ADJUSTMENT PROCEDURES

ENGINE OIL INSPECTION

E12FCAC

1. Pull out the oil level gauge and remove oil adhered to the level gauge, wiping with clean cloth.
2. Insert the level gauge into the oil level gauge guide.
3. Pull out the level gauge slowy and check that the oil level is in the illustrated range.

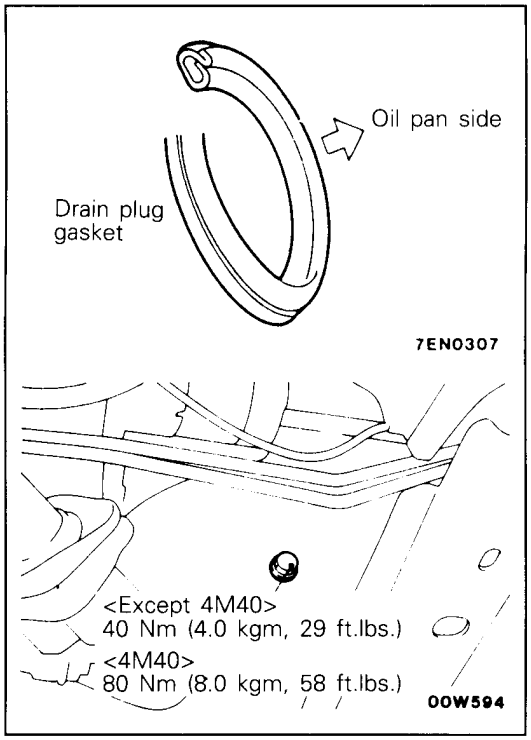
NOTE
1. For this inspection, place the vehicle on a level surface.
2. Check while the engine is stationary. If the engine has been started, stop it and allow for some time before inspection.

4. If below the minimum level, supply with specified oil.

Specified oil: (API classification)

<4G64, 6G72, 6G74>	**SG or higher**
<4D56, 4M40>	**CD or higher**

Caution
Refilling beyond the maximum level has adverse effect on engine performance.



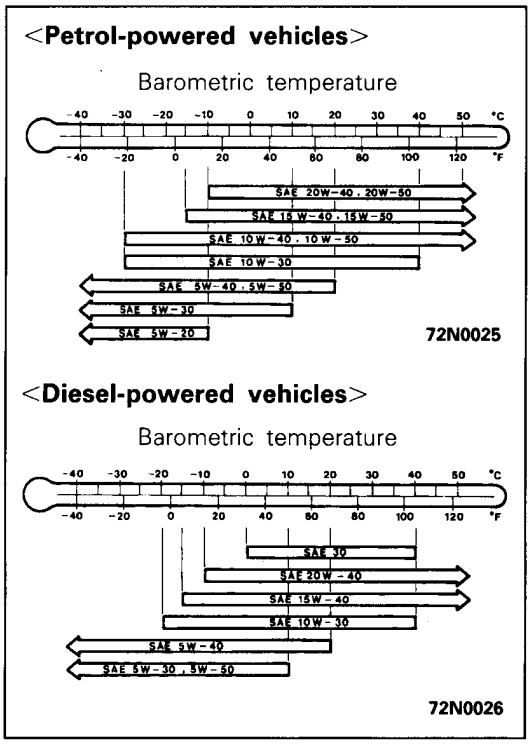
5. Run the engine at idle and stop. Then allow some time and check oil level again to make sure it is within the specified range.
6. Check that the engine oil is not excessively contaminated and not mixed with the coolant or petrol, and that it has proper viscosity.

ENGINE OIL REPLACEMENT E12FAAD

1. Warm up the engine.
2. Drain the engine oil by removing the filler cap and then removing the drain plug.

Caution
Use care as oil could be hot.

3. Replace the drain plug gasket and install so it faces in the direction shown in the illustration. Then tighten the drain plug to the specified torque.



4. Fill with new engine oil.

Specified oil: (API classification)

<4G64, 6G72, 6G74>	**SG or higher**
<4D56, 4M40>	**CD or higher**

Oil quantity:

<4G64>	**4.5 dm^3 (4.8 U.S. qts., 4.0 Imp. qts.)**
<6G72>	**4.3 dm^3 (4.5 U.S. qts., 3.8 Imp. qts.)**
<6G74>	**4.3 dm^3 (4.5 U.S. qts., 3.8 Imp. qts.)**
<4D56>	**5.5 dm^3 (5.8 U.S. qts., 4.8 Imp. qts.)**
<4M40>	**5.5 dm^3 (5.8 U.S. qts., 4.8 Imp. qts.) [excluding volume of oil in the oil filter and oil cooler]**

5. Race the engine for a few minutes.
6. Stop the engine and check the oil level with a level gauge.

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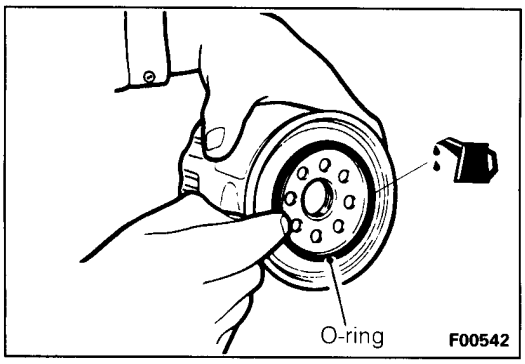

OIL FILTER REPLACEMENT

E12FBAE

1. Warm up the engine.
2. Remove the engine oil drain plug to drain the engine oil.
3. Remove the air intake hose, and cover the alternator with a rag so that oil will not get on the alternator <4D56>.
4. Use an oil filter wrench to remove the engine oil filter.
5. Clean the mounting surface of the filter bracket.
6. Apply a small amount of engine oil to the O-ring of the new oil filter.
   <4G64, 6G72, 4D56>
7. Install the oil filter by hand.

   Tightening torque:
   11 – 13 Nm (1.1 – 1.3 kgm, 8 – 9 ft.lbs.) <4G64, 6G72>
   20 Nm (2.0 kgm, 14 ft.lbs.) <4D56>

8. <6G74>
   Screw in the oil filter by hand, and after the O-ring contacts the flange surface, tighten it another 3/4 turns with a filter wrench, etc. [approx. 14 Nm (1.4 kgm, 10 ft.lbs.)]
9. <4M40>
   Screw in the oil filter by hand, and after the O-ring contacts the flange surface, tighten it another 5/8 turns with a filter wrench, etc. [approx. 20 Nm (2.0 kgm, 14 ft.lbs.)]
10. Pour in the engine oil.
11. Race the engine 2 or 3 times and check that no oil leaks from the mounting section of the oil filter.

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NOTES

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OIL LEVEL WARNING SYSTEM INSPECTION E12FDAA

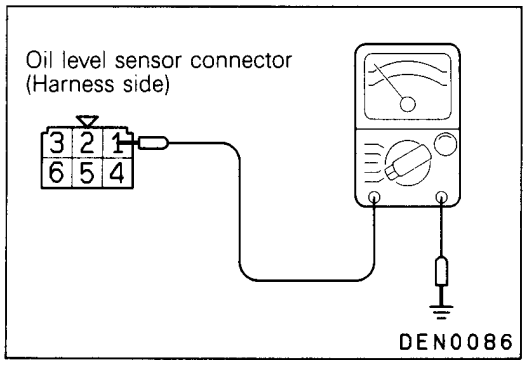
(1) Check that the proper amount of oil has been filled.
(2) When the ignition switch is turned to ON (do not start the engine), check that the oil level warning lamp illuminates.

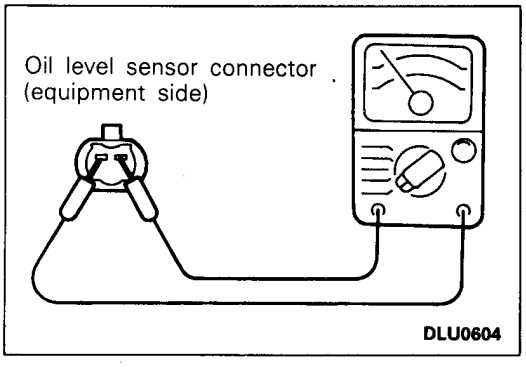
NOTE
If the oil level warning lamp does not illuminate, the cause is probably a blown lamp, or a malfunction in the relay.

(3) When the engine is started, check that the oil level warning lamp turns off.
If the oil level warning lamp will not go out, disconnect the connector of the oil level relay and measure the voltage of the No. 1 terminal on the harness side of the connector while idling the engine in order to confirm that it is the same as the battery voltage.

NOTE
If the voltage at the connector is the same as the battery voltage, the problem is probably a malfunction of either the oil level relay or the oil level sensor. If the voltage at the connector is lower than the battery voltage, the problem is probably a malfunction of either the alternator or the wiring harness.

(4) Disconnect the oil level sensor connector. Check that the oil level warning lamp illuminates after approximately 20 seconds.
If the oil level warning lamp does not illuminate, replace the oil level relay.





(5) Check the continuity between the oil level sensor terminals.

Engine oil temperature	Oil level	Continuity
At 40°C (104°F) or lower	Normal (proper volume)	Continuity
	Low (drained)	Continuity
At 70°C (158°F) or higher	Normal (proper volume)	Continuity
	Low (drained)	No continuity

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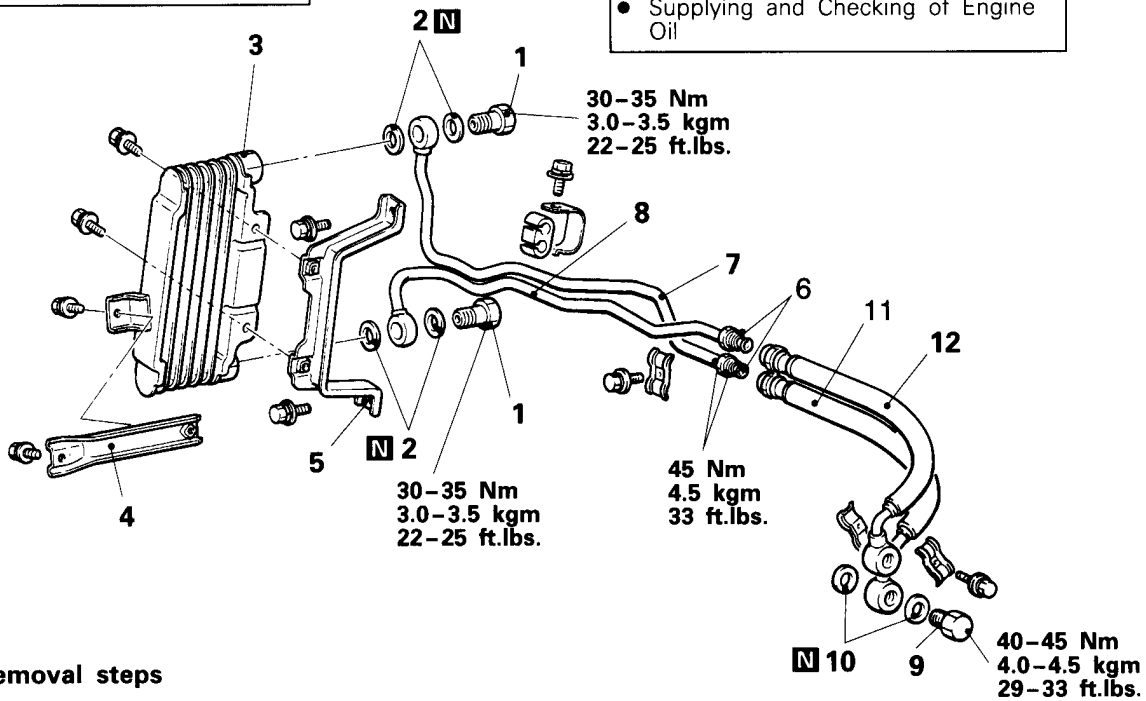
ENGINE OIL COOLER <6G72-12 VALVE>

REMOVAL AND INSTALLATION

E12JA--

Pre-removal Operation
- Removal of the Radiator Grille

Post-installation Operation
- Installation of the Radiator Grille
- Supplying and Checking of Engine Oil



Removal steps

◆◆ 1. Eye bolts
2. Gaskets
3. Engine oil cooler
4. Stay
5. Bracket
6. Engine oil cooler pipe connection
7. Return pipe
8. Feed pipe
◆◆ 9. Eye bolts
10. Gaskets
◆◆ 11. Return hose
◆◆ 12. Feed hose

04E0002

SERVICE POINT OF REMOVAL

E12JBAH

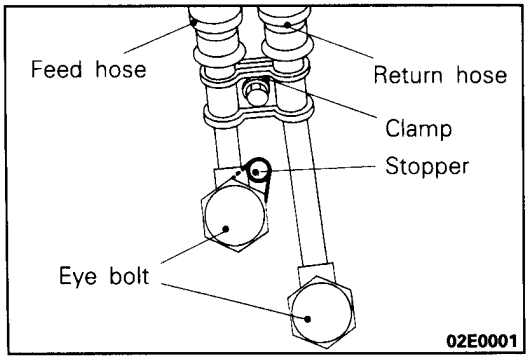
1. REMOVAL OF EYE BOLTS

Caution
Be sure to hold the weld nut of the oil cooler while loosening the eye bolt.

INSPECTION

E12JCAF

- Check for foreign material between oil cooler fins.
- Check the oil cooler fins for bend or damage.
- Check the oil cooler pipes for crack, damage, clogging or deterioration.



SERVICE POINTS OF INSTALLATION

E12JDAH

12. INSTALLATION OF FEED HOSE/11. RETURN HOSE/9. EYE BOLTS (ENGINE SIDE)

(1) Provisionally tighten the eye bolts, and install the clamp so that it touches the crimps on the hoses.
(2) Fully tighten the eye bolt on the return hose.
(3) Place the feed hose against the stopper, and fully tighten the eye bolt on the feed hose.

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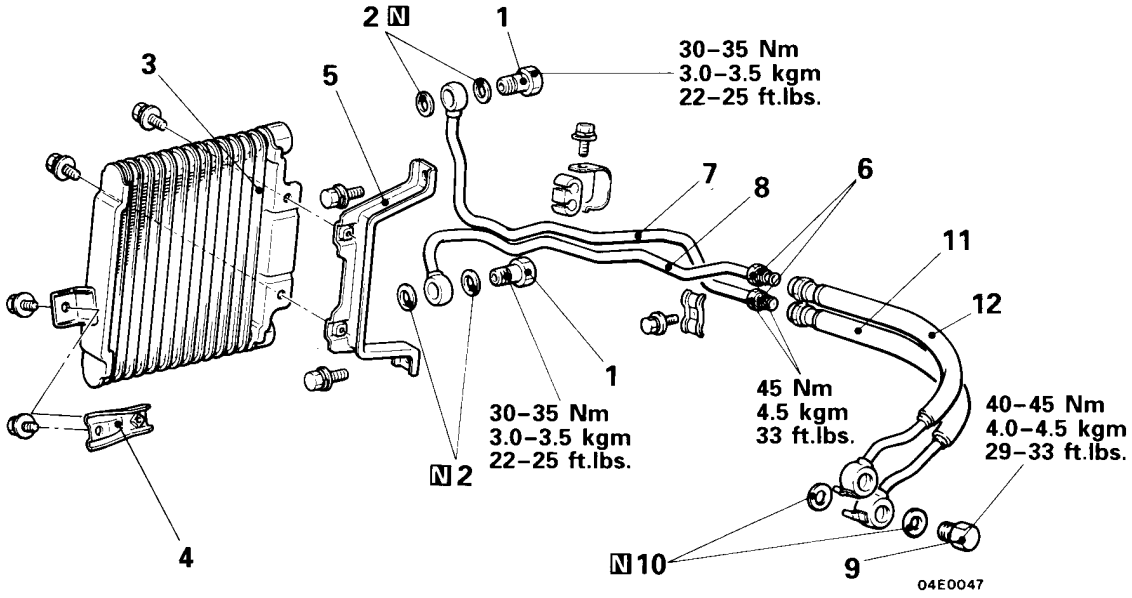
ENGINE OIL COOLER <6G74>

REMOVAL AND INSTALLATION M11MA--

Pre-removal Operation
- Removal of the Radiator Grille

Post-installation Operation
- Installation of the Radiator Grille
- Supplying and Checking of Engine Oil



Removal steps

◆◆ 1. Eye bolts
2. Gaskets
3. Engine oil cooler
4. Stay
5. Bracket
6. Engine oil cooler pipe connection
7. Return pipe
8. Feed pipe
◆◆ 9. Eye bolts
10. Gaskets
◆◆ 11. Return hose
◆◆ 12. Feed hose

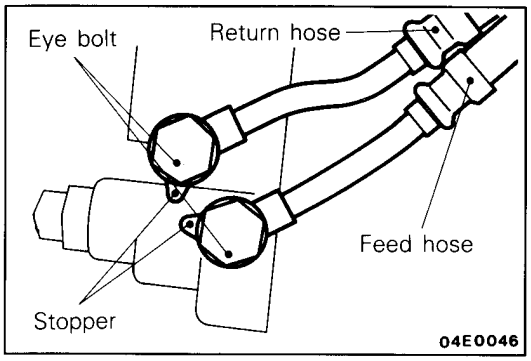
SERVICE POINT OF REMOVAL M11MBAC

1. REMOVAL OF EYE BOLTS

Caution
Be sure to hold the weld nut of the oil cooler while loosening the eye bolt.

INSPECTION M11MCAC

- Check for foreign material between oil cooler fins.
- Check the oil cooler fins for bend or damage.
- Check the oil cooler pipes for crack, damage, clogging or deterioration.



SERVICE POINTS OF INSTALLATION M11MDAA

12. INSTALLATION OF FEED HOSE/11. RETURN HOSE /9. EYE BOLTS (ENGINE SIDE)

(1) Provisionally tighten the eye bolts, and install the clamp so that it touches the crimps on the hoses.
(2) Fully tighten the eye bolt on the return hose.
(3) Place the feed hose against the stopper, and fully tighten the eye bolt on the feed hose.

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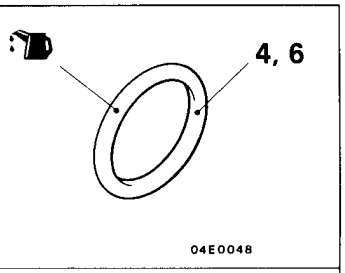
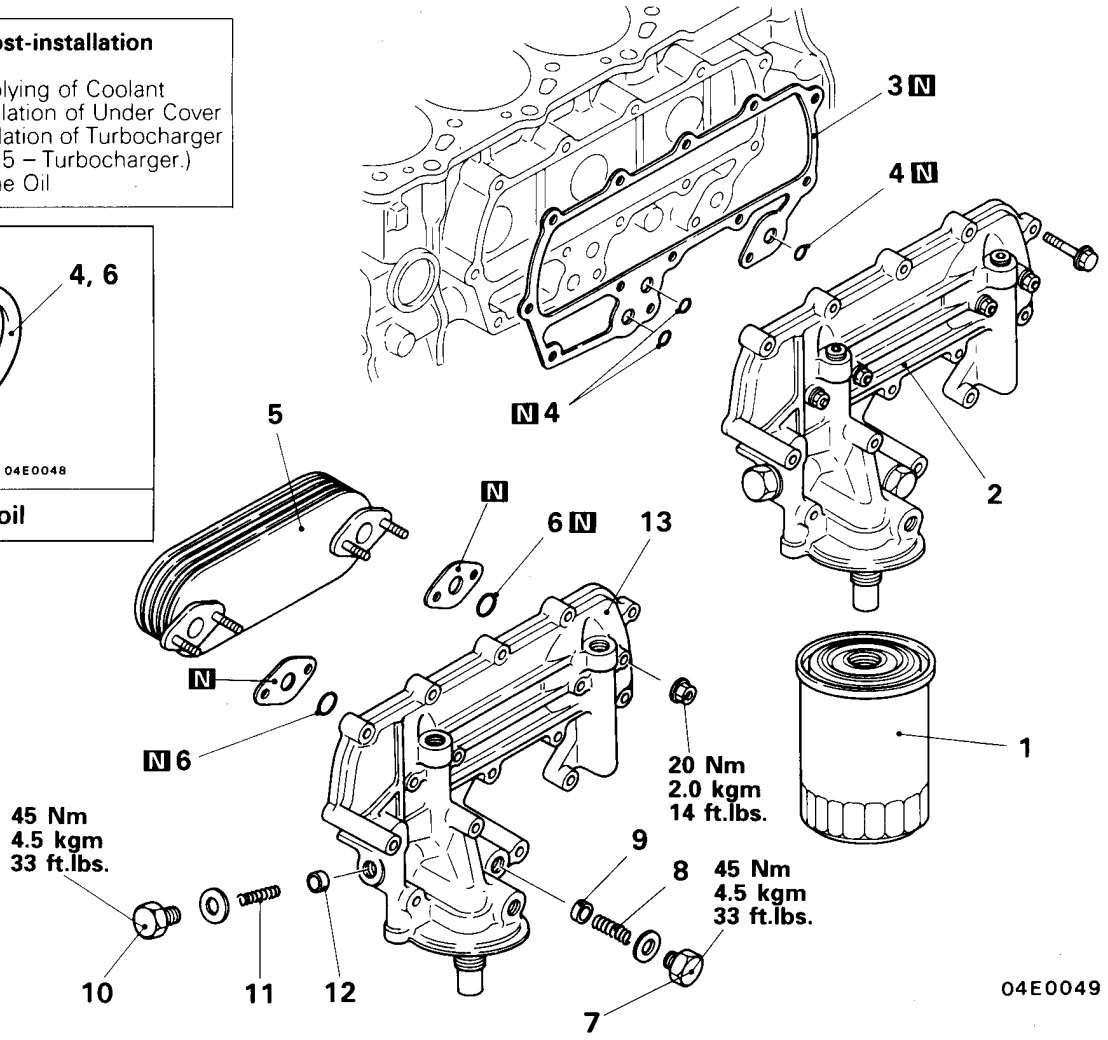
ENGINE OIL COOLER <4M40>

REMOVAL AND INSTALLATION

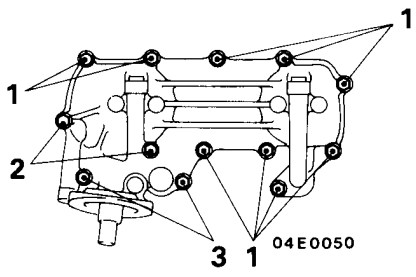
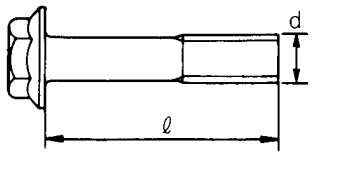
Pre-removal and Post-installation Operations
- Draining and Supplying of Coolant
- Removal and Installation of Under Cover
- Removal and Installation of Turbocharger (Refer to GROUP 15 – Turbocharger.)
- Supplying of Engine Oil



Engine oil



Removal steps
1. Oil filter (Refer to P.12-2.)
2. Oil cooler assembly
3. Gasket
4. O-ring
5. Oil cooler element
6. O-ring
7. Plug
8. Bypass valve spring
9. Plunger
10. Plug
11. Regulator valve spring
12. Plunger
13. Oil cooler body

Symbol	Head mark	d × ℓmm (in.)	Remarks
1	7T	8 × 32 (0.31 × 1.26)	 
2	7T	8 × 75 (0.31 × 2.95)	
3	7T	10 × 80 (0.39 × 3.15)	

INSPECTION

- Check the oil cooler fins for bend or damage.

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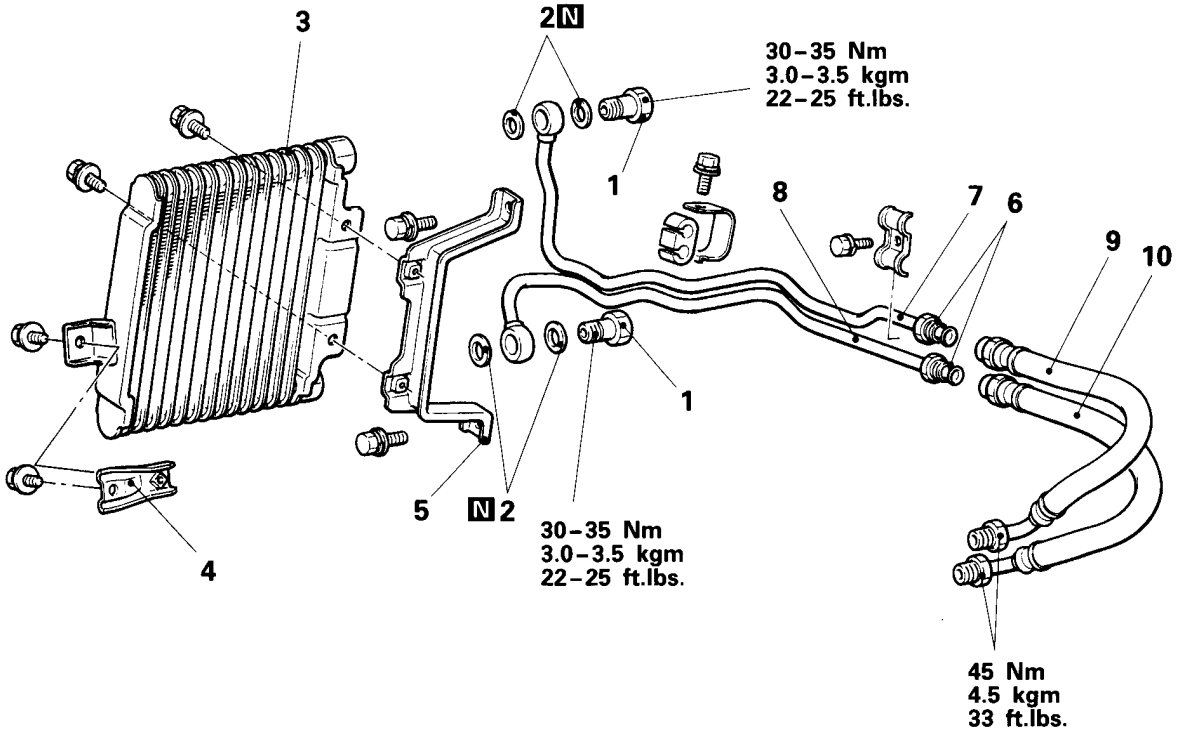
ENGINE OIL COOLER <4D56>

REMOVAL AND INSTALLATION

E12JA--

Pre-removal Operation
(1) Removal of the Radiator Grille
(2) Removal of the Oil Filter (Refer to P.12-4.)
(3) Removal of the Brake Master Cylinder Heat Protector

Post-installation Operation
(1) Installation of the Brake Master Cylinder Heat Protector
(2) Installation of the Oil Filter (Refer to P.12-4.)
(3) Installation of the Radiator Grille
(4) Supplying and Checking of Engine Oil



04E0001

Removal steps

◆◆ 1. Eye bolts
2. Gaskets
3. Engine oil cooler
4. Stay
5. Bracket
6. Engine oil cooler pipe connection
7. Return pipe
8. Feed pipe
◆◆ 9. Return hose
◆◆ 10. Feed hose

SERVICE POINT OF REMOVAL

E12JBAI

1. REMOVAL OF EYE BOLTS

Caution
Be sure to hold the weld nut of the oil cooler while loosening the eye bolt.

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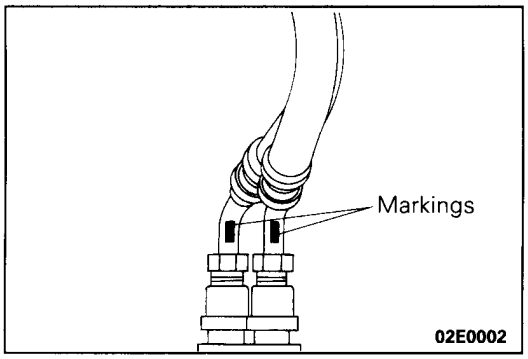
INSPECTION E12JCAF

- Check for foreign material between oil cooler fins.
- Check the oil cooler fins for bend or damage.
- Check the oil cooler pipes for crack, damage, clogging or deterioration.



SERVICE POINT OF INSTALLATION E12JDAI

10. INSTALLATION OF FEED HOSE/9. RETURN HOSE (ENGINE SIDE)

Install the return hose and the feed hose with the markings facing upwards.

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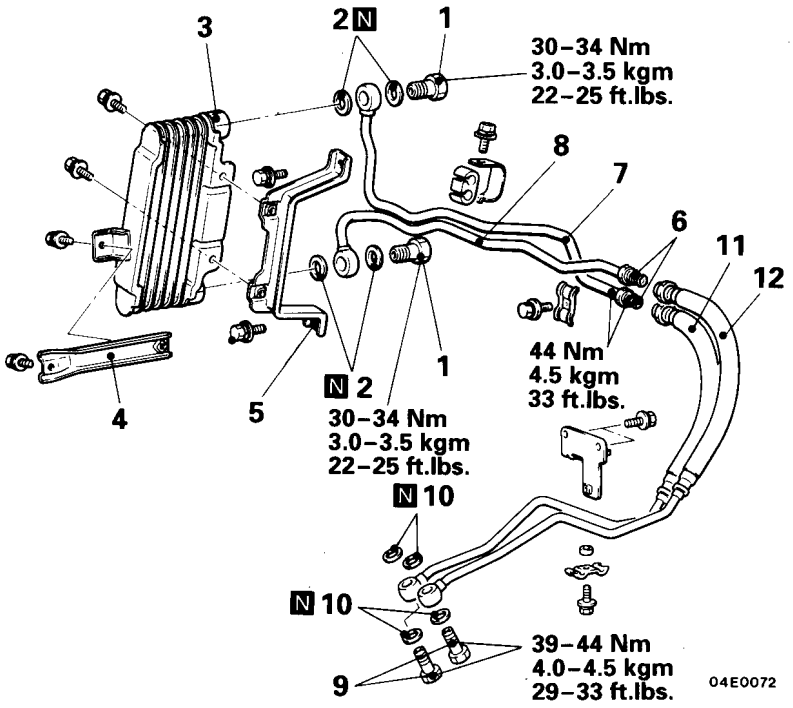
ENGINE OIL COOLER <6G72-24 VALVE>

REMOVAL AND INSTALLATION

Pre-removal Operation
- Removal of Radiator Grille

Post-installation Operation
- Installation of Radiator Grille
- Supplying and Checking of Engine Oil



Removal steps

◆◆ 1. Eye bolts
2. Gaskets
3. Engine oil cooler
4. Stay
5. Bracket
6. Engine oil cooler pipe connection
7. Return pipe
8. Feed pipe
9. Eye bolts
10. Gaskets
11. Return hose
12. Feed hose

SERVICE POINT OF REMOVAL

1. REMOVAL OF EYE BOLTS

Caution
Be sure to hold the weld nut of the oil cooler while loosening the eye bolt.

INSPECTION

- Check for foreign material between the oil cooler fins.
- Check the oil cooler fins for bends or damage.
- Check the oil cooler pipes for cracks, damage, clogging or deterioration.

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FUEL

E13AA--

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WARNING REGARDING SERVICING OF SUPPLEMENTAL RESTRAINT SYSTEM (SRS) EQUIPPED VEHICLES WARNING!

(1) Improper service or maintenance of any component of the SRS, or any SRS-related component, can lead to personal injury or death to service personnel (from inadvertent firing of the air bag) or to the driver (from rendering the SRS inoperative.)

(2) Service or maintenance of any SRS component or SRS-related component must be performed only at an authorized MITSUBISHI dealer.

(3) MITSUBISHI dealer personnel must thoroughly review this manual, and especially its GROUP 52B – Supplemental Restraint System (SRS) and GROUP 00 – Maintenance Service before beginning any service or maintenance of any component of the SRS or any SRS-related component.

NOTE
The SRS includes the following components: SRS diagnosis unit, SRS warning light, air bag module, clock spring and interconnecting wiring. Other SRS-related components (that may have to be removed/installed in connection with SRS service or maintenance) are indicated in the table of contents by an asterisk (*).

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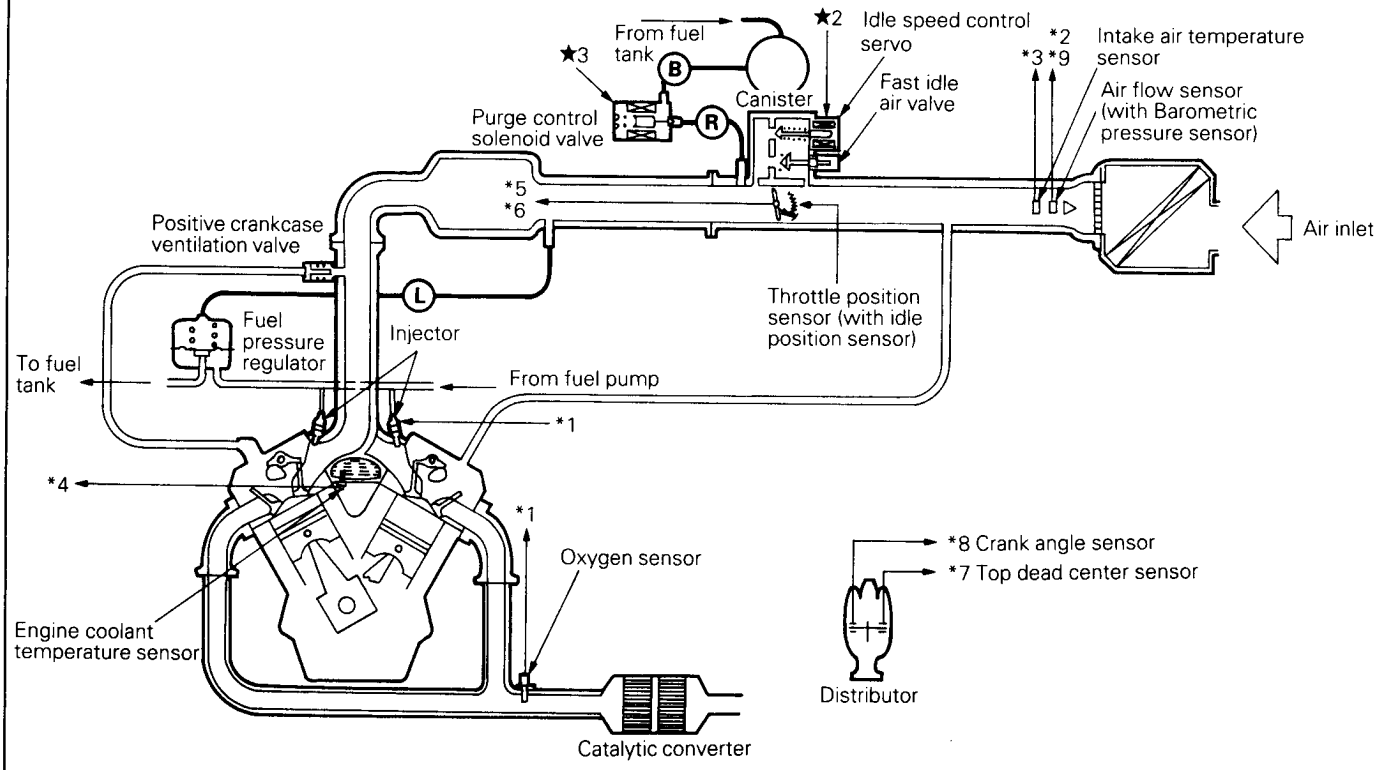
FUEL SYSTEM <6G72 Engine>

GENERAL INFORMATION

MULTI POINT INJECTION SYSTEM DIAGRAM

E13BBAG

*1 Oxygen sensor *2 Air-flow sensor *3 Intake air temperature sensor *4 Engine coolant temperature sensor *5 Throttle position sensor *6 Idle position switch *7 Top dead center sensor *8 Crank angle sensor *9 Barometric pressure sensor	• Ignition switch-ST • Ignition switch-IG1 • Power supply • Vehicle-speed sensor • Air conditioner switch • Inhibitor switch <A/T>	⇨ Engine control unit ⇨	★1 Injector ★2 Idle speed control servo ★3 Purge control solenoid valve • Fuel pump control (control relay) • Air conditioner power relay • Ignition timing control • Self-diagnosis circuit • Engine warning lamp



7FU1163

Vacuum hose colour
R: Red
B: Black
L: Light Blue

SPECIFICATIONS

GENERAL SPECIFICATIONS

E13CA-A

Items	Specifications
Fuel	
Tank capacity dm^3 (U.S.gal., Imp.gal.)	
Standard Wheelbase	75 (19.8, 16.5)
Long Wheelbase	92 (24.3, 20.2)
Fuel pump	
Type	Electrical, in-tank type
Driven by	Electric motor
Throttle body	
Throttle bore mm (in.)	55 (2.165)
Throttle position sensor	Variable resistor type
Idle speed control servo	Stepper motor type Stepper motor type by-pass air control system with the Fast Idle Air Valve
Idle position switch	Rotary contact type
Engine control unit	
Identification model No.	E2T37472
Sensors	
Air flow sensor	Karman vortex type
Barometric pressure sensor	Semiconductor type
Intake air temperature sensor	Thermistor type
Engine coolant temperature sensor	Thermistor type
Oxygen sensor	Zirconia type
Vehicle-speed sensor	Reed switch type
Top dead centre sensor	Photo interruptor type
Crank angle sensor	Photo interruptor type
Actuators	
Control relay type	Contact switch type
Injector type and number	Electromagnetic, 6
Purge control solenoid valve	ON/OFF type solenoid valve
Fuel pressure regulator	
Regulated pressure kPa (kg/cm^2, psi)	335 (3.35, 47.6)

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SERVICE SPECIFICATIONS

E13CB-A

Items		Specifications
Standard value		
Accelerator cable play	mm (in.)	1–2 (0.04–0.08)
Basic ignition timing		5° ± 2° BTDC at curb idle
Curb idle speed	r/min.	700 ± 100
Idle speed when air conditioner ON	r/min.	900 at neutral position 600 at D range <A/T>
Basic idle speed	r/min.	700 ± 50
Throttle position sensor output voltage	V	0.4–1.0
Throttle position sensor resistance	kΩ	3.5–6.5
Idle speed control servo (stepper motor) coil resistance [at 20°C (68°F)]	Ω	28–33
Intake air temperature sensor resistance [at 20°C (68°F)]	kΩ	2.7
Engine coolant temperature sensor resistance	kΩ	
20°C (68°F)		2.4
80°C (176°F)		0.3
Fuel pressure (at curb idle)	kPa (kg/cm^2, psi)	
Vacuum hose disconnection		330–350 (3.3–3.5, 47–50)
Vacuum hose connection		Approx. 270 (2.7, 38)
Injector coil resistance [at 20°C (68°F)]	Ω	13–16

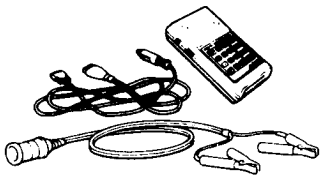
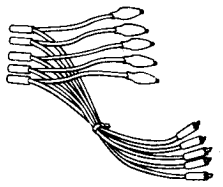
SEALANT

E13CE-A

Items	Specified sealant	Quantity
Engine coolant temperature sensor threaded portion	3M Nut Locking Part No. 4171 or equivalent	As required

SPECIAL TOOLS

E13DA-A

Tool	Number	Name	Use
	MB991341	Multi-use tester assembly	• Reading diagnosis code • MPI system inspection
	MB991419	ROM pack (for multi-use tester)	• Reading diagnosis code • MPI system inspection
	MB991348	Test harness set	• Adjustment of throttle position sensor • Inspection with oscilloscope

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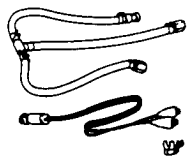
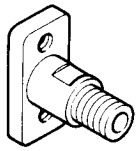
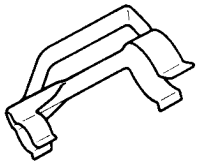
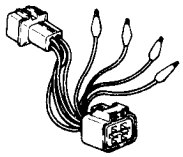
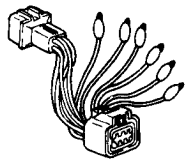
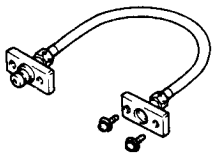
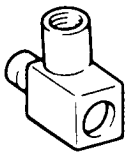
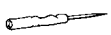
Tool	Number	Name	Use
	MD998706	Injector test set	• Checking injection condition of injector
	MD998740	Injector test adaptor	
	MD998746	Clip	
	MD998464	Test harness (4 pin, square)	• Oxygen sensor inspection
	MD998463	Test harness (6 pin, square)	• Idle speed control servo inspection • Inspection with oscilloscope
	MD998753	Extension hose	• Measurement of fuel pressure
	MD998700	Hose adapter	
For red harness (for DLI) For white harness (for LC) 	MB991223	Inspection harness set connector • Pin contact pressure inspection harness • Marketing tester connection probe (for general connectors)	Measurement of terminal voltages

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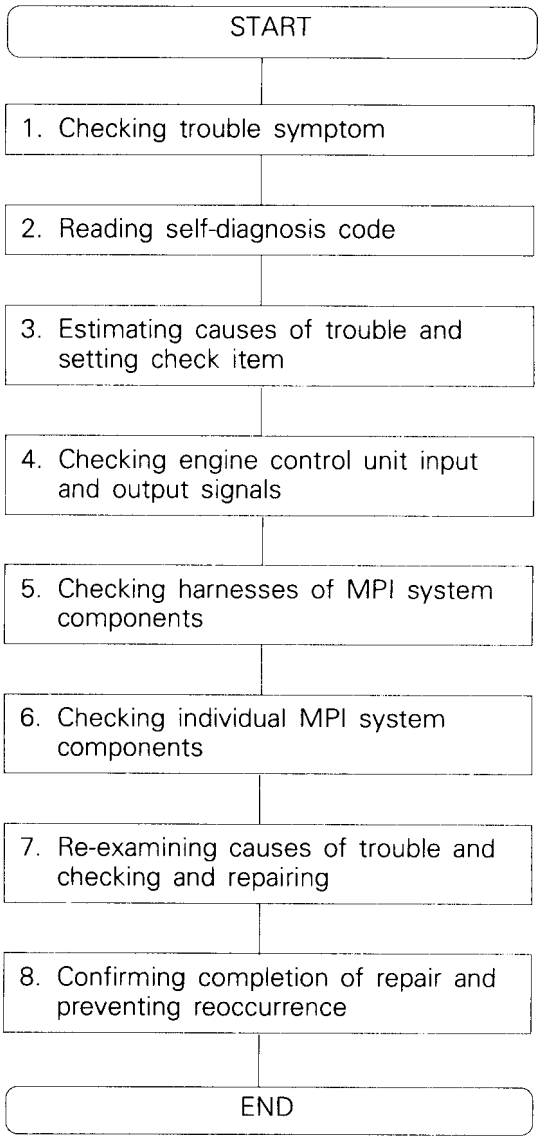

TROUBLESHOOTING

E13EFAJ

EXPLANATION OF TROUBLESHOOTING PROCEDURES

The effective troubleshooting procedures for troubles of the MPI system are explained in the following.

1. Checking trouble symptom
   - Reproduce the problem symptom and check the contents of the trouble and the conditions under which the symptom occures (engine condition, operating state, etc.).
2. Reading self-diagnosis code
   - Read the self-diagnosis code and when a fault code is output, correct the fault referring to DIAGNOSIS CHART.
3. Estimating causes of trouble and setting check item
   - Referring to CHECK CHART CLASSIFIED BY PROBLEM SYMPTOMS, determine the check items and procedures to be followed.
4. Checking engine control unit input and output signals
   - Using a multi-use tester or analyzer, check the input and output signals of the engine control unit.
   - If the input and output signals are normal, the sensor input/actuator control is judged as normal. Then, check the input and output signals of the next check item.
5. Checking harnesses of MPI system components
   - If the input and output signals of the engine control unit are not normal, check the body harnesses of the MPI system components and repair as necessary.
   - After repair, check the input and output signals of the engine control unit again. If they are normal this time, check the input and output signals of the next check item.
6. Checking individual MPI system components
   - If the body harnesses are normal but the input and output signals of the engine control unit are abnormal, check the MPI system components individually and repair or replace as necessary.
   - After repair or replacement, check the input and output signals of the engine control unit again. If they are normal this time, check the input and output signals of the next check item.
7. Re-examining causes of trouble and checking and repairing
   - If the harness check and individual component check have resulted normal but the input and output signals of the engine control unit are abnormal, re-examine the causes of trouble referring to the troubleshooting hints. Then, check and repair including other groups.
8. Confirming completion of repair and preventing reoccurrence
   - Try to reproduce the problem symptom to make sure that the symptom will not occur again.
   - Remove the true cause of the trouble to prevent its reoccurrence.

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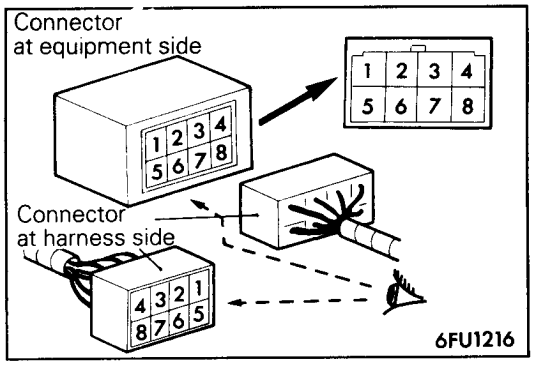
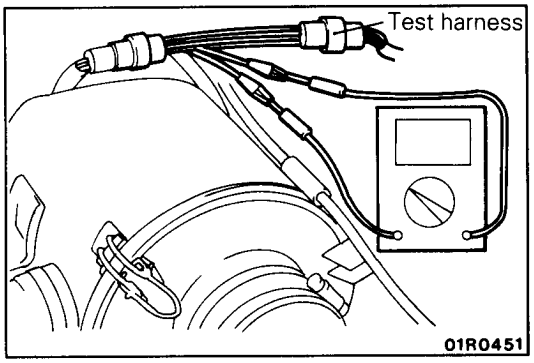
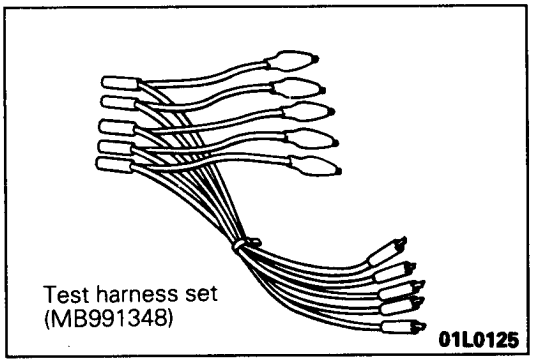


EXPLANATION AND PRECAUTION RELATED TO HARNESS CHECKING

- Connector symbols are described as seen from the terminal end for the connector.
- The abbreviation "SV" used for the normal judgment value when checking the voltage is the abbreviation for system voltage.

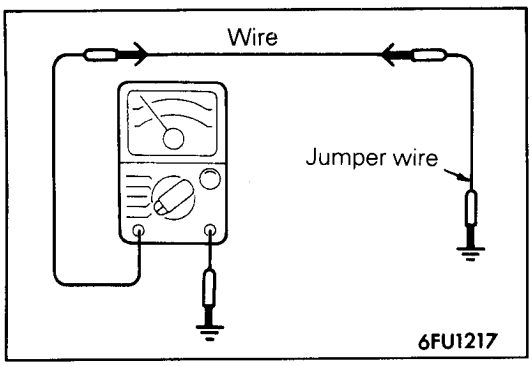


- Be sure to use the special tool (test harness) when, for a waterproof connector, checking while the circuit is conductive. If probe is inserted from the harness side, the waterproof capability will be lowered, thereby causing/corrosion, so never do so.
- When a connector is disconnected in order to check terminal voltage, etc., never insert a probe if the terminal to be checked is a female pin, because the forceful insertion of a probe will cause improper or incomplete contact.



- Also, if there is no test harness that conforms to the connector, use the test harness set (MB991348) which can be directly connected between the terminals.

- When disconnecting the connector and inspecting the terminal voltage, etc., if the inspection terminal is a female pin, the special tool (inspection harness set: MB991223) should be used instead of inserting a probe.



- When checking for damaged or disconnected wiring of a harness (open circuit) and if both ends of the harness are unconnected, use a jumper wire to earth one end of the harness, and then check for continuity between the other end and earth. By doing this, you can check for damaged or disconnected wiring, and, if there is no continuity, the harness should be repaired.

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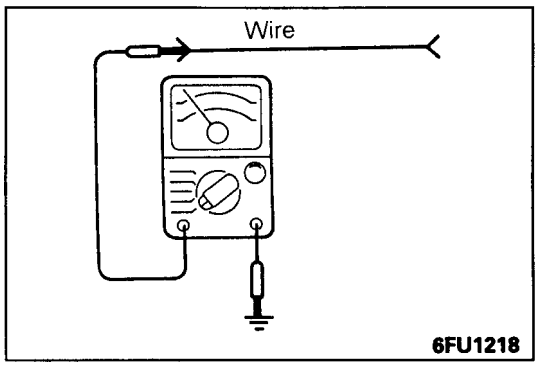
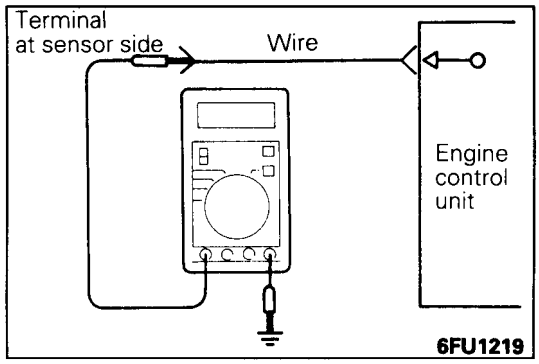
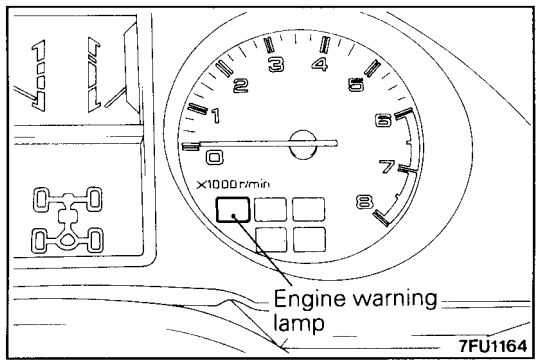


- When checking for a harness short-circuit (short-circuit to earth), open one end of the harness and then check for continuity between the other end and earth. If there is continuity, the harness is short-circuited to earth and should be repaired.



- If the voltage (power-supply voltage) supplied to a sensor is not normal, repair the harness. If the voltage to the sensor is still not normal after the harness has been repaired, replace the engine control unit and check again.



ENGINE WARNING LAMP (CHECK ENGINE LAMP)

Among the self-diagnosis items, a engine warning lamp comes on to notify the driver of the emission control items when an irregularity is detected. However, when an irregular signal returns to normal and the engine control unit judges that it has returned to normal, the engine warning lamp goes out. Moreover, when the ignition switch is turned off, the lamp goes out. Even if the ignition switch is turned on again, the lamp does not come on until the irregularity is detected. Here, immediately after the ignition switch is turn on, the engine warning lamp is lit for 5 seconds to indicated that the engine warning lamp operates normally.

Item indicated by the lightening engine warning lamp

Engine control unit	Crank angle sensor
Oxygen sensor	Top dead centre sensor
Air flow sensor	Barometric pressure sensor
Intake air temperature sensor	Ignition timing adjustment signal
Throttle position sensor	Injector
Engine coolant temperature sensor	

Caution
Engine warning lamp will come on when the line of terminal for ignition timing adjustment is short-circuited. Therefore, the lamp will come on even when the terminal for ignition timing adjustment is earthed at the time of adjusting ignition timing. In this case, however, it is not abnormal.

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ENGINE WARNING LAMP INSPECTION

(1) Check to be sure, when the ignition switch is set to the "ON"position, that the lamp illuminates for about five seconds and then switches OFF.
(2) If the lamp does not illuminate, check for damage or disconnection of the harness, or for a blown fuse or a failed light bulb.

SELF-DIAGNOSIS

The engine control unit monitors the input/output signals (some signals at all times and the others under specified conditions) of the engine control unit. When it is noticed that an irregularity has continued for a specified time or longer from when the irregular signal is initially monitored, passing a certain number, the engine control unit judges that an irregularity has occurred, memorizes the malfunction code, and outputs the signal to the self-diagnosis output terminals. There are 13 diagnosis items, including the normal state, and the diagnosis results can be read out with a multi-use tester. Moreover, since memorization of the malfunction codes is backed up direrctly by the battery, the diagnosis results are memorized even if the ignition key is turned off. The malfunction codes will, however, be erased when the battery terminal or the engine control unit connector is disconnected.

The malfunction codes are also erased by setting the ignition switch to the "ON" position and then sending the malfunction-code-erase signal from the multi-use tester to the engine control unit.

Caution
If the sensor connector is disconnected while the ignition switch is ON, the malfunction code is memorized. In this instance, either send the malfunction-code-erase signal from the multi-use tester to the engine control unit, the diagnosis memory will be erased.

The 13 diagnosis items are provided as follows, and if plural items are activated, they are all indicated sequentially from the smallest code number.

Caution
Ignition timing adjustment signal malfunction code is output when the ignition timing adjustment terminal line is short-circuited to the earth. Therefore, the malfunction code is output when the ignition timing adjustment terminal is earthed, however, this is not a malfunction.

DIAGNOSIS CHART

Output preference order	Diagnosis item	Diagnosis code		Check item (Remedy)
		No.	Memory	
1	Engine control unit	—	—	(Replace engine control unit)
2	Oxygen sensor	11	Retained	• Harness and connector • Oxygen sensor • Fuel pressure • Injectors (Replace if defective.) • Intake air leaks
3	Air flow sensor	12	Retained	• Harness and connector (If harness and connector are normal, replace air flow sensor assembly.)
4	Intake air temperature sensor	13	Retained	• Harness and connector • Intake air temperature sensor
5	Throttle position sensor	14	Retained	• Harness and connector • Throttle position sensor • Idle position switch

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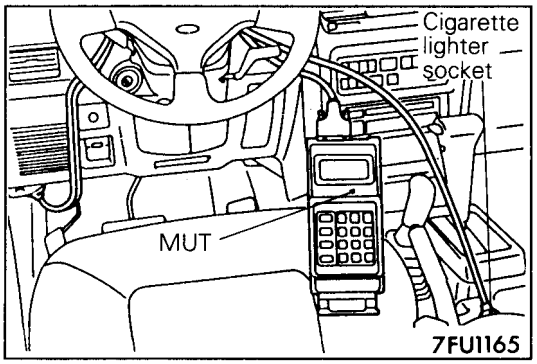
Output preference order	Diagnosis item	Diagnosis code		Check item (Remedy)
		No.	Memory	
6	Engine coolant temperature sensor	21	Retained	• Harness and connector • Engine coolant temperature sensor
7	Crank angle sensor	22	Retained	• Harness and connector (If harness and connector are normal, replace distributor assembly.)
8	Top dead centre sensor	23	Retained	• Harness and connector (If harness and connector are normal, replace distributor assembly.)
9	Vehicle speed sensor (reed switch)	24	Retained	• Harness and connector • Vehicle speed sensor (reed switch)
10	Barometric pressure sensor	25	Retained	• Harness and connector (If harness and connector are normal, replace barometric pressure sensor assembly.)
11	Ignition timing adjustment signal	36	—	• Harness and connector
12	Injector	41	Retained	• Harness and connector • Injector coil resistance
13	Normal state	—	—	—

NOTE
Replace the engine control unit if a malfunction code is output although the inspection reveals that there is no problem with the check items.

READ OUT OF MALFUNCTION CODE

PRECAUTIONS FOR OPERATION

(1) When battery voltage is low; no detection of failure is possible. Be sure to check the battery for voltage and other conditions before starting the test.
(2) Diagnosis item is erased if the battery or the engine control unit connector is disconnected. Do not disconnect the battery before the diagnosis result is completely read.



READING STEPS – USING THE MULTI-USE TESTER (MUT)

(1) Read and make a note of the self-diagnosis output.
(2) Refer to the diagnosis chart to remedy the problem.
(3) After turning the ignition switch once to OFF, turn it back to ON.
(4) Erase the problem codes.
(5) Recheck that everything is normal.

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CHECK CHART CLASSIFIED BY PROBLEM SYMPTOMS

Problem symptoms / Check Items	Starting		Idling stability			Driving						Stopping	Reference page
	Will not start	Starting problem	Idling instability (Rough idling)	Incorrect idling speed	Improper idling continuity	Hesitation, sag	Poor acceleration	Stumble	Shock	Surge	Knocking	Run-on (Dieseling)	
Power Supply and Ignition Switch–IG	①1												P. 13–23
Engine Control Unit Power Earth	②2												P. 13–26
Fuel Pump	③3	①1			①1	①1	①1						P. 13–27
Air Flow Sensor						⑧8		⑤5			③1		P. 13–30
Intake Air Temperature Sensor			⑤			④4	④4				①1		P. 13–34
Barometric Pressure Sensor			⑦			⑦7	⑥6				②2		P. 13–36
Engine Coolant Temperature Sensor		3	⑥5	①1	⑤5	⑥6	⑤5	④4		③3			P. 13–38
Throttle Position Sensor						⑤5		③3	④4				P. 13–40
Idle Position Switch			③3	②2	④4								P. 13–42
Top Dead Center Sensor	⑤5	⑥7			⑧7				②2				P. 13–44
Crank Angle Sensor	⑥6	⑦8			⑨8				③3				P. 13–48
Ignition Switch-ST <M/T>	④4	③4											P. 13–50
Ignition Switch-ST and Inhibitor Switch <A/T>	④4	③4		④									P. 13–52
Vehicle Speed Sensor					⑥								P. 13–54
Air Conditioner Switch and Power Relay				③									P. 13–56
Oxygen Sensor			⑨										P. 13–58
Injectors	⑧8	②2	②2		③3	②2	②2	①1		①1		①	P. 13–61
Idle Speed Control Servo (Stepper Motor)		④5	①1	⑤3	②2								P. 13–66
Ignition Coil and Power Transistor	⑦7				⑩9		⑦7		①1				P. 13–71
Purge Control Solenoid Valve			⑧										P. 13–75
Fuel Pressure		⑤6	④4		⑦6	③3	③3	②2		22			P. 13–77

○: Warm engine (figures inside the ○ indicate the checking sequence.)
□: Cold engine (figures inside the □ indicate the checking sequence.)

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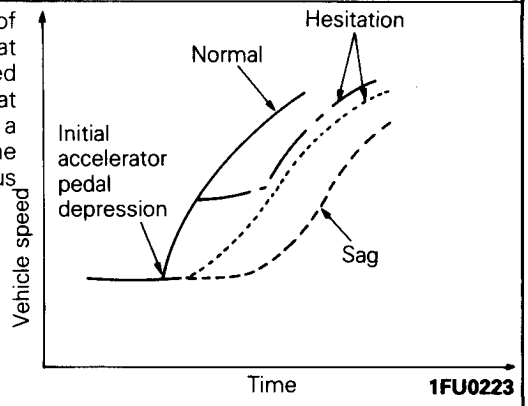
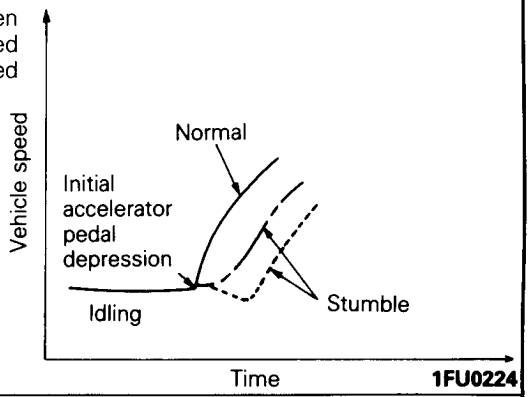
PROBLEM SYMPTOMS TABLE (FOR YOUR INFORMATION)

Item		Symptom
Starting	Won't start (no initial combustion)	The starter is used to crank the engine, but there is no combustion within the cylinders, and the engine won't start.
	Starting problem (initial combustion, then stall)	There is combustion within the cylinders, but then the engine soon stalls.
	(Starting takes a long time.)	Engine won't start quickly.
Idling stability	Idling instability (Rough idling)	Engine speed doesn't remain constant; changes during idling. Usually, a judgement can be based upon the movement of the tachometer pointer, and the vibration transmitted to the steering wheel, shift lever, body, etc. This is called rough idling.
	Incorrect idling speed	The engine doesn't idle at the usual correct speed.
	Improper idling continuity Die out Pass out	This non-continuity of idling includes the following elements. (1) Die out ..... The engine stalls when the foot is taken from the accelerator pedal, regardless of whether the vehicle is moving or not. (2) Pass out ..... The engine stalls when the accelerator pedal is depressed or while it is being used.
Driving	Hesitation Sag	"Hesitation" is the delay in response of the vehicle speed (engine r/min) that occurs when the accelerator is depressed in order to accelerate from the speed at which the vehicle is now traveling, or a temporary drop in vehicle speed (engine r/min) during such acceleration. Serious hesitation is called "sag". 
	Poor acceleration	Poor accleration is inability to obtain an acceleration corresponding to the degree of throttle opening, even though acceleration is smooth, or the inability to reach maximum speed.
	Stumble	Engine r/min response is delayed when the accelerator pedal is initially depressed for acceleration from the stopped condition. 
	Shock	The feeling of a comparatively large impact or vibration when the engine is accelerated or decelerated.
	Surge	This is repeated surging ahead during constant speed travel or during variable speed travel.
	Knocking	A sharp sound like a hammer striking the cylinder walls during driving and which adversely affects driving.
Stopping	Run-on (Dieseling)	The engine continues to run even after the switch is turned OFF. This is called dieseling.

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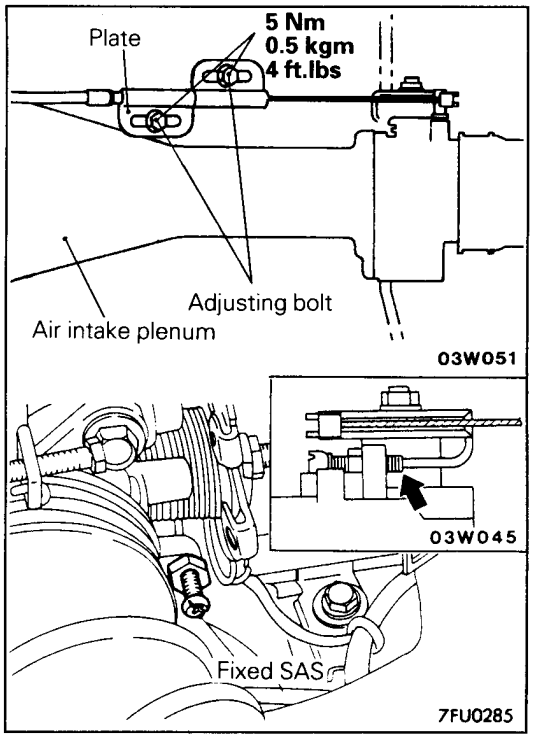
SERVICE ADJUSTMENT PROCEDURES

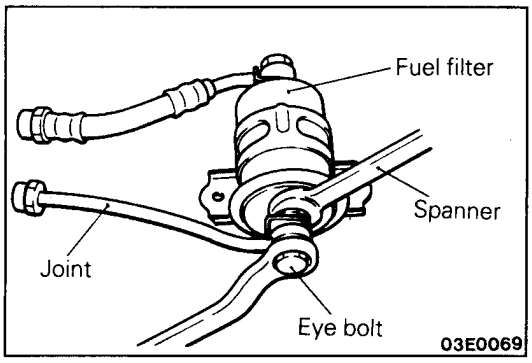
ACCELERATOR CABLE INSPECTION AND ADJUSTMENT <VEHICLES WITHOUT AUTO-CRUISE CONTROL SYSTEM>

E13FCAZ1

For models equipped with the auto-cruise control system, refer to P. 13-188.



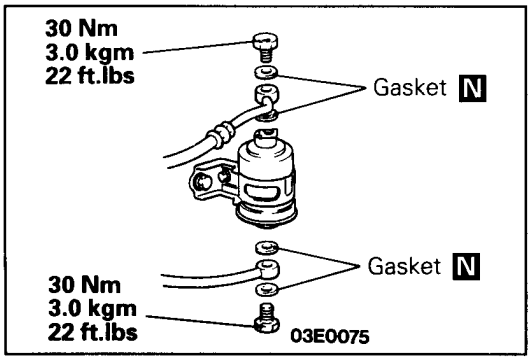
(1) Check that there are no sharp bends in the accelerator cable.
(2) Check that the throttle link is touching the fixed SAS stopper.
(3) Move the plate so that the inner cable play is at the standard value, and tighten the adjusting bolt.
Standard value: 1–2 mm (0.04–0.08 in.)



FUEL FILTER REPLACEMENT

E13FZAL

(1) Hold the fuel filter with a spanner, and remove the eye bolt.
Caution
The fuel line has some residual pressure, so cover it with a rag.
(2) Remove the fuel filter.
(3) Use a new gasket when installing the fuel filter, and tighten the eye bolt of the high pressure fuel hose to the specified torque.



(4) After installing, check that there are no fuel leaks.
① Apply battery voltage to the fuel pump drive terminal to operate the fuel pump. (Refer to P.13-15)
② Check that there are no leaks in the fuel line when the fuel is under pressure.

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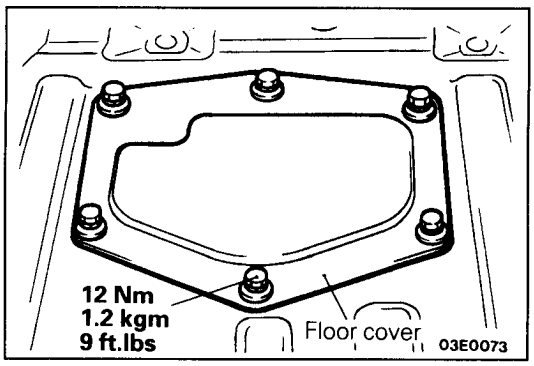
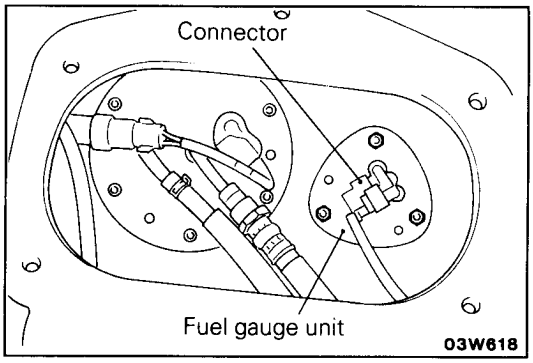
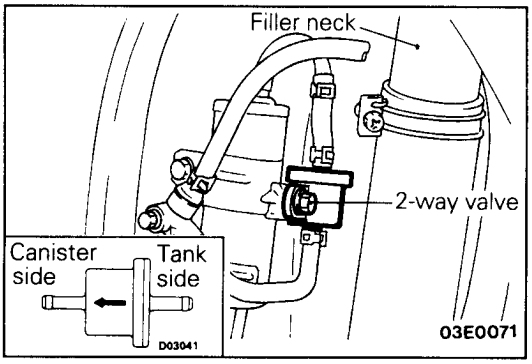


FUEL GAUGE UNIT REPLACEMENT E13FDAC1

(1) Take out the carpet in the cargo compartment and remove the floor cover.



(2) Disconnect the connector from the fuel gauge unit, and remove the fuel gauge unit.
(3) Install the fuel gauge unit so that the packing stoppers (2 places) match the hole in the fuel gauge unit.
(4) Install the floor cover packing and the floor cover.

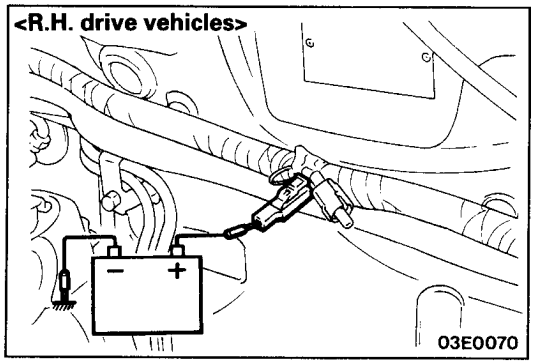


2-WAY VALVE REPLACEMENT E13FFAC1

(1) Remove the filler neck protector inside the left rear fender.
(2) Replace the 2-way valve.

Caution
Be careful not to mistake the direction of the 2-way valve.

(3) Install the filler neck protector.

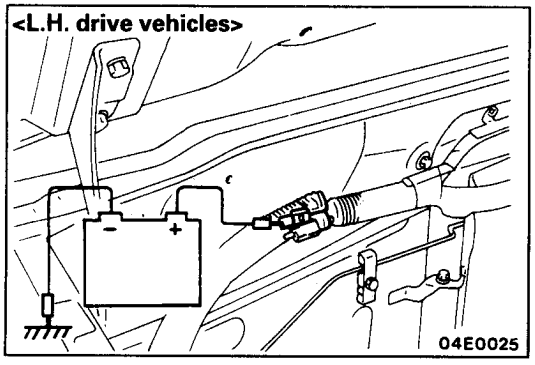


FUEL PUMP OPERATION CHECK E13FGCE

(1) Use the multi-use tester to force-drive the fuel pump, and check the operation of the fuel pump.
(For inspection using the multi-use tester, refer to P.13-28.)
(2) If the fuel pump does not operate, inspect by the following procedure, and if the results are normal, then inspect the drive circuit.
① Turn the ignition switch to OFF.
② When the fuel pump drive connector is connected directly to the battery, check if the sound of the fuel pump operation can be heard.

NOTE
As the fuel pump is an in-tank type, the fuel pump sound is hard to hear, so remove the fuel tank cap and check from the tank inlet.

③ Check if the fuel pressure can be felt by pinching the high pressure fuel hose with fingertips.



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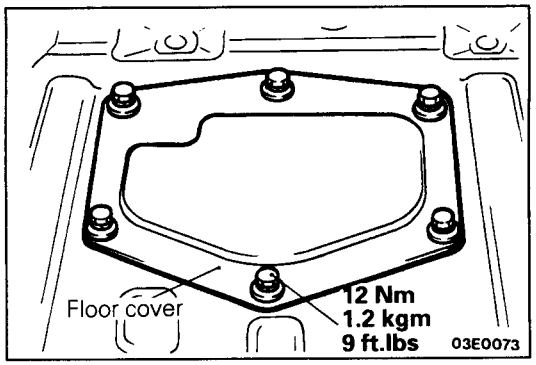
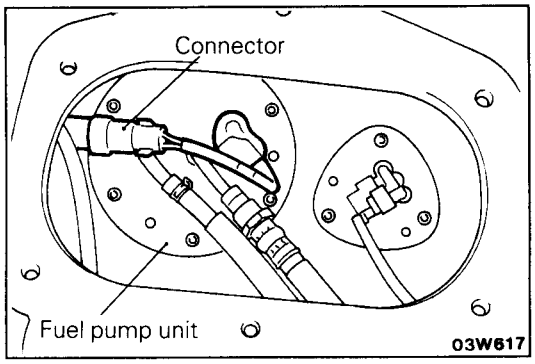


HOW TO REDUCE THE FUEL LINE INTERNAL PRESSURE

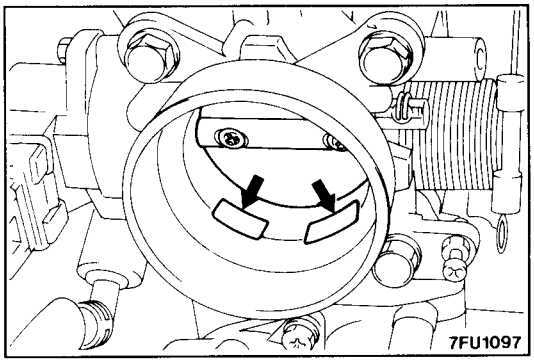
E13HABG

When removing the fuel pipe and hose, etc., fuel under high pressure will be inside the fuel line, so carry out the following procedure to release the pressure to prevent the fuel from spraying out.

(1) Take out the carpet in the cargo compartment and remove the floor cover.



(2) Disconnect the fuel pump unit connector.
(3) After starting the engine and letting it run until it stops, turn the ignition switch to OFF.
(4) Connect the fuel pump unit connector.
(5) Install the floor cover packing and the floor cover.



THROTTLE BODY (THROTTLE VALVE AREA) CLEANING

E13HAJB1

(1) Start the engine and warm it up until the temperature of the engine coolant reaches 80°C (176°F) or higher; then stop the engine.
(2) Disconnect the air intake hose at the throttle body side.
(3) Plug the bypass intake port inlet in the throttle body.

Caution
Never let cleaning liquid get into the bypass intake.

(4) Spray cleaning liquid (from the intake port of the throttle body) onto the valve, and then leave as is for about five minutes.
(5) Start the engine and race it a few times; then let it run at idle speed for about one minute.

NOTE
The engine idling speed is unstable (or the engine stalls), let the engine run with the throttle valve slightly open.

(6) If deposits are not removed from the throttle valve, repeat steps (4) and (5).
(7) Remove the plug from the bypass intake port inlet in the throttle body.
(8) Connect the air intake hose.
(9) Using the multi-use tester, erase the self-diagnosis code.
(10) Adjust the basic idle speed. (Refer to P. 13-18.)

NOTE
If hunting of the idling engine occurs after adjusting the basic idling speed, remove the battery (–) cable from the battery terminal for more than 10 seconds, and then idle the engine again.

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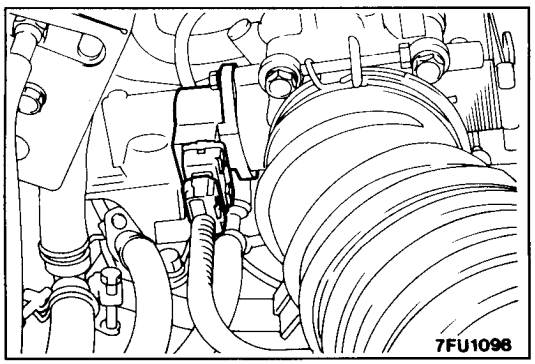
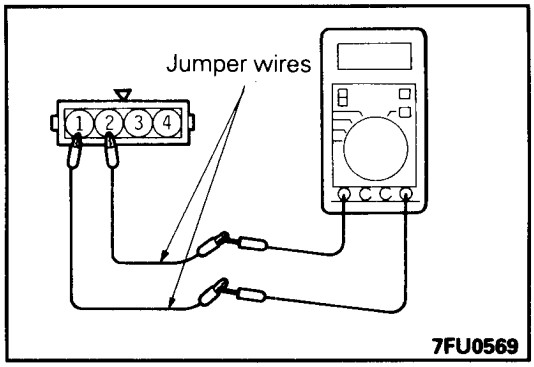
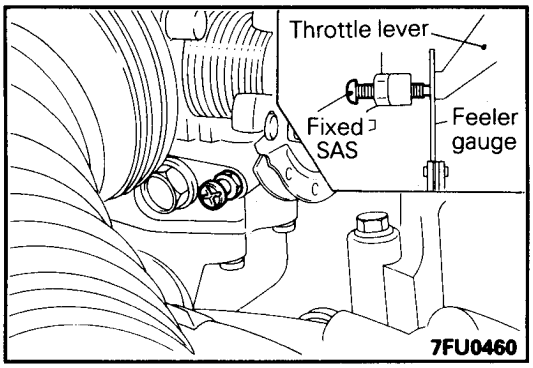


IDLE POSITION SWITCH AND THROTTLE POSITION SENSOR ADJUSTMENT E13HAKD1

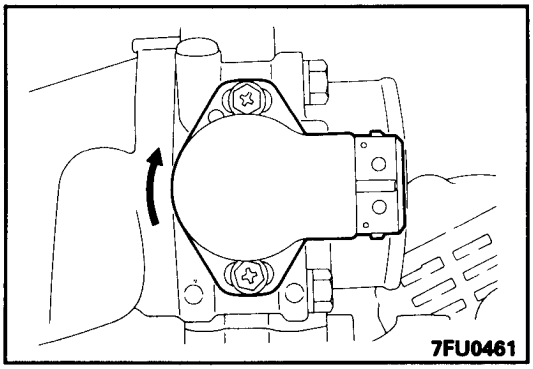
(1) Disconnect the connector of the throttle-position sensor.



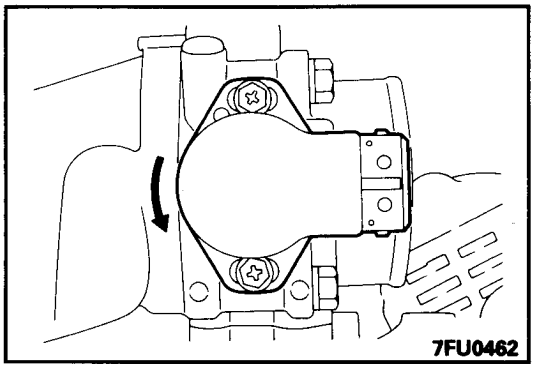
(2) Using jumper wires, connect an ohmmeter across terminal ② (idle position switch) and terminal ④ (sensor earth) of the throttle position sensor.



(3) Insert a 0.65 mm (0.0256 in.) thick feeler gauge between the fixed SAS and throttle lever.



(4) Loosen the throttle position sensor mounting bolts and turn the throttle position sensor body fully clockwise.
(5) In this condition, check that there is continuity across terminals ① and ②.



(6) Slowly turn the throttle position sensor counterclockwise until you find a point at which there is no continuity across terminals ① and ②. Then, tighten the throttle position sensor mounting bolt securely.
(7) Connect the throttle position sensor connector.

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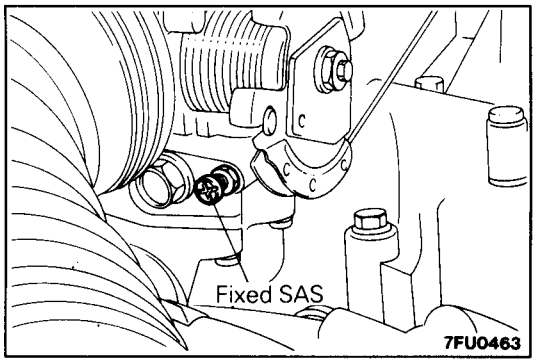
(8) Connect the multi use tester (MUT) to the diagnosis connector.
(9) Turn the ignition switch ON (but do not start the engine).
(10) Using the MUT, select item No. 14 and read the throttle position sensor output voltage.

Standard value: 400–1,000 mV

(11) If the voltage is out of specification, check the throttle position sensor and associated harnesses.
(12) Remove the feeler gauge.
(13) Turn the ignition switch OFF.



FIXED SAS ADJUSTMENT E13HAMC1

NOTE
1. The fixed SAS has been factory-adjusted. Never attempt to move it.
2. Should it be out of proper adjustment, adjust by following the procedure given below.

(1) Sufficiently slacken the accelerator cable.
(2) Loosen the lock nut on the fixed SAS.
(3) Sufficiently loosen the fixed SAS by turning it counterclockwise to fully close the throttle valve.
(4) Tighten the fixed SAS slowly to find a point at which it contacts the throttle lever (where the throttle valve starts opening). From that point, tighten the fixed SAS further $1\frac{1}{4}$ turns.
(5) Holding the fixed SAS to prevent it from turning, tighten the lock nut securely.
(6) Adjust the accelerator cable tension. (Refer to P. 13-14.).
(7) Adjust the basic idle speed.
(8) Adjust the idle position switch and throttle position sensor (TPS). (Refer to P. 13-17.).

BASIC IDLE SPEED ADJUSTMENT E13HAND

NOTE
1. The basic idle speed has been factory-adjusted with the speed adjusting screw (SAS) and does not normally require adjustment.
2. If the adjustment is required, first check that the ignition plug, injector, ISC servo, and compression pressure are normal.

(1) Before starting the inspection and adjustment procedures, set the vehicle in the following conditions:
- Engine coolant temperature: 80 to 95°C (176 to 205°F)
- Lights, electric cooling fan, accessories: OFF
- Transmission: Neutral (P for vehicles with an automatic transmission)
- Steering wheel: Straightforward position

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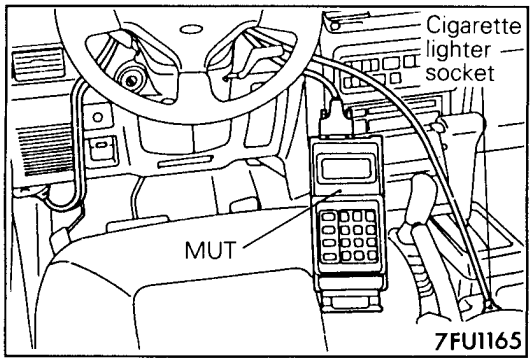
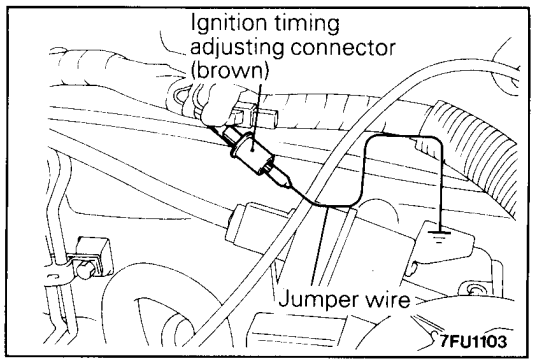


(2) Connect the multi use tester (MUT) to the diagnosis connector.

NOTE
When the multi-use tester is connected, the diagnosis control terminal will be earthed.

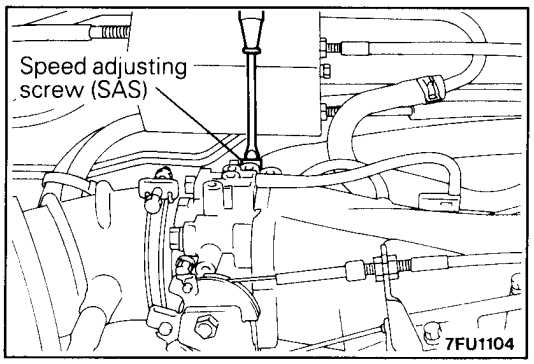


(3) Remove the waterproof female connector from the ignition timing adjusting connector (brown).
(4) Using a jumper wire, earth the ignition timing adjusting terminal.

(5) Start the engine and run at idle.
(6) Check the basic idle speed. Using the MUT, select item No. 22 and read the idle speed.

Standard value: 700 ± 50 r/min.

NOTE
1. The engine speed may be low by 20 to 100 r/min. while the vehicle is new [distance driven approx. 500 km (300 miles) or less], but no adjustment is necessary.
2. If the engine stalls or speed is low despite a sufficient distance driven [approx. 500 km (300 miles) or more], it is probably due to deposits on the throttle valve. In this case, clean the throttle valve. (Refer to P. 13-16.).



(7) If the basic idle speed is out of specification, adjust by turning the speed adjusting screw (SAS).

NOTE
If the idle speed is higher than the standard value even with SAS fully tightened, check to see if there is evidence of the fixed SAS being moved. If the fixed SAS seems to have been moved, adjust it. If it does not seem to have been moved, there may be a leak caused by deteriorated fast idle air valve (FIAV). In such a case, replace the throttle body.

(8) Turn the ignition switch OFF.
(9) Remove the jumper wire from the ignition timing adjusting terminal and replace the connector back again.
(10) Start the engine again and run at idle for 10 minutes to make sure that the engine runs at proper idle speed.

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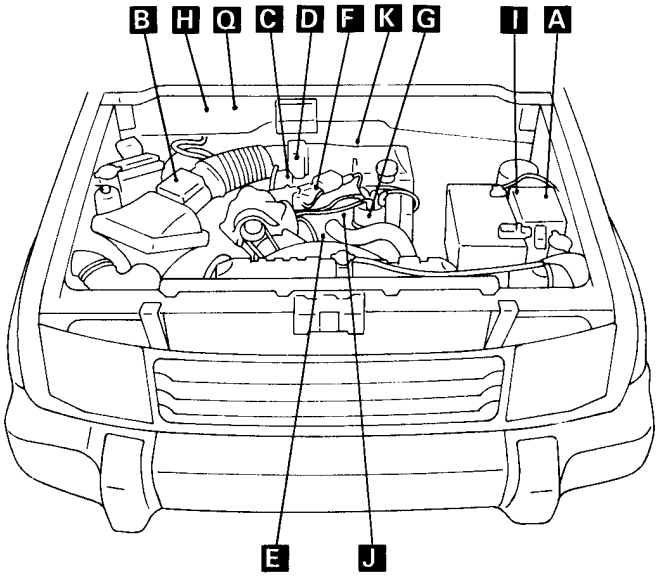
ON-VEHICLE INSPECTION OF MPI COMPONENTS

E13QAAC

COMPONENT LOCATION



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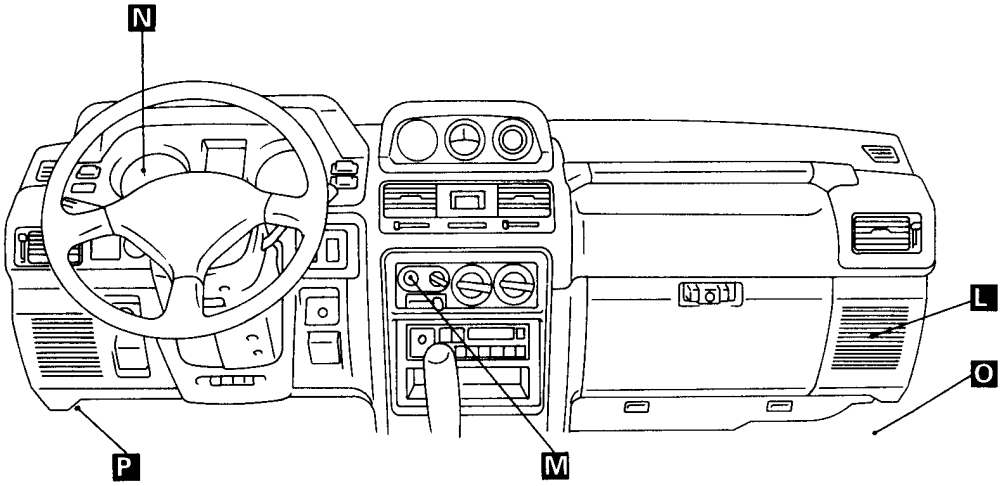

7FU1167

Name	Symbol	Name	Symbol
Air conditioner relay	A	Idle speed control servo	C
Air conditioner switch	M	Ignition coil (power transistor)	F
Air flow sensor (incorporating intake air temperature sensor and barometric pressure sensor)	B	Ignition timing adjustment terminal	Q
Crank angle sensor and top dead center sensor	G	Injector	J
Engine control relay	L	Oxygen sensor	K
Engine control unit	O	Purge control solenoid valve	I
Engine coolant temperature sensor	E	Self-diagnosis connector	P
Fuel pump check terminal	H	Throttle position sensor (with idle position switch)	D
		Vehicle-speed sensor (reed switch)	N

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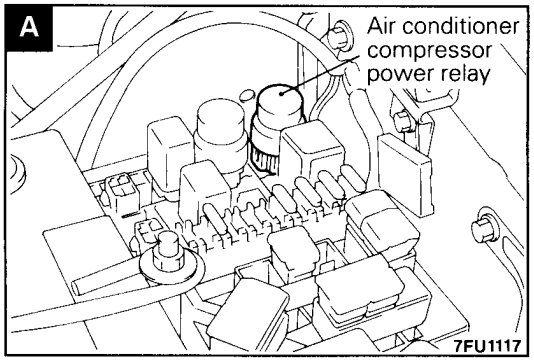
A



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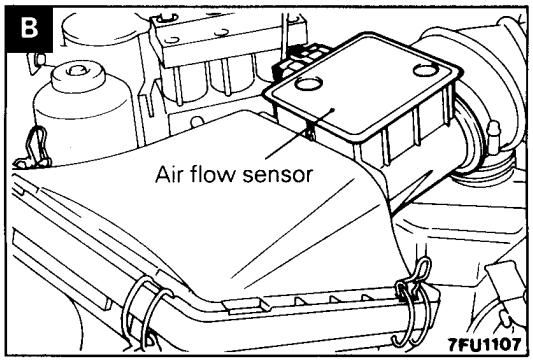

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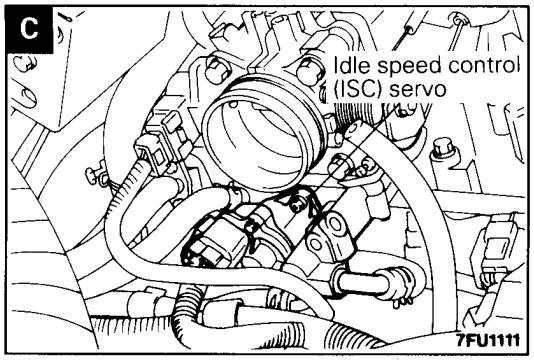

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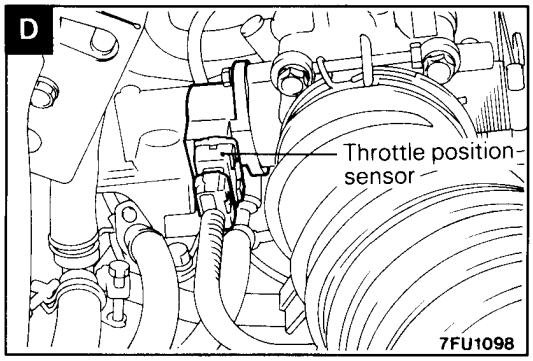

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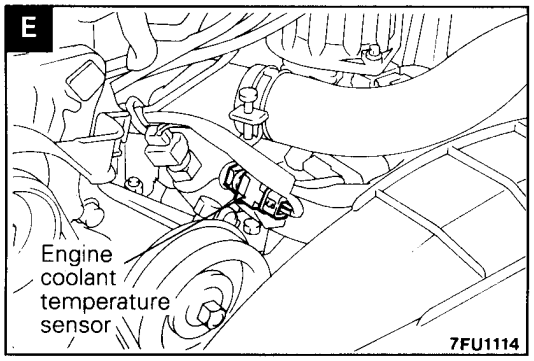

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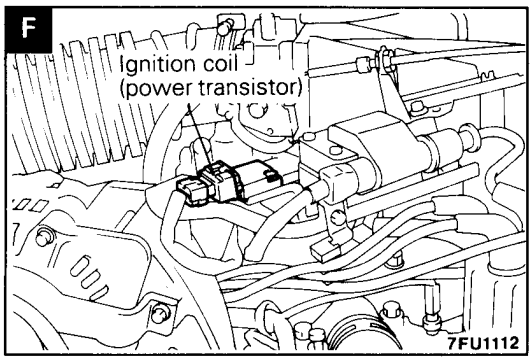

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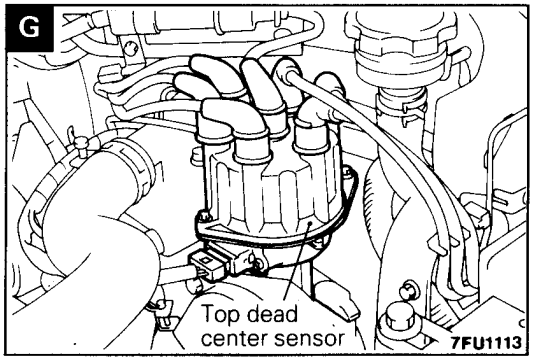

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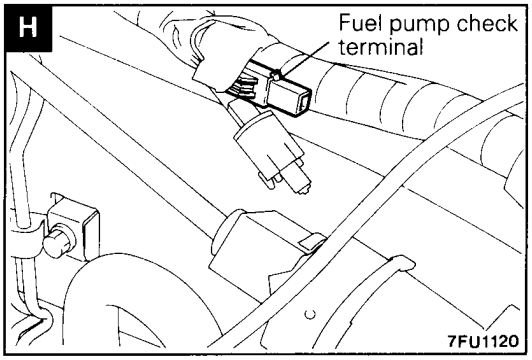

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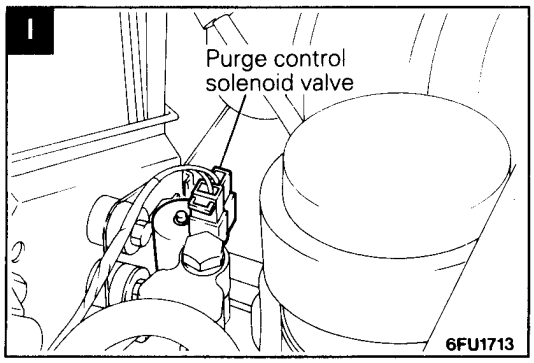

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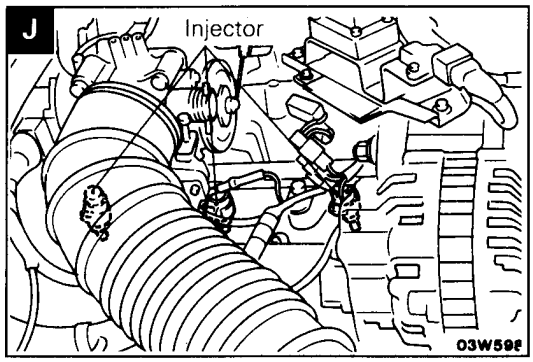

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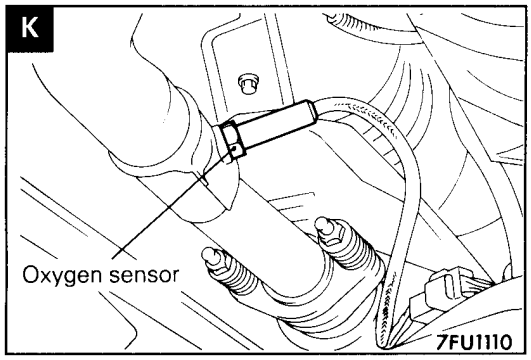

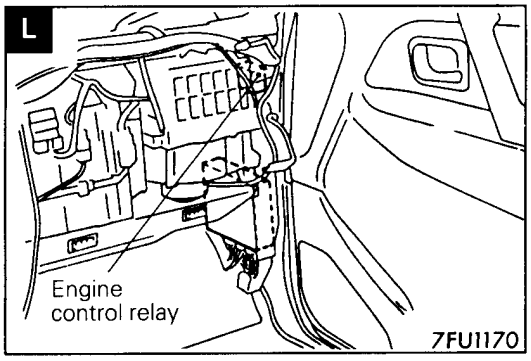

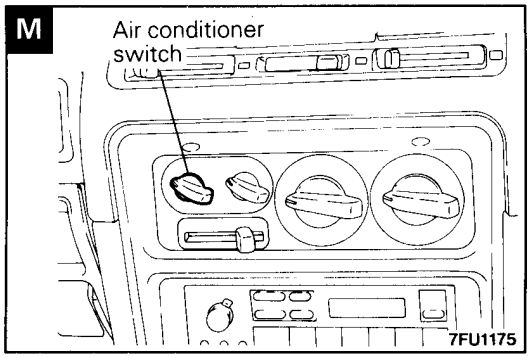

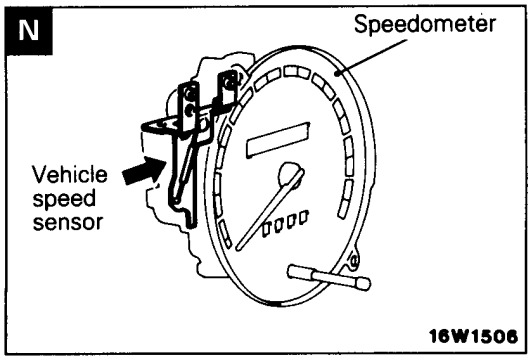

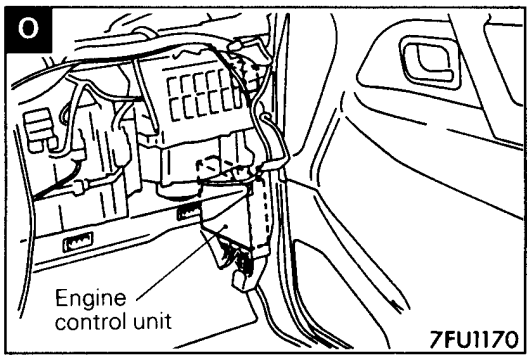

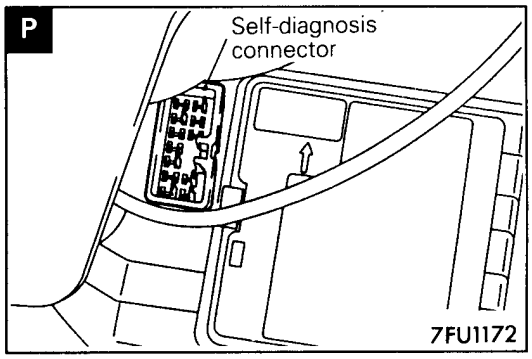

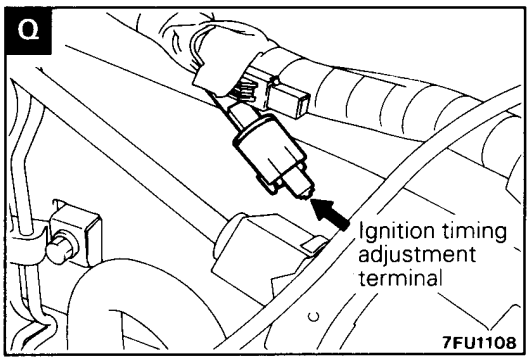

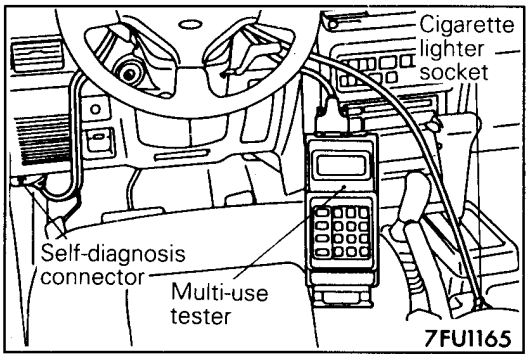

COMPONENT INSPECTION PROCEDURE

USING MULTI-USE TESTER (MUT)

(1) Check by the service data and actuator test function. If any abnormality is found, check the body harness, components, etc. and repair as necessary.
(2) After repair, check again with the MUT to make sure that the input and output signals are now normal.
(3) Erase the self-diagnosis trouble code in memory.
(4) Disconnect the MUT.
(5) Start the engine and perform running test, etc. to make sure that the troubles have been corrected.

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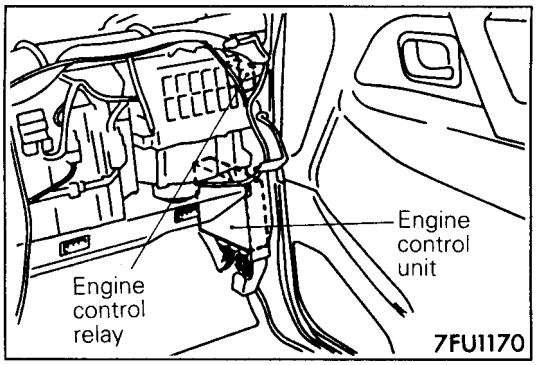
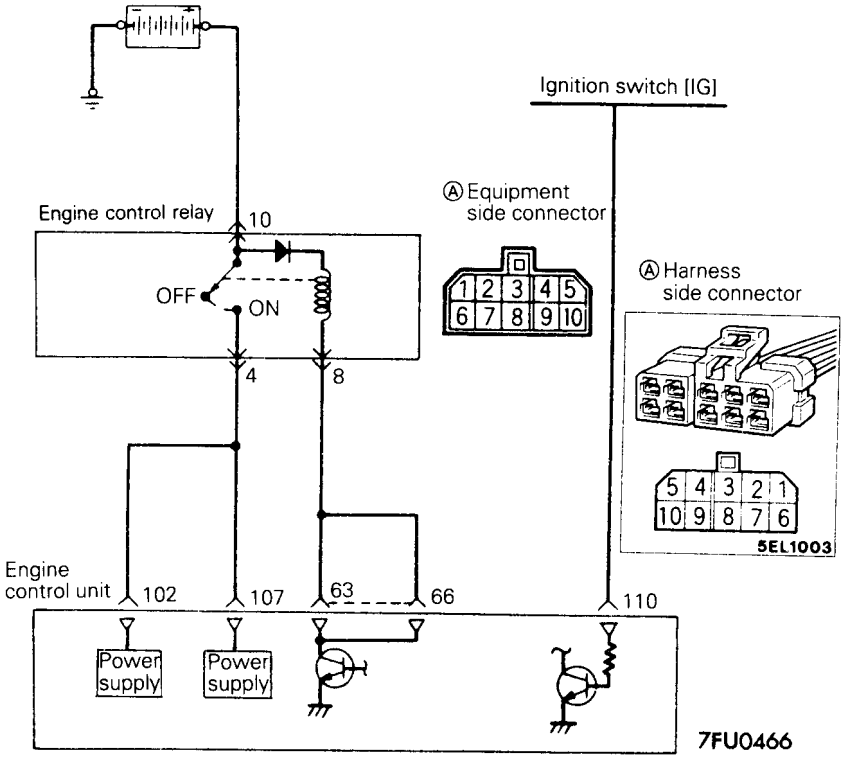
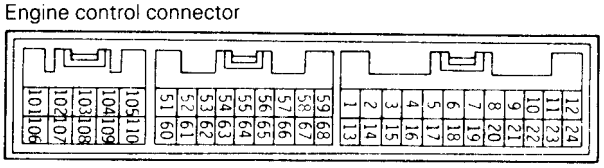
POWER SUPPLY AND IGNITION SWITCH-IG







OPERATION

- While the ignition switch is ON, battery power supply is supplied to the engine control unit, injectors, air-flow sensor, etc.
- When the ignition switch is switched ON, battery voltage is supplied from the ignition switch to the engine control unit. When battery voltage is supplied to the engine control unit, the power transistor is switched ON and current flows to the engine control relay coil.
- As a result, the engine control relay switch is switched ON, and power is supplied, by way of the engine control relay switch, from the battery to the engine control unit.

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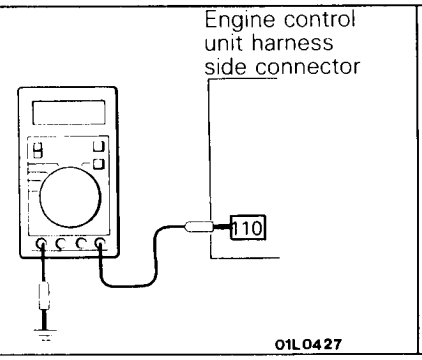
INSPECTION
Using Multi-use tester (MUT)

Function	Item No.	Data display	Check conditions	Standard value V
Data reading	16	Engine control unit power-supply voltage	Ignition switch: ON	SV

HARNESS INSPECTION

1



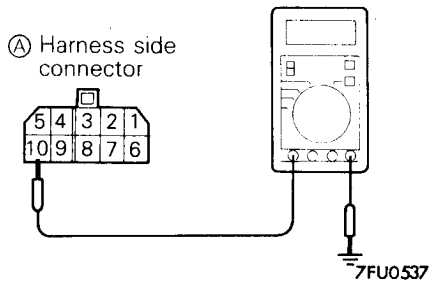
Measure the ignition switch terminal input voltage.
- Engine control unit connector: Disconnected
- Ignition switch: ON

Voltage (V)
SV

OK → 2

NG → Repair the harness. (Ignition switch – 110)

2



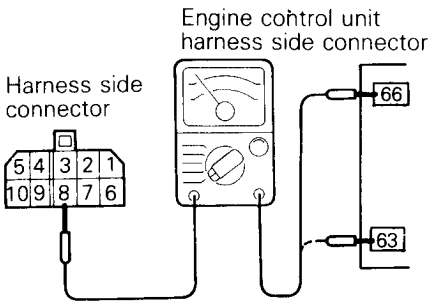
Measure the power supply voltage of the engine control relay
- Connector: Disconnected

Voltage (V)
SV

OK → 3

NG → Repair the harness. (Battery – Ⓐ10)

3

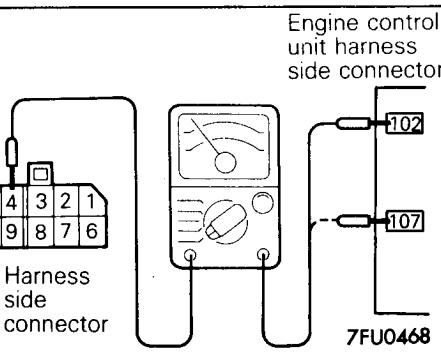


Check for an open-circuit, or a short-circuit to earth, between the engine control unit and the engine control relay.
- Engine control unit connector: Disconnected
- Engine control relay connector: Disconnected

OK → 4

NG → Repair the harness. (Ⓐ8 – 63, Ⓐ8 – 66)

4



Check for an open-circuit, or a short-circuit to earth, between the engine control unit and the engine control relay.
- Engine control relay connector: Disconnected
- Engine control unit connector: Disconnected

OK → STOP

NG → Repair the harness. (Ⓐ4 – 102, 107)

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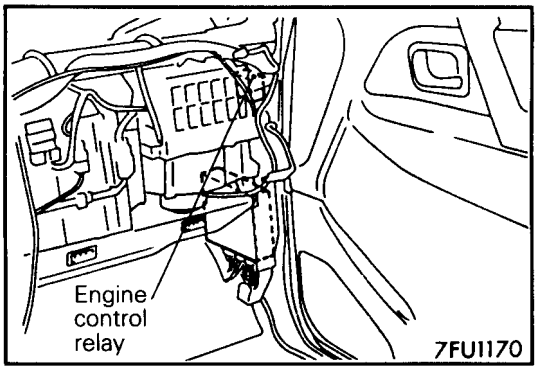
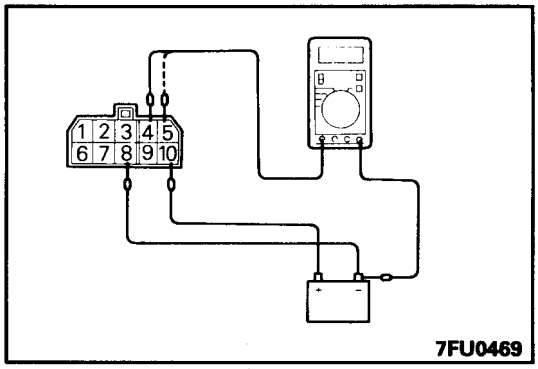


ENGINE CONTROL RELAY INSPECTION

(1) Disconnect the control relay.

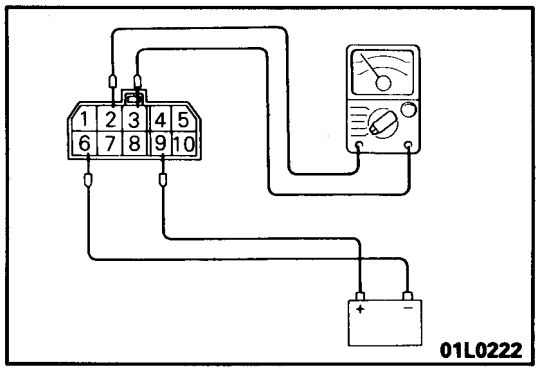


(2) Using jumper wires, connect terminal ⑩ of the control relay to the ⊕ terminal of the battery and connect terminal ⑧ of the relay to the ⊖ terminal of the battery.

CAUTION

- **When connecting the jumper wires, be careful not to connect them to the wrong terminals, since this could damage the relay.**

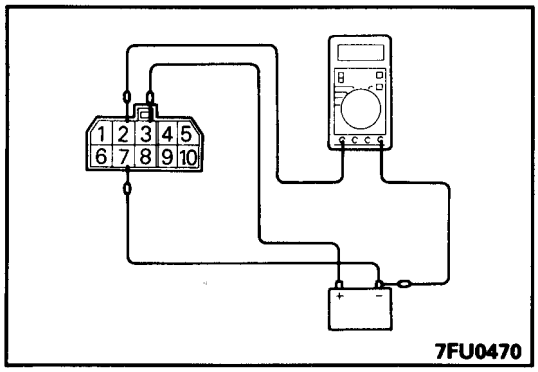
(3) Measure the voltage at terminal ④ and terminal ⑤ of the control relay while coming off and on the connection of the jumper wire to the battery ⊖ terminal.



Jumper wire	Terminal ④ voltage	Terminal ⑤ voltage
Connected	SV	SV
Disconnected	0V	0V

(4) Using jumper wires, connect terminal ⑨ of the control relay to the ⊕ terminal of the battery and connect terminal ⑥ of the relay to the ⊖ terminal of the battery.

(5) Check the continuity between at terminal ② and terminal ③ of the control relay while coming off and on the connection of the jumper wire to the battery ⊖ terminal.



Jumper Wire	Continuity between Terminals ② and ③
Connected	Continuity
Disconnected	No Continuity

(6) Using jumper wires, connect terminal ③ of the control relay to the ⊕ terminal of the battery and connect terminal ⑦ of the relay to the ⊖ terminal of the battery.

(7) Measure the voltage at terminal ② of the control relay while coming off and on the connection of the jumper wire to the battery ⊖ terminal.

Jumper Wire	Terminal ② Voltage
Connected	SV
Disconnected	0V

(8) Replace the control relay if faulty.

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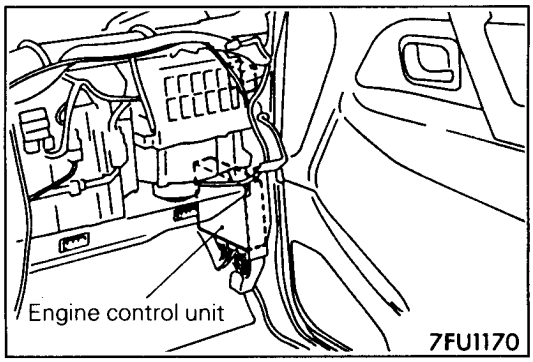
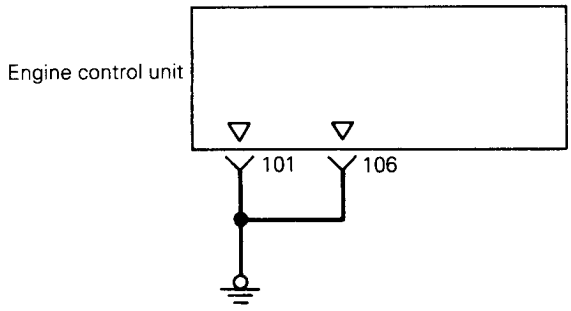
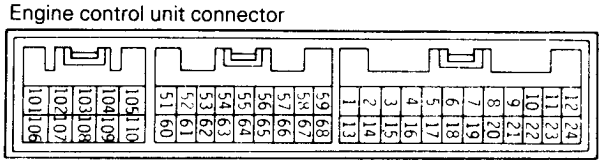
ENGINE CONTROL UNIT POWER EARTH







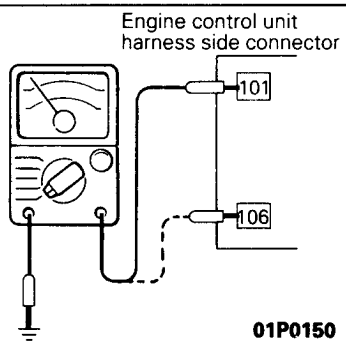
OPERATION

Earthing of the engine control unit

TROUBLESHOOTING HINTS

If there is incorrect or incomplete contact of the engine control unit's earth line, the engine control unit will not function correctly.

HARNESS INSPECTION

1		Check for continuity of the earth circuit. • Engine control unit connector: Disconnected	OK → STOP NO → Repair the harness. (101 – Earth, 106 – Earth)

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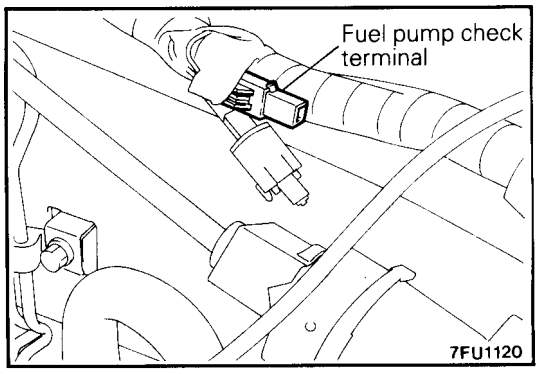
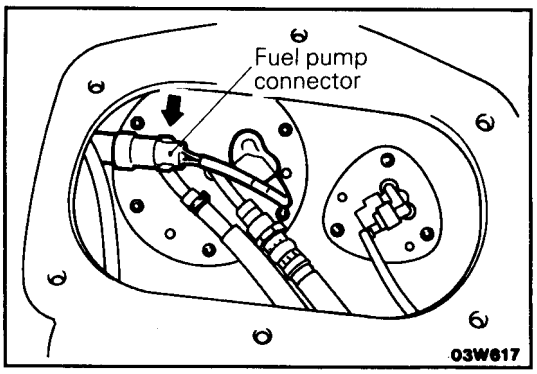
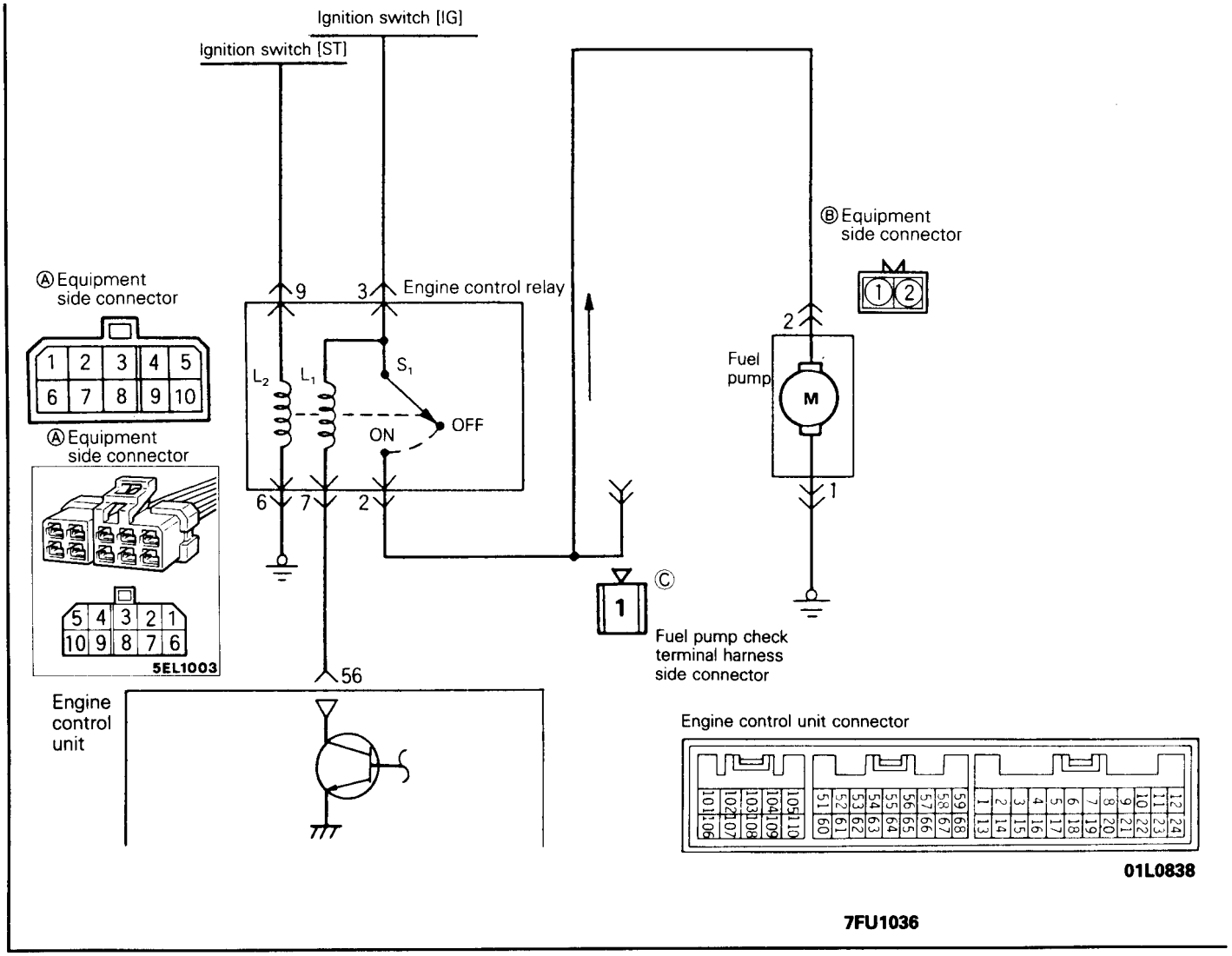
FUEL PUMP







OPERATION

- Activates the fuel pump during engine cranking and while the engine is running.
- When the ignition switch is set to the START position, current flows, by way of the control relay coil, from the ignition switch to earth. As a result, the control relay switch is switched ON, and the power for activation of the fuel pump is supplied, by way of the control relay switch, from the battery to the fuel pump.
- While the engine is running, the engine control unit switches ON the power transistor, after which current flows to the control relay coil, and the power for activation of the fuel pump is supplied to the fuel pump.
- When the control relay switch is switched ON, battery voltage is also applied to the engine control unit, and so the engine control unit detects the fact that the power for activation of the fuel pump is being supplied to the fuel pump.

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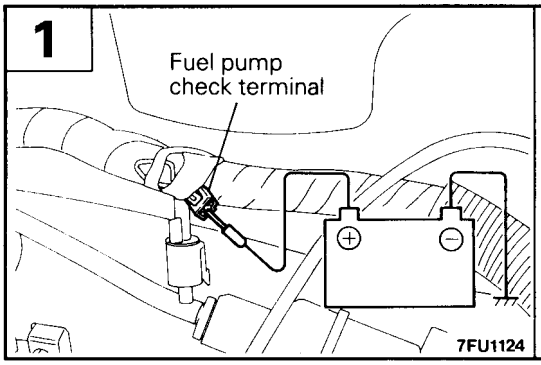
INSPECTION

Using Multi-use tester (MUT)

Function	Item No.	Activation	Check conditions	Check description	Normal condition
Actuater test	07	Activates fuel pump and circulates fuel.	• Engine cranking • Fuel pump forced activation Make the check under both of above conditions.	Pinch the return hose and feel the pulsations of the fuel flow.	Pulsations can be felt.
				Listen (close to the fuel tank) for pump sounds.	Sounds can be heard.

HARNESS INSPECTION

1

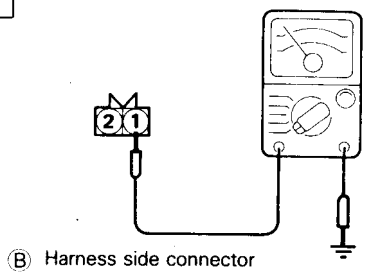


Check the fuel pump.
- Apply battery voltage to the checking terminal and operate the pump.

OK → 2

NG → 4

2

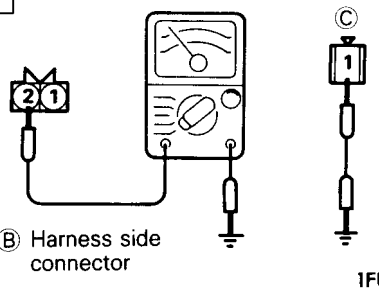


Check the earth circuit of the fuel pump.
- Connector: Disconnected

OK → 3

NG → Repair the harness. (Ⓑ 1 – Earth)

3

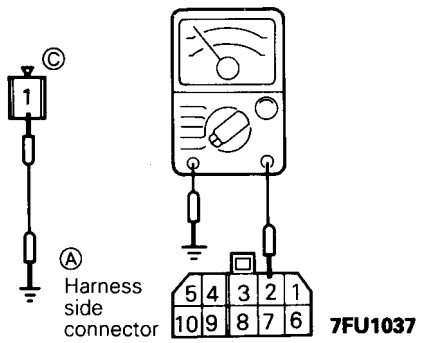


Check for continuity between the fuel pump and the checking terminal.
- Connector: Disconnected

OK → 4

NG → Repair the harness. (Ⓑ 2 – Ⓒ 1)

4



Check for continuity between the checking terminal and the control relay terminal.
- Control relay connector: Disconnected
- Fuel pump connector: Disconnected

OK → 5

NG → Repair the harness. (Ⓐ 2 - Ⓒ 1)

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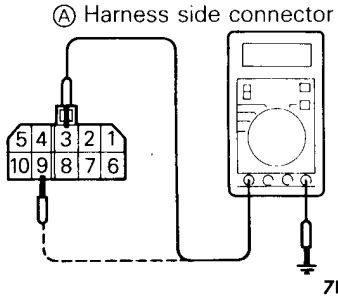
5



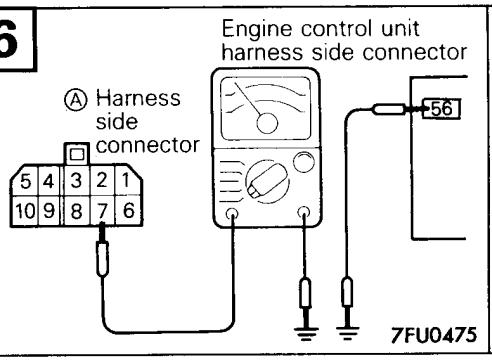
Measure the power supply voltage of the control relay.
- Connector: Disconnected
- Ignition switch: START (when checking Ⓐ 9)
- Ignition switch: ON (when checking Ⓐ 3)

Voltage (V)
8 or higher

OK → 6

NG → Repair the harness. (Ignition switch [ON]–Ⓐ3 Ignition switch [ST]–Ⓐ9)

6

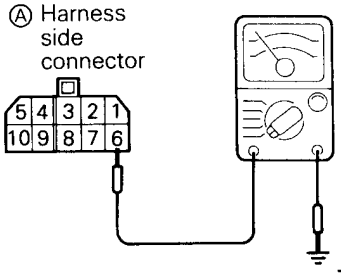


Check for an open-circuit, or a short-circuit to earth, between the control relay and the engine control unit.
- Control relay connector: Disconnected
- Engine control unit connector: Disconnected

OK → 7

NG → Repair the harness. (Ⓐ7–56)

7

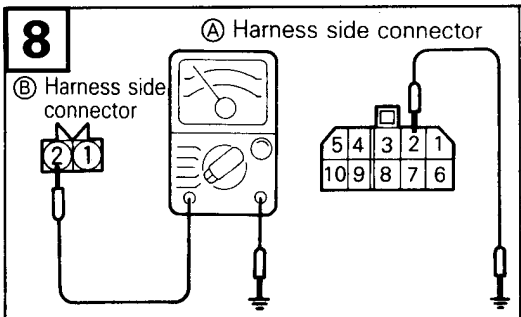


Check for continuity of the earth circuit.
- Connector: Disconnected

OK → 8

NG → Repair the harness. (Ⓐ6–Earth)

8



Check for an open-circuit, or a short-circuit to earth, between the control relay and the fuel pump.
- Control relay connector: Disconnected
- Fuel pump connector: Disconnected

OK → STOP

NG → Repair the harness. (Ⓐ2–Ⓑ2)

ENGINE CONTROL RELAY INSPECTION

Refer to P. 13-25.

FUEL PUMP INSPECTION

Refer to P. 13-15.

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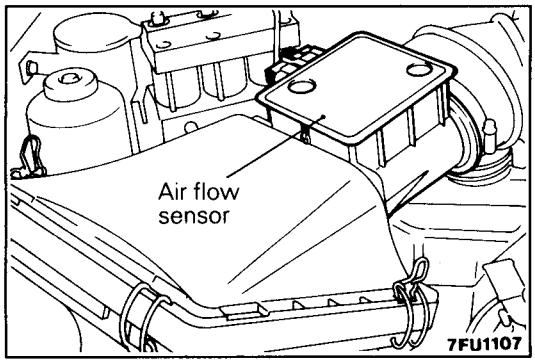
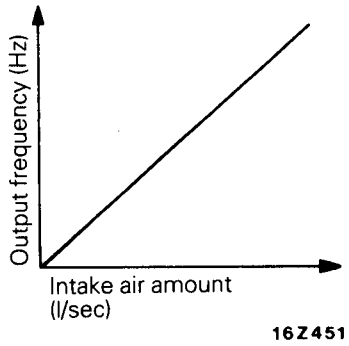
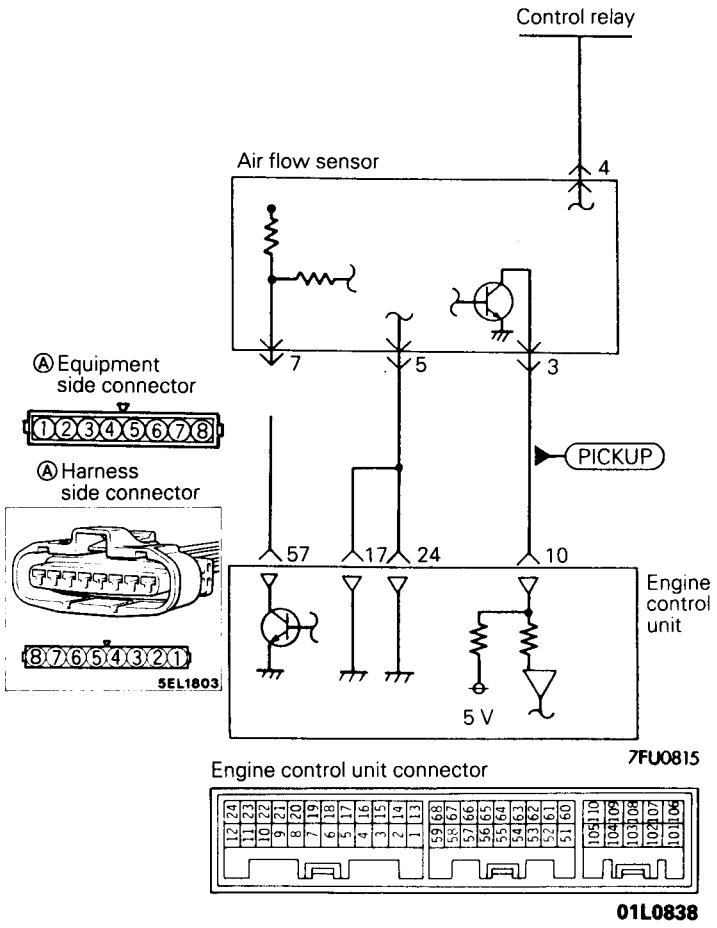
AIR FLOW SENSOR







OPERATION

- The flow sensor is incorporated within the air cleaner; it functions to convert the amount of engine air intake to pulse signals of a frequency proportional to the amount of engine air intake, and to input those signals to the engine control unit. The engine control unit then, based upon those signals, calculates the amount of fuel injection, etc.
- The power for the air flow sensor is supplied from the control relay to the air flow sensor, and is earthed at the engine control unit. The air flow sensor, by intermitting the flow of the 5V voltage applied from the engine control unit, produces pulse signals.

TROUBLESHOOTING HINTS

Hint 1:
If the engine sometimes stalls, try starting the engine and shaking the air flow sensor harness. If the engine then stalls, incorrect or improper contact of the air flow sensor connector is the probable cause.
Hint 2:
If, when the ignition switch is switched ON (but the engine is not started), the air flow sensor output frequency is any value other than zero, a malfunction of the air flow sensor or of the engine control unit is the probable cause.

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Hint 3:
If idling is possible even though the air flow sensor output frequency is deviated from the standard value, the cause is usually a malfunction other than of the air flow sensor.

[Examples]
(1) the flow of air within the air flow sensor is disturbed. (Air duct disconnection or clogged air cleaner element.)
(2) Incomplete combustion within a cylinder. (Malfunction of spark plugs, ignition coil, injectors, compression pressure, etc.)
(3) Air is taken into the intake manifold through a leaking gasket, etc.

INSPECTION

Using Multi-use tester (MUT)
Air flow sensor

Function	Item No.	Data display	Check conditions	Engine conditions	Standard value Hz
Data reading	12	Sensor detection air flow (frequency)	• Engine coolant temperature: 80–95°C (176–203°F) • Lights and accessories: OFF • Transmission: neutral (P range for vehicles with A/T) • Steering wheel: neutral position	700 r/min. (idling)	25–45
				2,000 r/min.	70–90
				Racing	Frequency increases by racing.

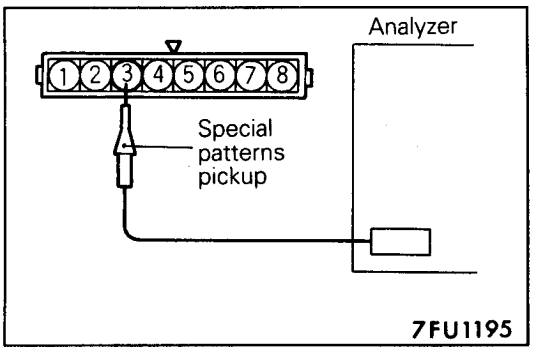
NOTE
When the vehicle is new [driven approximately 500 km (300 miles) or less], the air-flow sensor output frequency may be approximately 10% higher than indicated above.

Air flow sensor reset signal

Function	Item no.	Data display	Inspection condition	Engine condition	Normal display
Data list	34	Reset signal condition	• Engine is warming up	700 r/min. (Idle)	ON
				2000 r/min.	OFF

Volumetric efficiency

Function	Item no.	Data display	Inspection condition	Engine condition	Normal display
Data list	37	Volumetric efficiency	• Engine coolant temperature: 80–95°C (176–203°F) • Lights, electrical cooling fan and all accessories: OFF • Transmission: Neutral (P range for vehicles with A/T) • Steering wheel: Straight forward position	700 r/min. (idle)	20–35%
				2000 r/min.	15–30%
				Racing	Volumetric efficiency increases according to amount of racing.



Wave Pattern Inspection Using an Analyzer
Measurement Method

(1) Disconnect the air flow sensor connector, and connect the special tool (test harness: MB991348) in between. (All terminals should be connected.)
(2) Connect the analyzer special patterns pickup to terminal ③ of the air flow sensor connector.

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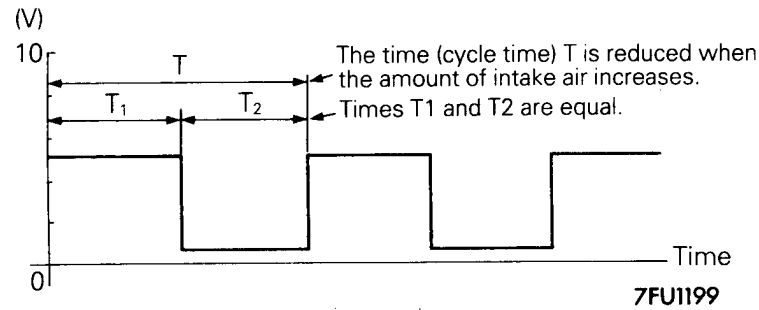
Standard wave pattern

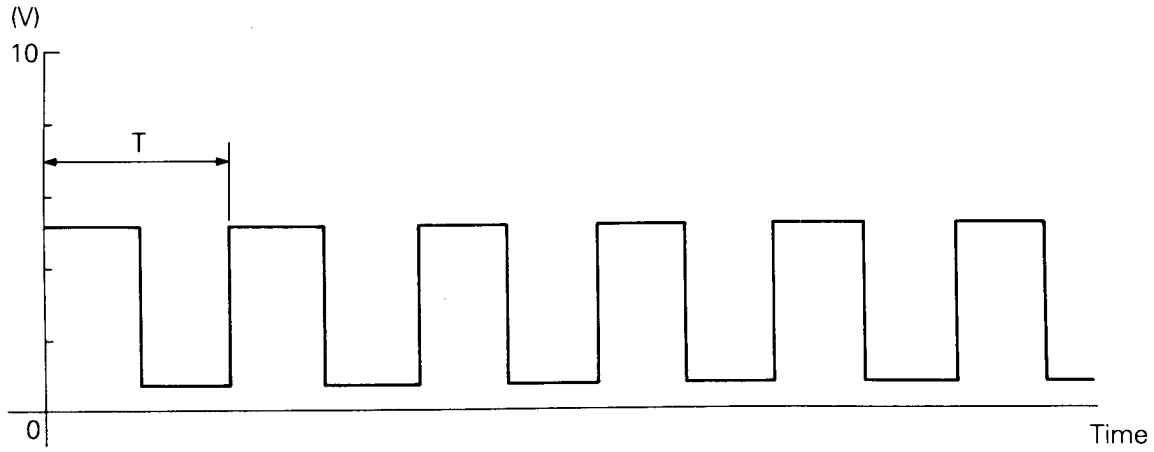


7FU1199

Observation conditions

Function	Special patterns
Pattern height	Low
Pattern selector	Display
Engine r/min.	Idle r/min. (700 r/min.)

Observation conditions (from conditions on previous page, engine speed is increased by racing.)



7FU0880

Wave pattern observation points

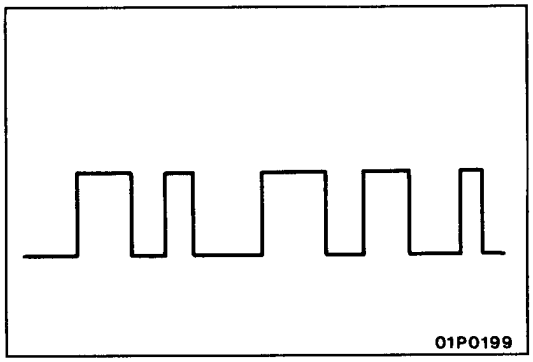
Check that cycle time T becomes shorter and the frequency increases when the engine speed is increased.

Examples of abnormal wave patterns

- Example 1

  Cause of problem
  Sensor interface malfunction

  Wave pattern characteristics
  Rectangular wave pattern is output even when the engine is not started.



01P0199

- Example 2

  Cause of problem
  Damaged rectifier or vortex generation column

  Wave pattern characteristics

  Unstable wave pattern with non-uniform frequency. However, when an ignition leak occurs during acceleration, the wave pattern will be distorted temporarily, even if the air flow sensor is normal.

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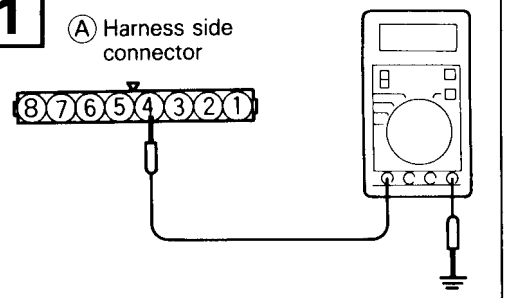
PWJE9086

HARNESS INSPECTION

1



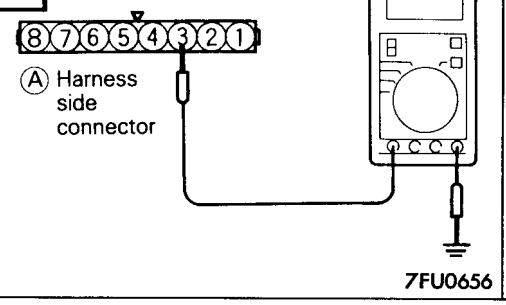
Measure the power supply voltage.
- Connector: Disconnected
- Ignition switch: ON

Voltage (V)
5V

OK → 2

NG → Repair the harness. (Ⓐ4 – Control relay) or check the control relay

2



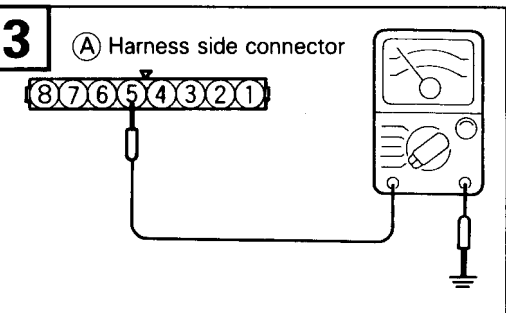
Measure the terminal voltage.
- Connector: Disconnected
- Ignition switch: ON

Voltage (V)
4.8 – 5.2

OK → 3

NG → Repair the harness. (Ⓐ3 – 10)

3

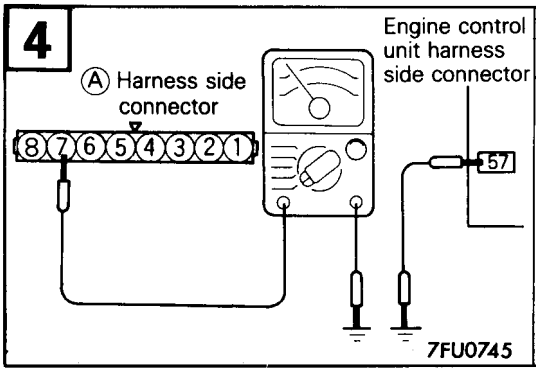


Check for continuity of the earth circuit.
- Connector: Disconnected

OK → 4

NG → Repair the harness. (Ⓐ 5 – 17, 24)

4



Check for continuity between the air flow sensor and the engine control unit.
- Air flow sensor connector: Disconnected
- Engine control unit connector: Disconnected

OK → STOP

NG → Repair the harness. (Ⓐ 7 – 57)

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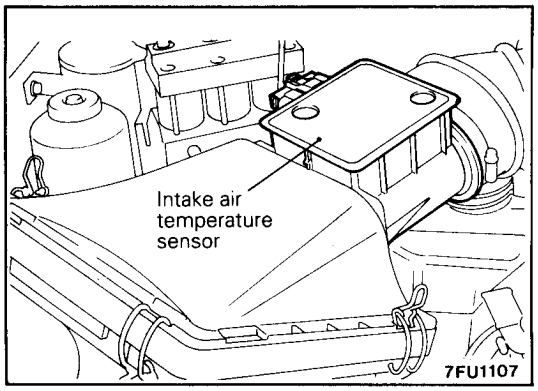
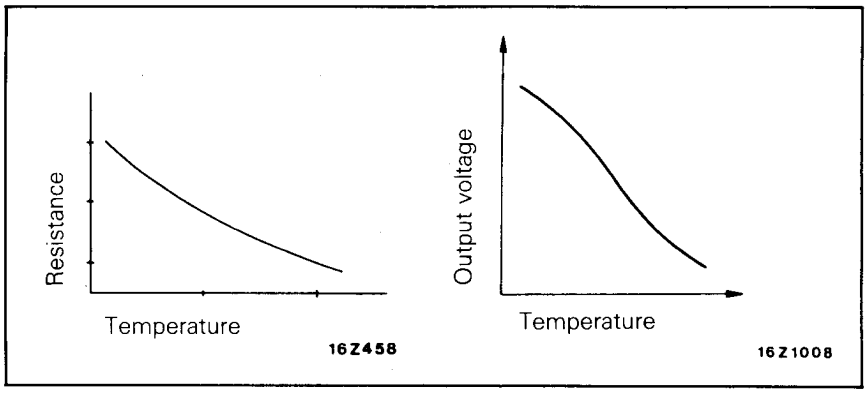
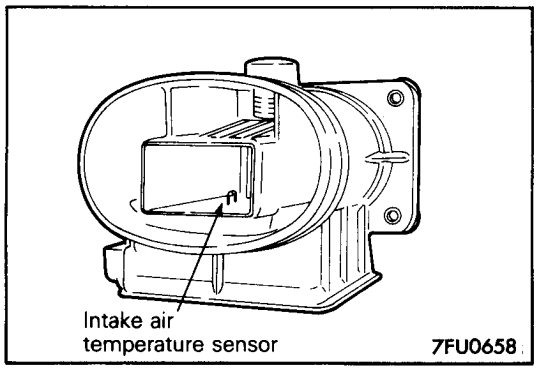
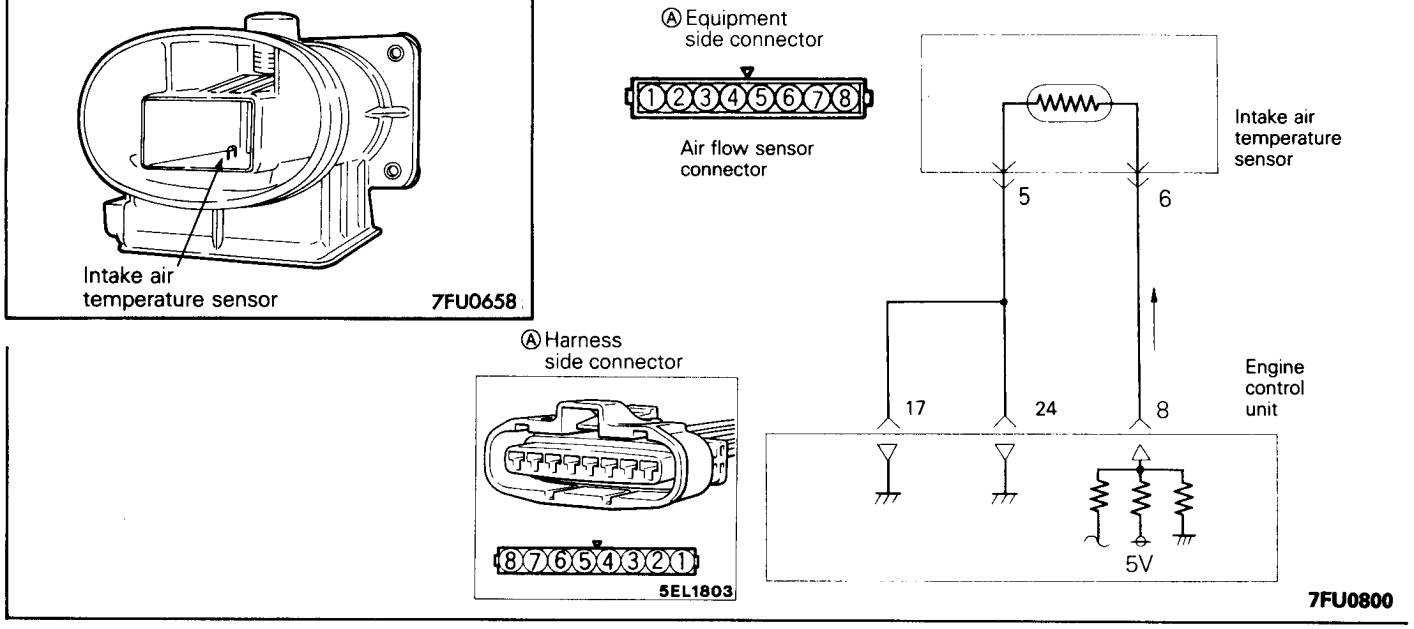
INTAKE AIR TEMPERATURE SENSOR

M13YGAA









OPERATION

- The intake air temperature sensor functions to convert the temperature of the air (intaken to the engine) to voltage, and to input that voltage (as signals) to the engine control unit. The engine control unit, based upon those signals, then corrects the amount fo fuel injection, etc.
- The 5V power supply within the engine control unit is supplied, by way of the resistance within the unit, to the intake air temperature sensor, it passes through the intake air temperature sensor, which is a type of resistor, and is earthed at the engine control unit. Note that the resistance of the intake air temperature sensor decreases when the temperature of the intake air increases.
- The intake air temperature sensor terminal voltage becomes higher when the resistance of the intake air temperature sensor increases, and becomes lower when the resistance decreases. Consequently, the intake air temperaturesensor terminal voltage varies in accordance with the temperature of the intake air, becoming lower when the temperature of the intake air increases.

TROUBLESHOOTING HINTS

Because the intake air temperature of the intake air in the air cleaner, it indicates a temperature different than the temperature of the outside air when the engine is running.

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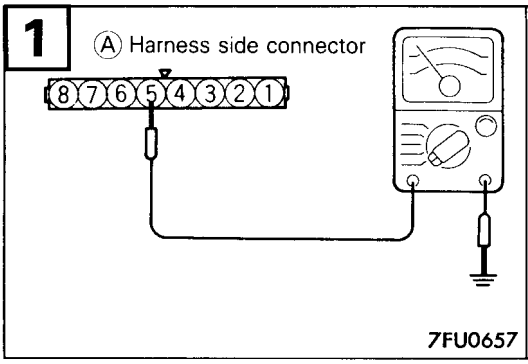
INSPECTION

Using Multi-use tester (MUT)

Function	Item No.	Data display	Check conditions	Intake air temperature °C (°F)	Standard value °C
Data reading	13	Sensor detection temperature	Ignition switch: ON Or, engine running	When –20 (–4)	–20
				When 0 (32)	0
				When 20 (68)	20
				When 40 (104)	40
				When 80 (176)	80

HARNESS INSPECTION

1

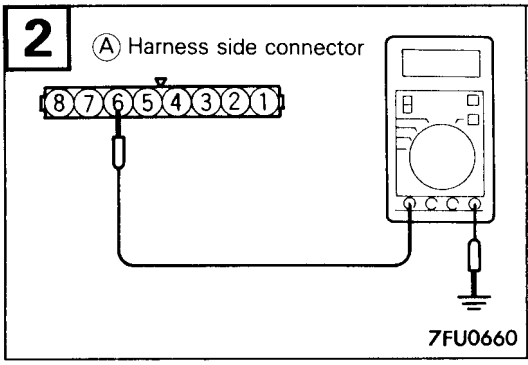


Check for continuity of the earth circuit.
- Connector: Disconnected

OK → 2

NG → Repair the harness. (Ⓐ5 – 17, 24)

2

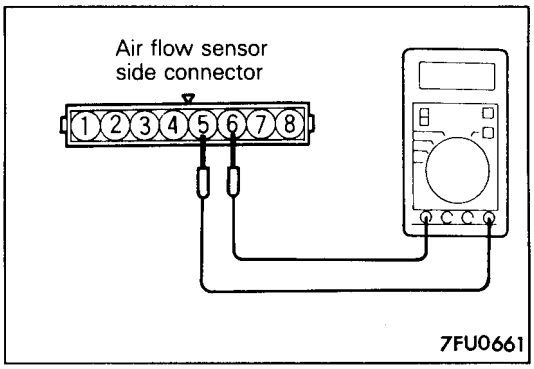


Measure the power supply voltage.
- Connector: Disconnected
- Ignition switch: ON

Voltage (V)
4.5 – 4.9

OK → STOP

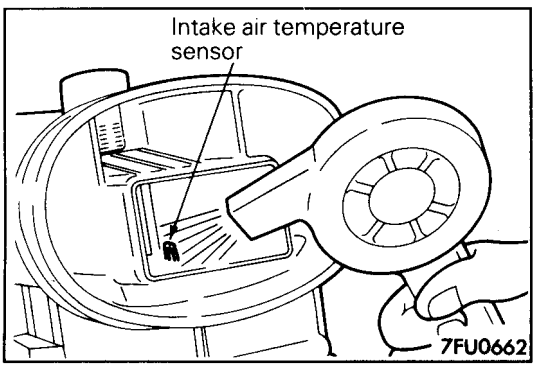
NG → Repair the harness. (Ⓐ6 – 8)



SENSOR INSPECTION

(1) Disconnect the air flow sensor connectors.
(2) Measure resistance between terminals ⑤ and ⑥.

Temperature °C (°F)	Resistance kΩ
0 (32)	6.0
20 (68)	2.7
80 (176)	0.4



(3) Measure resistance while heating the sensor using a hair drier.

Temperature °C (°F)	Resistance kΩ
Higher	Smaller

(4) If the value deviates from the standard value or the resistance remains unchanged, replace the air flow sensor assembly.

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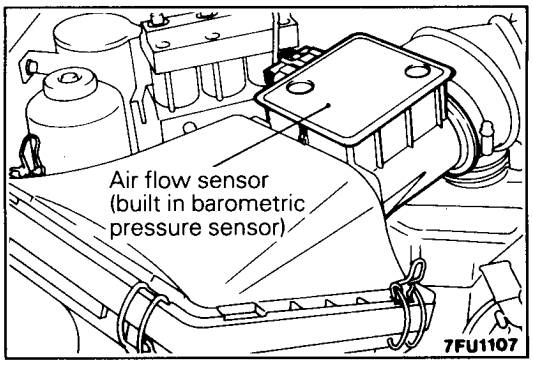
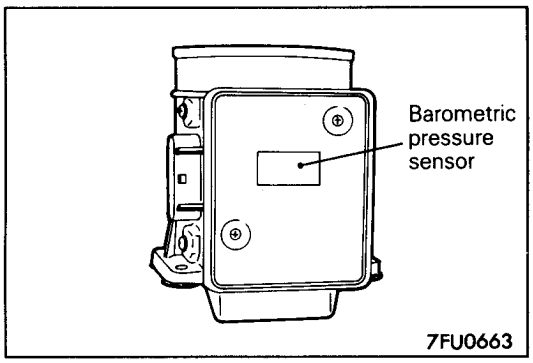
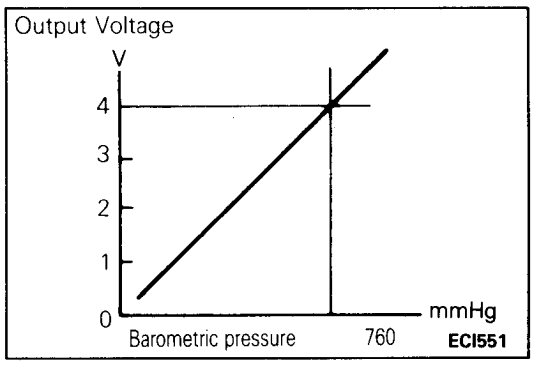
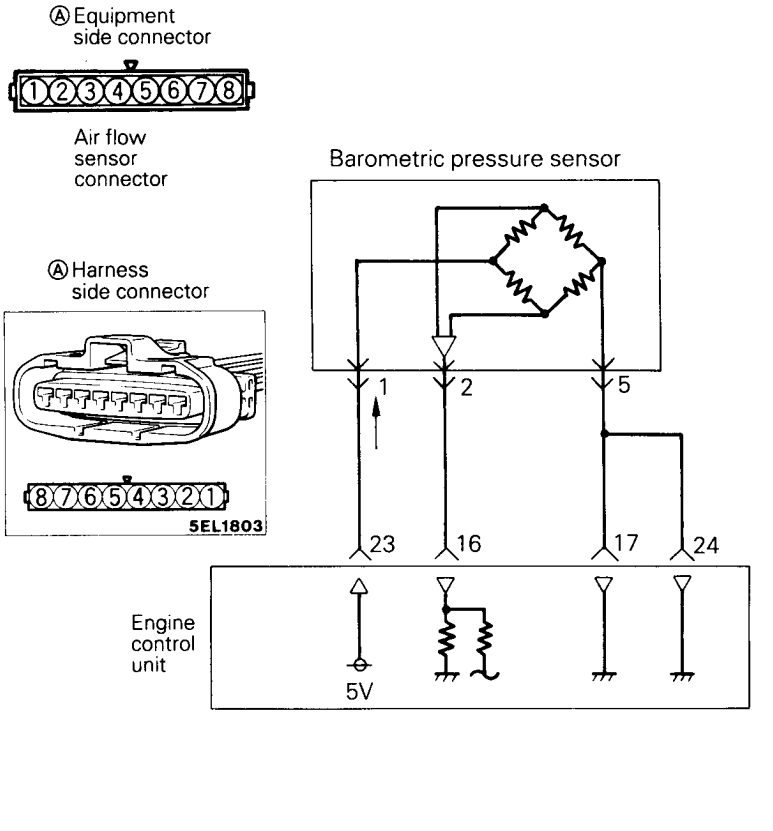
BAROMETRIC PRESSURE SENSOR









OPERATION

- The barometric pressure sensor functions to convert the barometric pressure to voltage, and to input that voltage (as signals) to the engine control unit. The engine control unit, based upon those signals, then corrects the amount of fuel injection, etc.
- The 5V power supply within the engine control unit is supplied to the barometric pressure sensor; it passes through the circuitry within the sensor, and is earthed at the engine control unit.
- The barometric-pressure sensor output voltage is supplied to the engine control unit in proportion to the barometric pressure (absolute pressure).

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TROUBLESHOOTING HINTS

Hint 1:
If there is a malfunction of the barometric pressure sensor, driveability of the vehicle will become worse particularly at high altitude.

Hint 2:
If, during high-speed driving, there is a noticeable sharp drop of the displayed pressure of the barometric-pressure sensor, check for clogging of the air cleaner.

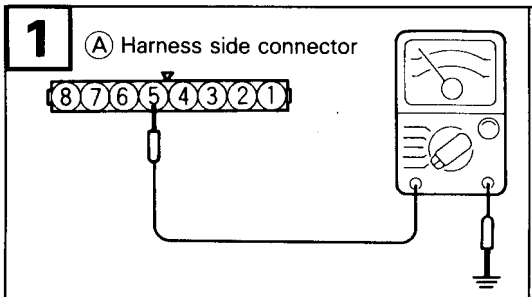
INSPECTION

Using Multi-use tester (MUT)

Function	Item No.	Data display	Check conditions	Altitude m (ft.)	Standard value mmHg
Data reading	25	Sensor detection pressure	Ignition switch: ON	When at 0 (0)	760
				When at 600 (1,969)	710
				When at 1,200 (3,937)	660
				When at 1,800 (5,906)	610

HARNESS INSPECTION

1

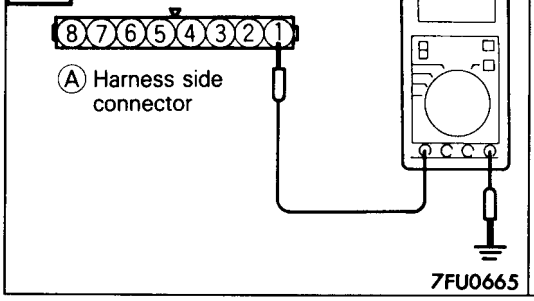


Check for continuity of the earth circuit.
- Connector: Disconnected

OK → 2

NG → Repair the harness. (Ⓐ 5 – 14, 24)

2



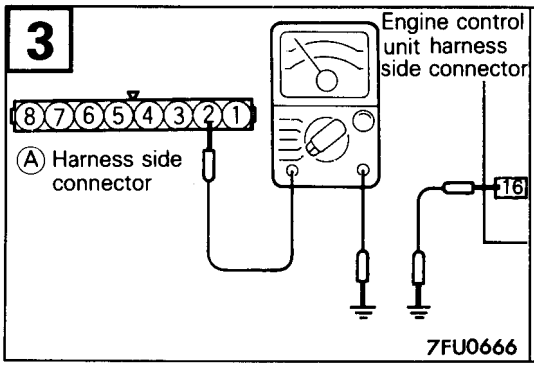
Measure the power supply voltage of the barometric pressure sensor.
- Connector: Disconnected
- Ignition switch: ON

Voltage (V)
4.8 – 5.2

OK → 3

NG → Repair the harness. (Ⓐ 1 – 23)

3



Check for an open-circuit or a short-circuit to earth, between the engine control unit and the barometric pressure sensor.
- Air flow sensor connector: Disconnected
- Engine control unit connector: Disconnected

OK → STOP

NG → Repair the harness. (Ⓐ 2 – 16)

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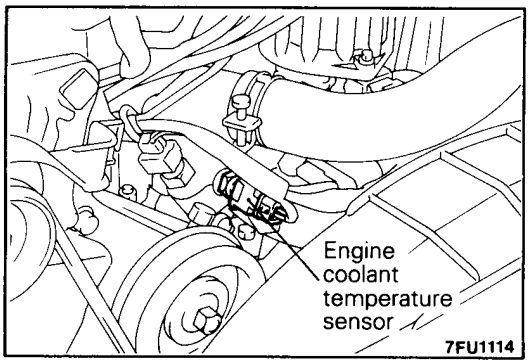
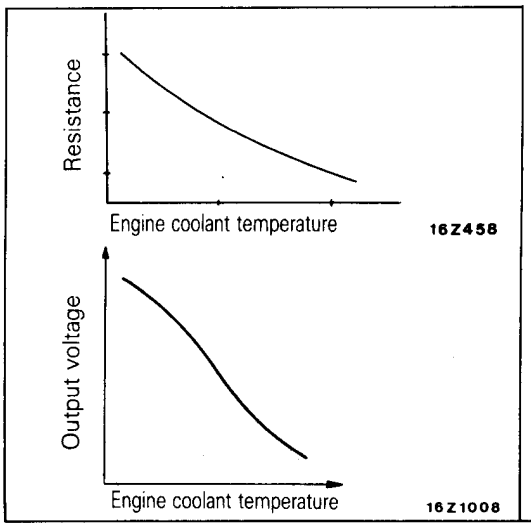
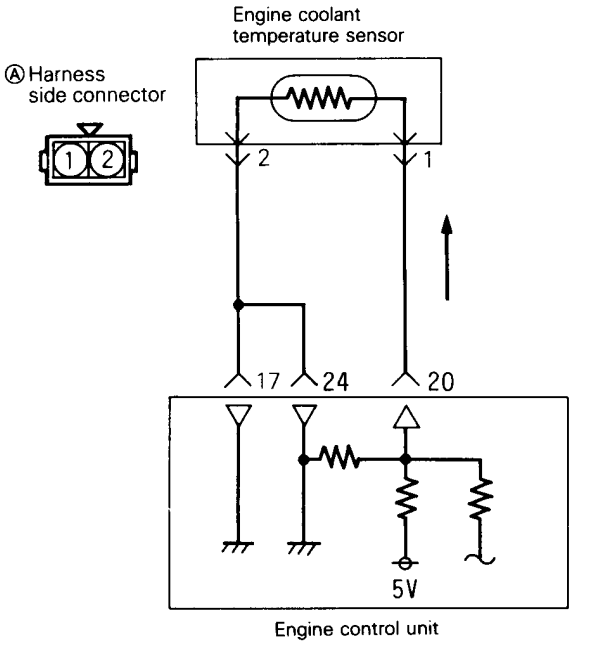
ENGINE COOLANT TEMPERATURE SENSOR







OPERATION

- The engine coolant temperature sensor functions to convert the barometric pressure to voltage, and to input that voltage (as signals) to the engine control unit.The engine control unit, based upon those signals, regulates the amount of fuel injection and the fast-idling speed when the engine is cold.
- The 5V power supply within the engine control unit is supplied, by way of the resistance within the unit, to the engine coolant temperature sensor; it passes through the engine coolant temperature sensor, which is a type of resistor, and is earthed at the engine control unit. Note that the resistance of the engine coolant temperature sensor decreases when the temperature of the engine coolant increases.
- The engine coolant temperature sensor terminal voltage becomes higher when the resistace of the engine coolant temperature sensor increases, and becomes lower when the resistance decreases. Consequently, the engine coolant temperature sensor terminal voltage varies in accordance with the temperature of the engine coolant, becoming lower when the temperature of the engine coolant increases.

TROUBLESHOOTING HINTS

If, during engine warm-up, the fast-idling speed is not correct, or black smoke is emitted, the problem is usually a malfunction of the coolant temperature sensor.

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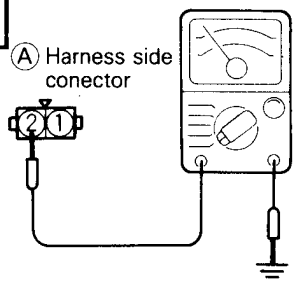
INSPECTION

Using Multi-use tester (MUT)

Function	Item No.	Data display	Check conditions	Engine coolant temperature °C (°F)	Standard value °C
Data reading	21	Sensor detection temperature	Ignition switch: ON Or, engine running	When –20 (–4)	–20
				When 0 (32)	0
				When 20 (68)	20
				When 40 (104)	40
				When 80 (176)	80

HARNESS INSPECTION

1



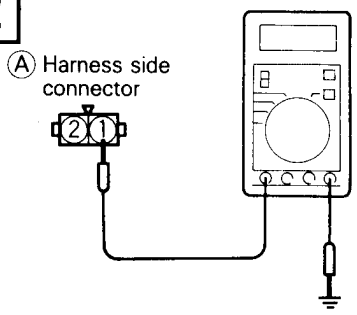
7FU0668

Check for continuity of the earth circuit.
- Connector: Disconnected

OK → 2

NG → Repair the harness. (Ⓐ 2 – 17, 24)

2



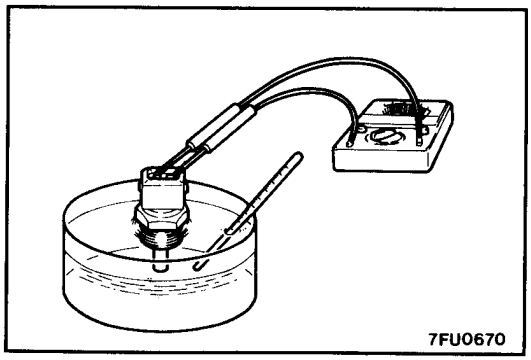
7FU0669

Measure the power supply voltage.
- Connector: Disconnected
- Ignition switch: ON

Voltage (V)
4.5 – 4.9

OK → STOP

NG → Repair the harness. (Ⓐ 1 – 20)



7FU0670

SENSOR INSPECTION

(1) Remove engine coolant temperature sensor from the intake manifold.

(2) With temperature sensing portion of coolant temperature sensor immersed in hot water check resistance.

Temperature °C (°F)	Resistance kΩ
0 (32)	5.8
20 (68)	2.4
40 (104)	1.1
80 (176)	0.3

(3) If the resistance deviates from the standard value greatly, replace the sensor.

INSTALLATION

(1) Apply specified sealant to threaded portion.

Specified sealant: 3M Nut locking No. 4171 or equivalent

(2) Install engine coolant temperature sensor and tighten it to specified torque.

Sensor tightening torque: 30 Nm (3.0 kgm, 22 ft.lbs)

(3) Fasten harness connectors securely.

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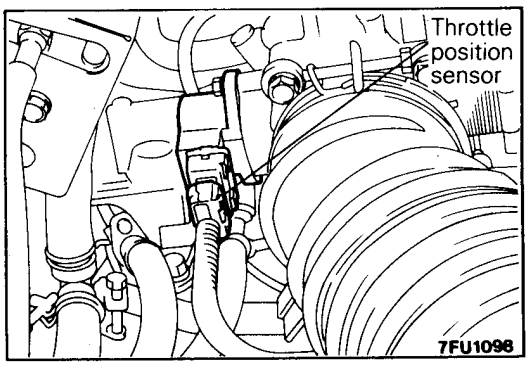
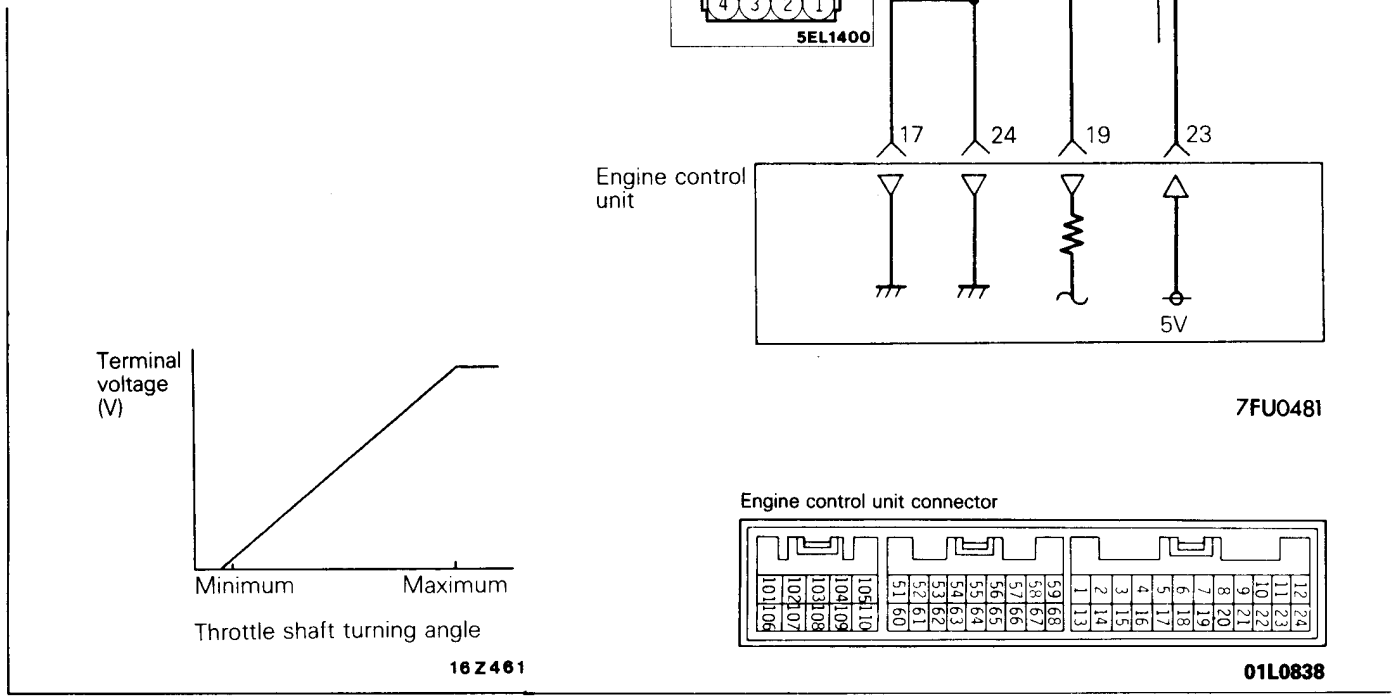
THROTTLE POSITION SENSOR





OPERATION

- The throttle position sensor functions to convert the degree of opening of the throttle valve to voltage, and to input that voltage (as signals) to the engine control unit. The engine control unit, based upon those signals, then regulates the amount of fuel injection, etc.
- The 5V power supply within the engine control unit is supplied to the throttle position sensor, after which it passes through the resistance within the sensor and is earthed at the engine control unit.
- When the throttle valve shaft is rotated all the way from the idling position to the fully open position, the resistance between the throttle position sensor's variable-resistance terminal and the earth terminal also increases in accordance with that rotation, and, as a result, the voltage of the throttle position sensor's variable-resistance terminal also becomes higher in accordance with that rotation.

TROUBLESHOOTING HINTS

Hint 1:
The signals of the throttle position sensor are more important fore control of the automatic transmission than for control of the engine; shifting "impact shocks" are producec if there is a malfunction of the throttle position sensor.
Hint 2:
If the voltage of the throttle position sensor deviates from the standard value, check once again after making the throttle position sensor adjustment. In addition, if there are any indication that the fixed SAS has been moved, adjust the fixed SAS.

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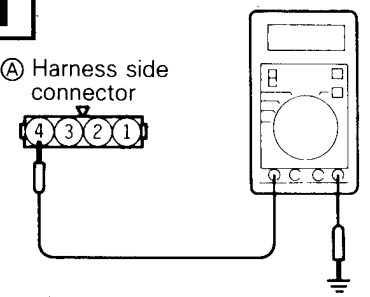
INSPECTION

Using Multi-use tester (MUT)

Function	Item No.	Data display	Check conditions	Throttel valve	Standard value mV
Data reading	14	Sensor detection voltage	Ignition switch: left ON for 15 secondes or more	Set to idling position.	300 – 1,000
				Open gradually.	Becomes higher proportionally to valve opening
				Open fully.	4,500 – 5,500

HARNESS INSPECTION

1



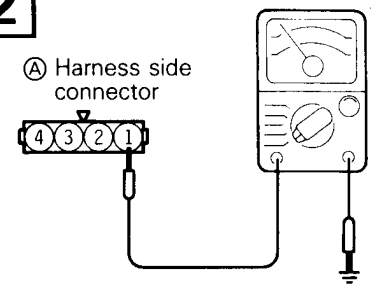
Measure the power supply voltage of the throttle position sensor.
- Connector: Disconnected
- Ignition switch: ON

Voltage (V)
4.8 – 5.2

OK → 2

NG → Repair the harness. (Ⓐ4 – 23)

2

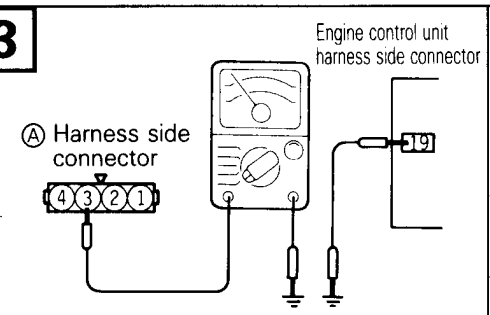


Check for continuity of the earth circuit.
- Connector: Disconnected

OK → 3

NG → Repair the harness. (Ⓐ 1 – 17, 24)

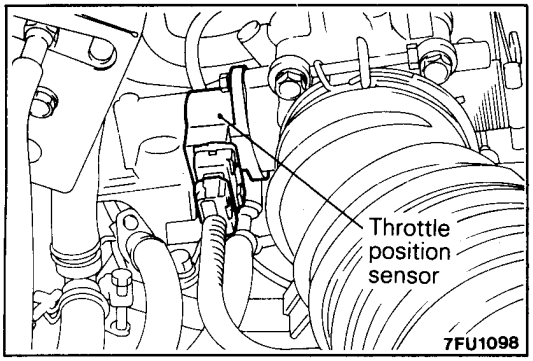
3



Check for an open-circuit, or a short-circuit to earth, between the engine control unit and the throttle position sensor.
- Throttle position sensor connector: Disconnected
- Engine control unit connector: Disconnected

OK → STOP

NG → Repair the harness. (Ⓐ3 – 19)



SENSOR INSPECTION

(1) Disconnect the throttle position sensor connector.

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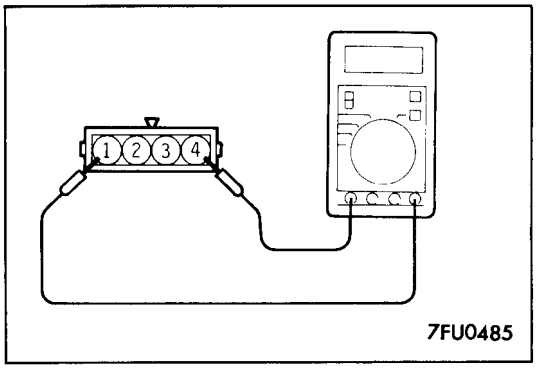
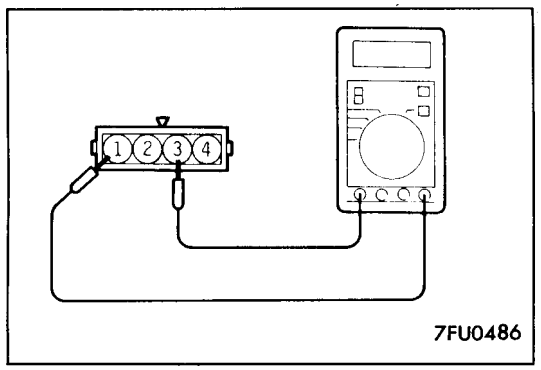


(2) Measure resistance between terminal ④ (sensor earth) and terminal ① (sensor power).

Standard value: 3.5–6.5 kΩ

(3) Connect a pointer type ohmmeter between terminal ④ (sensor earth) and terminal ② (sensor output).

(4) Operate the throttle valve slowly from the idle position to the full open position and check that the resistance changes smoothly in proportion with the throttle valve opening angle.

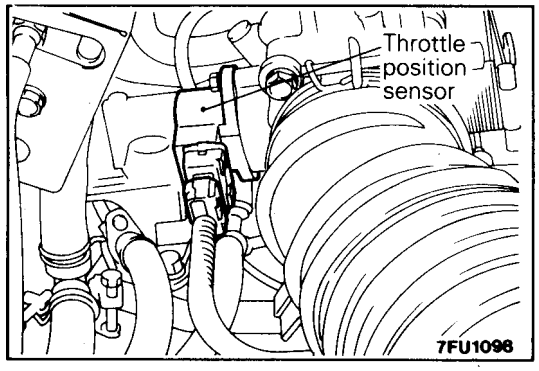


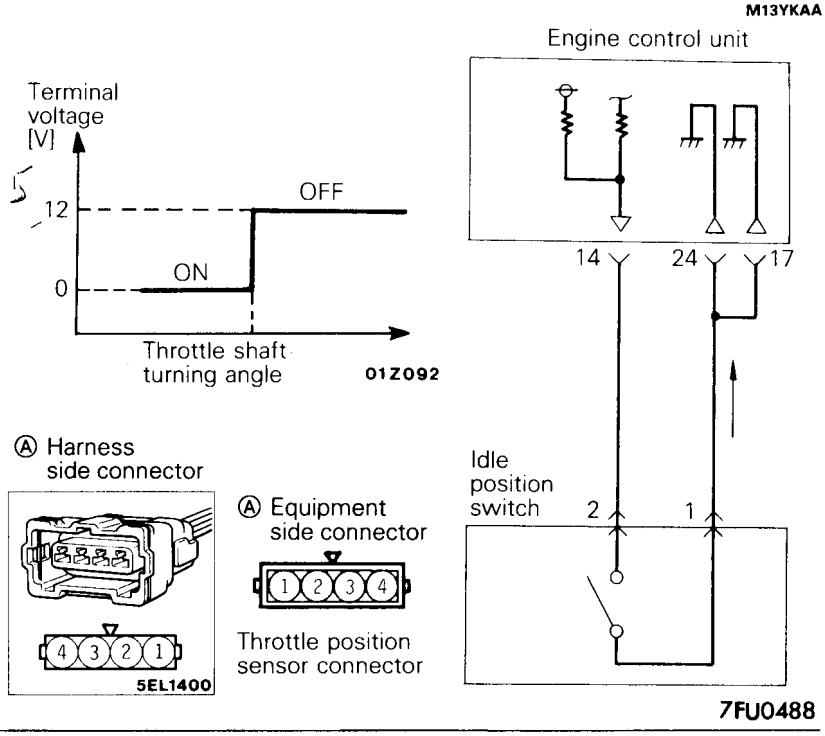
(5) If the resistance is out of specification, or fails to change smoothly, replace the throttle position sensor.

TPS installation torque: 2.0 Nm (0.2 kgm, 1.5 ft.lbs)

For the idle position switch and throttle position sensor adjusting procedure, refer to P. 13-17.

IDLE POSITION SWITCH





OPERATION

- The idle-position switch functions to convert (to HIGH/LOW-level voltage) data as to whether the accelerator is depressed or released, and to input that voltage (as signals) to the engine control unit. The engine control unit, based upon those signals, regulates the idle-speed control servo.
- Voltage within the engine control unit is applied, by way of the resistance, to the idle-position switch. When the foot is taken off the accelerator, the idle-position switch is switched ON, so the current is earthed. As result, the idle-position switch terminal voltage changes from HIGH to LOW level.

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TROUBLESHOOTING HINTS

If there is an abnormal condition of the idle-position switch output even though the results of the checking of the idle-position switch harness and of the component itself indicate a normal condition, the cause may be presumed to be one of the following.

(1) Improper adjustment of the accelerator cable or the automatic-cruise-control cable.
(2) Improper adjustment of the fixed SAS.

INSPECTION

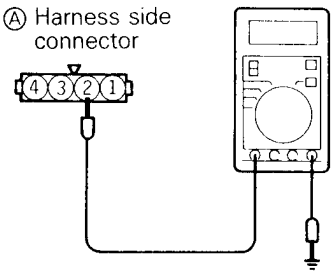
Using Multi-use tester (MUT)

Function	Item No.	Data display	Check conditions	Throttle valve	Normal display
Data reading	26	Switch status	Ignition switch: ON (Operate the accelerator several times and check.)	Set to idling position.	ON
				Open slightly.	OFF

HARNESS INSPECTION

1

Ⓐ Harness side connector



7FU0489

Measure the power supply voltage of the idle position switch.
- Connector: Disconnected
- Ignition switch: ON

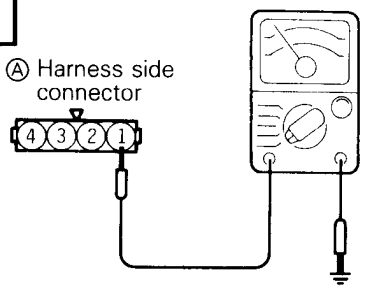
Voltage (V)
4 or higher

OK → 2

NO → Repair the harness. (Ⓐ2 – 14)

2

Ⓐ Harness side connector

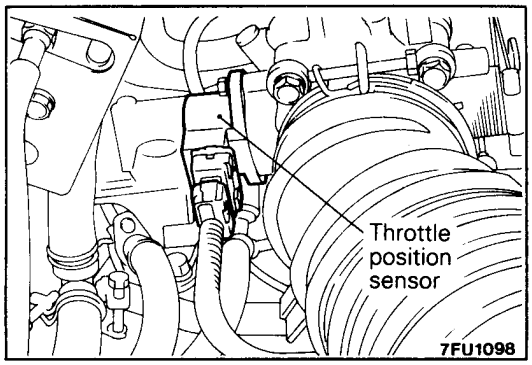


7FU0483

Check for continuity of the earth circuit.
- Connector: Disconnected

OK → STOP

NO → Repair the harness. (Ⓐ1 – 17, 24)



7FU1098

SENSOR INSPECTION

(1) With the accelerator pedal released, check to be sure that the throttle valve lever or the fixed SAS is pushed.

NOTE
If it is not pushed, adjust the fixed SAS (Refer to P. 13-18.)

(2) Disconnect the throttle position sensor connector.

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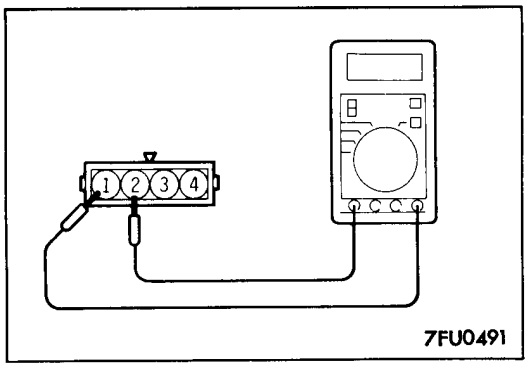


(3) Check the continuity across the throttle position sensor connector terminal ① (Sensor earth) and ② (Idle position switch).

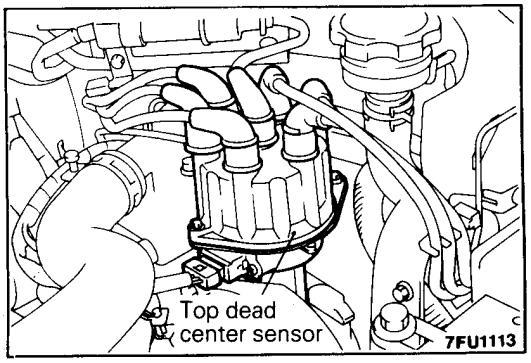
Accelerator pedal	Continuity
Depressed	Non-conductive (∞Ω)
Released	Conductive (0Ω)

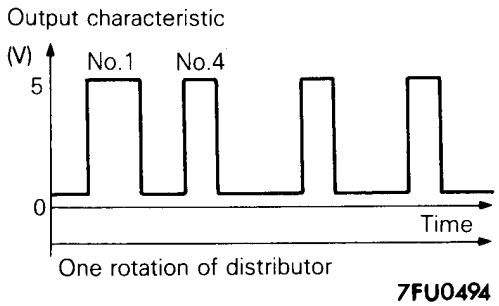
NOTE
If there is no continuity when the accelerator pedal is returned, loosen the throttle-position sensor installation screw; then, after turning all the way in the clockwise direction, check again.

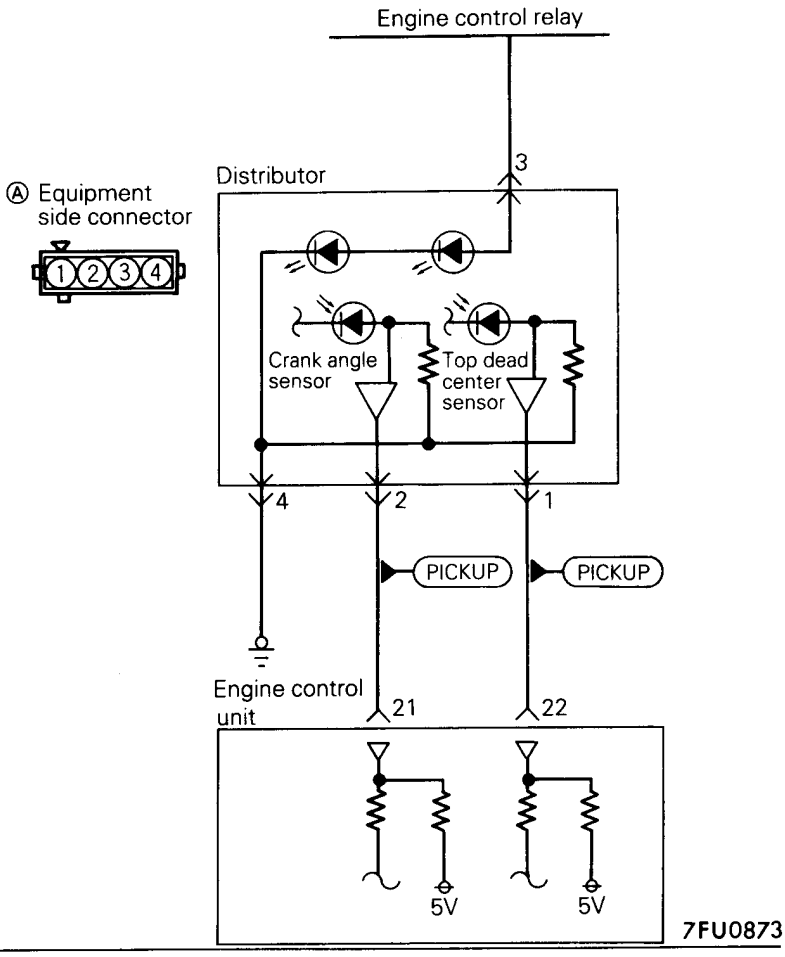
(4) Replace the throttle-position sensor (idle-position switch incorporated) if there is a malfunction.

NOTE
For the idle position switch and throttle position sensor adjusting procedure, refer to P. 13-17.

TOP DEAD CENTER SENSOR







OPERATION

- The top dead center sensor functions to detect the top dead center position of the No. 1 cylinder and to convert those data to pulse signals that are input to the engine control unit. the engine control unit, based upon those signals, calculates the sequence of fuel injection.

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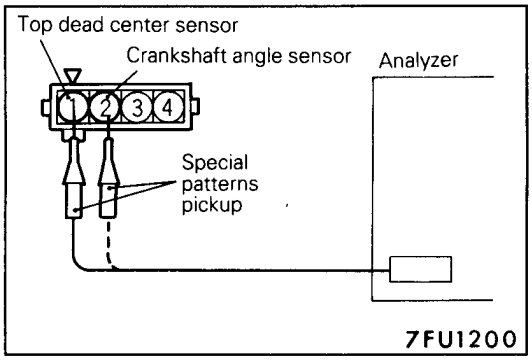
- The power for the top dead center sensor is supplied from the control relay and is earthed to the vehicle body. The top dead center sensor, by intermitting the flow (to earth) of the 5V voltage applied from the engine control unit, produces pulse signals.

TROUBLESHOOTING HINTS

If there is a malfunction of the top dead center sensor, the sequential injection will not be correct, resulting in such problems as engine stalling, unstable idling, and poor acceleration.

INSPECTION

Wave Pattern Inspection Using an Analyzer



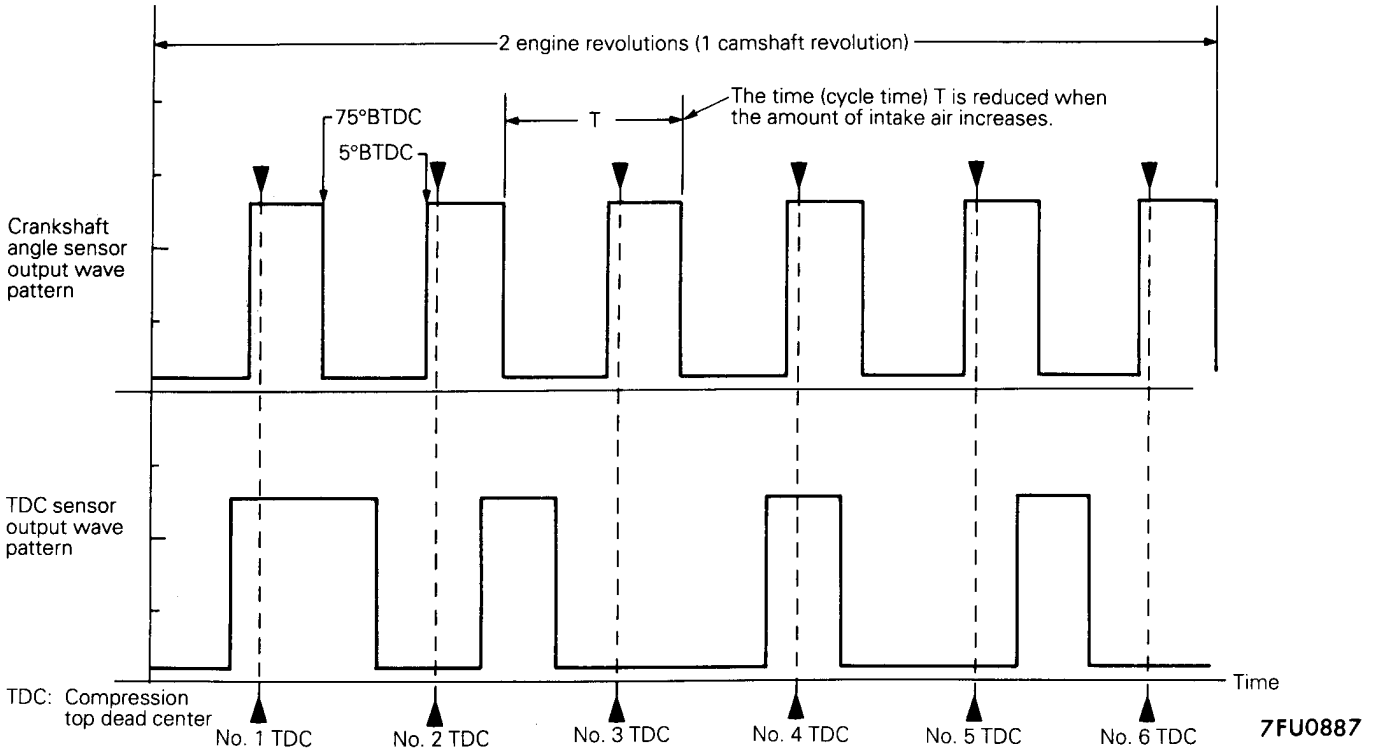
Measurement Method

(1) Disconnect the crankshaft angle sensor connector and connect the special tool (test harness: MB991348) in between. (All terminals should be connected.)
(2) Connect the analyzer special patterns pickup to terminal ① of the crankshaft angle sensor connector. (When inspecting the TDC sensor signal wave pattern.)
(3) Connect the analyzer special patterns pickup to terminal ② of the crankshaft angle sensor connector. (When inspecting the crankshaft angle sensor signal wave pattern.)

Standard wave pattern

Observation conditions

Function	Special patterns
Pattern height	Low
Pattern selector	Display
Engine r/min.	Idle r/min. (700 r/min.)



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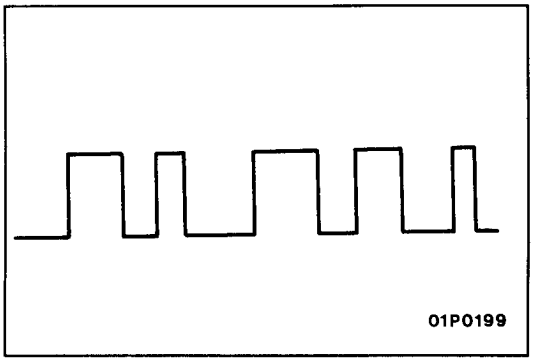
Wave pattern observation points

Check that cycle time T becomes shorter and the frequency increases when the engine speed is increased.

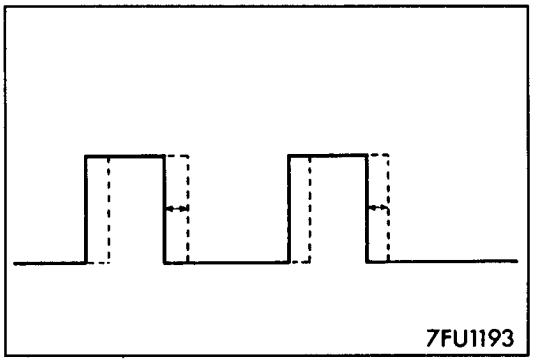


Examples of abnormal wave patterns

- Example 1

  Cause of problem
  Sensor interface malfunction

  Wave pattern characteristics
  Short wave pattern is output even when the engine is not started.

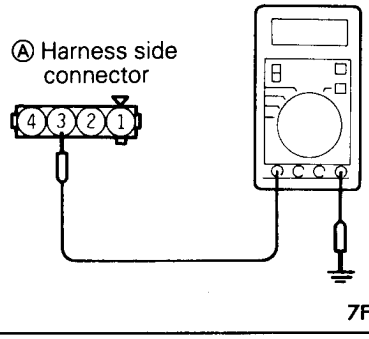


- Example 2

  Cause of problem
  Loose timing belt
  Abnormality in sensor disk

  Wave pattern characteristics
  Wave pattern is displaced to the left or right.

HARNESS INSPECTION

1		Measure the power supply voltage. • Sensor connector: Disconnected • Ignition switch: ON Voltage (V): SV	OK → 2 NG → Repair the harness. (Ⓐ3–Engine control relay)

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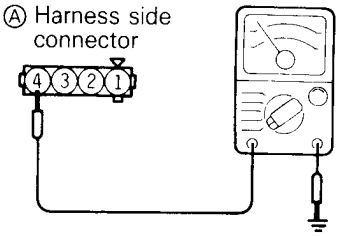
2

Ⓐ Harness side connector



7FU0497

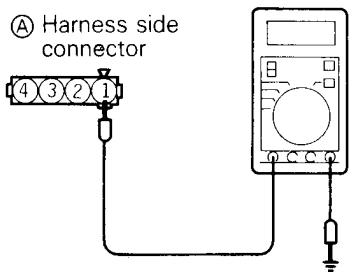
Check for continuity of the earth circuit.
- Connector: Disconnected

OK → 3

NOT OK → Repair the harness. (Ⓐ4 – Earth)

3

Ⓐ Harness side connector



7FU0498

Check the output circuit voltage.
- Connector: Disconnected
- Ignition switch: ON

Voltage (V)
4.8 – 5.2

OK → STOP

NOT OK → Repair the harness. (Ⓐ1 – 22)

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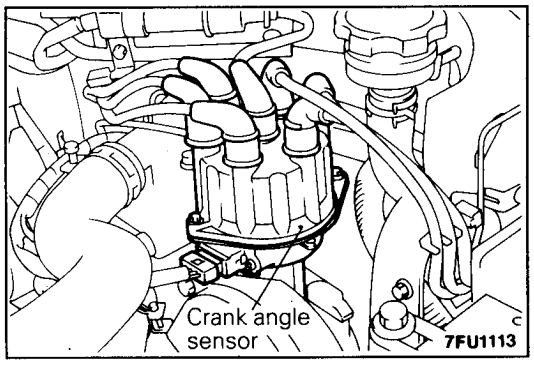
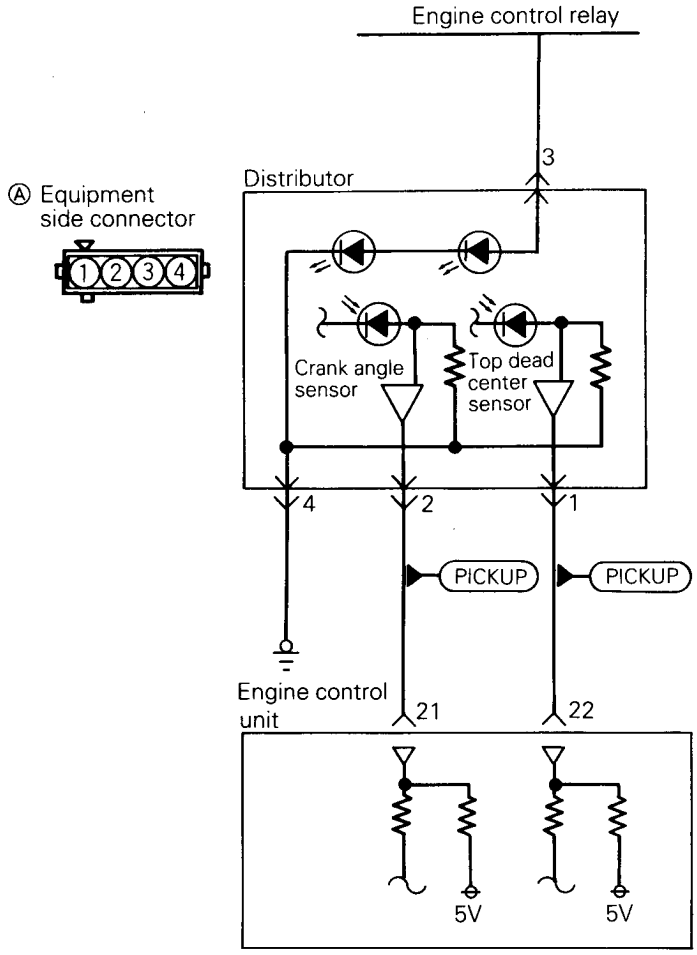
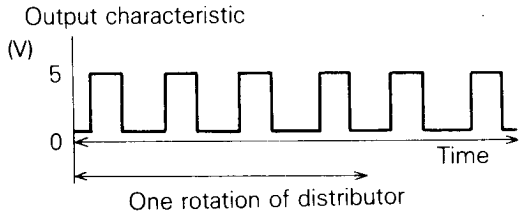
CRANK ANGLE SENSOR







7FU0553

7FU0873

OPERATION

- The crank-angle sensor functions to detect the crank angle (position) of each cylinder, and to convert those data to pulse signals, which are then input to the engine control unit. The engine control unit, based upon those signals, calculates the engine rpm, and also regulates the fuel injection timing and the ignition timing.
- The power for the crank-angle sensor is supplied from the control relay and is earthed to the vehicle body. The crank-angle sensor, by intermitting the flow (to earth) of the 5V voltage applied from the engine control unit, produces pulse signals.

TROUBLESHOOTING HINTS

Hint 1:
If an impact is suddenly felt during driving or the engine suddenly stalls during idling, try shaking the crank-angle sensor during idling. If the engine stalls, the cause may be presumed to be improper or incomplete contact of the crank-angle sensor's connector.
Hint 2:
If the crank-angle sensor output rpm is 0 r/min. during cranking when the engine cannot be started, the cause may be presumed to be a malfunction of the crank-angle sensor or a broken timing belt.
Hint 3:
If the indicated value of the crank-angle sensor output rpm is 0 r/min. during cranking when the engine cannot be started, the cause may be presumed to be a failure of the ignition coil's primary current to intermittently pulse correctly, so a malfunction of the ignition system circuitry, the ignition coil and/or the power transistor is the probable cause.

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Hint 4:
If idling is possible even though the crank-angle sensor indicated r/min. is a deviation from the standard value, the cause is usually a malfunction of something other than the crank-angle sensor.

Examples:
(1) Malfunction of the engine coolant-temperature sensor.
(2) Malfunction of the idle-speed control servo.
(3) Improper adjustment of the standard idling speed.

INSPECTION

Using Multi-use tester (MUT)

Function	Item No.	Data display	Check conditions	Check description	Normal condition
Data reading	22	Cranking r/min.	• Engine is being cranked. • Tachometer connected. (The tachometer is used to check the intermittent pulsation of the ignition coil's primary current.)	Compare the cranking rpm and the rpm indicated by the multi-use tester.	Both agree.

Function	Item No.	Data display	Check conditions	Engine coolant temperature °C (°F)	Standard value r/min.
Data reading	22	Idling r/min.	• Engine: idling • Idle-position switch: ON	When –20 (–4)	1,500–1,700
				When 0 (32)	1,250–1,450
				When 20 (68)	1,050–1,250
				When 40 (104)	850–1,050
				When 80 (176)	600–800

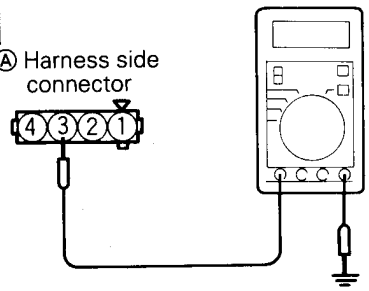
Wave Pattern Inspection Using an Analyzer

Refer to the top dead center sensor section (P.13-44).

HARNESS INSPECTION

1

Ⓐ Harness side connector



7FU0496

Measure the power supply voltage.
- Connector: Disconnected
- Ignition switch: ON

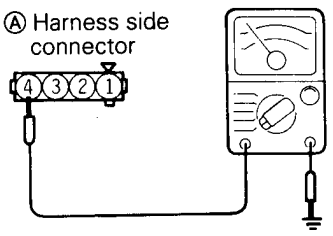
Voltage (V)
SV

OK → 2

NG → Repair the harness. (Ⓐ3–Engine control relay)

2

Ⓐ Harness side connector



7FU0497

Check for continuity of the earth circuit.
- Connector: Disconnected

OK → 3

NG → Repair the harness. (Ⓐ4–Earth)

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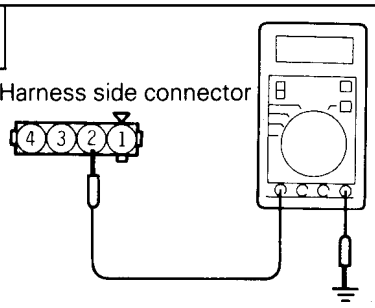
3

Ⓐ Harness side connector



7FU0501

Check the voltage of the output circuit.

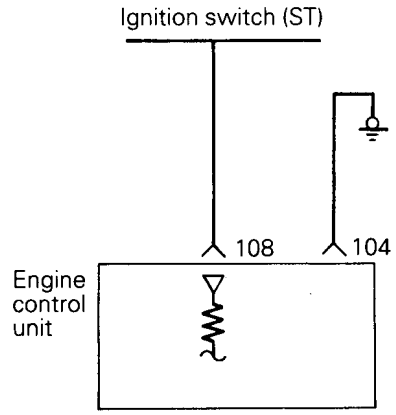
- Connector: Disconnected
- Ignition switch: ON

Voltage (V)
4.8–5.2

OK → STOP

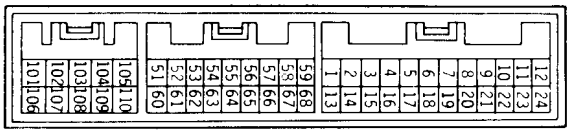
OK → Repair the harness. (Ⓐ2–21)

IGNITION SWITCH-ST [M/T ONLY]



1FU0638

Engine control unit connector



01L0838

OPERATION

- The ignition switch-ST inputs HIGH-level signals to the engine control unit during engine cranking. The engine control unit, based on those signals, regulates fuel injection during starting, etc.
- When the ignition switch is set to START, the battery voltage during engine cranking is, by way of the ignition switch, applied to the engine control unit, and the engine control unit thus detects the fact that the engine is cranking.

INSPECTION

Using Multi-use tester (MUT)

Function	Item No.	Data display	Check conditions	Engine	Normal display
Data reading	18	Switch status	• Ignition switch: ON	Stopped	OFF
				Cranking	ON

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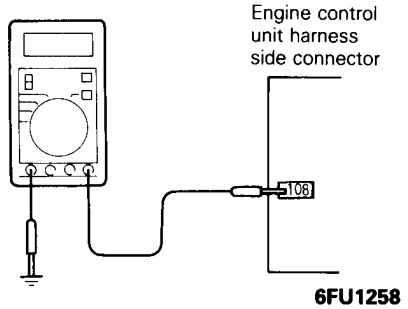
HARNESS INSPECTION

1



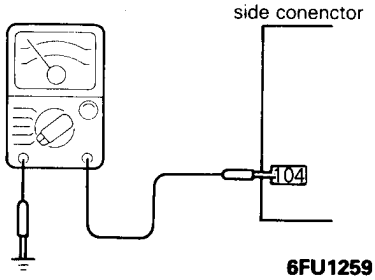
Measure the input voltage to the engine control unit.
- Engine control unit connector: Disconnected
- Ignition switch: START

Voltage (V)
8 or higher

OK → 2

NG → Repair the harness. (108 – Ignicion switch)

2



Check for continuity of the earth circuit.
- Engine control unit connector: Disconnected

OK → STOP

NG → Repair the harness (104–Earth)

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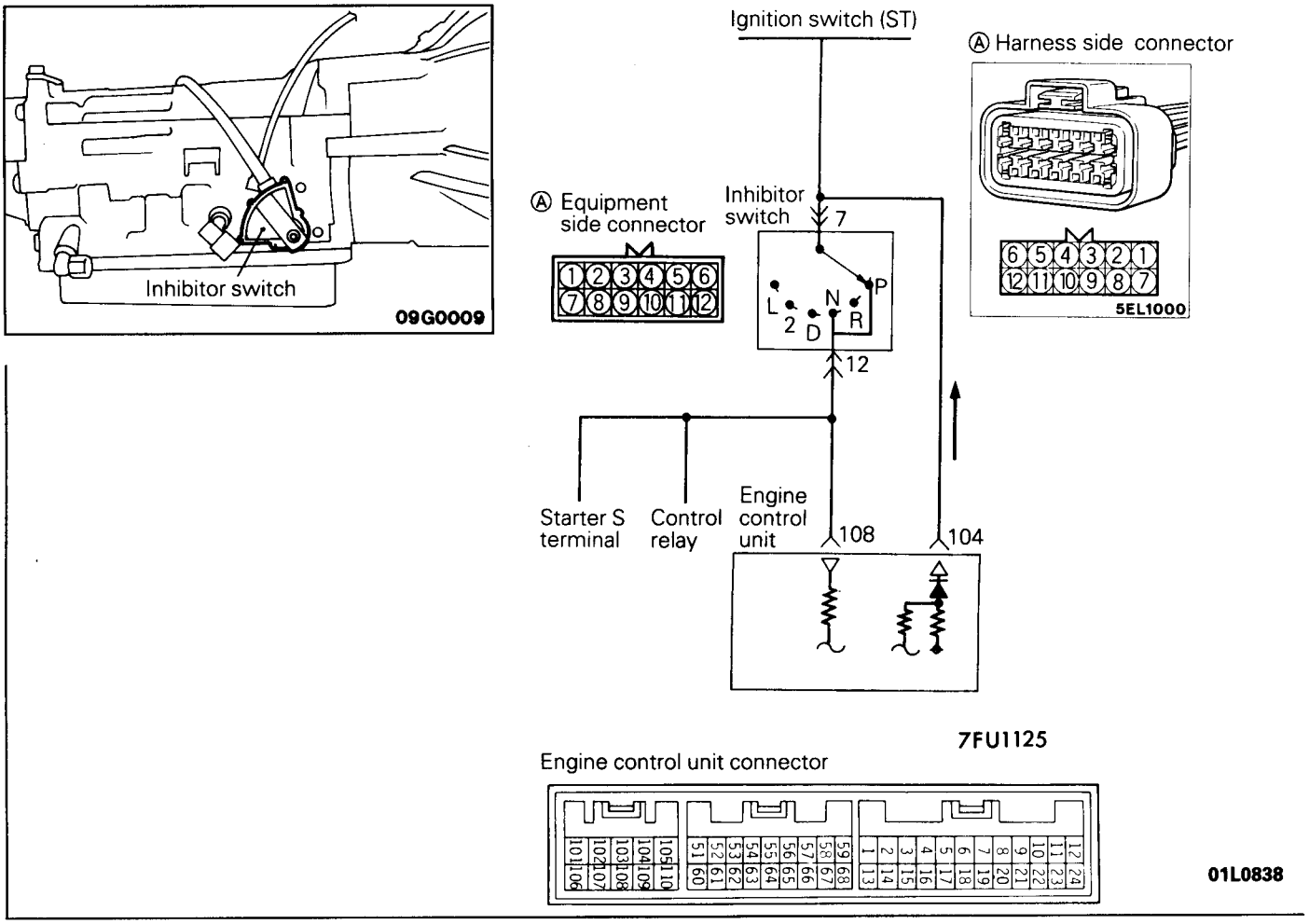
IGNITION SWITCH-ST and INHIBITOR SWITCH [A/T only]



OPERATION

- The ignition switch-ST inputs HIGH-level signals to the engine control unit during engine cranking. The engine control unit, based on those signals, regulates fuel injection during starting, etc.
- When the ignition switch is set to START, the battery voltage during engine cranking is, by way of the ignition switch, and the inhibitor switch, applied to the engine control unit, and the engine control unit thus detects the fact that the engine is cranking. Note that battery voltage is not applied to the engine control unit if the position of the select lever is other than the "P" or "N" range.
- The inhibitor switch functions to convert the voltage to HIGH level or LOW level depending upon whether the select lever is at the "P" or "N" range or is at some position other than the "P" or "N" range, and inputs the result to the engine control unit. the engine control unit, based upon those signals, then regulates the operation of the idle-speed control servo.
- Battery voltage within the engine control unit is applied, by way of the resistance, to the inhibitor switch. When the select lever is set to the "P" or "N" range, contunuity is created, via the starter motor, between the engine control unit's inhibitor switch terminal and earth, and the terminal voltage becomes LOW level.

TROUBLESHOOTING HINTS

If the output of the inhibitor switch is abnormal even though the results of the checking of the inhibitor switch harness and of the component itself are normal, it is probable that the cause is improper adjustment of the control cable.

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INSPECTION
Using Multi-use tester (MUT)

Ignition switch – ST

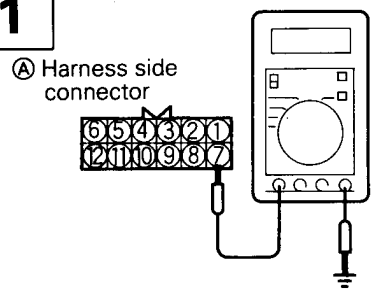
Function	Item No.	Data display	Check conditions	Engine	Normal display
Data reading	18	Switch status	• Ignition switch: ON	Stopped	OFF
				Cranking	ON

Inhibitor switch

Function	Item No.	Data display	Check conditions	Select lever position	Normal display
Data reading	29	Shift position	• Ignition switch: ON	P or N	P or N
				D, 2, L or R	D, 2, L or R

HARNESS INSPECTION

1



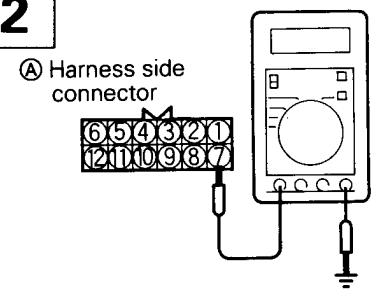
Measure the power supply voltage of the inhibitor switch.
- Engine control unit connector: Disconnected
- Inhibitor switch connector: Disconnected
- Ignition switch: START

Voltage (V)
5V

OK → 2 Check the power supply circuit.

NG →

2



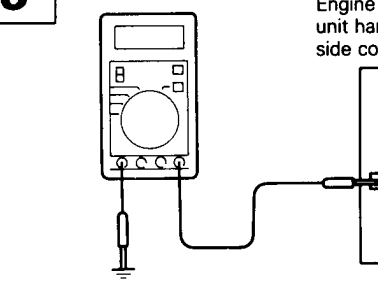
Measure the inhibitor switch terminal input voltage.
- Engine control unit connector: Connected
- Inhibitor switch connector: Disconnected
- Ignition switch:ON

Voltage (V)
5V

OK → 3 Repair the harness. (Ⓐ7–104)

NG →

3



Measure the input voltage of engine control unit
- Engine control unit connector: Disconnected
- Inhibitor switch connector: Connected
- Select lever: P range
- Ignition switch: START

Voltage (V)
8 or higher

OK → STOP Repair the harness. (Ⓐ12–108)

NG →

INHIBITOR SWITCH INSPECTION

Refer to GROUP 23 – Service Adjustment Procedures.

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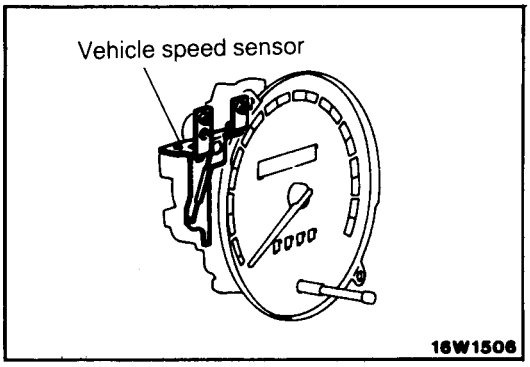
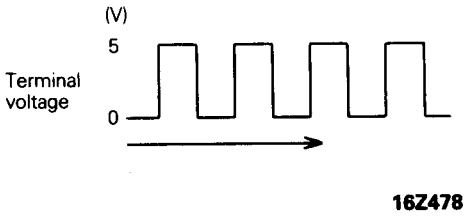
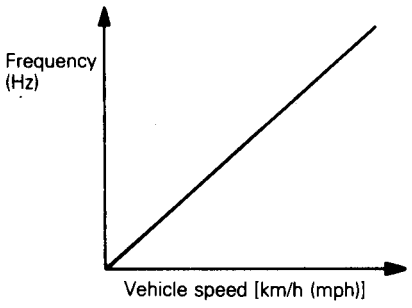
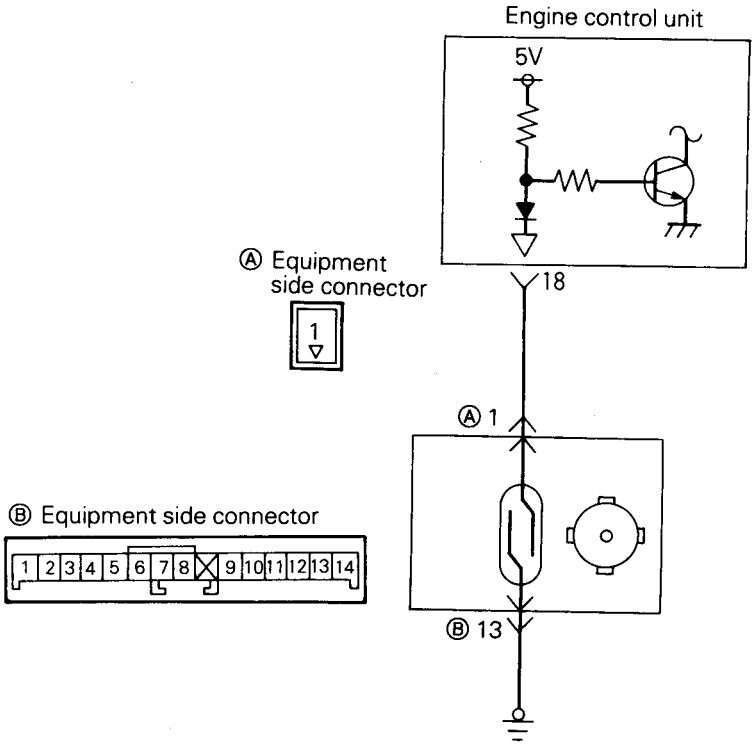
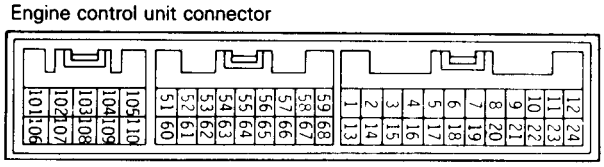
VEHICLE SPEED SENSOR











OPERATION

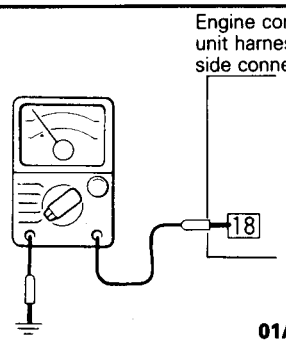
- The vehicle-speed sensor is incorporated within the speedometer; it converts vehicle-speed data to pulse signals and inputs those signals to the engine control unit. The engine control unit, based upon those signals, regulates the idle-speed servo, etc.
- The vehicle-speed sensor, by intermitting by the lead switch the flow (to earth) of the approximately 5V voltage applied from the engine control unit, produces vehicle-speed signals.

TROUBLESHOOTING HINTS

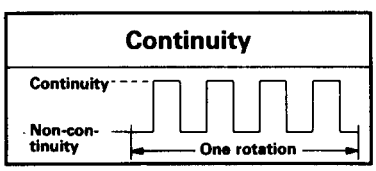
If there is damaged or disconnected wiring, or a short-circuit, of the vehicle-speed sensor signal circuit, the engine may stall when the vehicle speed is reduced and the vehicle is stopped.

HARNESS INSPECTION

1



Check the vehicle speed sensor output circuit for continuity.
- Engine control unit connector: Disconnected.
- Move the vehicle.



OK → STOP

NG → 2

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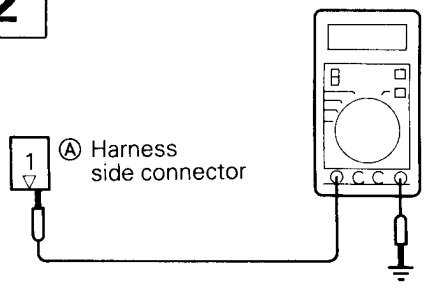
2



7FU1128

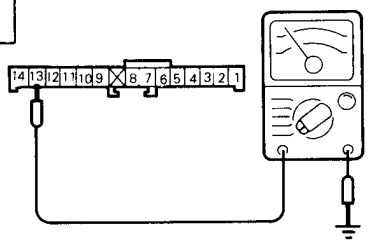
Measure the power supply voltage of the vehicle speed sensor.
- Connector: Disconnected
- Ignition switch: ON

Voltage (V)
4.5 – 4.9

OK → 3

Repair the harness. (Ⓐ 1 – 18)

3



7FU1129

Check for continuity of the earth circuit.
- Connector: Disconnected

OK → STOP

Repair the harness. (Ⓐ13 – Earth)

SENSOR INSPECTION

Refer to GROUP 54 – Meters and Gauges

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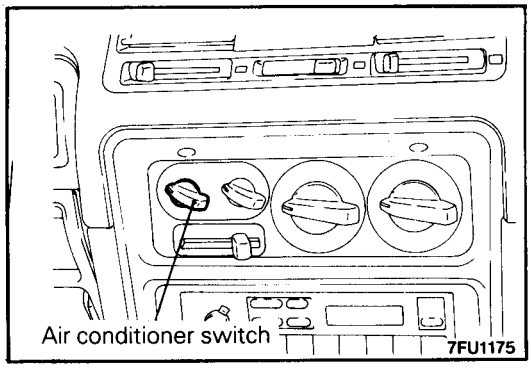
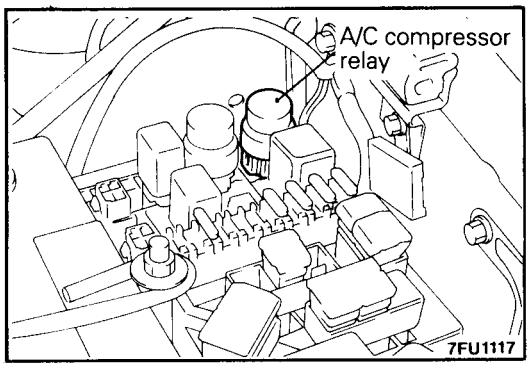
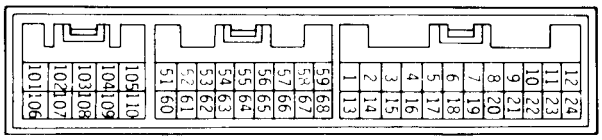
AIR CONDITIONER SWITCH AND POWER RELAY

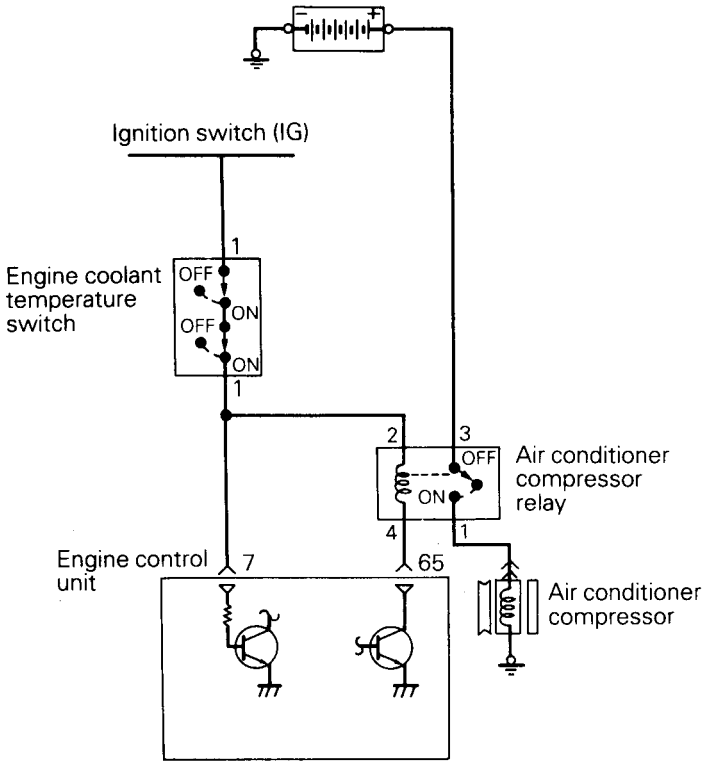




Engine control unit connector



01L0838



7FU0821

OPERATION

- The air conditioner switch applies battery voltage to the engine control unit when the air conditioner is switched ON.
- When the air conditioner signals are input, the engine control unit activates the idle-speed control servo, and also switches ON the power transistor. As a result, current flows to the power relay coil and the relay switch is switched ON; the air-conditioner compressor's magnetic clutch is activated.

TROUBLESHOOTING HINTS

If the air conditioner compressor's magnetic clutch is not activated when the air conditioner switch is switched ON during idling, it is probable that the cause is a malfunction of the air conditioner control system.

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INSPECTION

Using Multi-use tester (MUT)
Air conditioner switch

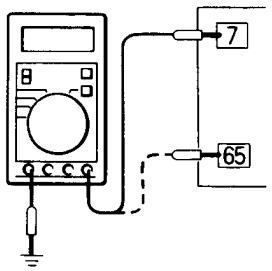
Function	Item No.	Data display	Check conditions	Air conditioner switch	Normal display
Data reading	28	Switch status	• Engine idling (The air conditioner compressor should be activated when the air conditioner switch is switched ON.)	OFF	OFF
				ON	ON

Air conditioner power relay

Function	Item No.	Data display	Check conditions	Air conditioner switch	Normal display
Data reading	49	Air conditioner power relay status	• Engine: idling after warm up	OFF	OFF (Compressor clutch non-activation)
				ON	ON (Compressor clutch activation)

HARNESS INSPECTION

1



01R0863

Measure the power supply voltage of the air conditioner circuit.
- Engine control unit connector: Disconnect
- Ignition switch: ON
- Air conditioner switch: ON

Voltage (V)
5V

OK → STOP

NG → Check the Air conditioner circuit.

AIR CONDITIONER INSPECTION

Refer to GROUP 55.

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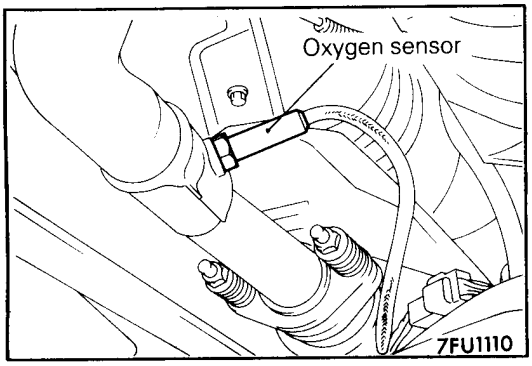
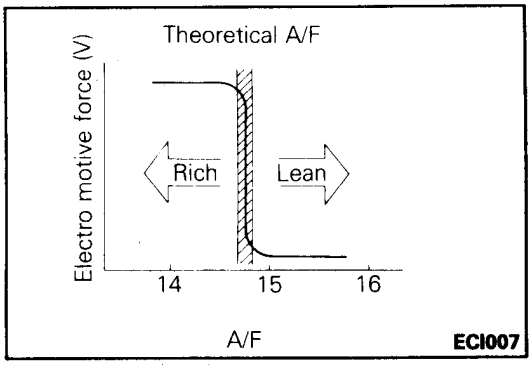
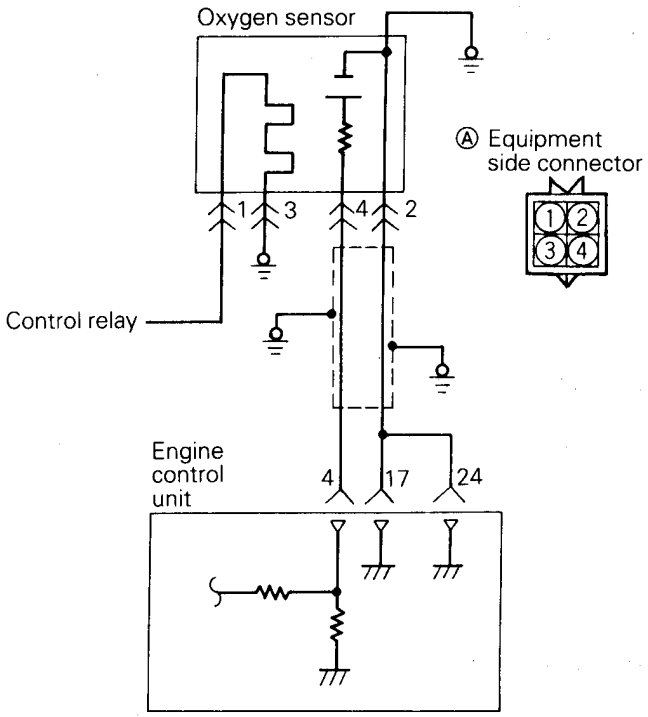
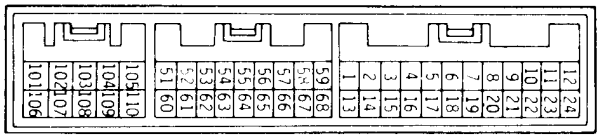
OXYGEN SENSOR







Engine control unit connector



01L0838

OPERATION

- The oxygen sensor functions to detect the concentration of oxygen in the exhaust gas; it converts those data to voltage, and inputs the resulting signals to the engine control unit.
- If the air/fuel mixture ratio is richer than the theoretical air/fuel mixture ratio (i.e., if the concentration of oxygen in the exhaust gas is sparse), a voltage of approximately 1V is output; if the air/fuel mixture ratio in leaner than the theoretical air/fuel mixture ratio (i.e., if the concentration is dense), a voltage of approximately 0V is output.
- The engine control unit, based upon those signals, regulates the amount of fuel injection so that the air/fuel mixture ratio becomes the theoretical air-/fuel mixture ratio.
- Battery power supply is applied, by way of the control relay, to the oxygen sensor heater. As a result, the sensor element is heated by the heater, so that the oxygen sensor shows excellent response even if the temperature of the exhaust gas is low.

TROUBLESHOOTING HINTS

Hint 1:
The exhaust gas purification performance will worsen if there is a malfunction of the oxygen sensor.
Hint 2:
If the oxygen sensor output voltage deviates from the standard value even though the results of the checking of the oxygen sensor are normal, the cause is probably a malfunction of a component related to air/fuel mixture ratio control.

[Examples]
(1) Malfunction of an injector.
(2) Air leakage into the intake manifold from a leaking gasket.
(3) Malfunction of the air-flow sensor, the intake air temperature sensor, the barometric-pressure sensor, or the engine coolant temperature sensor.

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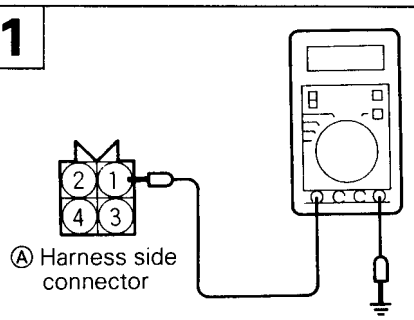
INSPECTION

Using Multi-use tester (MUT)

Function	Item No.	Data display	Check conditions	Engine condition r/min.	Standard value mV
Data reading	11	Sensor detection voltage	• Engine: warm-up (Make the mixture lean by engine speed reducion, and rich by racing.)	When sudden deceleration from 4,000	200 or lower
				When engine is suddenly raced	600–1,000
			• Engine: warm up using the oxygen sensor signal, check the air/fuel mixture ratio, and also check the condition of control by the engine control unit	700 (Idling)	400 or lower ↕ (changes) 600–1,000
				2,000	

HARNESS INSPECTION

1



7FU1131

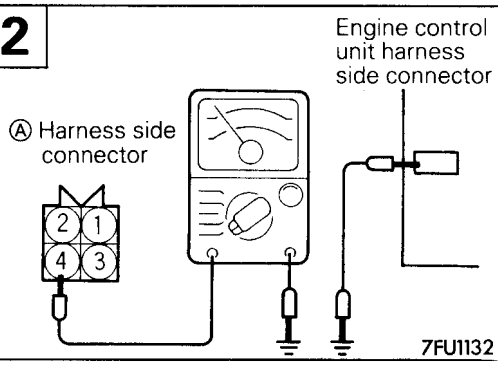
Measure the power supply voltage of the oxygen sensor.
- Connector: Disconnected
- Ignition switch: ON

Voltage (V)
5V

OK → 2

NG → Repair the harness. (Ⓐ1–Engine control ralay)

2



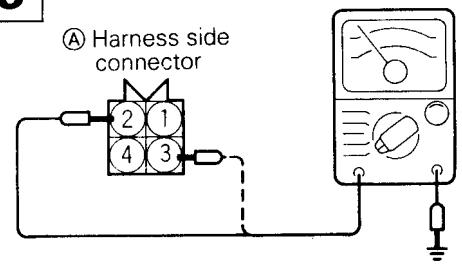
7FU1132

Check for an open-circuit, or a short-circuit to earth, between the engine control unit and the oxygen sensor.
- Oxygen sensor connector: Disconnected
- Engine control unit connector: Disconnected

OK → 3

NG → Repair the harness. (Ⓐ4–4)

3



7FU1133

Check for continuity of the earth circuit.
- Connector: Disconnected

OK → STOP

NG → Repair the harness. (Ⓐ2–17, 24) (Ⓐ3–Earth)

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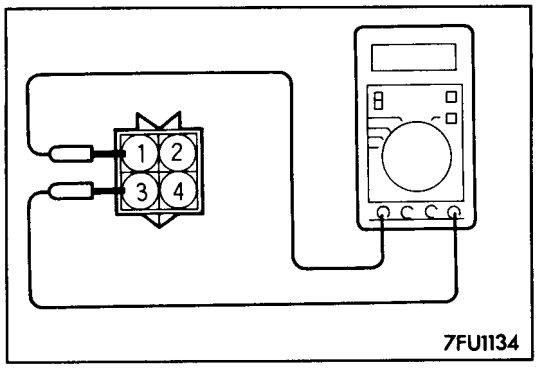
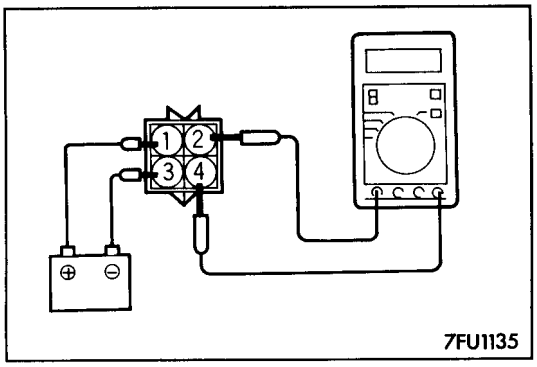


SENSOR INSPECTION

(1) Disconnect the oxygen sensor connector.
(2) Check that there is continuity [approx. 20 Ω at 20°C (68°F)] between oxygen sensor connector terminal ① and terminal ③.
(3) If there is no continuity, replace the oxygen sensor.



(4) Warm the engine until the engine coolant temperature reaches 80°C (176°F) or more.
(5) Use the jumper leads to connect the oxygen sensor terminal ① (connect (+) terminal) and terminal ③ (connect (–) terminal) to the battery (+) and (–) terminals respectively.

Caution
Be careful when connecting the jumper leads, as connecting the terminals incorrectly will damage the oxygen sensor.

(6) Connect a digital-type voltmeter to terminal ② and terminal ④.
(7) While repeatedly racing the engine, measure the oxygen sensor output voltage.

Engine	Oxygen sensor output voltage	Notes
When racing the engine	0.6–1.0V	When the air/fuel mixture ratio is enriched by racing the engine repeatedly, a normal oxygen sensor will output a voltage of 0.6–1.0V.

NOTE
For removal and installation of the oxygen sensor, refer to GROUP 15 – Exhaust Pipe, Main Muffler and Catalytic Converter.

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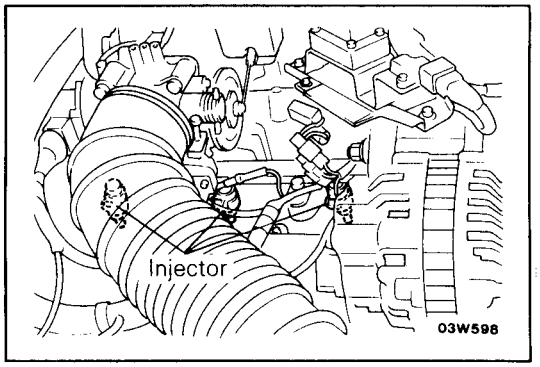
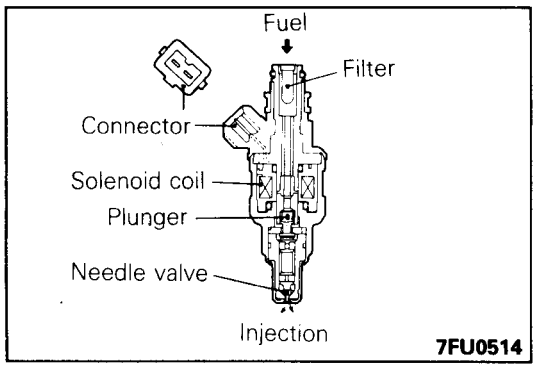
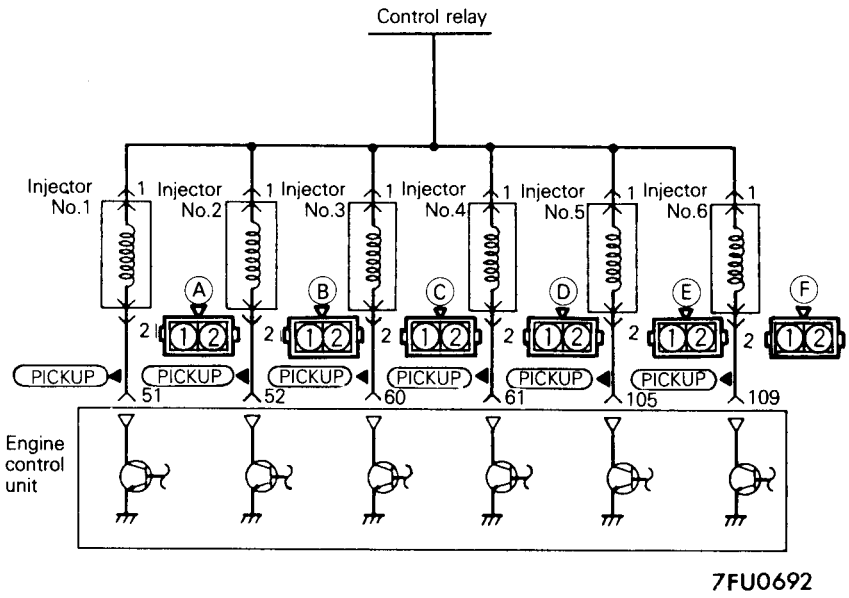
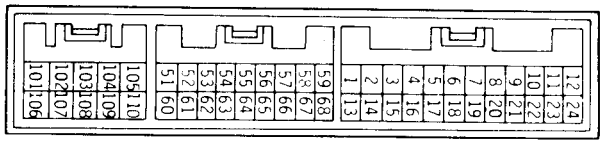
INJECTORS







Engine control unit connector



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OPERATION

- The iniectors are electromagnetic-valve-equipped injection nozzles that function to inject fuel based upon injection signals from the engine control unit.
- Because the surface area of the injection ports is fixed and because the pressure of the fuel relative to the pressure within the manifold is also regulates to a fixed pressure, the amount of fuel injection by injectors is determined by the length of time that the needle valve is open, or, in other words, by the length of time of current flow to the solenoid coil.
- Battery power supply is supplied, by way of the control relay, to the injectors. When the engine control unit switches ON the power transistor within the unit and current flows to the solenoid coil, the injectors open and fuel is injected.

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TROUBLESHOOTING HINTS

Hint 1:
If there is a problem with starting while the engine is warm, perform the combustion test and check for leakage of the injectors.
Hint 2:
If the engine can't be started, and the injectors are not activated during cranking, the cause is probably a malfunction such as described below, not with the injectors.
(1) Malfunction of the circuit for supply of power to the engine control unit, or of the earth circuit.
(2) Malfunction of the control relay.
(3) Malfunction of the crank-angle sensor and/or the top dead center sensor.

Hint 3:
If there is a cylinder for which the idling condition does not change when, during idling, the fuel injection of the injectors is cut off in sequence, check that cylinder as described below.
(1) Check the injector and harness.
(2) Check the spark plugs and the high-tension cable.
(3) Check the compression pressure.

Hint 4:
If the injector activation time deviates from the standard value even though the results of the checking of the injector's harness and of the injector itself are normal, the cause may be presumed to be one of the following.
(1) Incomplete combustion within the cylinder.
(Malfunction of the spark plugs, the ignition coil, the compression pressure, etc.)
(2) Increased engine resistance.

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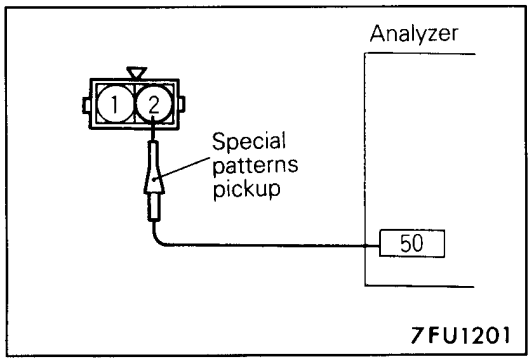
INSPECTION

Using Multi-use tester (MUT)

Function	Item No.	Data display	Check conditions	Engine coolant temperature C° (°F)	Standard value ms
Data reading	41	Activation time*1	Engine cranking	When 0 (32)*2	Approx. 14
				When 20 (68)	Approx. 40
				When 80 (176)	Approx. 9

Function	Item No.	Data display	Check conditions	Engine condition r/min.	Standard value ms
Data reading	41	Activation time*3	• Engine coolant temp: 85–95°C (185–205°F) • Lights and accessories: OFF • Transmission: neutral (P range for vehicles with A/T) • Steering wheel: neutral position	700 (idling) r/min.	2.7–3.2
				2,000	2.6–3.1
				When raced suddenly	Increases.

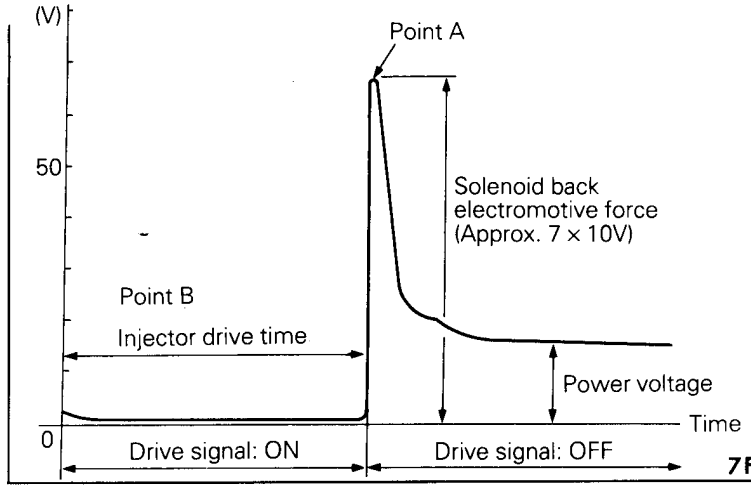
NOTE
*1: Indicates the injector-activation time when the power source voltage is 11V and the cranking speed is 250 rpm or less.
*2: At a coolant temperature of 0°C (32°F), there is synchromous injection for all six cylinders.
*3: For a new vehicle [driven approximately 500 km (300 miles) or less] the injector-activation may be about ten percent linger then indicated above.



Wave Pattern Inspection Using an Analyzer

(1) Disconnect the injector connector, and connect the special tool (test harness: MB991348) in between. (The power side and the ECU side terminals should both be connected.)
(2) Connect the analyzer special patterns pickup to the ECU test harness clip.

Standard wave pattern



Observation conditions

Function	Special patterns
Pattern height	Variable
Variable knob Pattern selector	Display
Engine r/min.	Idle r/min. (700 r/min.)

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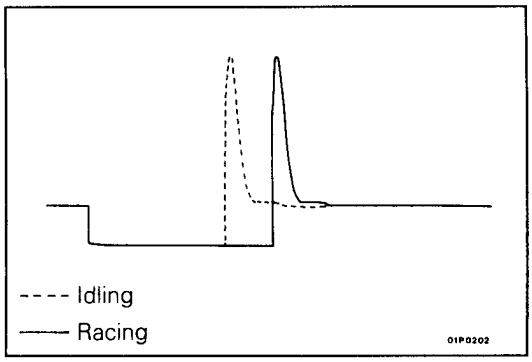
Wave pattern observation points

Point A: Height of back electromotive force in the solenoid coil

Contrast with standard wave pattern	Probable cause
Solenoid coil back electromotive force is low or doesn't appear at all.	Short in the injector solenoid

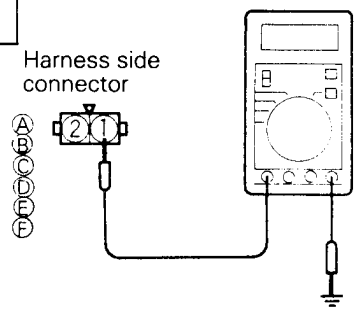
Point B: Injector drive time



- The injector drive timing will synchronized with the multi-use tester display.
- When the engine is suddenly raced, the drive time will be greatly extended at first, but the drive time will soon match the engine speed.

HARNESS INSPECTION

1



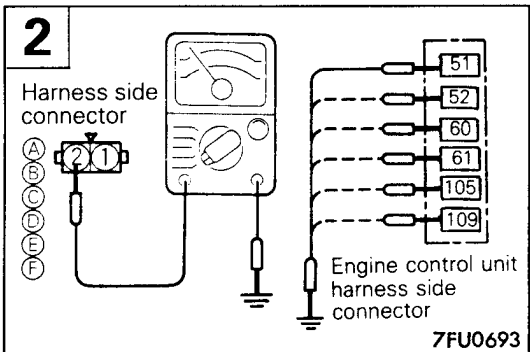
Measure the power supply voltage of the injector.
- Connector: Disconnected
- Ignition switch: ON

Voltage (V)
5V

OK → 2

NO → Repair the harness. (A B C D E F 1 –Engine control relay) Check the power supply.

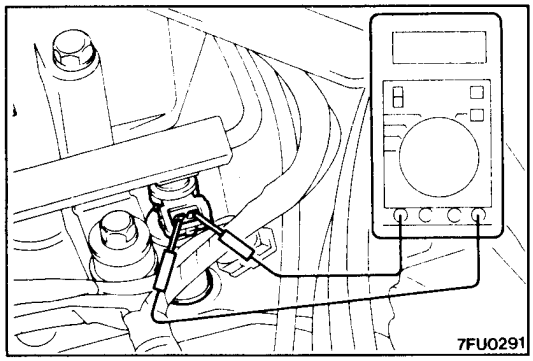
2



Check for an open-circuit, or a short-circuit to earth, between the engine control unit and the injector.
- Engine control unit connector: Disconnected
- Injector connector: Disconnected

OK → STOP

NO → Repair the harness. (A B C D E F 2 – 51 52 60 61 105 109)



ACTUATOR INSPECTION

Measuring Resistance Between Terminals

(1) Disconnect the connector for the injectors.
(2) Measure the resistance between terminals.
Standard value: 13–16 Ω at 20°C (68°F)
(3) Connect the connector for the injectors.

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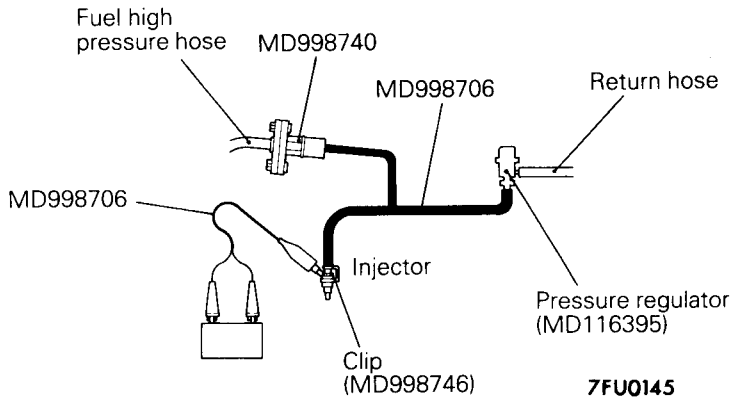
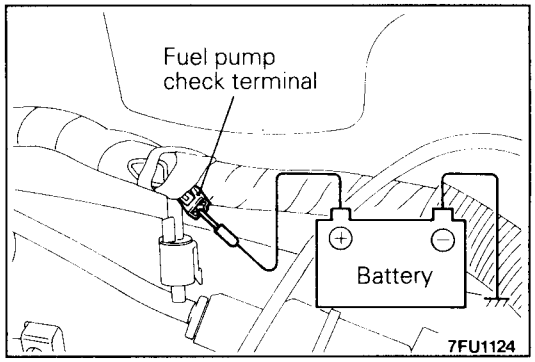
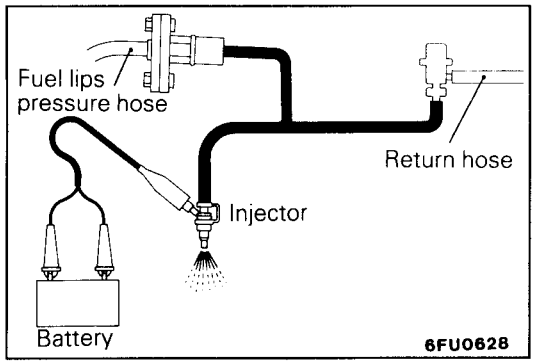
Checking the Injection Condition

(1) Following the steps below, bleed out the residual pressure within the fuel pipe line to prevent flow of the fuel. (Refer to P. 13-16.)
(2) Remove the injector.
(3) Arrange the special tool (injector test set), adaptor, fuel pressure regulator and clips as shown in the illustration below.

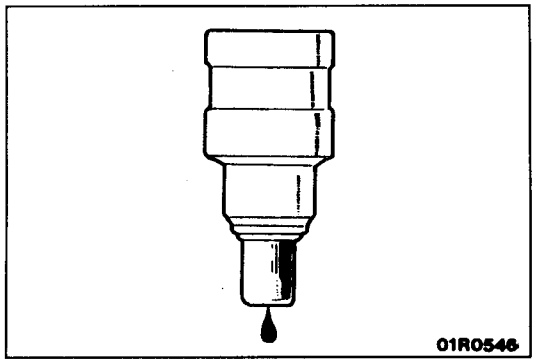




(4) Connect the battery's negative (–) terminal.
(5) Apply battery voltage to the fuel pump check terminal and activate the fuel pump.



(6) Activate the injector and check the atomized spray condition of the fuel. The condition can be considered satisfactory unless it is extremely poor.



(7) Stop the actuation of the injector, and check for leakage from the injector's nozzle.

Standard value: 1 drop or less per minute

(8) Activate the injector without activating the fuel pump; then, when the spray emission of fuel from the injector stops. disconnect the special tool and restore it to its original condition.

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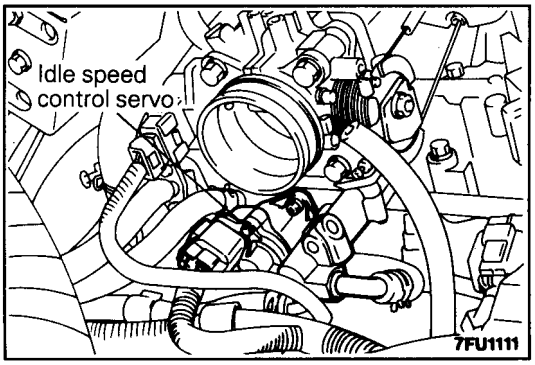
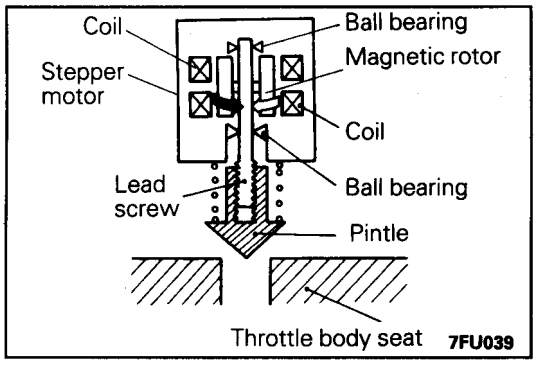
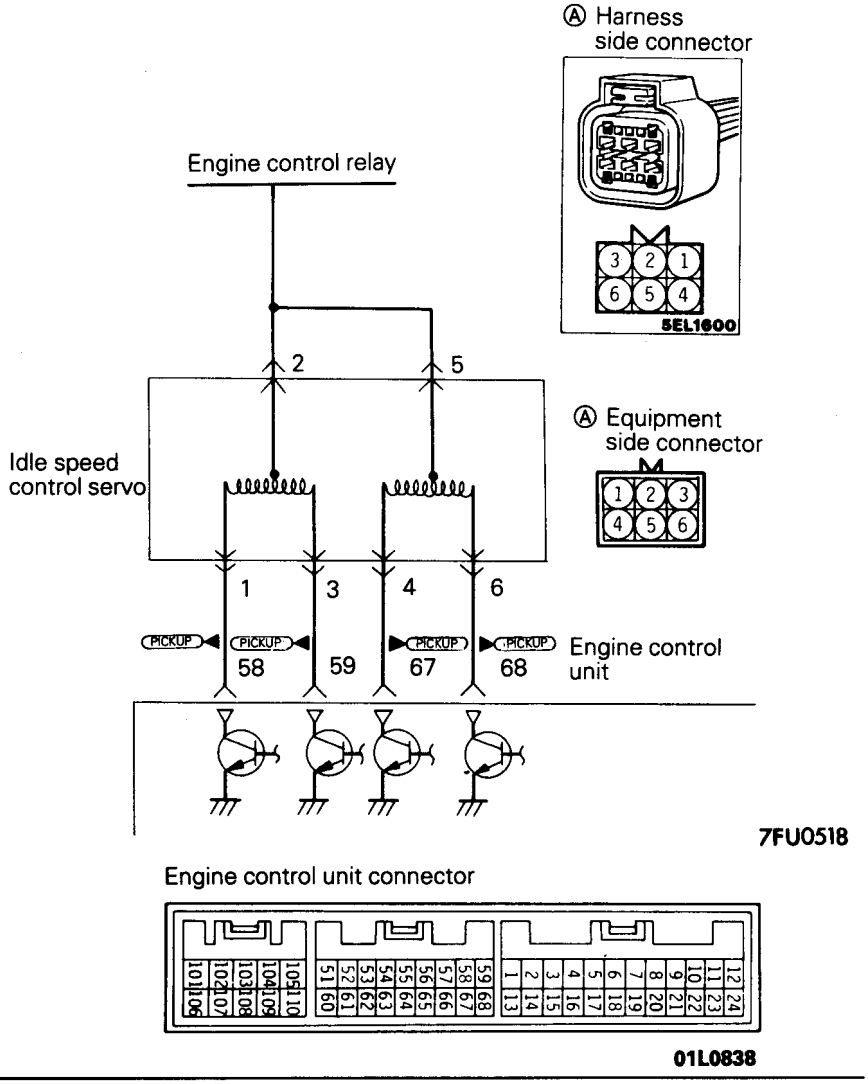
IDLE SPEED CONTROL SERVO (STEPPER MOTOR)







Engine control unit connector

01L0838

OPERATION

- The amount of air taken in during idling is regulated by the opening and closing of the servo valve located in the air passage that that bypasses the throttle valve.
- The servp valve is opened or closed by the activation of the stepper motor (incorporated within the idle-speed control servo) in the forward or reverse direction.
- Battery power supply is supplied, by way of the control relay, to the coil of the stepper motor. The engine control unit switches ON the power transistors (located within the engine control unit) in sequential order, and, when current flows to the stepper motor coil, the stepper motor is activated in the forward or reverse direction.

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TROUBLESHOOTING HINTS

Hint 1:
If the number stepper motor steps increases to 100–120 steps or decreases to 0 step, the cause may be presumed to be a malfunction of the stepper moto or damaged or disconnected wiring of the harness.

Hint 2:
If the number of stepper motor steps deviates from the standard value even through the results of the checking of the harness of the idle-speed control servo and of the component itself indicate no abnormal condition, the cause may be presumed to be one of the following.
(1) Improper adjustment of the standard idling speed.
(2) Depossits adhered to the throttle valve.
(3) Leakage of air into the intake manifold from a gasket gap, etc.
(4) Incomplete combustion within the cylinder. (Malfunction of the spark plugs, the ignition coil, the injectors, the compression pressure, etc.)

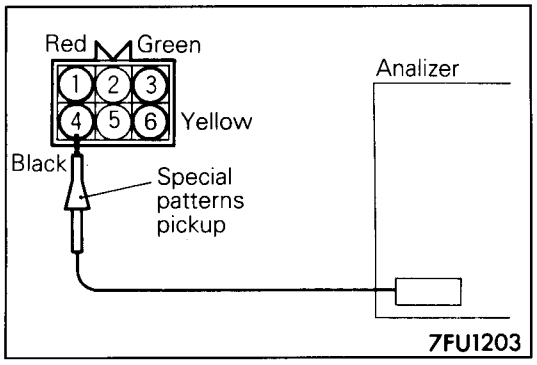
INSPECTION

Using Multi-use tester (MUT)

Function	Item No.	Data display	Check conditions	Load conditions	Standard value STP
Data reading	45	Stepper motor steps	• Engine coolant temperature: 85–95°C (185–205°F) • Lights and accessories: OFF • Transmission: neutral (P range for vehicles with A/T) • Steering wheel: neutral position • Idle-position switch: ON (The compressor clutch should be actived when the air conditioner switch is switched ON.) • Engine: idling	• Air conditioner switch: OFF	2–12
				• Air conditioner switch: ON	30–70
				• Air conditioner switch: ON • Selector lever: shift to D range	20–60

NOTE
When the vehicle is new [driven approximately 500 km (300 miles) or less] the number of steps may be about 30 steps greater than the standard value indicated above.

Caution
When the select lever is shifted to the "D" range, the brakes must be used to prevent the vehicle from moving forward.



Wave Pattern Inspection Using an Analyzer

Observation method

(1) Disconnect the stepper motor connector, and connect the special tool (test harness: MB998463) in between.
(2) Connect the analyzer special patterns pickup to the stepper motor-side connector terminal ① (red clip on the special tool), terminal ③ (green clip), terminal ④ (black clip) and terminal ⑥ (yellow clip) respectively.

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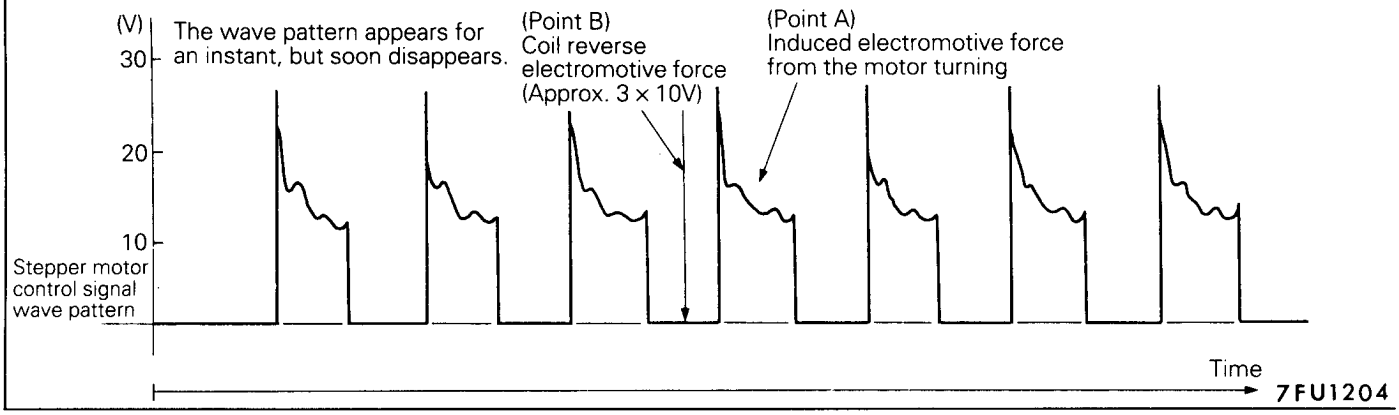
Standard wave pattern

Observation conditions

Function	Special patterns
Pattern height	High
Pattern selector	Display
Engine condition	Turn the ignition switch from OFF to ON (without starting the engine).
	While the engine is idling, turn the air conditioner switch to ON.
	Immediately after starting the warm engine (approx. 1 minute).



Wave pattern observation points

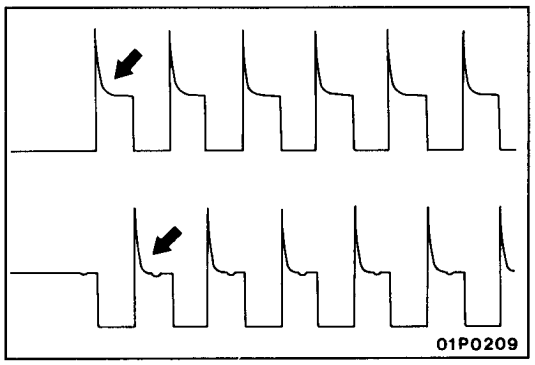
Check that the standard wave pattern appears when the stepper motor is operating.

(Point A): Presence or absence of induced electromotive force from the motor turning. (Refer to the abnormal wave pattern.)

Contrast with standard wave pattern	Probable cause
Induced electromotive force does not appear or is extremely small.	Motor is malfunctioning

(Point B): Height of coil reverse electromotive force

Contrast with standard wave pattern	Probable cause
Coil reverse electromotive force does not appear or is extremely small.	Short in the coil



Abnormal wave pattern

Cause of problem

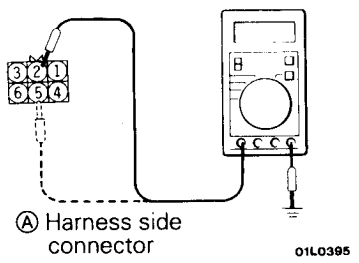
Motor is malfunctioning. (Motor is not operating.)

Wave pattern characteristics

Induced electromotive force from the motor turning does not appear.

HARNESS INSPECTION

1



Measure the power supply voltage of idle speed control servo.

- Idle speed control servo connector: Disconnected
- Ignition switch: ON

Voltage (V)
5V

OK → 2

NG → Repair the harness. (Engine control relay–Ⓐ2 Engine control relay–Ⓐ5)

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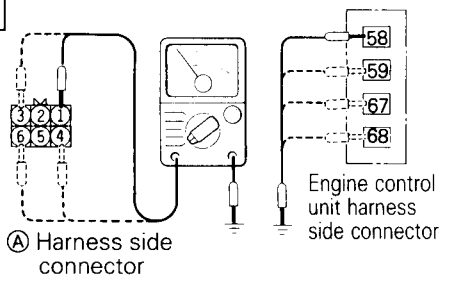
2

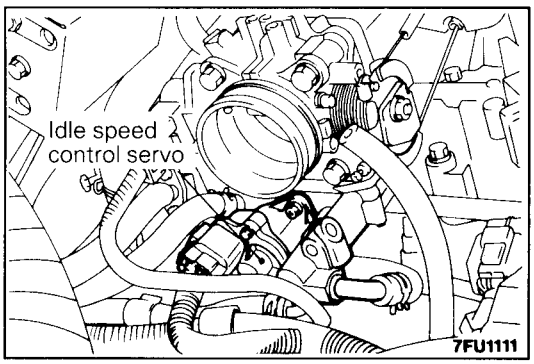


Check for an open-circuit, or a short-circuit to earth, between the engine control unit and idle speed control servo.

- Engine control unit connector: Disconnected
- Idle speed control servo connector: Disconnected

OK → STOP

NG → Repair then harness. (Ⓐ1–58, Ⓐ3–59, Ⓐ4–67, Ⓐ6–68)

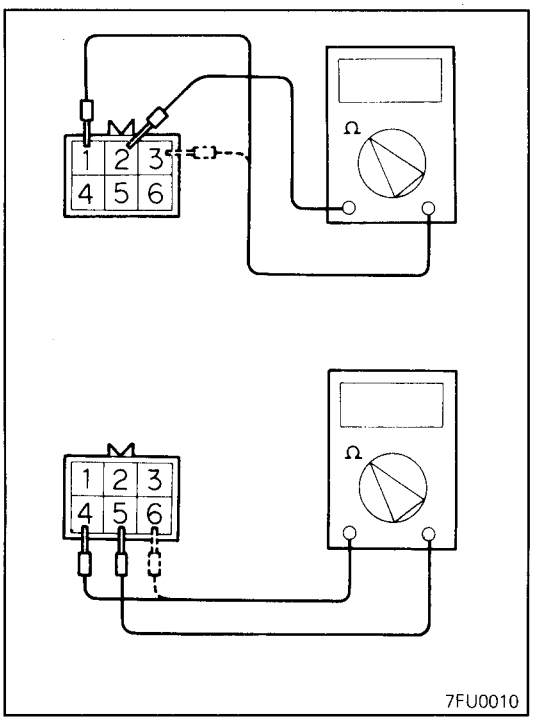


ACTUATOR INSPECTION

Checking Operation Sound

(1) Check that when the ignition switch is placed in the ON position (the engine not started), the operating sound of the stepper motor can be heard over the idle speed control servo.

(2) If no operating sound can be heard, check the stepper motor drive circuit. (If the circuit is good, a defective stepper motor or engine control unit is suspected.)



Checking the Coil Resistance

(1) Disconnect the idle speed control servo connector and connect the special tool (test harness).

(2) Measure the resistance between terminal ② (White clip of the special tool) of the connector at the idle speed control servo side and terminal ① (red clip) or terminal ③ (blue clip).

Standard value: 28–33 Ω [at 20°C (68°F)]

(3) Measure the resistance between terminal ⑤ (green clip of the special tool) of the connector at the idle speed control servo side and terminal ⑥ (yellow clip) or terminal ④ (black clip).

Standard value: 28–33 Ω [AT 20°C (68°F]

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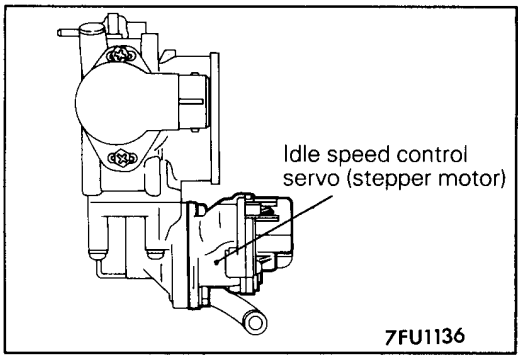
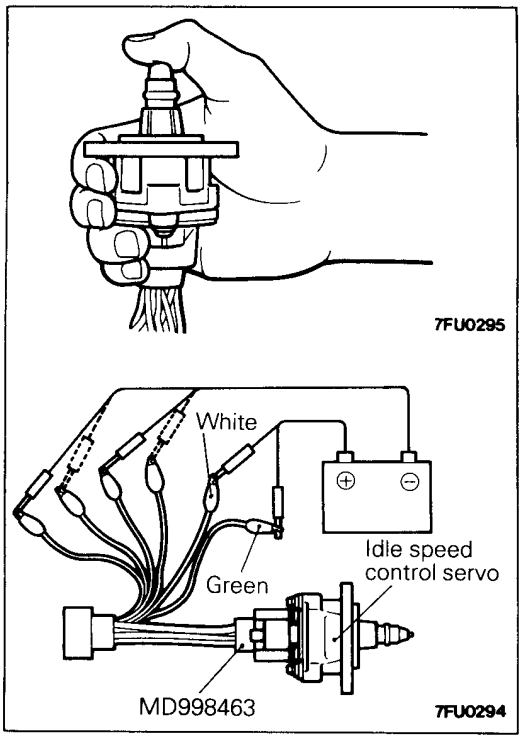


Checking the operation

(1) Remove the throttle body.
(2) Remove the stepper motor.



(3) Connect the special tool (test harness) to the Idle speed control servo connector.
(4) Connect the positive ⊕ terminal of a power source (approx 6V) to the white clip or the green clip.
(5) Holding the idle speed control servo as shown in the illustration, connect the negative ⊖ terminal of the power source to each clip in the sequence described below, and check whether or not there is vibration (a feeling of very slight shaking of the stepper motor) as a result of activation of the stepper motor.
    ① Connect the negative ⊖ terminal of the power source to the red and black clips.
    ② Connect the negative ⊖ terminal of the power source to the blue and black clips.
    ③ Connect the negative ⊖ terminal of the power source to the blue and yellow clips.
    ④ Connect the negative ⊖ terminal of the power source to the red and yellow clips.
    ⑤ Connect the negative ⊖ terminal of the power source to the red and black clips.
    ⑥ Repeat the test in the reverse (⑤–①) sequence.
(6) If, as a result of this test, vibration is felt, the stepper motor can be considered to be normal.

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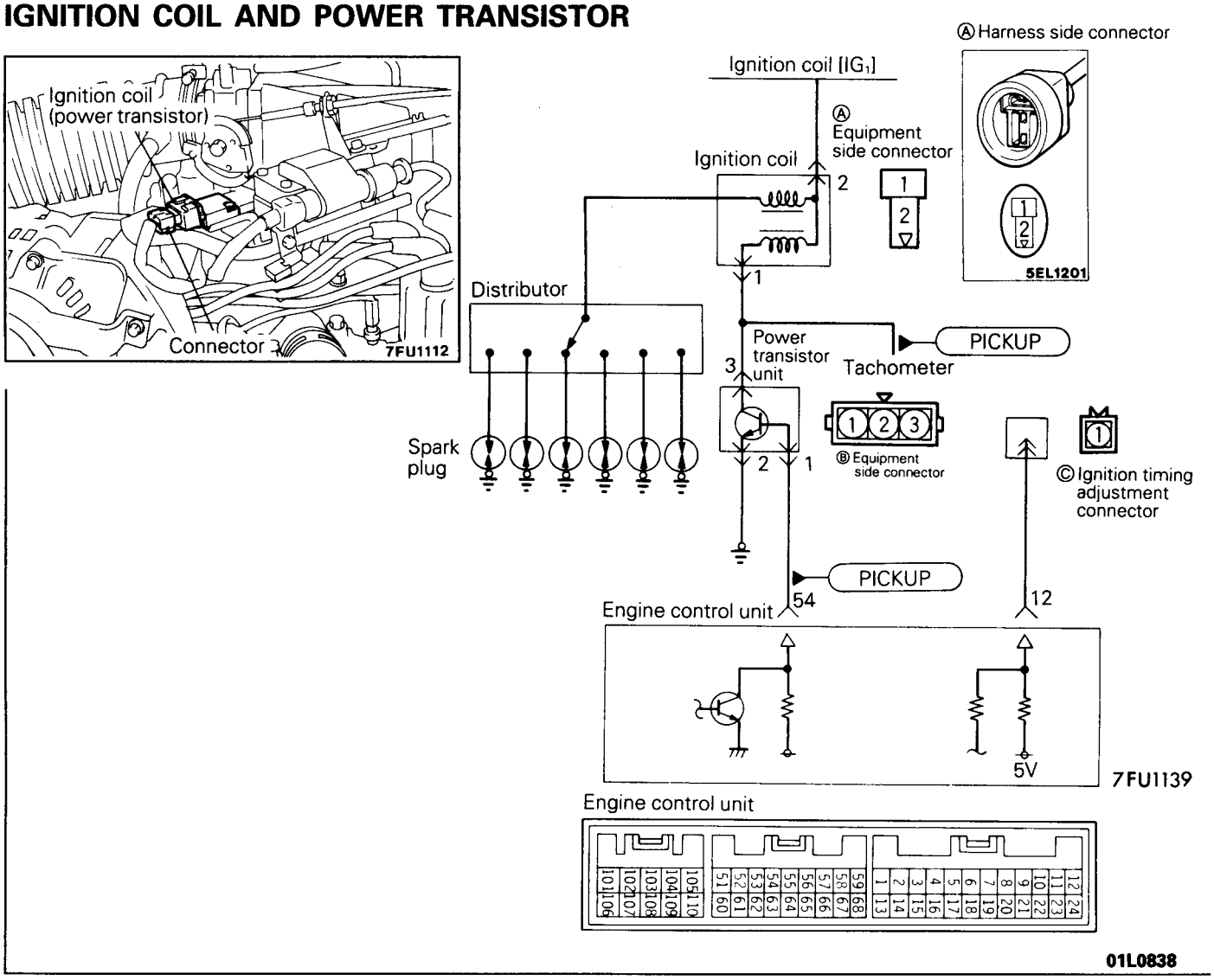
IGNITION COIL AND POWER TRANSISTOR



OPERATION

- When the power transistor unit is switched ON by the signals from the engine control unit, the primary current of the ignition coil will flow. When the power transistor unit is switched OFF, the primary current flow is interrupted, and high voltage is produced at the secondary coil.
- When the engine control unit switches OFF the power transistor within the unit, the battery voltage within the unit is applied to the power transistor unit, and the power transistor unit is switched ON. In addition, the power transistor unit is switched OFF when the engine control unit switches ON the power transistor within the unit.

INSPECTION

Using Multi-use tester (MUT)

Spark advance value

Function	Item No.	Data display	Check conditions	Engine condition r/min.	Standard value °BTDC
Data reading	44	Spark advance	• Engine: warm • Timing light: set (The timing light is set so as to check the actual ignition timing.)	700 (Idling)	7–23
				2,000	25–31

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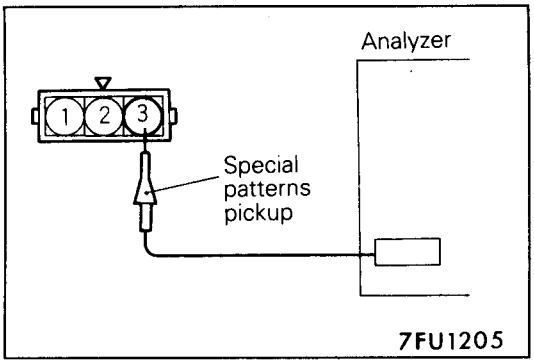
Ignition timing adjustment mode

Function	Item No.	Data display	Inspection condition	Engine condition	Normal display
Data list	36	Existence of continuity at earth connection of the ignition timing adjustment terminal	Engine: idling	Earth the ignition timing adjustment terminal.	ON
				Remove the earth connection of the ignition timing adjustment terminal.	OFF



Wave Pattern Inspection Using an Analyzer

- Ignition coil primary signal

Refer to GROUP 16 – Ignition System.

- Power transistor control signal

<Measurement method>

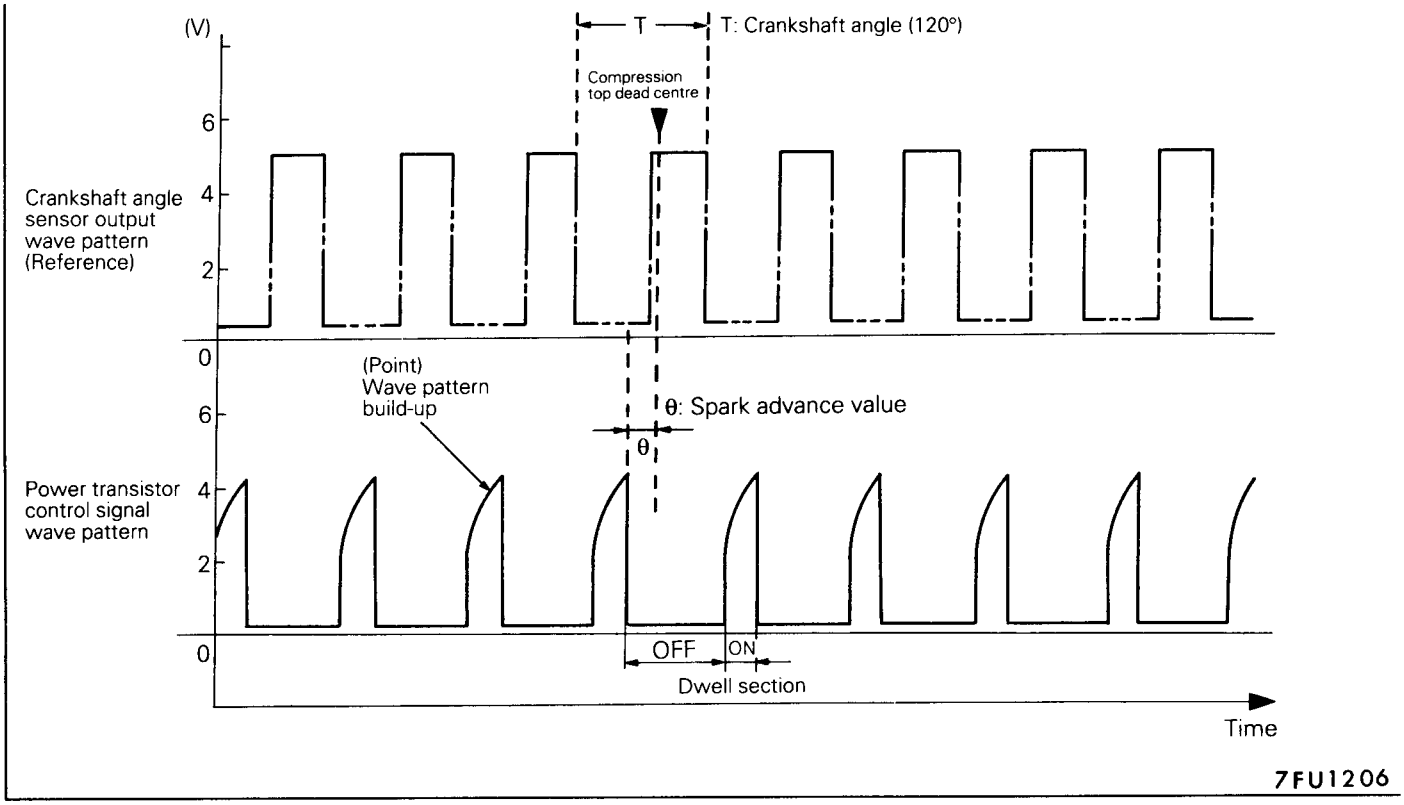
(1) Disconnect the power transistor connector, and connect the special tool (test harness: MB991348) in between. (All terminals should be connected.)

(2) Connect the analyzer special patterns pickup to the power transistor connector terminal ③.

Standard wave pattern

Observation conditions

Function	Special patterns
Pattern height	Low
Pattern selector	Display
Engine	Approx. 1200 r/min.



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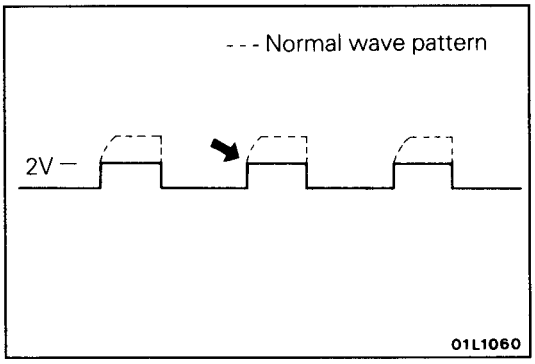
Wave pattern observation points

(Point): Condition of wave pattern build-up and maximum voltage (Refer to abnormal wave pattern examples 1 and 2.)



Examples of abnormal wave patterns

- Example 1

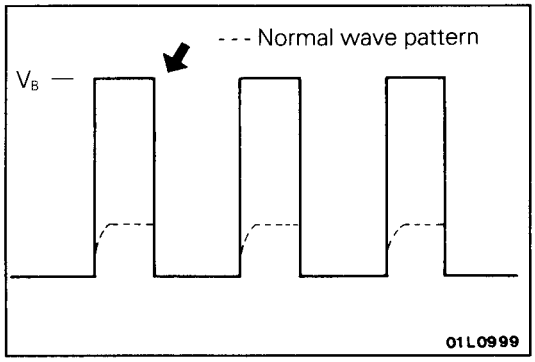
Wave pattern during engine cranking

Cause of problem

Broken wire in ignition primary circuit

Wave pattern characteristics

Top-right part of the build-up section cannot be seen, and voltage value is approximately 2V too low.



Example 2

Wave pattern during engine cranking

Cause of problem

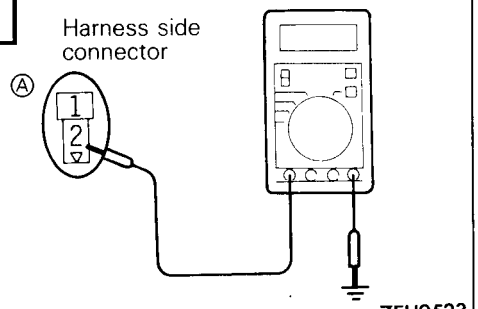
Malfunction in power transistor

Wave pattern characteristics

Power voltage results when the power transistor is ON.

HARNESS INSPECTION

1



Measure the power supply voltage of the ignition coil.

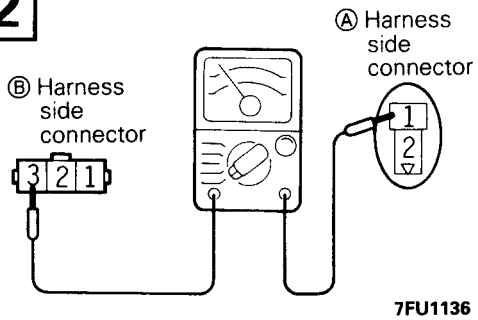
- Connector: Disconnected
- Ignition switch: ON

Voltage (V)
5V

OK → 2

NG → Repair the harness. (Ⓐ2 – Ignition switch)

2



Check for an open-circuit, or a short-circuit to ground, between the power transistor and ignition coil.

- Ignition coil connector: Disconnected
- Power transistor connector: Disconnected

OK → 3

NG → Repair the harness. (Ⓐ1 – Ⓑ3)

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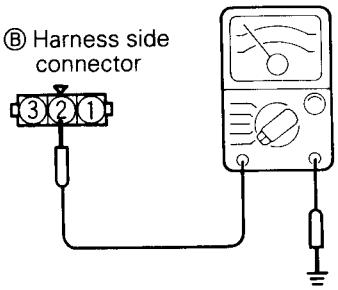
3

Ⓑ Harness side connector



7FU0837

Check for continuity of the earth circuit.

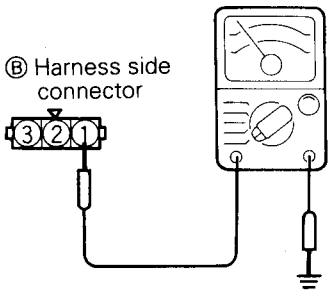
- Connector: Disconnected

OK → 4

NO → Repair the harness. (Ⓑ2 – Earth)

4

Ⓑ Harness side connector



7FU0838

Measure the voltage of the control signal circuit of the power transistor.

- Connector: Disconnected
- Ignition switch: START

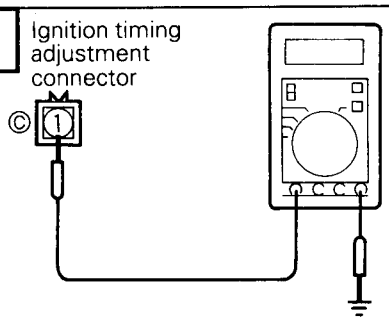
Voltage (V)
2 – 6

OK → 5

NO → Repair the harness. (Ⓑ1 – 54)

5

Ignition timing adjustment connector



7FU1060

Measure the voltage of the ignition timing adjustment terminal.

- Ignition switch: ON

Voltage (V)
4.0 – 5.2

OK → STOP

NO → Repair the harness. (©1 – 12)

ACTUATOR INSPECTION

Refer to Group 16.

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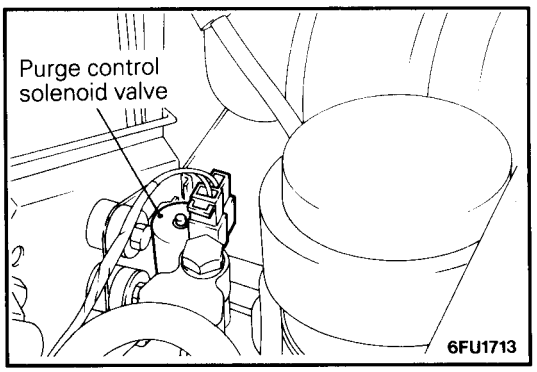
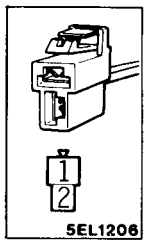
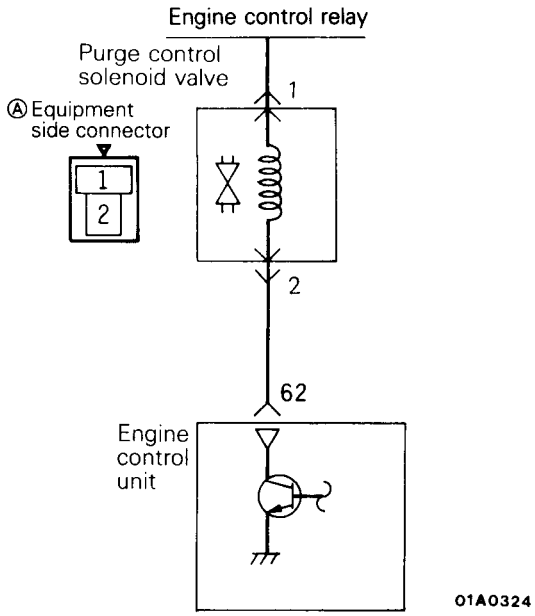
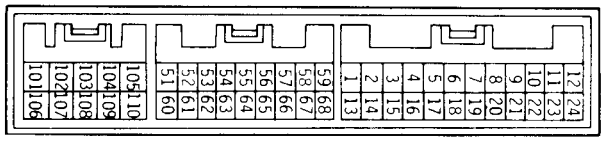
PURGE CONTROL SOLENOID VALVE







Engine control unit connector



01L0838

OPERATION

- The purge-control solenoid valve is an ON/OFF type of solenoid valve; it functions to regulate the introduction of purge air from the canister to the intake air plenum.
- Battery power supply is supplied, by way of the control relay, to the purge-control solenoid valve. When the engine control unit switches ON the power transistor within the unit, current flows to the coil, and purge air is introduced.

INSPECTION

Using Multi-use tester (MUT)

Function	Item No.	Activation	Check conditions	Normal condition
Actuator test	08	Solenoid valve is switched from OFF to ON.	• Ignition switch: ON	Operating sound is heard when driven.

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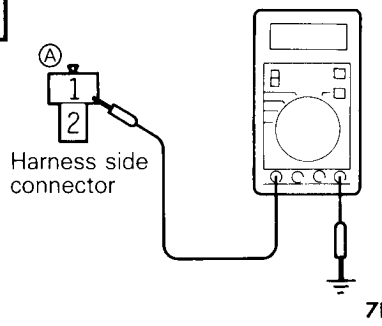
HARNESS INSPECTION

1



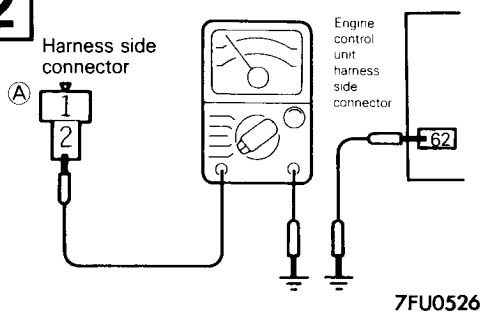
Measure the power supply voltage.
- Connector: Disconnected
- Ignition switch: ON

Voltage (V)
5V

OK → 2

NG → Repair the harness. (Engine control relay – Ⓐ1)

2



Check for an open-circuit, or a short-circuit to earth, between the purge control solenoid valve and the engine control unit.
- Purge control solenoid valve connector: Disconnected
- Engine control unit connector: Disconnected

OK → STOP

NG → Repair the harness. (Ⓐ2–62)

ACTUATOR INSPECTION

Refer to Group 17.

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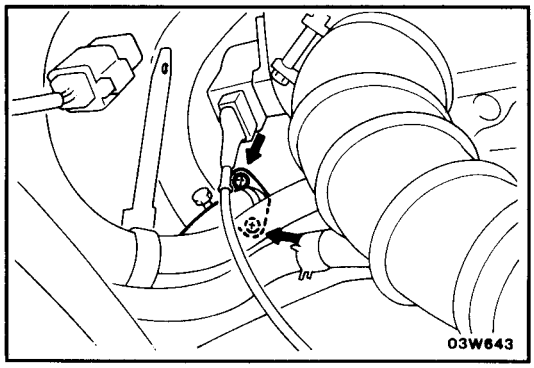
FUEL PRESSURE

HOW TO REDUCE THE FUEL LINE INTERNAL PRESSURE

Refer to P. 13-16.

FUEL PUMP OPERATION CHECK

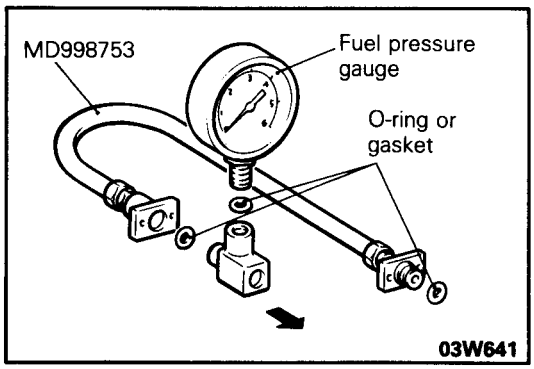
Refer to P. 13-15.



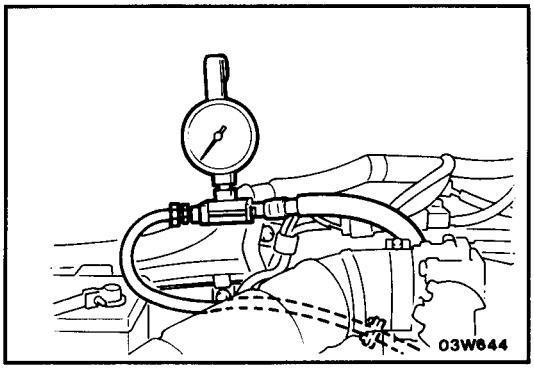
FUEL PRESSURE TEST M13FNAD

(1) Reduce the internal pressure of the fuel pipes and hoses.
(2) Disconnect the fuel high pressure hose at the delivery pipe side.

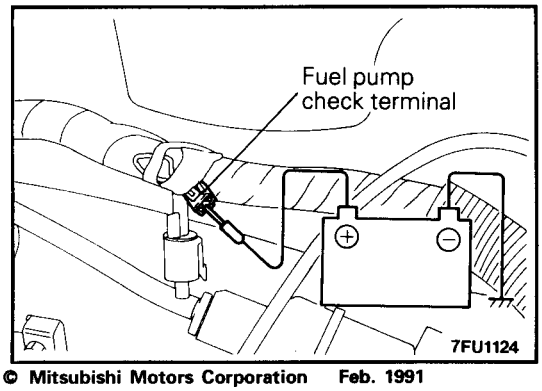
Caution
Cover the hose connection with rags to prevent splash of fuel that could be caused by some residual pressure in the fuel pipe line.



(3) Set a fuel pressure gauge on the special tool, placing an adequate O-ring or gasket between the gauge end special tool prevent fuel leaks.



(4) Attach the special tool set in step (3) to the delivery pipe.
(5) Connect the (–) battery terminal.



(6) Connect a jumper wire to the terminal for activation of the fuel pump and to the positive (+) terminal of the battery to activate the fuel pump. With fuel pressure applied, check to be sure that there is no fuel leakage from the fuel pressure gauge and the special tool connection part.
(7) Disconnect the jumper wire (from the terminal for activation of the fuel pump) to stop the fuel pump.
(8) Start the engine and let it idle.

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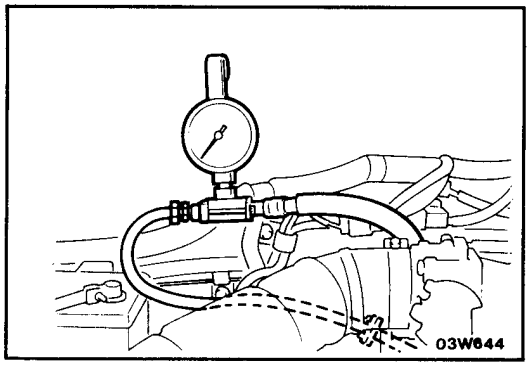
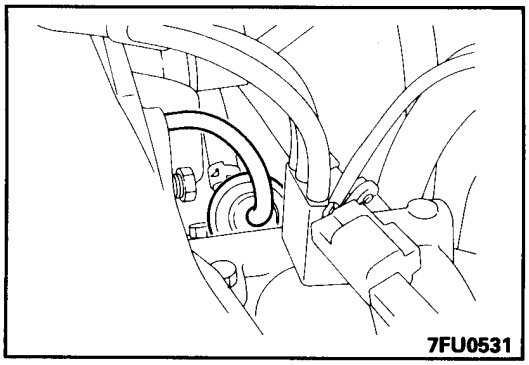


(9) Measure the fuel pressure during idling.

Standard value: Approx. 270 kPa (2.7 kg/cm², 38 psi) at curb idle



(10) Disconnect the vacuum hose from the fuel pressure regulator, and then measure the fuel pressure while using a finger to plug the end of the hose.

Standard value: 330–370 kPa (3.3–3.5 kg/cm², 47–53 psi) at curb idle speed

(11) Check to be sure that the fuel pressure during idling does not decrease even after the engine is raced a few times.

(12) Use a finger to gently press the fuel return hose while repeatedly racing the engine, and check to be sure that there is fuel pressure in the return hose also.

NOTE
There will be no fuel pressure in the return hose if there is insufficient fuel flow.

(13) If the fuel pressure measured in steps (9) to (12) deviates from the standard value range, check for the probable cause by referring to the table below, and then make the appropriate repair.

Condition	Probable cause	Remedy
• Fuel pressure is too low. • Fuel pressure drops during racing. • No fuel pressure in fuel return hose.	Fuel filter is clogged.	Replace the fuel filter.
	Malfunction of the valve seat within the fuel pressure regulator, or fuel leakage to return side caused by spring deterioration.	Replace the fuel pressure regulator.
	Fuel pump low discharge pressure.	Replace the fuel pump.
Fuel pressure is too high.	The valve within the fuel pressure regulator is sticking.	Replace the fuel pressure regulator.
	Clogging of the fuel return hose and/or the pipe.	Clean or replace the hose and/or pipe.
No change of the fuel pressure when vacuum hose is connected and when not connected.	Damaged vacuum hose or nipple clogging.	Replace the vacuum hose, or clean the nipple.

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(14)Stop the engine and check for a change of the value indicated by the fuel pressure gauge. The condition is normal if there is no decrease of the indicated value within two minutes.
If there is a decrease of the indicated value, monitor the speed of the decrease, and, referring to the table below, determine the cause of the problem and make the appropriate repair.

Condition	Probable cause	Remedy
After the engine is stopped, the fuel pressure drops gradually.	Injector leakage.	Replace the injector.
	Leakage at the fuel pressure regulator valve seat.	Replace the fuel pressure regulator.
There is a sudden sharp drop of the fuel pressure immediately after the engine is stopped.	The check valve (within the fuel pump) is not closed.	Replace the fuel pump.

(15)Remove all remaining pressure from inside the fuel pipe. (Refer to P. 13-16.)
(16)Disconnect the fuel pressure gauge and the special tool from the delivery pipe.

Caution
Because there will be a slight amount of remaining pressure in the fuel pipe line, use rags to cover so that fuel doesn't splatter.

(17)Replace the O-ring at the end of the fuel high-pressure hose with a new one.
(18)After connecting the fuel high-pressure hose to the delivery pipe, tighten the installation bolt at the specified torque.

Tightening torque: 5 Nm (0.5 kmg, 3.6 ft.lbs)

(19)Check to be sure that there is no fuel leakage.
① Apply battery voltage to the terminal for activation of the fuel pump so as to activate the fuel pump.
② With fuel pressure applied, check for leakage of the fuel line.

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FUEL SYSTEM <6G72 – 24Valve Engine, 6G74 Engine>

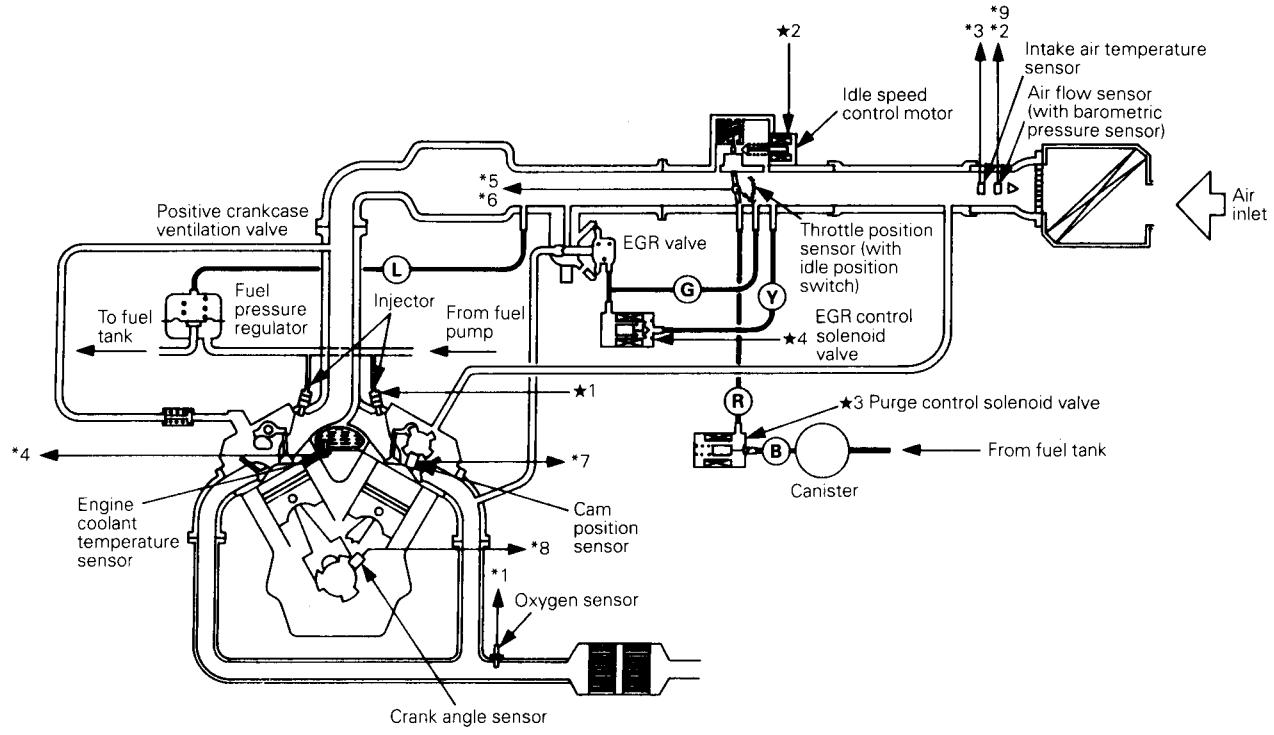
GENERAL INFORMATION

MULTI POINT INJECTION SYSTEM DIAGRAM

<SOHC>

*1 Oxygen sensor *2 Volume air flow sensor *3 Intake air temperature sensor *4 Engine coolant temperature sensor *5 Throttle position sensor *6 Idle position switch *7 Cam position sensor *8 Crank angle sensor *9 Barometric pressure sensor	• Ignition switch-ST • Ignition switch-IG$_1$ • Power supply • Vehicle speed sensor • Air conditioner switch • Power steering pressure switch • Inhibitor switch	⇨ Engine control unit ⇨

★1 Injector
★2 Idle speed control motor
★3 Purge control solenoid valve
★4 EGR control solenoid valve
• Fuel pump control (control relay)
• Air conditioner power relay
• Ignition timing control
• Self diagnostic circuit
• Engine warning lamp

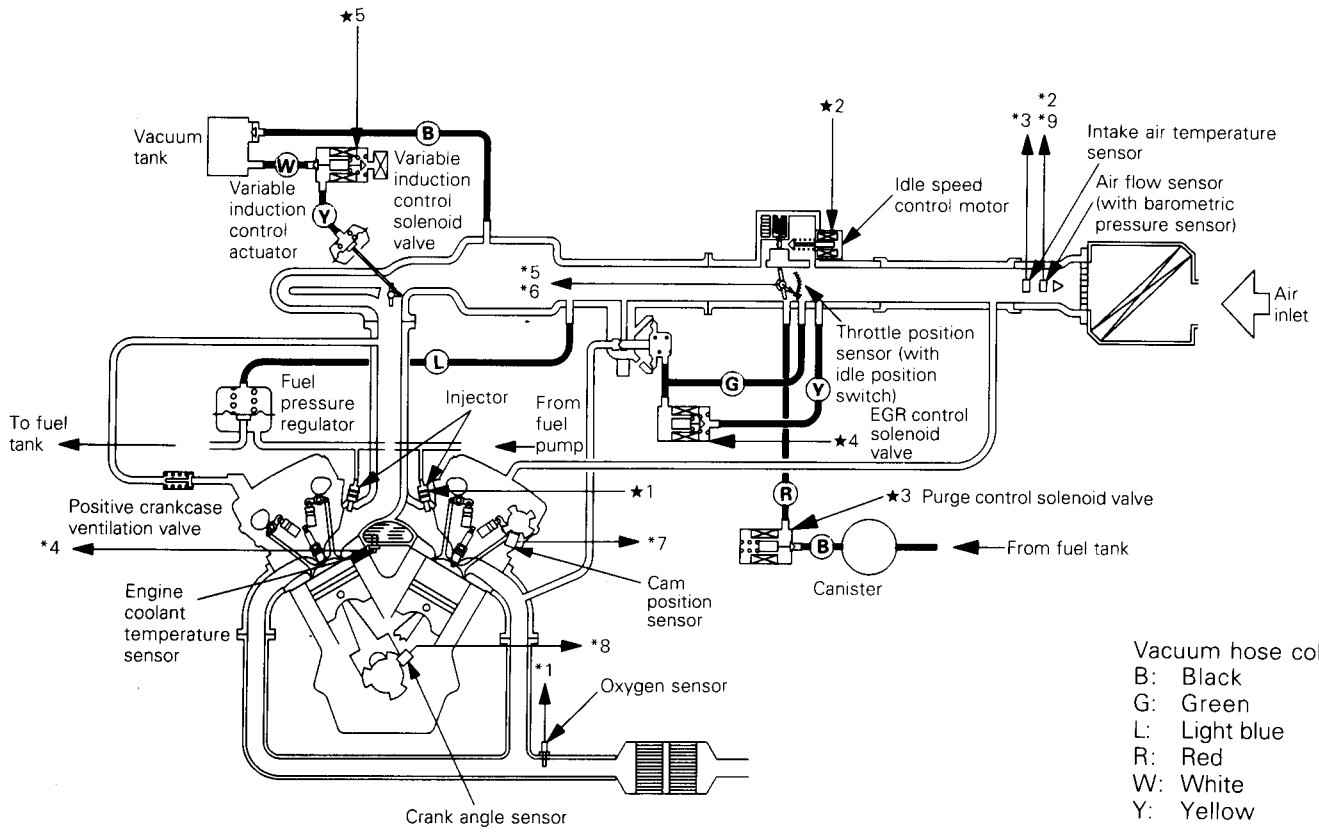


Vacuum hose color
B: Black
G: Green
L: Light blue
R: Red
Y: Yellow

7FU1738

<DOHC>

*1 Oxygen sensor *2 Volume air flow sensor *3 Intake air temperature sensor *4 Engine coolant temperature sensor *5 Throttle position sensor *6 Idle position switch *7 Cam position sensor *8 Crank angle sensor *9 Barometric pressure sensor *10 EGR temperature sensor	• Ignition switch-ST • Ignition switch-IG_1 • Power supply • Vehicle speed sensor • Air conditioner switch • Power steering pressure switch • Inhibitor switch • Detonation sensor	⇨ Engine control unit ⇨	★1 Injector ★2 Idle speed control motor ★3 Purge control solenoid valve ★4 EGR control solenoid valve ★5 Variable induction control solenoid valve • Fuel pump control (control relay) • Air conditioner power relay • Ignition timing control • Self diagnostic circuit • Engine warning lamp



Vacuum hose color
B: Black
G: Green
L: Light blue
R: Red
W: White
Y: Yellow

7FU1510

SPECIFICATIONS

GENERAL SPECIFICATIONS

E13CA-A

Items	Specifications
Fuel	
Tank capacity dm^3 (U.S.gal., Imp.gal.)	
Standard Wheelbase	75 (19.8, 16.5)
Long Wheelbase	92 (24.3, 20.2)
Fuel pump	
Type	Electrical, in-tank type
Driven by	Electric motor
Throttle body	
Throttle bore mm (in.)	60 (2.36)
Throttle position sensor	Variable resistor type
Idle speed control servo	Stepper motor type Stepper motor type by-pass air control system with the Fast Idle Air Valve
Idle position switch	Rotary contact type
Engine control unit	
Identification model No.	
<SOHC>	E2T37483
<DOHC>	E2T39974 <Up to 1994 model> E2T39977 <From 1995 model>
Sensors	
Air flow sensor	Karman vortex type
Barometric pressure sensor	Semiconductor diffusion-type
Intake air temperature sensor	Thermistor type
Engine coolant temperature sensor	Thermistor type
Oxygen sensor	Zirconia type
Vehicle-speed sensor	Reed switch type
Inhibitor switch	Contact switch type
Detnation sensor <DOHC>	Piezoelectric type
Cam position sensor	Hall element type
Crank angle sensor	Hall element type
Power steering pressure switch	Contact switch type
Actuators	
Control relay type	Contact switch type
Injector type and number	Electromagnetic, 6
Purge control solenoid valve	ON/OFF type solenoid valve
EGR control solenoid valve	Duty cycle type solenoid valve
Fuel pressure regulator	
Regulated pressure kPa (kg/cm^2, psi)	329 (3.35, 47.6)

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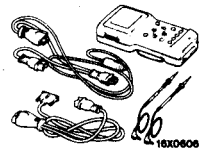
SERVICE SPECIFICATIONS

Items		Specifications
Standard value		
Accelerator cable play	mm (in.)	1–2 (0.04–0.08)
Basic ignition timing		5°±3° BTDC at curb idle
Curb idle speed	r/min.	700±100
Idle speed when air conditioner ON	r/min.	900 at neutral position 650 at D range <A/T>
Basic idle speed	r/min.	700±50
Throttle position sensor output voltage	mV	400–1000
Throttle position sensor resistance	kΩ	3.5–6.5
Idle speed control servo (stepper motor) coil resistance [at 20°C (68°F)]	Ω	28–33
Intake air temperature sensor resistance [at 20°C (68°F)]	kΩ	2.7
Engine coolant temperature sensor resistance	kΩ	
20°C (68°F)		2.4
80°C (176°F)		0.3
Fuel pressure (at curb idle)	kPa (kg/cm^2, psi)	
Vacuum hose disconnected		324–343 (3.3–3.5, 47–50)
Vacuum hose connected		Approx. 265 (2.7, 38)
Injector coil resistance [at 20°C (68°F)]	Ω	13–16

SEALANT

Items	Specified sealant	Remarks
Engine coolant temperature sensor threaded portion	3M Nut Locking Part No. 4171 or equivalent	Drying sealant

SPECIAL TOOLS

Tool	Number	Name	Use
	MB991502	MUT-II	• Reading diagnosis code • MPI system inspection
 16X0607		ROM pack	

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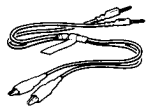
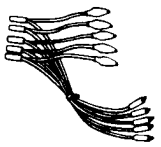
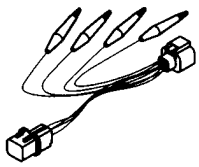
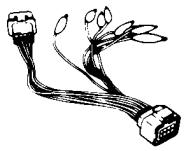
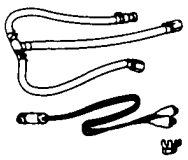
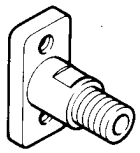
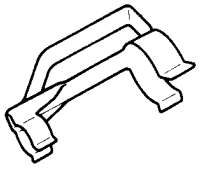
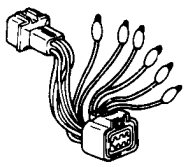
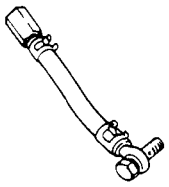
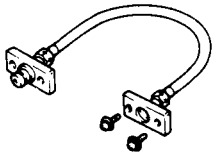
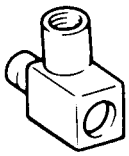
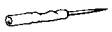
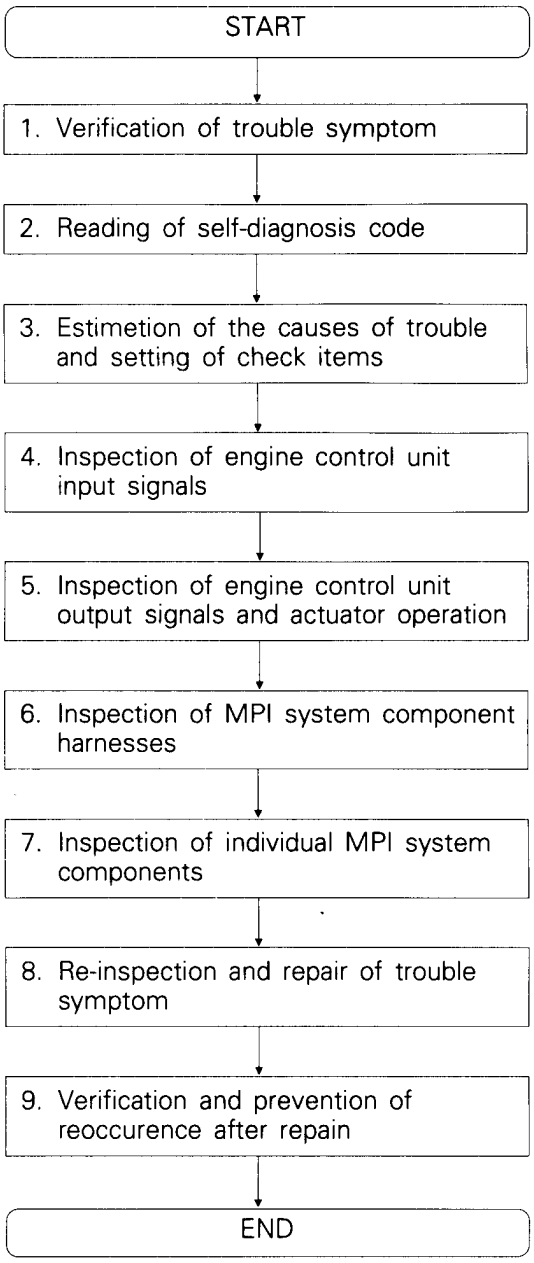
Tool	Number	Name	Use
	MB991529	Diagnosis code check harness	• Reading diagnosis code • Basic idle speed adjustment
	MB991348	Test harness set	• Adjustment of throttle position sensor • Inspection with analyzer
	MD998464	Test harness (4 pin, square)	• Oxygen sensor inspection
	MD998474	Test harness (8 pin, square)	• Inspection with analyzer
	MD998706	Injector test set	• Checking injection condition of injector
	MD998740	Injector test adaptor	
	MD998746	Clip	
	MD998463	Test harness (6 pin, square)	• Idle speed control servo inspection • Inspection with analyzer

Tool	Number	Name	Use
	MD998709	Adapter hose	<SOHC> Measurement of fuel pressure
	MD998742	Hose adapter	
	MD998753	Extension hose	<DOHC> • Measurement of fuel pressure
	MD998700	Hose adapter	
For red harness (for DLI) For white harness (for LC) 	MB991223	Inspection harness set connector • Pin contact pressure inspection harness • Marketing tester connection probe (for general connectors)	• Measurement of terminal voltages

TROUBLESHOOTING



EXPLANATION OF TROUBLESHOOTING PROCEDURES

Effective troubleshooting procedures for MPI system problems are given below.

1. Verification of trouble symptom
   - Reproduce trouble symptom and verify the characteristics of the trouble and the conditions (engine condition, driving conditions, etc.) under which it is produced.
2. Reading of self-diagnosis code
   - Read self-diagnosis code and if a malfunction code is output, locate and correct the trouble referring to the DIAGNOSIS CHART.
3. Estimation of the causes of trouble and setting of check items
   - Referring to the Check Chart, verify the check items and checking order for the trouble symptom.
4. Inspection of engine control unit input signals
   - Inspect the engine control unit input signals by using the MUT-II or an analyzer.
   - Sensor input is normal if input signals are normal, then inspect the next inspection item.
5. Inspection of engine control unit output signals and actuator operation
   - Inspect the engine control unit output signals and actuator operation by using the MUT-II. Drive the actuator by instructing the actuator test function and verify the actuator operation.
   - Inspect the engine control unit output signals by using an oscilloscope.
   - Actuator control is normal if engine control unit output signals and actuator are normal, then inspect the next inspection item.
6. Inspection of MPI system component harness
   - If the engine control unit input/output signals are abnormal, check the MPI system component body harness and repair as necessary.
   - After repair, check the engine control unit input/output signals again. If they are normal, proceed to check the input/output signals of the next check item.
7. Inspection of individual MPI system components
   - If the body harness is normal but the engine control unit input/output signals are abnormal, check individual MPI system components and repair or replace as necessary.
   - After repair or replacement, check the engine control unit input/output signals again. If they are normal, proceed to check the input/output signals of the next check item.

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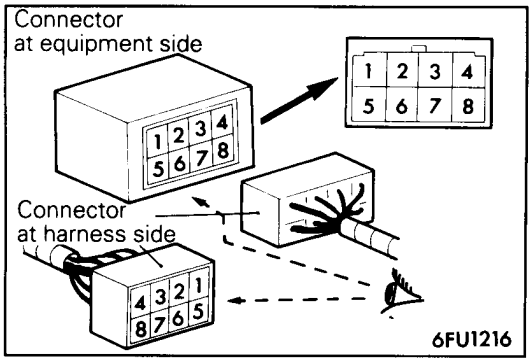
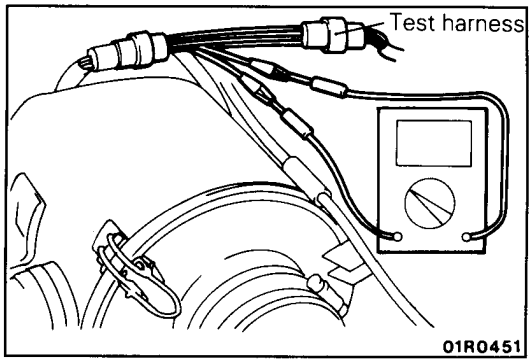
8. Re-inspection and repair of trouble symptom
   - If the harness inspection and individual component inspection results are normal but the engine control unit input/output signals are abnormal, re-examine the causes of trouble referring to the troubleshooting hints and the checks and repairs included in other groups.
9. Verification and prevention of reoccurrence after repair
   - Perform tests to see if the same problems occur again and make sure that the same problems will not be repeated.
   - Remove the true causes of the trouble to prevent its reoccurrence.

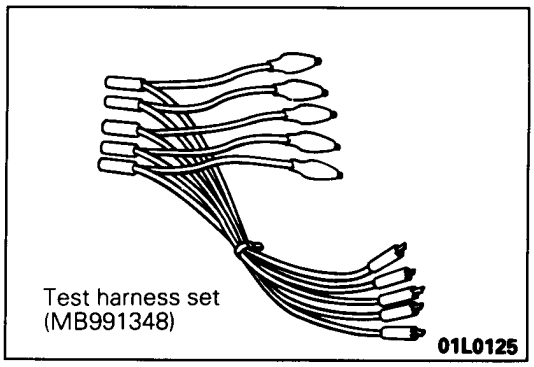


EXPLANATION AND PRECAUTION RELATED TO HARNESS CHECKING

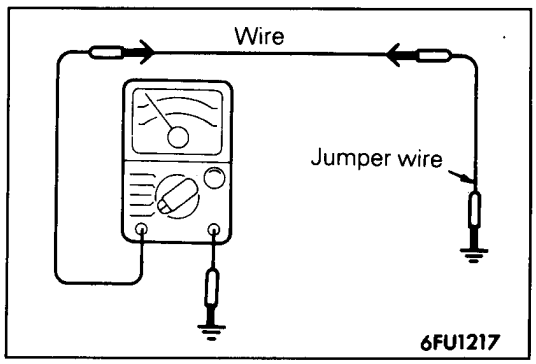
- Connector symbols are described as seen from the terminal end for the connector.
- The abbreviation "SV" used for the normal judgment value when checking the voltage is the abbreviation for system voltage.



- Be sure to use the special tool (test harness) when, for a waterproof connector, checking while the circuit is conductive. If probe is inserted from the harness side, the waterproof capability will be lowered, thereby causing/corrosion, so never do so.
- When a connector is disconnected in order to check terminal voltage, etc., never insert a probe if the terminal to be checked is a female pin, because the forceful insertion of a probe will cause improper or incomplete contact.



- Also, if there is no test harness that conforms to the connector, use the test harness set (MB991348) which can be directly connected between the terminals.
- When disconnecting the connector and inspecting the terminal voltage, etc., if the inspection terminal is a female pin, the special tool (inspection harness set: MB991223) should be used instead of inserting a probe.



- When checking for damaged or disconnected wiring of a harness (open circuit) and if both ends of the harness are unconnected, use a jumper wire to earth one end of the harness, and then check for continuity between the other end and earth. By doing this, you can check for damaged or disconnected wiring, and, if there is no continuity, the harness should be repaired.

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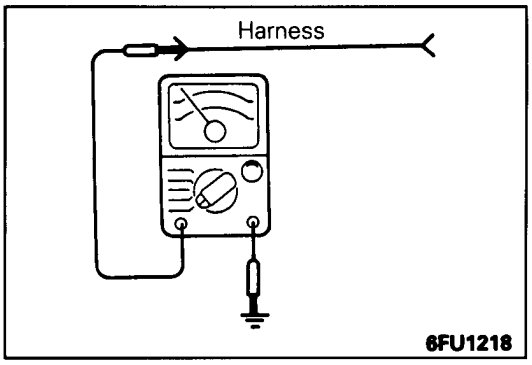
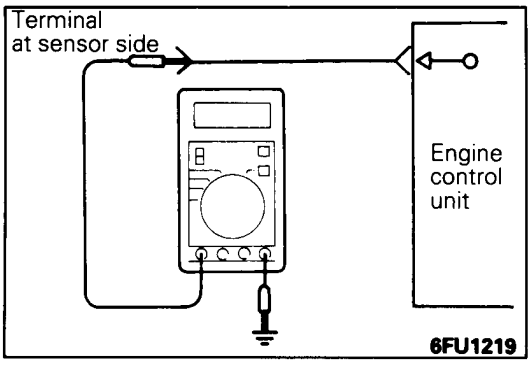
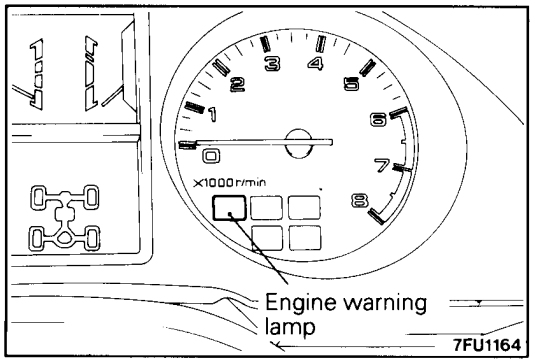


- When checking for a harness short-circuit (short-circuit to earth), open one end of the harness and then check for continuity between the other end and earth. If there is continuity, the harness is short-circuited to earth and should be repaired.
- Use an analog voltmeter resistor (or a circuit tester) when inspecting the continuity.



- If the impressed voltage is not normal even if wire is normal, change the engine control nuit and inspect again.
- Use a digital voltmeter (or a circuit tester) when measuring the voltage. Use an analog voltmeter, however, when inspecting the power transistor drive voltage.



ENGINE WARNING LAMP (CHECK ENGINE LAMP)

Among the self-diagnosis items, a engine warning lamp comes on to notify the driver of the emission control items when an irregularity is detected.

However, when an irregular signal returns to normal and the engine control unit judges that it has returned to normal, the engine warning lamp goes out.

Moreover, when the ignition switch is turned off, the lamp goes out. Even if the ignition switch is turned on again, the lamp does not come on until the irregularity is detected.

Here, immediately after the ignition switch is turn on, the engine warning lamp is lit for 5 seconds to indicated that the engine warning lamp operates normally.

Item indicated by the lightening engine warning lamp

Engine control unit	Cam position sensor
Oxygen sensor	Barometric pressure sensor
Air flow sensor	Detonation sensor <DOHC>
Intake air temperature sensor	Ignition timing adjustment signal
Throttle position sensor	Injector
Engine coolant temperature sensor	EGR system
Crank angle sensor	Ignition coil. Power transistor unit

Caution

Engine warning lamp will come on when the line of terminal for ignition timing adjustment is short-circuited. Therefore, the lamp will come on even when the terminal for ignition timing adjustment is earthed at the time of adjusting ignition timing. In this case, however, it is not abnormal.

ENGINE WARNING LAMP INSPECTION

(1) Check to be sure, when the ignition switch is set to the "ON"position, that the lamp illuminates for about five seconds and then switches OFF.
(2) If the lamp does not illuminate, check for damage or disconnection of the harness, or for a blown fuse or a failed light bulb.

SELF-DIAGNOSIS

The engine control unit monitors the input/output signals (some signals at all times and the others under specified conditions) of the engine control unit. When it is noticed that an irregularity has continued for a specified time or longer from when the irregular signal is initially monitored, passing a certain number, the engine control unit judges that an irregularity has occurred, memorizes the malfunction code, and outputs the signal to the self-diagnosis output terminals. There are 18 diagnosis items, including the normal state, and the diagnosis results can be read out with a voltmeter or MUT-II. Moreover, since memorization of the malfunction codes is backed up directly by the battery, the diagnosis results are memorized even if the ignition key is turned off. The malfunction codes will, however, be erased when the battery terminal or the engine control unit connector is disconnected.
The malfunction codes are also erased by setting the ignition switch to the "ON" position and then sending the malfunction-code-erase signal from the MUT-II to the engine control unit.

Caution
If the sensor connector is disconnected while the ignition switch is ON, the malfunction code is memorized. In this instance, either send the malfunction-code-erase signal from the MUT-II to the engine control unit, or disconnect the battery's negative (–) terminal for ten seconds or longer; the diagnosis memory will be erased.

The 18 diagnosis items are provided as follows, and if plural items are activated, they are all indicated sequentially from the smallest code number.

Caution
Ignition timing adjustment signal malfunction code is output when the ignition timing adjustment terminal line is short-circuited to the earth. Therefore, the malfunction code is output when the ignition timing adjustment terminal is earthed, however, this is not a malfunction.

DIAGNOSIS CHART

Output preference order	Diagnosis item	Diagnosis code		Check item (Remedy)
		No.	Memory	
1	Engine control unit	—	—	(Replace engine control unit)
2	Oxygen sensor	11	Retained	• Harness and connector • Oxygen sensor • Fuel pressure • Injectors (Replace if defective) • Intake air leaks
3	Air flow sensor	12	Retained	• Harness and connector (if harness and connector are normal, replace air flow sensor assembly.)
4	Intake air temperature sensor	13	Retained	• Harness and connector • Intake air temperature sensor
5	Throttle position sensor	14	Retained	• Harness and connector • Throttle position sensor • Idle position switch
6	Engine coolant temperature sensor	21	Retained	• Harness and connector • Engine coolant temperature sensor
7	Crank angle sensor	22	Retained	• Harness and connector (If harness and a connector are normal, replace distributor assembly.)
8	Cam position sensor	23	Retained	• Harness and connector (If harness and a connector are normal, replace distributor assembly.)
9	Vehicle speed sensor (reed switch)	24	Retained	• Harness and connector • Vehicle speed sensor (reed switch)
10	Barometric pressure sensor	25	Retained	• Harness and connector (If harness and connector are normal, replace barometric sensor assembly.)

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Output preference order	Diagnosis item	Diagnosis code		Check item (Remedy)
		No.	Memory	
11	Detonation sensor <DOHC>	31	Retained	• Harness and connector (If harness and connector are normal; replace detonation sensor.)
12	Ignition timing adjustment signal	36	—	• Harness and connector
13	Injector	41	Retained	• Harness and connector • Injector oil resistance
14	EGR system	43	Retained	• Harness and connector • EGR temperature sensor • EGR valve • EGR solenoid • EGR valve control vacuum
15	Ignition coil, Power transistor unit (No. 1–4 cylinder)	44	Retained	• Harness and connector • Ignition coil • Power transistor unit
16	Ignition coil, Power transistor unit (No. 2–5 cylinder)	52	Retained	• Harness and connector • Ignition coil • Power transistor unit
17	Ignition coil, Power transistor unit (No. 3–6 cylinder	53	Retained	• Harness and connector • Ignition coil • Power transistor unit
18	Normal state	—	—	—

NOTE
Replace the engine control unit if a malfunction code is output although the inspection reveals that there is no problem with the check items.

TROUBLE DIAGNOSIS QUICK REFERENCE CHART

Trouble code No.	Diagnosis item	Description	Major cause	Remarks (Symptoms, etc.)
–	Engine control unit	Trouble in engine control unit itself	–	• Engine stalls • Engine cannot be started.
11	Oxygen sensor	Air-fuel ratio feedback control (closed loop control) is in effect but oxygen sensor signal voltage does not change (air-fuel mixture lean/rich).	(1) Defective oxygen sensor (2) Open or short circuit in oxygen sensor circuit, or connector in loose contact	• Poor exhaust emission purifying performance
			(3) Improper fuel pressure (4) Defective injector (5) Air drawn in through gasket clearance, etc. (6) Defective engine control unit	• Poor exhaust emission purifying performance • Poor startability • Unstable idling • Poor acceleration
12	Air flow sensor	Air flow sensor signal frequency 10Hz or less even with engine running	(1) Defective air flow sensor (2) Open or short circuit in air flow sensor circuit, or connector in loose contact (3) Defective engine control unit	• Poor acceleration* • Improper idling speed* • Unstable idling*
13	Intake air temperature sensor	(1) Intake air temperature sensor signal voltage over 4.5V (2) Intake air temperature sensor signal voltage less than 0.27V	(1) Defective intake air temperature sensor (2) Open or short circuit in intake air temperature sensor circuit, or connector in loose contact (3) Defective engine control unit	• Somewhat poor driveability* • At high temperatures (a) Poor startability* (b) Unstable idling*
14	Throttle position sensor	(1) Throttle position sensor signal voltage less than 0.2V (2) Throttle position sensor signal voltage over 2V even with idle position switch at ON	(1) Throttle position sensor out of order or maladjusted (2) Open or short circuit in throttle position sensor circuit, or connector in poor contact	• Somewhat poor acceleration • Engine stalls
			(3) Idle position switch ON failure (4) Short circuit in idle position signal line (5) Defective engine control unit	• Engine stalls. • Engine cannot be raced.

NOTE
* : Failsafe/backup function is in operation.

Trouble code No.	Diagnosis item	Description	Major cause	Remarks (Symptoms, etc.)
21	Engine coolant temperature sensor	(1) Engine coolant temperature sensor signal voltage over 4.6V (2) Engine coolant temperature sensor signal voltage less than 0.11V (3) Engine coolant temperature sensor signal indicates a low engine coolant temperature while the engine is in warmup operation.	(1) Defective engine coolant temperature sensor (2) Open or short circuit in engine coolant temperature sensor circuit, or connector in poor contact (3) Defective engine control unit	With engine cold ● Poor startability* ● Unstable idling* ● Poor acceleration*
22	Crank angle sensor	(1) Cranking the engine for more than four seconds does not cause the crank angle sensor signal voltage to change (go high or low). (2) Abnormal crank angle sensor signal	(1) Defective crank angle sensor (2) Open or short circuit in crank angle sensor circuit, or connector in loose contact (3) Defective cam position sensor, or connector in loose contact (4) Defective engine control unit	● Engine stalls. ● Engine cannot be started.
23	Cam position sensor	(1) Cam position sensor signal voltage does not change (go high or low) even with the engine running. (2) Abnormal top dead center signal pattern	(1) Defective cam position sensor (2) Open or short circuit in cam position sensor circuit, or connector in loose contact (3) Defective crank angle sensor, or connector in loose contact (4) Defective engine control unit	● Engine stalls.*
24	Vehicle speed sensor (reed switch)	With the engine in accelerated operation at an engine speed of over 3,000 r/min, the vehicle speed sensor signal voltage does not change (go high or low).	(1) Defective vehicle speed sensor (2) Open or short circuit in vehicle speed sensor circuit, or connector in loose contact (3) Defective engine control unit	When the vehicle is stopped with the engine in decelerated operation, the engine might stall.

NOTE
* : Failsafe/backup function is in operation.

Trouble code No.	Diagnosis item	Description	Major cause	Remarks (Symptoms, etc.)
25	Barometric pressure sensor	(1) Barometric pressure sensor signal voltage over 4.5V (2) Barometric pressure sensor signal voltage less than 0.2V	(1) Defective barometric pressure sensor (2) Open or short circuit in barometric pressure sensor circuit, or connector in loose contact (3) Defective engine control unit	• Unstable idling* • Poor acceleration* • Poor startability*
31	Detonation sensor <DOHC>	Abnormal detonation sensor signal voltage	(1) Defective detonation sensor (2) Open or short circuit in detonation sensor circuit, or connector in loose contact (3) Defective engine control unit	• Poor acceleration*
36	Ignition timing adjustment signal	Ignition timing adjustment signal line short-circuited to earth	(1) Ignition timing adjustment signal line short-circuited to earth (2) Defective engine control unit	• Poor acceleration • Overheated engine
41	Injector	Injector is not driven for more than four consecutive seconds during engine cranking or idling operation	(1) Defective injector (2) Open or short circuit in injector circuit, or connector in loose contact (3) Defective engine control unit	• Poor idling • Poor acceleration • Poor startability
44	Ignition coil and power transistor unit for 1-4 cylinders	With the engine running, no ignition signal is input (except in cases where no ignition signal is input to all the cylinders)	(1) Defective ignition coil (2) Open or short circuit in primary ignition circuit, or connector in loose contact (3) Defective power transistor unit (4) Defective engine control unit	• Unstable idling* • Poor acceleration* • Poor startability*
52	Ignition coil and power transistor unit for 2-5 cylinders	With the engine running, no ignition signal is input (except in cases where no ignition signal is input to all the cylinders)	(1) Defective ignition coil (2) Open or short circuit in primary ignition circuit, or connector in loose contact (3) Defective power transistor unit (4) Defective engine control unit	• Unstable idling* • Poor acceleration* • Poor startability*
53	Ignition coil and power transistor unit for 3-6 cylinders	With the engine running, no ignition signal is input (except in cases where no ignition signal is input to all the cylinders)	(1) Defective ignition coil (2) Open or short circuit in primary ignition circuit, or connector in loose contact (3) Defective power transistor unit (4) Defective engine control unit	• Unstable idling* • Poor acceleration* • Poor startability*

NOTE
* : Failsafe/backup function is in operation.

LIST OF FAIL-SAFE/BACK-UP FUNCTIONS

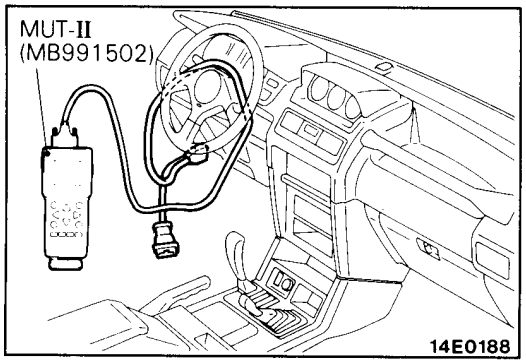
When the failure of a major sensor is detected by the self diagnosis functions, the preset control logic provides controls to assure safe operation of the vehicle.

Trouble item	Controls to be provided in the event of trouble
Air flow sensor	(1) Injector basic drive timing and basic ignition timing read from the preset map based on the throttle position sensor (TPS) signal and engine speed signal (crank angle sensor signal). (2) Idle speed control servo fixed at predetermined position, and no idling speed control achieved
Intake air temperature sensor	Controls provided on the assumption that intake air temperature is 25°C (77°F)
Throttle position sensor (TPS)	No additional fuel injection provided on the basis of throttle position sensor signal at acceleration
Engine coolant temperature sensor	Controls provided on the assumption that engine coolant temperature is 80°C (176°F) (Even if the sensor signal returns to normal, this control mode is retained until the ignition switch is set to OFF.)
Cam position sensor	(1) Fuel injected into all cylinders simultaneously (Provided that no No. 1 cylinder top dead center has been detected since the ignition switch was placed in the ON position) (2) Fuel cut 4 seconds after a failure was detected (Provided that no No. 1 cylinder top dead center has been detected since the ignition switch was placed in the ON position)
Barometric pressure sensor	Controls provided on the assumption that barometric pressure is 101 kPa (758 mm Hg, 29.8 in. Hg)
Detonation sensor <DOHC>	The ignition timing is switched from the timing for super petrol to the timing for standard petrol.
Ignition coil and power transistor unit	Fuel cut for cylinders whose ignition signal is abnormal
Oxygen sensor	No air-fuel ratio feedback control (closed loop control) achieved

READ OUT OF MALFUNCTION CODE

Precautions for Operation

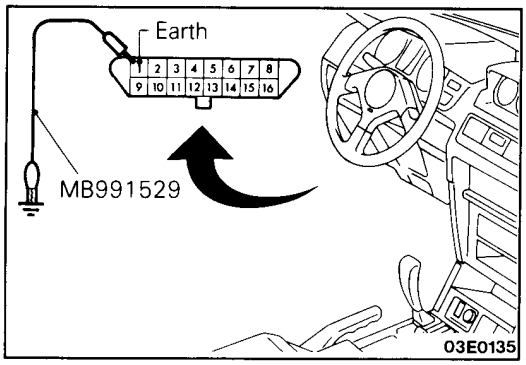
(1) When battery voltage is low, no detection of failure is possible. Be sure to check the battery for voltage and other conditions before starting the test.
(2) Diagnosis item is erased if the battery or the engine control unit connector is disconnected. Do not disconnect the battery before the diagnosis result is completely read.
(3) Be sure to connect or disconnect the MUT-II with the ignition switch turned off.

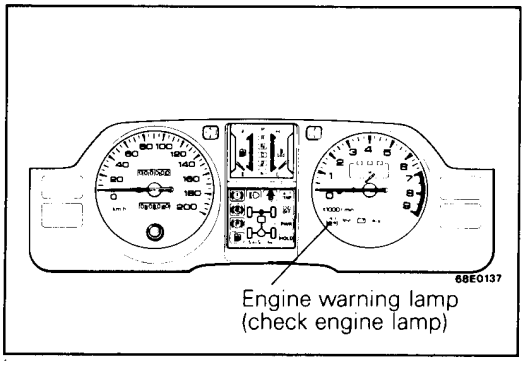


WHEN USING THE MUT-II

Caution
Turn off the ignition switch before disconnecting or connecting the MUT-II.

(1) Connect the MUT-II to the self-diagnosis connector.
(2) Turn the ignition switch to ON.
(3) Take a reading of the self-diagnosis output.
(4) Repair the problem location, referring to the diagnosis chart.
(5) After turning the ignition switch once to OFF, turn it back to ON.
(6) Erase the malfunction code.
(7) Recheck to be sure that the condition is normal.





WHEN USING THE ENGINE WARNING LAMP (CHECK ENGINE LAMP)

(1) Use the special tool (diagnosis code check harness) to earth the diagnosis test mode control terminal (terminal ①) of the diagnosis control terminal (16 pin).
(2) Turn the ignition switch to ON.
(3) Take a reading of a diagnosis output according to how often the engine warning lamp flashes.
(4) Repair the problem location, referring to the diagnostic chart.
(5) Erase the diagnostic trouble code by the following procedure.
   ① Turn the ignition switch to OFF.
   ② After removing the battery cable from the battery terminals for 10 seconds or more, reconnect the cable.
   ③ Warm up the engine and let it idle for approx. 15 minutes.
   ④ Turn the ignition switch to ON and take a reading of the diagnostic output to check if a normal code is output.

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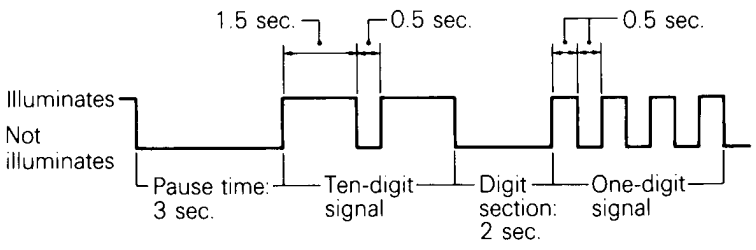
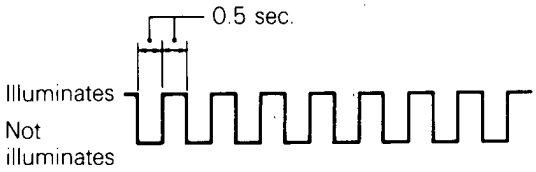
DIAGNOSIS RESULT DISPLAY METHOD USING THE CHECK ENGINE/MALFUNCTION INDICATOR LAMP

Example of flashing patterns when diagnosis code outputs	Normal flashing pattern
Diagnostic trouble code No. 24  6FU2060	 6FU2061

NOTE
Other diagnosis items are also output as lamp flashing corresponding to MUT-II diagnosis code numbers.

Diagnosis by DIAGNOSIS 2 MODE

(1) Using the MUT-II, changeover the diagnosis mode of the engine control unit to DIAGNOSIS 2 MODE.
(2) Carry out a road test.
(3) Read the diagnosis code in the same manner as "READ OUT OF MALFUNCTION CODE" and repair the malfunctioning part.
(4) Turn the ignition switch OFF and then turn it ON again.

NOTE
By turning the ignition switch OFF, the engine control unit will changeover the diagnosis mode from DIAGNOSIS 2 MODE to DIAGNOSIS 1 MODE.

(5) Erase the malfunction codes.

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CHECK CHART CLASSIFIED BY PROBLEM SYMPTOMS

Problem symptoms / Check Items	Starting		Idling stability			Driving						Stopping	Reference page
	Will not start	Starting problem	Idling instability (Rough idling)	Incorrect idling speed	Improper idling continuity	Hesitation, sag	Poor acceleration	Stumble	Shock	Surge	Knocking	Run-on (Dieseling)	
Power Supply and Ignition Switch-IG	①1												P.13-79-34
Engine Control Unit Power Earth	②2												P.13-79-37
Fuel Pump	③3	①1			①1	①1	①1						P.13-79-38
Air Flow Sensor					⑪11	⑩10		⑤5	⑤5		④4		P.13-79-41
Intake Air Temperature Sensor			⑤			⑥6	⑤5				②2		P.13-79-46
Barometric Pressure Sensor			⑦			⑨9	⑦7				③3		P.13-79-49
Engine Coolant Temperature Sensor		3	⑥5	①1	⑤5	⑧8	⑥6	④4		③3			P.13-79-51
Throttle Position Sensor						⑦7		③3	④4				P.13-79-54
Idle Position Switch			③3	②2	④4								P.13-79-57
Cam Position Sensor	⑤5	⑥7			⑧7				②2				P.13-79-60
Crank Angle Sensor	⑥6	⑦8			⑨8				③3				P.13-79-64
Ignition Switch-ST <M/T>	④4	③4											P.13-79-67
Ignition Switch-ST and Inhibitor Switch <A/T>	④4	③4		⑤									P.13-79-68
Vehicle Speed Sensor					⑥				⑥				P.13-79-70
Power Steering Fluid Pressure Switch				③									P.13-79-72
Air Conditioner Switch and Power Relay				④									P.13-79-74
Detonation Sensor <DOHC>											①1		P.13-79-76
Oxygen Sensor			⑨										P.13-79-80
Injectors	⑧8	②2	②2		③3	②2	②2	①1		①1		①	P.13-79-83
Idle Speed Control Servo (Stepper Motor)		④5	①1	⑥3	②2				⑧6				P.13-79-88
Ignition Coil and Power Transistor	⑦7				⑩9		⑦7		①1		⑤5		P.13-79-93, 99
Variable Induction Control Solenoid Valve						④4	④4						P.13-79-103
Purge Solenoid			⑧										P.13-79-105
EGR Control Solenoid Valve						⑤5		⑥6		④4			P.13-79-107
Anti-skid Brake Signal									⑦				P.13-79-109
Fuel Pressure		⑤6	④4		⑦6	③3	③3	②2		②2			P.13-79-110, 113

○ : Warm engine (figures inside the ○ indicate the checking sequence.)
□ : Cold engine (figures inside the □ indicate the checking sequence.)

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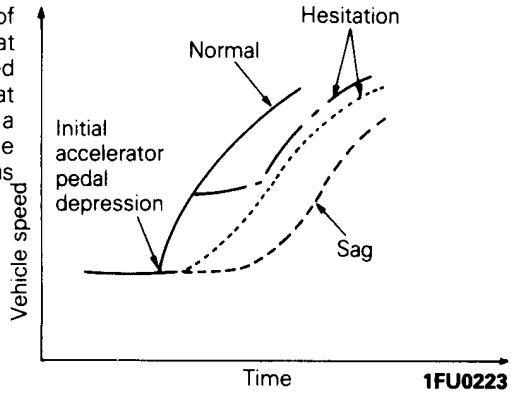
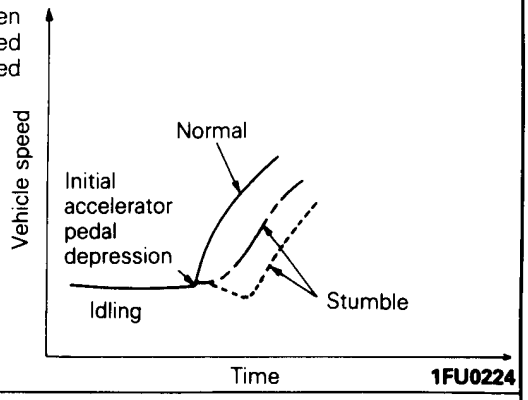
PROBLEM SYMPTOMS TABLE (FOR YOUR INFORMATION)

Item		Symptom
Starting	Won't start (no initial combustion)	The starter is used to crank the engine, but there is no combustion within the cylinders, and the engine won't start.
	Starting problem (initial combustion, then stall)	There is combustion within the cylinders, but then the engine soon stalls.
	(Starting takes a long time.)	Engine won't start quickly.
Idling stability	Idling instability (Rough idling)	Engine speed doesn't remain constant; changes during idling. Usually, a judgement can be based upon the movement of the tachometer pointer, and the vibration transmitted to the steering wheel, shift lever, body, etc. This is called rough idling.
	Incorrect idling speed	The engine doesn't idle at the usual correct speed.
	Improper idling continuity Die out Pass out	This non-continuity of idling includes the following elements. (1) Die out ..... The engine stalls when the foot is taken from the accelerator pedal, regardless of whether the vehicle is moving or not. (2) Pass out ..... The engine stalls when the accelerator pedal is depressed or while it is being used.
Driving	Hesitation Sag	"Hesitation" is the delay in response of the vehicle speed (engine r/min) that occurs when the accelerator is depressed in order to accelerate from the speed at which the vehicle is now traveling, or a temporary drop in vehicle speed (engine r/min) during such acceleration. Serious hesitation is called "sag". 
	Poor acceleration	Poor accleration is inability to obtain an acceleration corresponding to the degree of throttle opening, even though acceleration is smooth, or the inability to reach maximum speed.
	Stumble	Engine r/min response is delayed when the accelerator pedal is initially depressed for acceleration from the stopped condition. 
	Shock	The feeling of a comparatively large impact or vibration when the engine is accelerated or decelerated.
	Surge	This is repeated surging ahead during constant speed travel or during variable speed travel.
	Knocking	A sharp sound like a hammer striking the cylinder walls during driving and which adversely affects driving.
Stopping	Run-on (Dieseling)	The engine continues to run even after the switch is turned OFF. This is called dieseling.

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SERVICE ADJUSTMENT PROCEDURES

ACCELERATOR CABLE INSPECTION AND ADJUSTMENT <VEHICLES WITHOUT AUTO-CRUISE CONTROL SYSTEM> E13FCAZ3

Refer to P.13-14.

For models equipped with the auto-cruise control system, refer to P.13-188.

FUEL FILTER REPLACEMENT E13FZAM

Refer to P.13-14.

FUEL GAUGE UNIT REPLACEMENT E13FDAD

Refer to P.13-15.

2-WAY VALVE REPLACEMENT E13FFAD

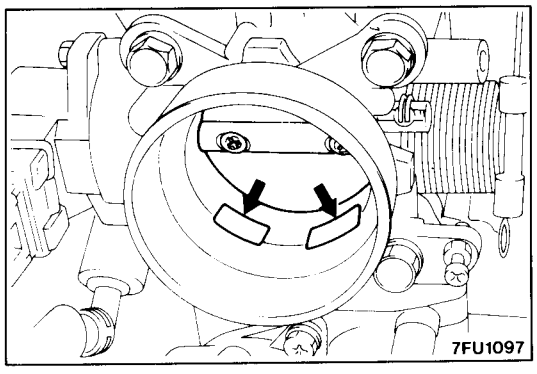
Refer to P.13-15.

FUEL PUMP OPERATION CHECK E13FGCF

Refer to P.13-15.

HOW TO REDUCE THE FUEL LINE INTERNAL PRESSURE E13HABH

Refer to P.13-16.



THROTTLE BODY (THROTTLE VALVE AREA) CLEANING

(1) Start the engine and warm it up until the temperature of the engine coolant reaches 80°C (176°F) or higher; then stop the engine.
(2) Disconnect the air intake hose at the throttle body side.
(3) Plug the bypass intake port inlet in the throttle body.

Caution
Never let cleaning liquid get into the bypass intake.

(4) Spray cleaning liquid (from the intake port of the throttle body) onto the valve, and then leave as is for about five minutes.
(5) Start the engine and race it a few times; then let it run at idle speed for about one minute.

NOTE
The engine idling speed becomes unstable (or the engine stalls) if the by-pass passage is plugged, (or the engine stalls), let the engine run with the throttle valve slightly open.

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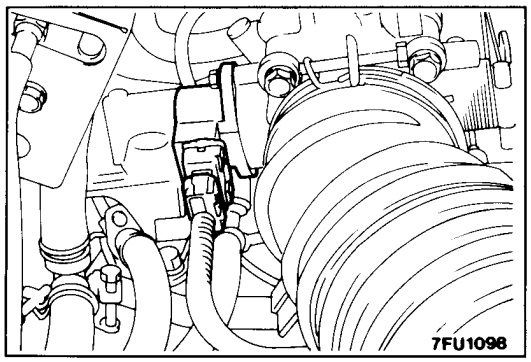
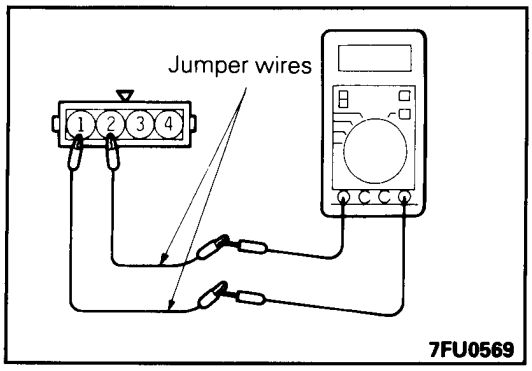
(6) If deposits are not removed from the throttle valve, repeat steps (4) and (5).
(7) Remove the plug from the bypass intake port inlet in the throttle body.
(8) Connect the air intake hose.
(9) Using the MUT-II, erase the self-diagnosis code or disconnect the negative battery cable for more than 10 seconds and then connect it again.
(10) Adjust the basic idle speed. (Refer to P.13-79-24)

NOTE
If hunting of the idling engine occurs after adjusting the basic idling speed, remove the battery (–) cable from the battery terminal for more than 10 seconds, and then idle the engine again.

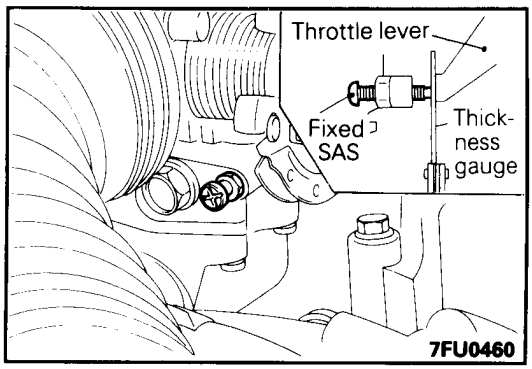


IDLE POSITION SWITCH AND THROTTLE POSITION SENSOR ADJUSTMENT

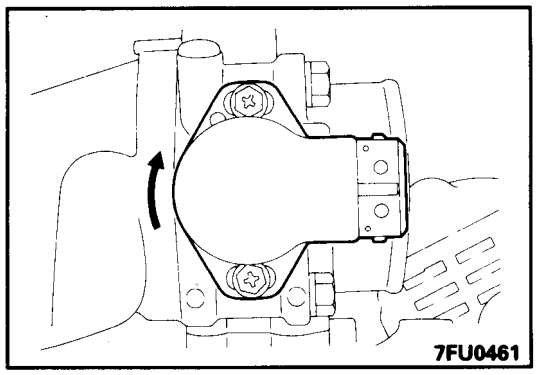
(1) Disconnect the connector of the throttle-position sensor.



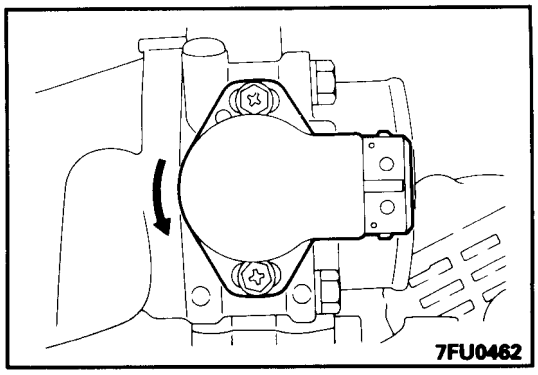
(2) Using jumper wires, connect an ohmmeter across terminal ② (idle position switch) and terminal ① (sensor earth) of the throttle position sensor.



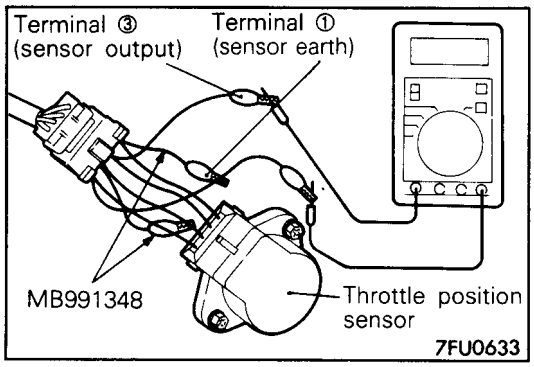
(3) Insert a 0.65 mm (0.0256 in.) thick thickness gauge between the fixed SAS and throttle lever.



(4) Loosen the throttle position sensor mounting bolts and turn the throttle position sensor body fully clockwise.
(5) In this condition, check that there is continuity across terminals ① and ②.



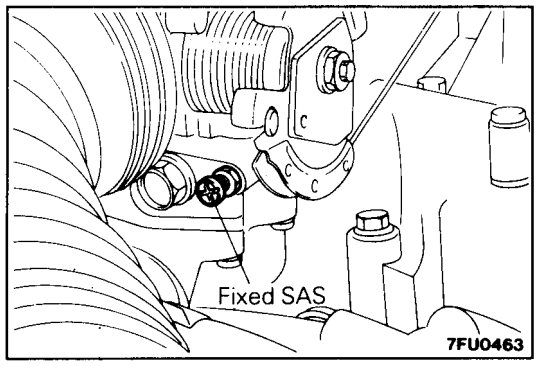
(6) Slowly turn the throttle position sensor counterclockwise until you find a point at which there is no continuity across terminals ① and ②. Then, tighten the throttle position sensor mounting bolt securely.
(7) Connect the throttle position sensor connector.



(8) If the MUT-II is used, connect it to the diagnosis connector.
(9) If a MUT-II is not used, perform the following operation.
  ① Disconnect the throttle position sensor's connector and make connections between the two disconnceted connector valves using the special tool (test harness set).
  ② Connect a digital voltmeter between terminal ③ (sensor output) and terminal ① (sensor earth) of the throttle position sensor.
(10) Switch ON the ignition switch.
  (Do not start the engine.)
(11) Check the output voltage of the throttle-position sensor. Note, if the MUT-II is used, that item No. 14 should be selected to get the read-out of the throttle-position sensor's output voltage.

Standard value : 400–1,000 mV

(12) If the voltage is out of specification, check the throttle position sensor and associated harnesses.
(13) Remove the feeler gauge.
(14) Turn the ignition switch OFF.



FIXED SAS ADJUSTMENT

NOTE
1. The fixed SAS has been factory-adjusted. Never attempt to move it.
2. Should it be out of proper adjustment, adjust by following the procedure given below.

(1) Sufficiently slacken the accelerator cable.
(2) Loosen the lock nut on the fixed SAS.
(3) Sufficiently loosen the fixed SAS by turning it counterclockwise to fully close the throttle valve.

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(4) Tighten the fixed SAS slowly to find a point at which it contacts the throttle lever (where the throttle valve starts opening). From that point, tighten the fixed SAS further $1\frac{1}{4}$ turns.
(5) Holding the fixed SAS to prevent it from turning, tighten the lock nut securely.
(6) Adjust the accelerator cable tension. (Refer to P.13-79-21)
(7) Adjust the basic idle speed.
(8) Adjust the idle position switch and throttle position sensor (TPS). (Refer to P.13-79-22)

BASIC IDLE SPEED ADJUSTMENT

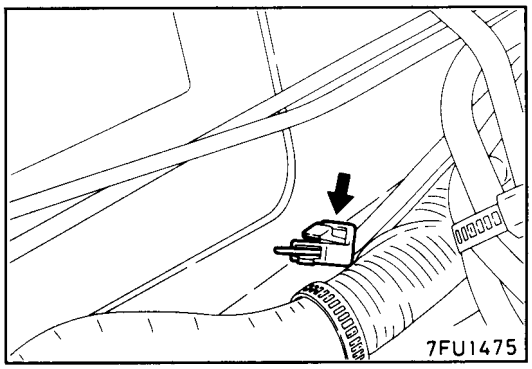
NOTE
1. The basic idle speed has been factory-adjusted with the speed adjusting screw (SAS) and does not normally require adjustment.
2. If the adjustment is required, first check that the ignition plug, injector, ISC servo, and compression pressure are normal.

(1) Before starting the inspection and adjustment procedures, set the vehicle in the following conditions:
- Engine coolant temperature: 80 to 95°C (176 to 205°F)
- Lamps, accessories: OFF
- Transmission: Neutral (P for vehicles with an automatic transmission)

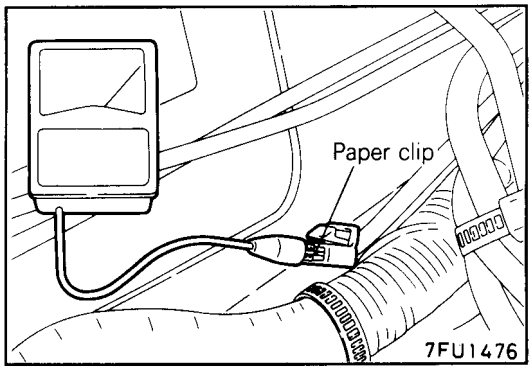
(2) If the MUT-II is used, connect it to the diagnosis connector.

NOTE
When the MUT-II is connected, the diagnostic control terminal is earthed.

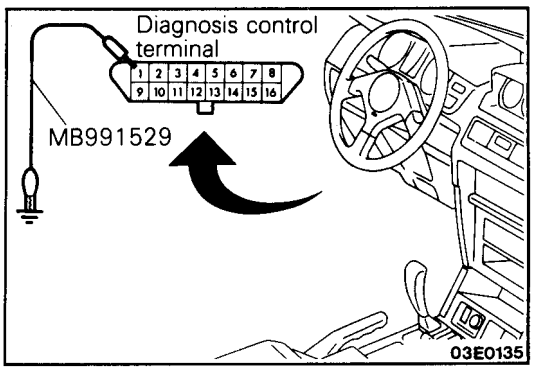
(3) If the MUT-II is not used, follow the steps below.
① Insert a paper clip into the 1-pin connector shown in the figure at the left.



② Connect a primary-voltage-detection type of tachometer to the paper clip.



③ Use the special tool (diagnosis code check harness) to earth the diagnosis test mode control terminal (terminal (1)) of the diagnosis control terminal (16 pin).



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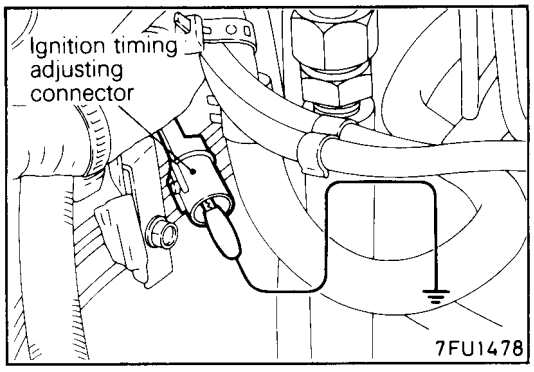
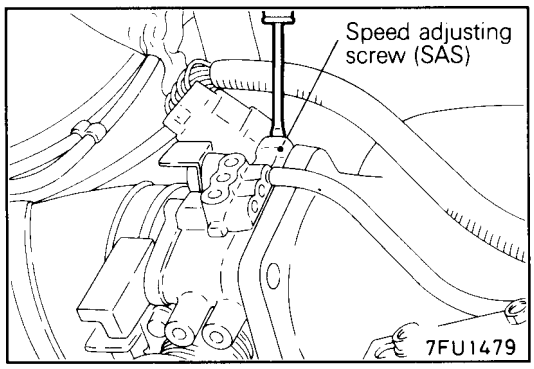


(4) Remove the water-resistant female connector from the ignition timing adjusting connector.
(5) Use a jumper wire to earth the terminal for adjustment of ignition timing.

(6) Start the engine and let it idle.
(7) Check the standard idling speed.

Standard value: 700 ± 50 r/min.

NOTE
1. The engine speed may be 20 to 100 r/min. lower than indicated above for a new vehicle (driven approximately 500 km (300 miles) or less), but no adjustment is necessary.
2. If the engine stalls or the r/min. is low even though the vehicle has been driven approximately 500 km (300 miles) or more, it is probable that deposits are adhered to the throttle valve, so clean it. (Refer to P.13-79-21)



(8) If not within the standard value range, turn the speed adjusting screw (SAS) to make the necessary adjustment.

NOTE
If the idling speed is higher then the standard value range even when the SAS is fully closed, check whether or not there is any indication that the fixed SAS has been moved. If there is an indication that it has been moved, adjust the fixed SAS. If there are no indications that it has been moved, it is possible that there is leakage as a result of deterioration of the fast idle air valve (FIAV), and, if so, the throttle body should be replaced.

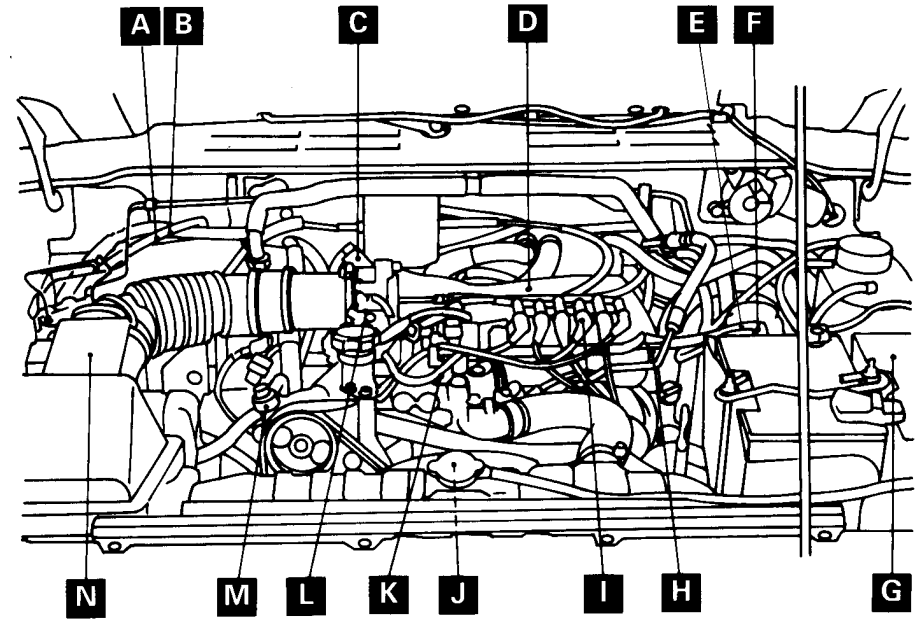
(9) Switch OFF the ignition switch.
(10) If the MUT-II was not used, disconnect the jumper wire from the diagnosis control terminal.
(11) Disconnect the jumper wire from the terminal for adjustment of ignition timing, and return the connector to its original condition.
(12) Start the engine again and let it run at idle speed for about ten minutes; check to be sure that the idling condition is normal.

ON-VEHICLE INSPECTION OF MPI COMPONENTS

COMPONENT LOCATION

<SOHC>

Name	Symbol	Name	Symbol
Air conditioner relay	G	Fuel pump check terminal	A
Air conditioner switch	R	Idle speed control servo	L
Air flow sensor (incorporating intake air temperature sensor and barometric pressure sensor)	N	Ignition coil (power transistor)	I
		Ignition timing adjustment terminal	B
Cam position sensor	H	Inhibitor switch	U
Control relay	T	Injector	D
Crank angle sensor	J	Oxygen sensor	V
Diagnosis connector	O	Power steering fluid pressure switch	M
EGR control solenoid valve	E	Purge control solenoid valve	F
Engine control unit	S	Throttle position sensor (with idle position switch)	C
Engine coolant temperature sensor	K		
Engine warning lamp (check engine lamp)	Q	Vehicle speed sensor	P



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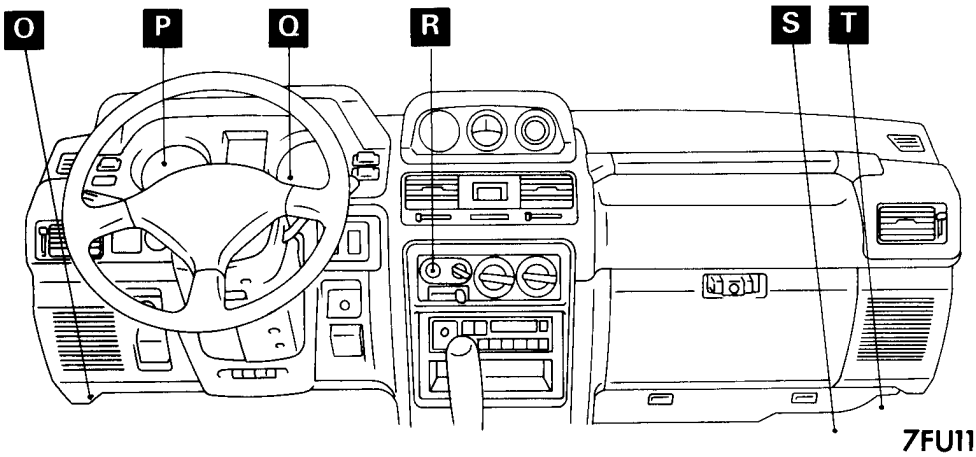

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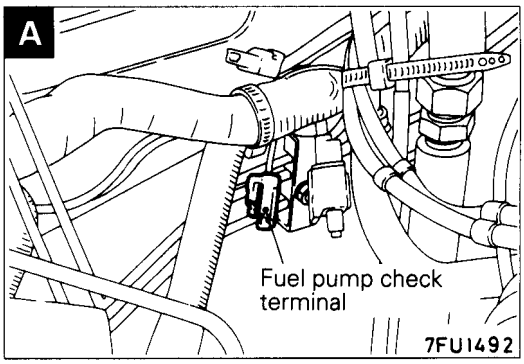

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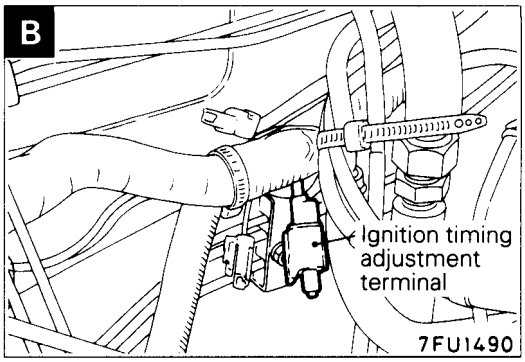

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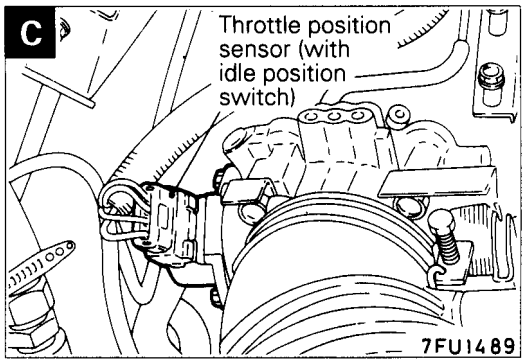

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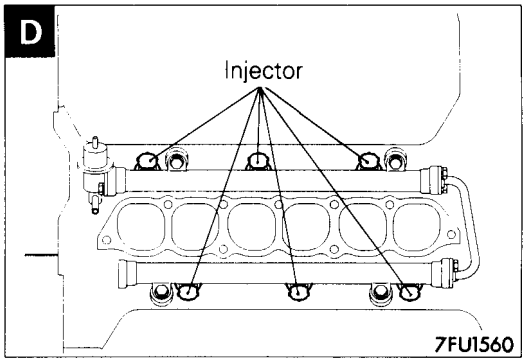

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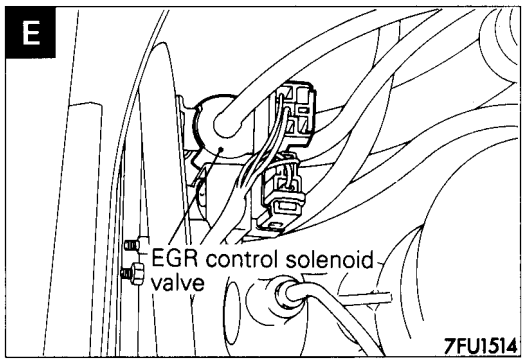

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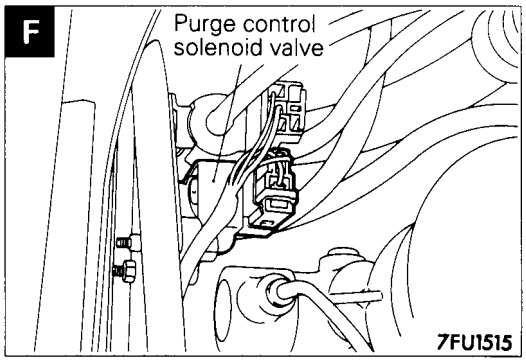

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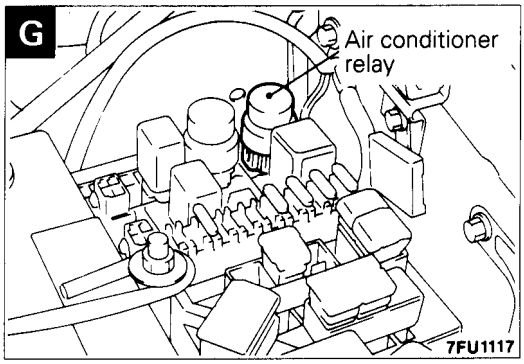

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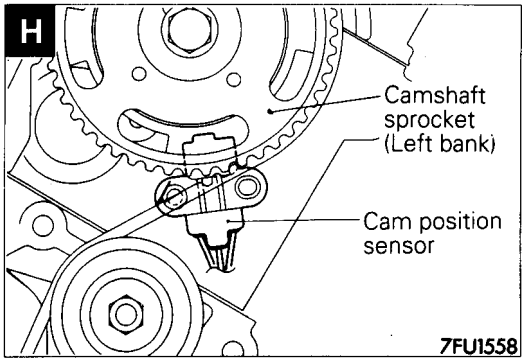

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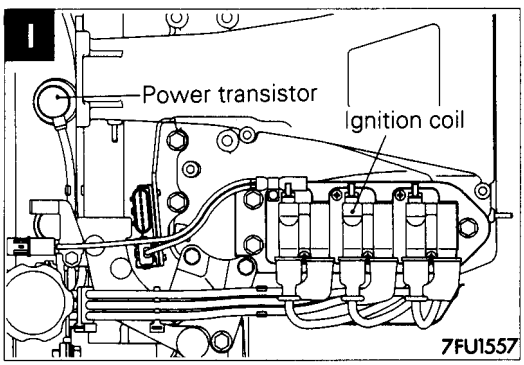

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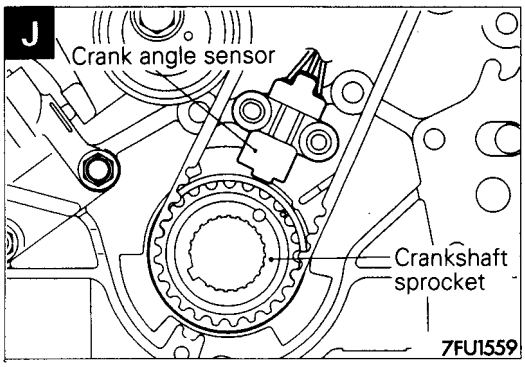

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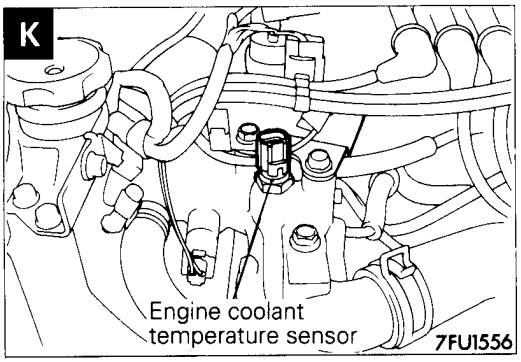

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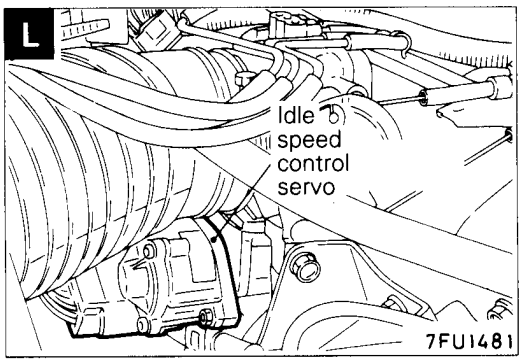

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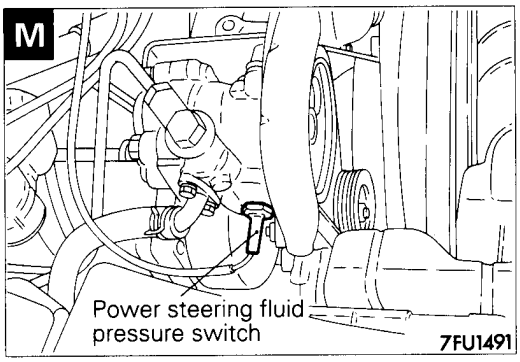

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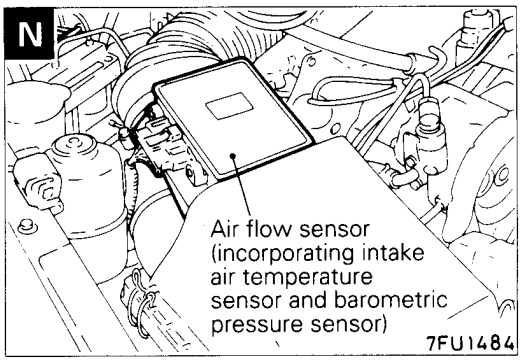

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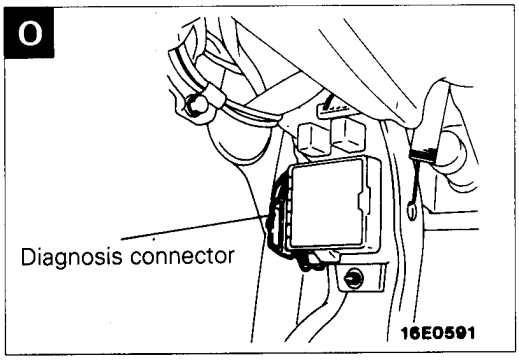

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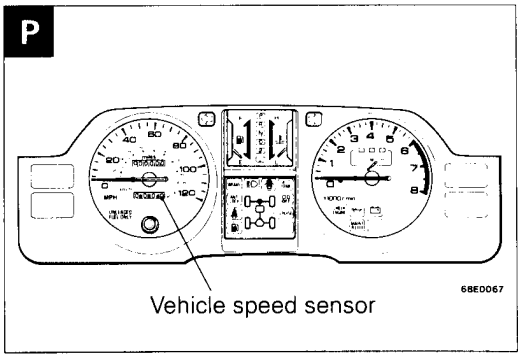

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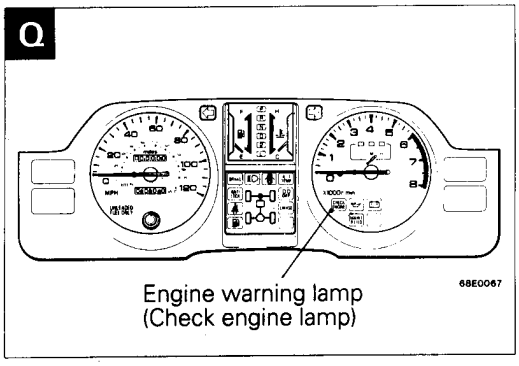

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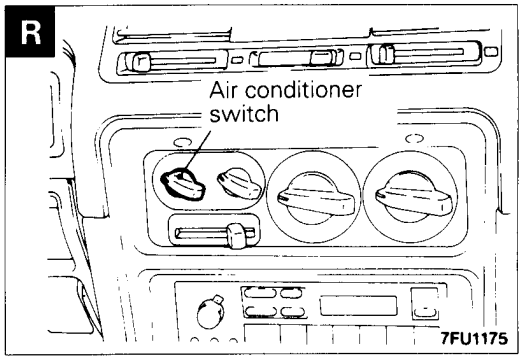

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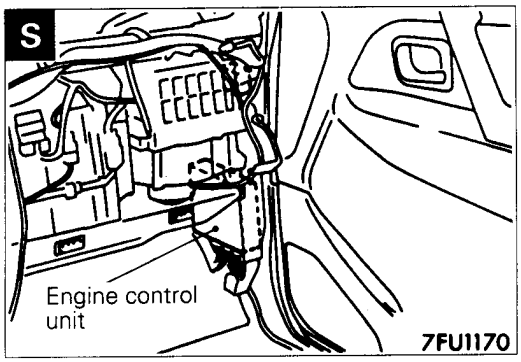

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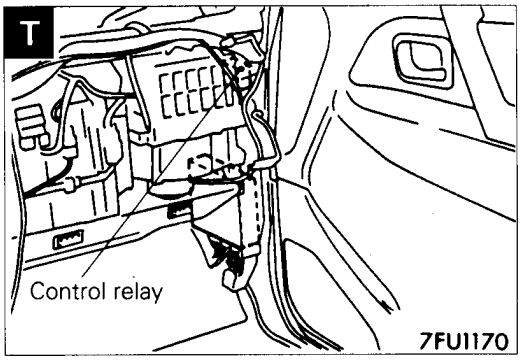

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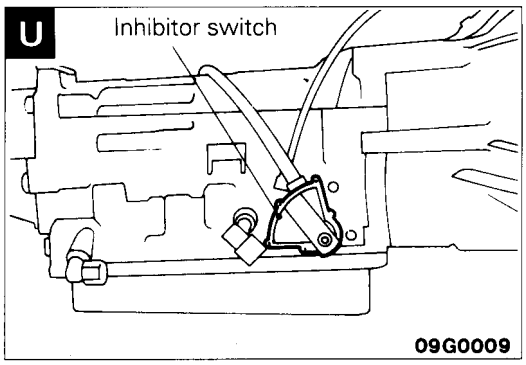

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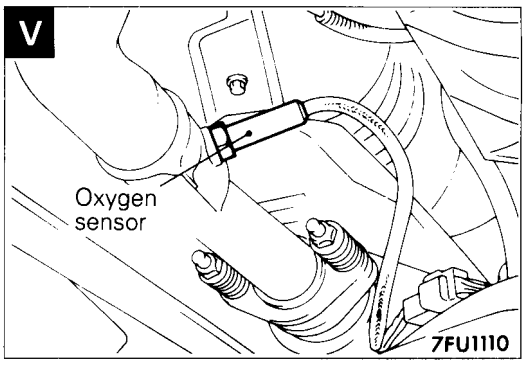
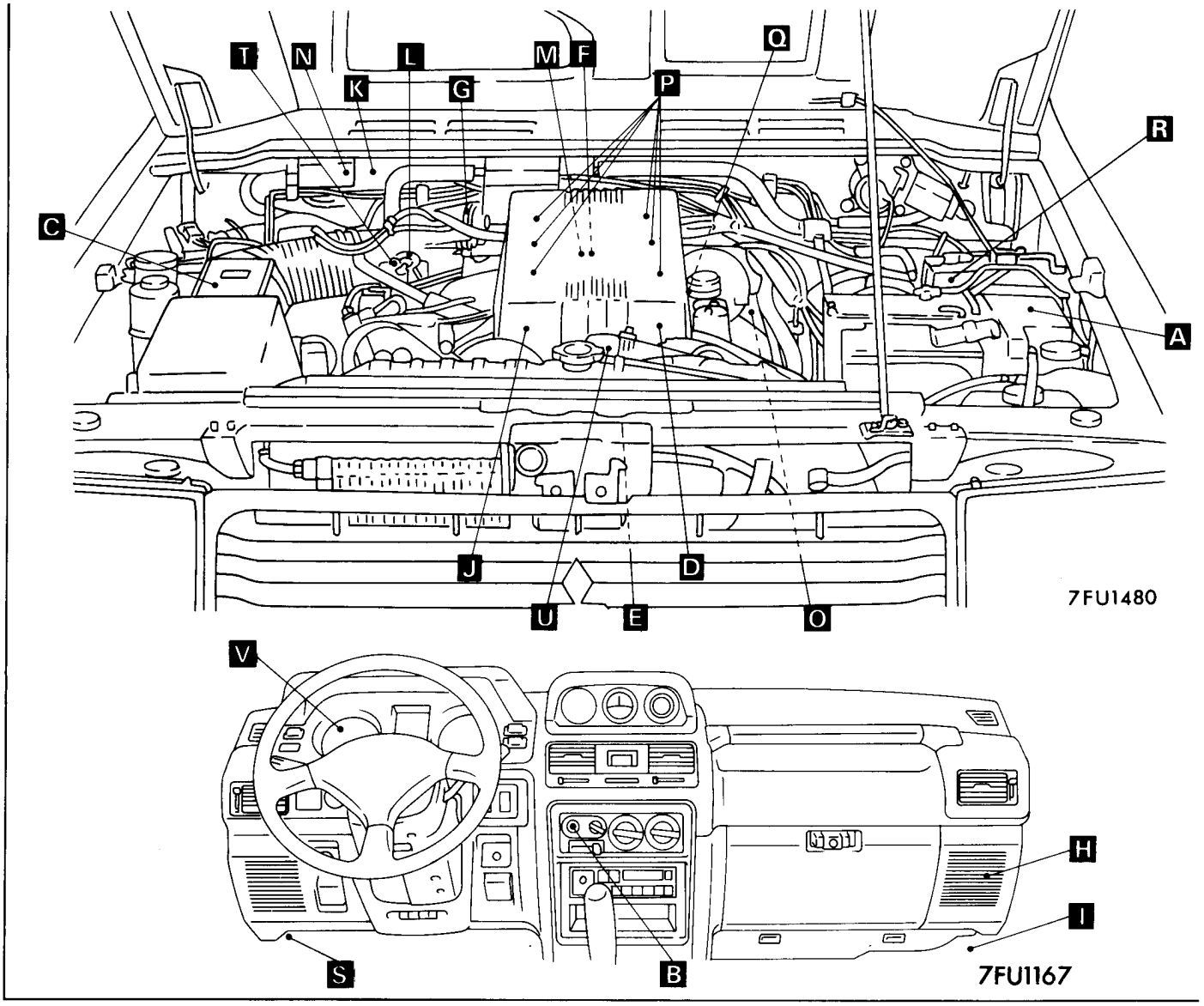


<DOHC>

Name	Symbol	Name	Symbol
Air conditioner relay	A	Idle speed control servo	L
Air conditioner switch	B	Ignition coil (power transistor)	M
Air flow sensor (incorporating intake air temperature sensor and barometric pressure sensor)	C	Ignition timing adjustment terminal	N
		Inhibitor switch	O
Cam position sensor	D	Injector	P
Crank angle sensor	E	Oxygen sensor	Q
Detonation sensor	F	Purge control solenoid valve	R
EGR control solenoid valve	G	Self-diagnosis connector	S
Engine control relay	H	Throttle position sensor (with idle position switch)	T
Engine control unit	I		
Engine coolant temperature sensor	J	Variable induction control solenoid valve	U
Fuel pump check terminal	K	Vehicle-speed sensor (reed switch)	V



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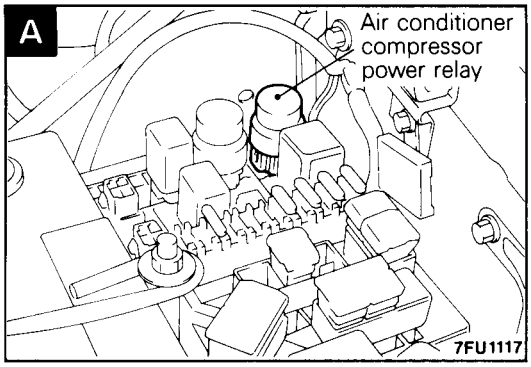

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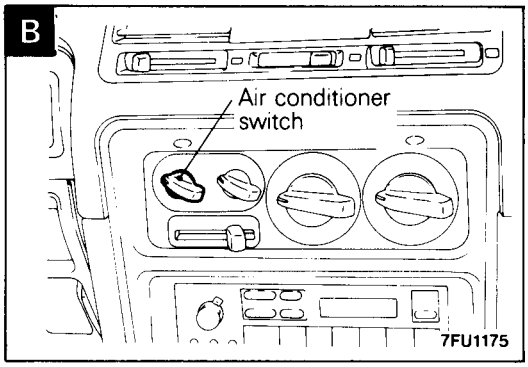

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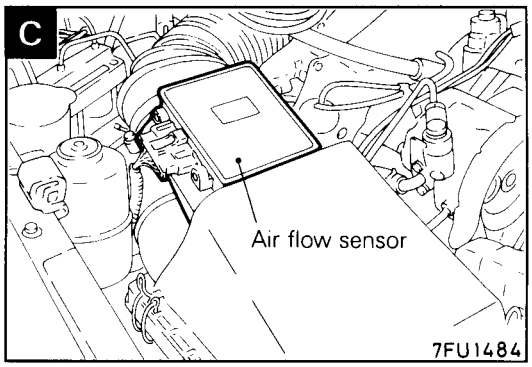

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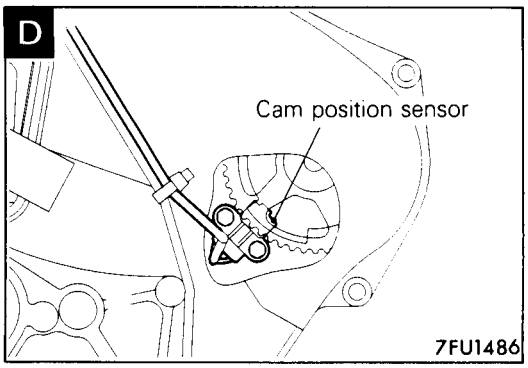

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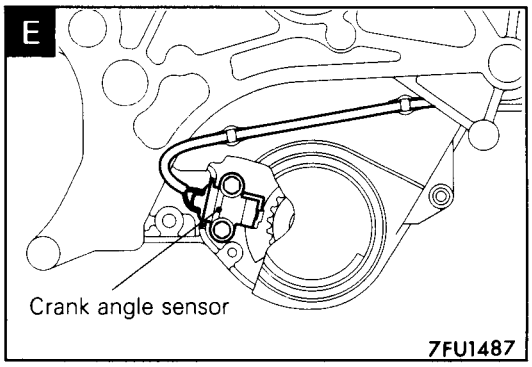

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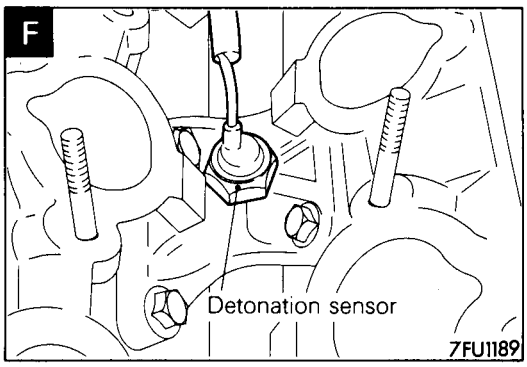

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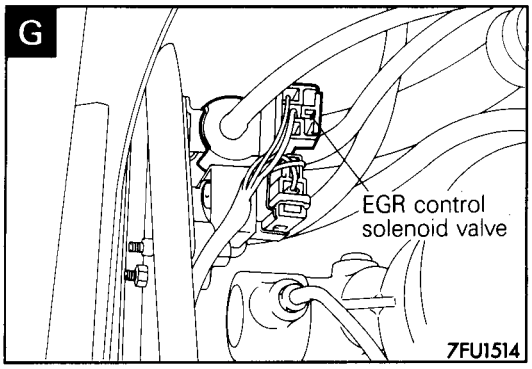

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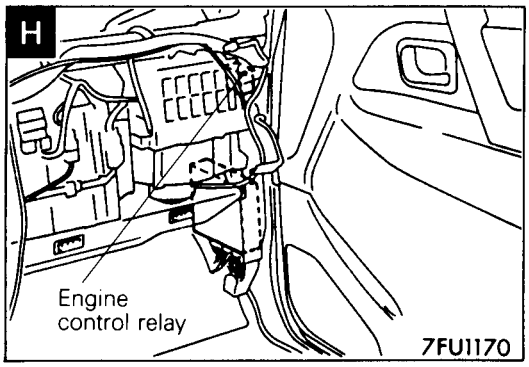

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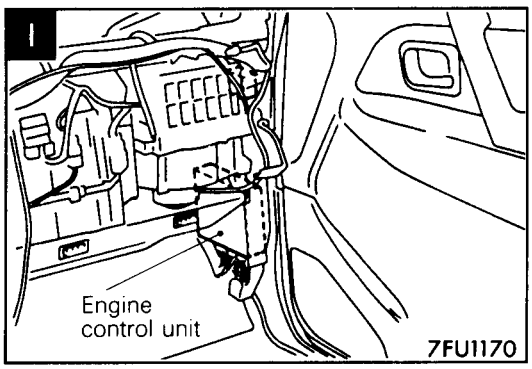

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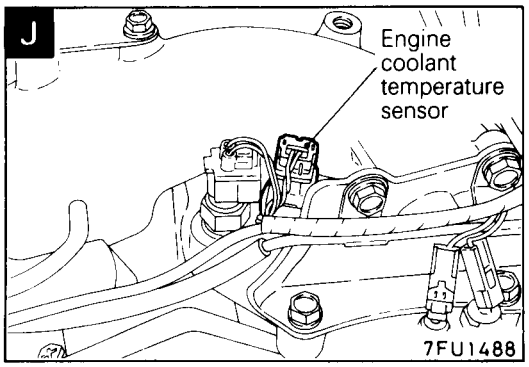

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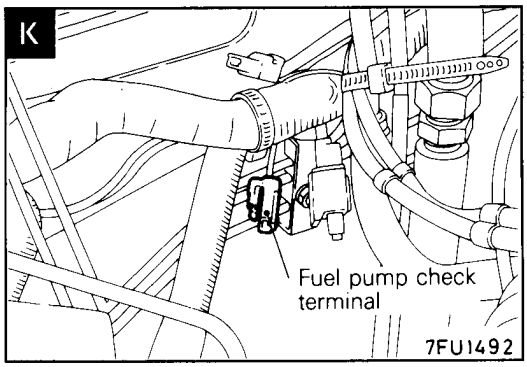

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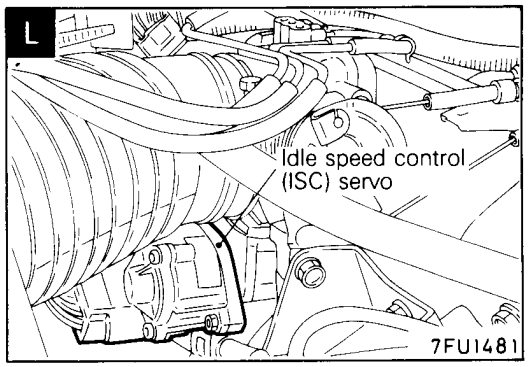

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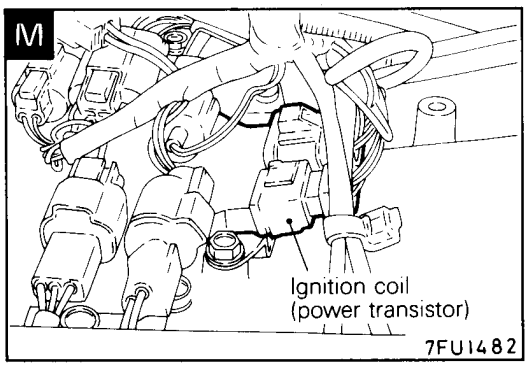

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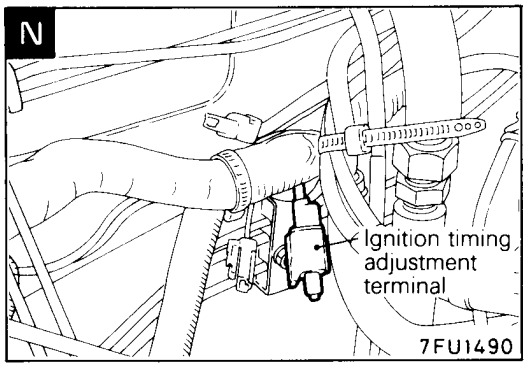

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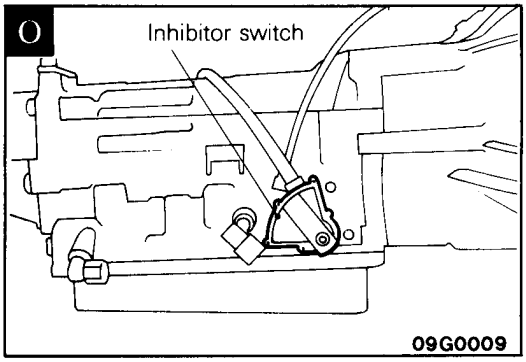

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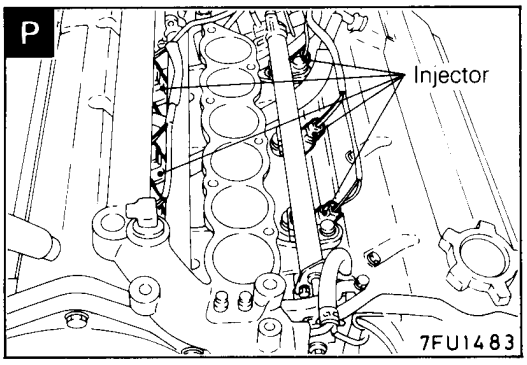

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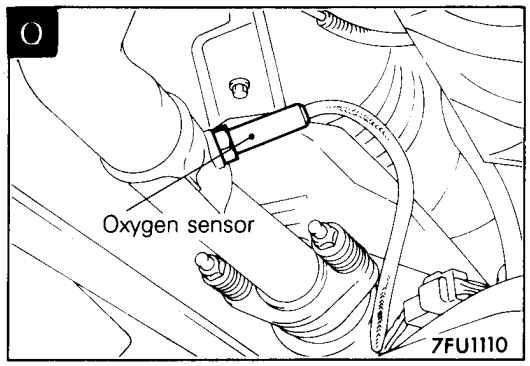

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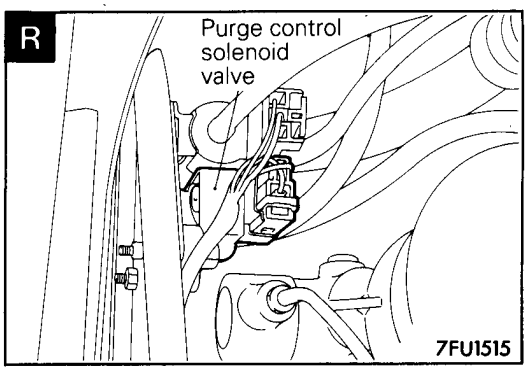

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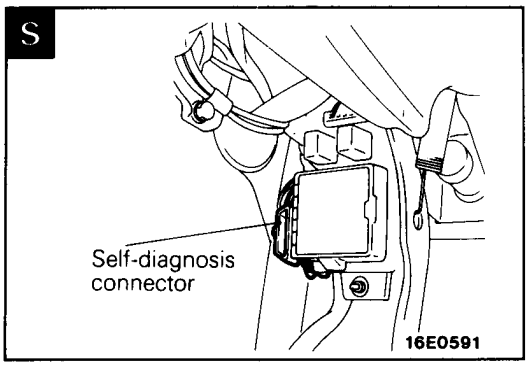

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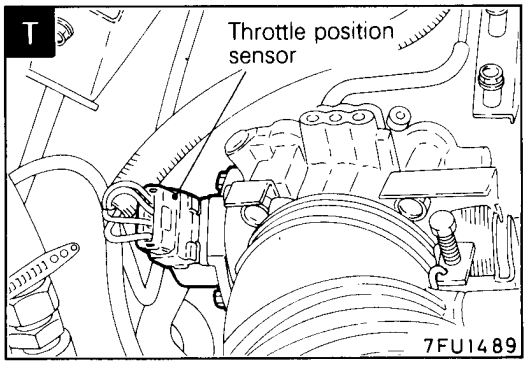

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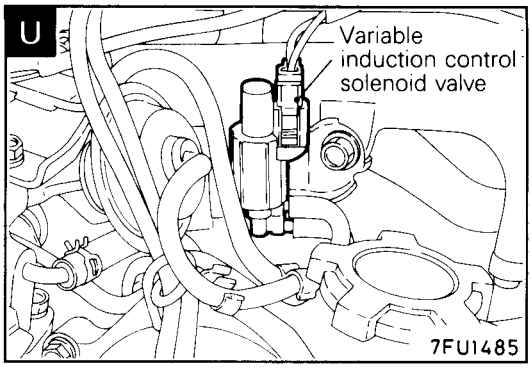
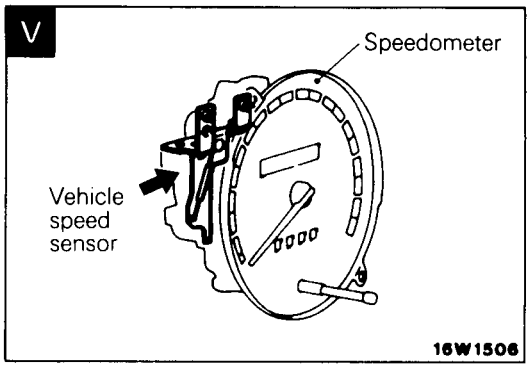
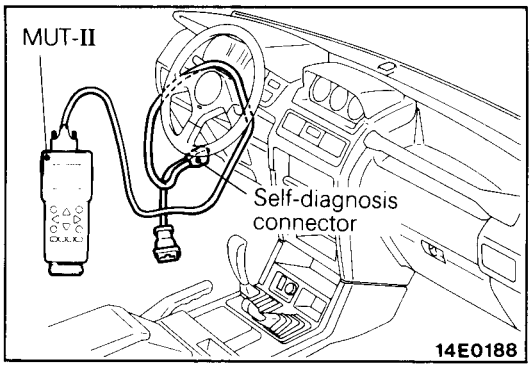




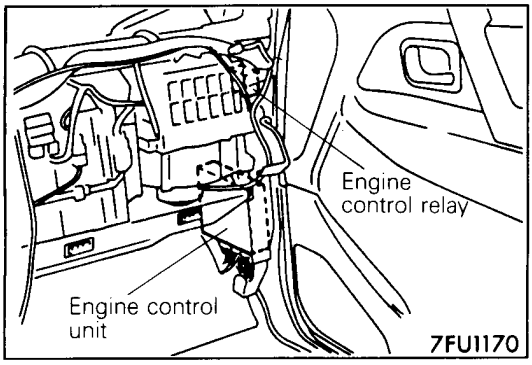


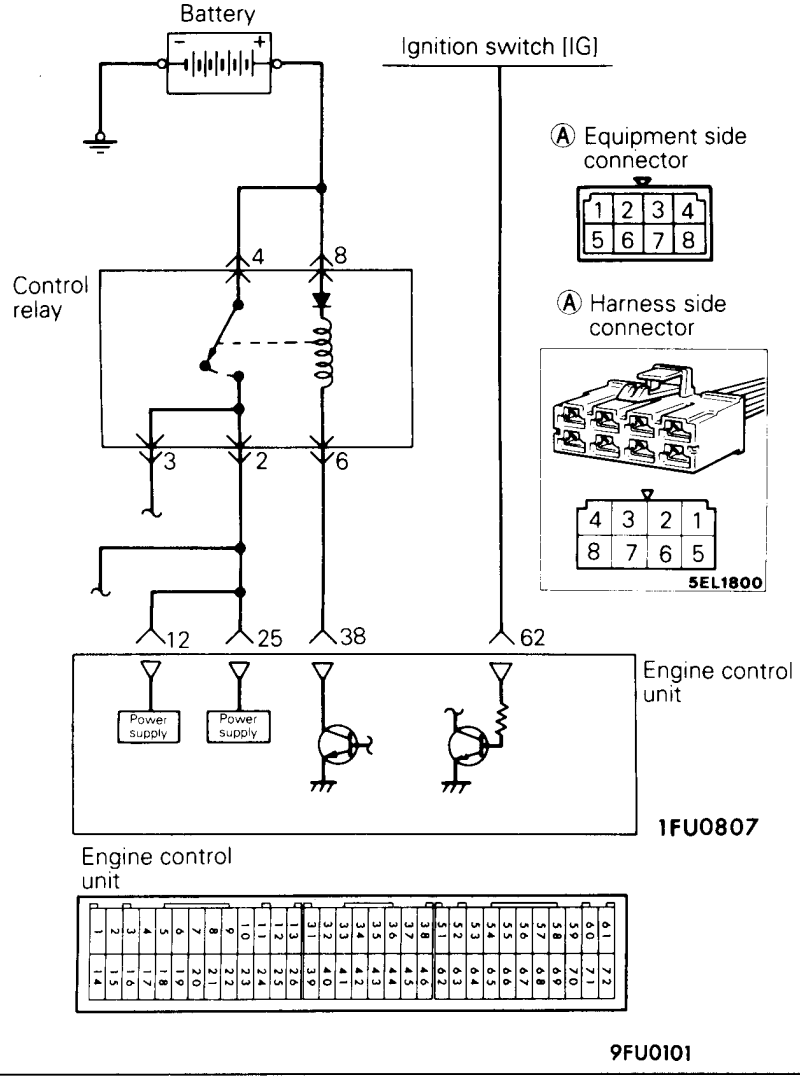
COMPONENT INSPECTION PROCEDURE

USING MUT-II

(1) Check by the service data and actuator test function. If any abnormality is found, check the body harness, components, etc. and repair as necessary.
(2) After repair, check again with the MUT-II to make sure that the input and output signals are now normal.
(3) Erase the self-diagnosis malfunction code in memory.
(4) Disconnect the MUT-II.
(5) Start the engine and perform running test, etc. to make sure that the troubles have been corrected.

POWER SUPPLY (Control relay) AND IGNITION SWITCH-IG





OPERATION

- While the ignition switch is ON, battery power is supplied to the engine control unit, the injector, the air flow sensor, etc.
- When the ignition switch is turned ON, the battery voltage is applied from the ignition switch to the engine control unit, which then turns ON the power transistor to energize the control relay coil. This turns ON the control relay switch and the power is supplied from the battery to the engine control unit through the control relay switch.

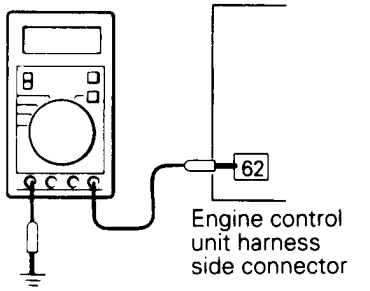
INSPECTION

Using MUT-II

Function	Item No.	Data display	Check condition	Standard value
Data reading	16	Engine control unit power voltage	Ignition switch: ON	SV

HARNESS INSPECTION

1



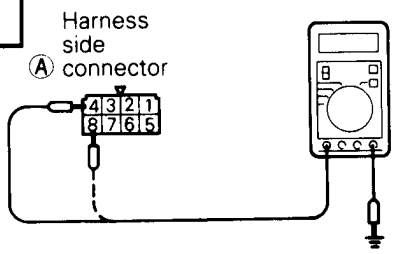
Measure the ignition switch (IG) terminal input voltage.

- Engine control unit connector: Disconnected

Ignition switch	Voltage (V)
OFF	0–1
ON	SV

OK → 2 Repair the harness. (Ignition switch – 62) or check the ignition switch

2



Measure the power supply voltage of the control relay.

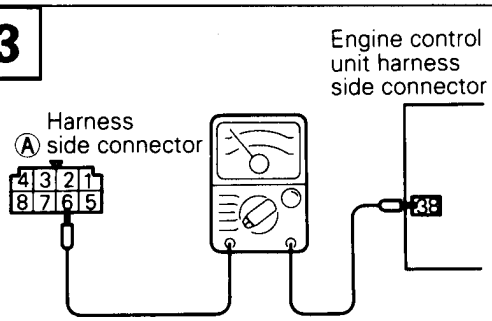
- Ignition switch: OFF
- Control relay connector: Disconnected

Voltage (V)
SV

OK → 3

NG → Repair the harness. (Battery – Ⓐ4, Ⓐ8)

3



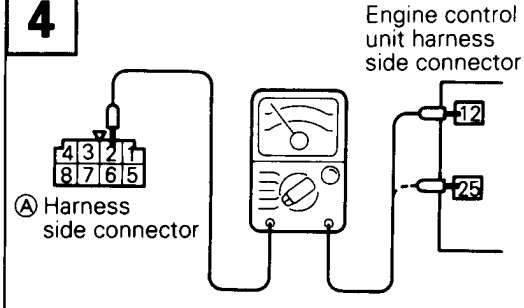
Check for an open-circuit, or a short-circuit to earth, between the engine control unit and the control relay.

- Engine control unit connector: Disconnected
- Control relay connector: Disconnected

OK → 4

NG → Repair the harness. (Ⓐ6 – 38)

4



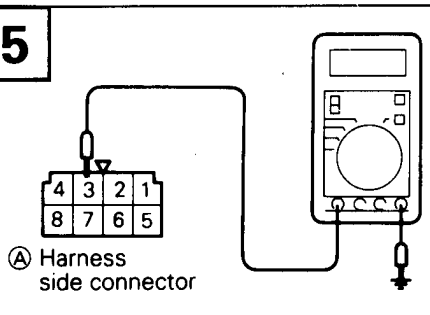
Check for an open-circuit, or a short-circuit to earth between the engine control unit and the control relay.

- Control relay connector: Disconnected
- Engine control unit connector: Disconnected

OK → 5

NG → Repair the harness. (Ⓐ2 – 12, 25)

5



Measure power voltage to the actuator.

- Control relay connector: Connected
- Engine control unit connector: Connected

Engine	Voltage (V)
Cranking	8V oder higher
Racing	SV

OK → STOP

NG → Replace the control relay or defective engine control unit

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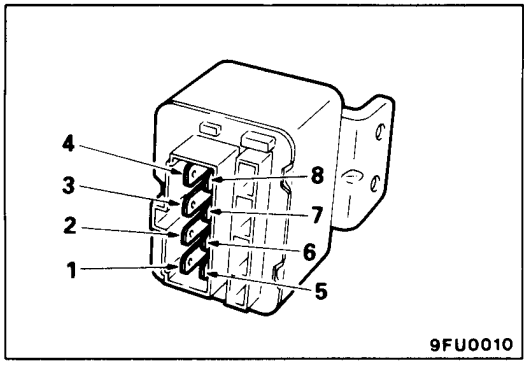
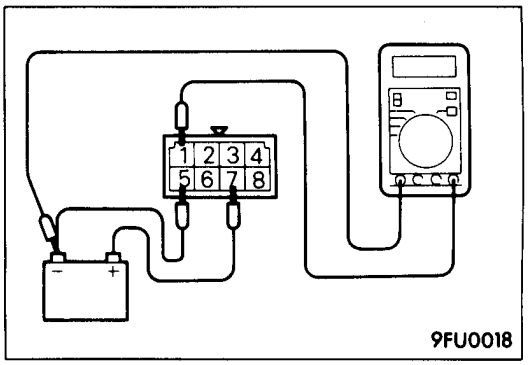
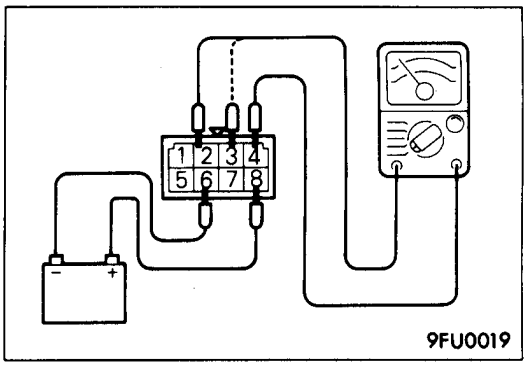






CONTROL RELAY INSPECTION

(1) Remove the control relay.
(2) Check for continuity between control relay terminals

Terminal No.	Continuity
5 – 7	Conductive
6 – 8	Conductive (only one direction)

(3) Using jumper wires, connect terminal ⑦ of control relay to battery ⊕ terminal and terminal ⑤ of control relay to battery ⊖ terminal.

Caution
When connecting jumper wires, make sure that it is applied to correct terminal. Otherwise, the relay could be damaged.

(4) Connecting and disconnecting the jumper wire to battery ⊖ terminal, measure the voltage at terminal ① of the control relay.

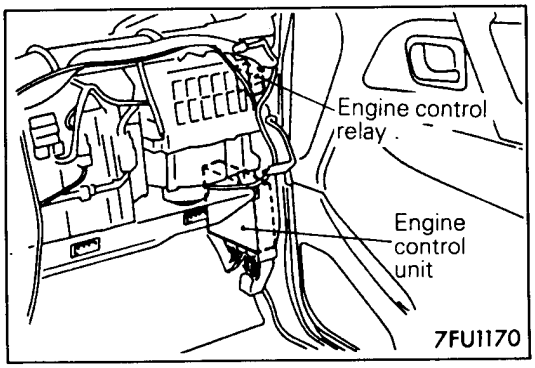
Jumper wire	Voltage
Connected	SV
Disconnected	0V

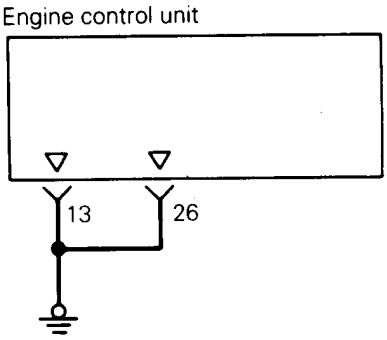
(5) Using jumper wires, connect terminal ⑧ of control relay to battery ⊕ terminal and terminal ⑥ of control relay to battery ⊖ terminal.
(6) Connecting and disconnecting the jumper wire to battery ⊖ terminal, check the continuity across terminals ② and ④ (or ③ and ④) of the control relay.

Jumper wire	Continuity across terminals 2 and 4	Continuity across terminals 3 and 4
Connected	Conductive (0 Ω)	Conductive (0 Ω)
Disconnected	Nonconductive (∞ Ω)	Nonconductive (∞ Ω)

(7) Replace the control relay if any defect is evident.

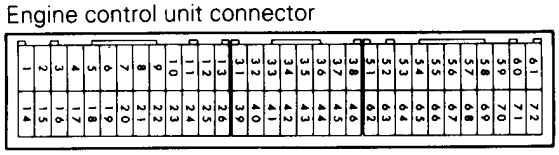
ENGINE CONTROL UNIT POWER EARTH





01A0191

Engine control unit connector



9FU0101

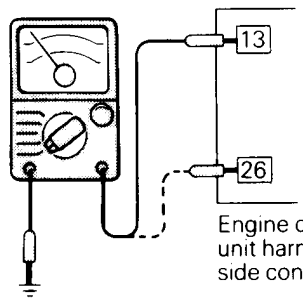
OPERATION

Earth the engine control unit.

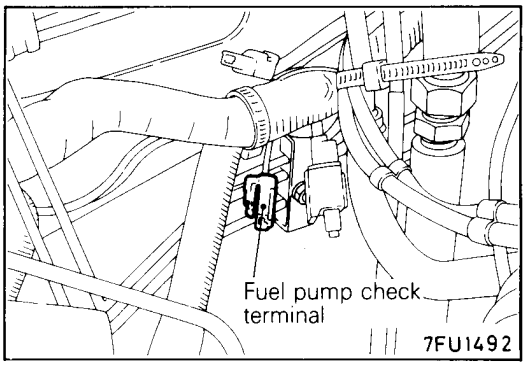
TROUBLESHOOTING HINTS

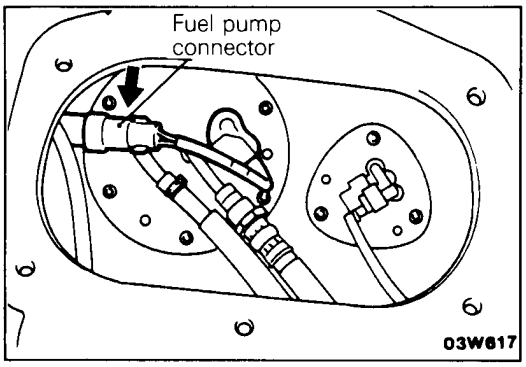
If the earth wire of the engine control unit is not connected securely to earth, the unit will not operate correctly.

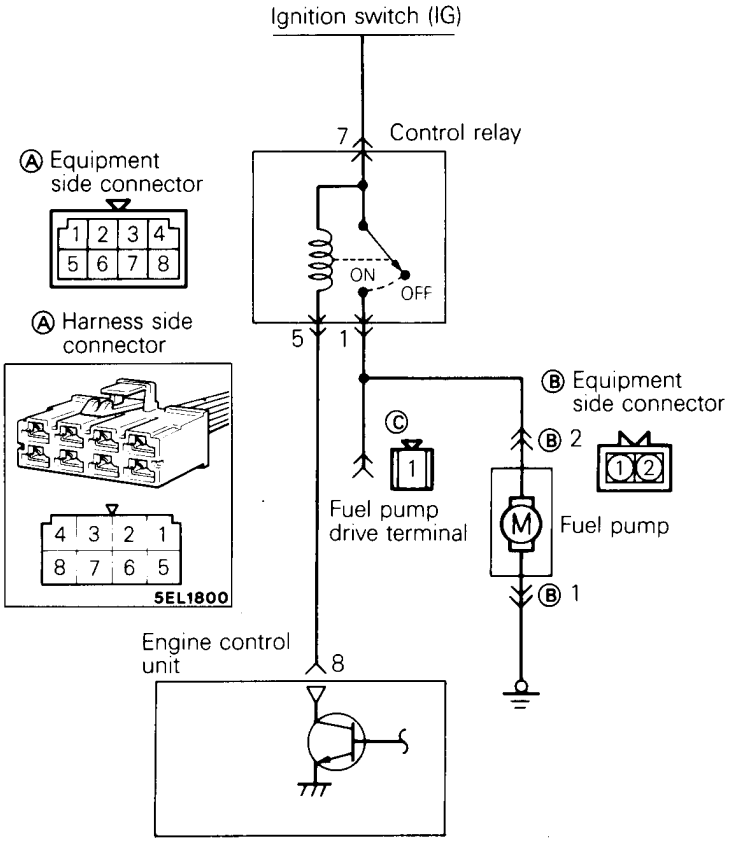
HARNESS INSPECTION

1	 01P0150	Check for continuity of the earth circuit • Engine control unit connector: Disconnected	OK → STOP NG → Repair the harness. (13 – Earth) (26 – Earth)

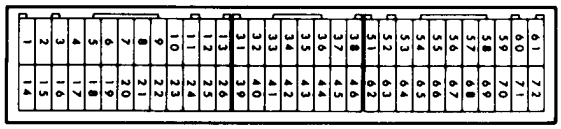
FUEL PUMP







Engine control unit connector



9FU0101

6AF0159

OPERATION

- The fuel pump is driven when the engine is cranking and while the engine is running.
- When the engine is cranking and while the engine is running, the engine control unit turns the power transistor ON to supply power to the control relay coil. This causes the control relay switch to turn ON, and current is supplied from the ignition switch via the control relay switch to drive the fuel pump.

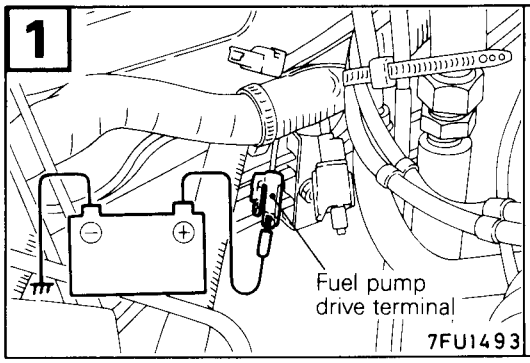
INSPECTION

Using MUT-II

Function	Item No.	Drive	Check condition	Check content	Normal state
Actuator test	07	Fuel pump is driven to circulate fuel	● Engine cranking ● Forced drive of fuel pump Check is made for above two conditions.	Hold return hose with fingers to feel pulsation indicating fuel flow	Pulsation is felt
				Listen to pump operating sound near fuel tank	Operating sound is heard

HARNESS INSPECTION

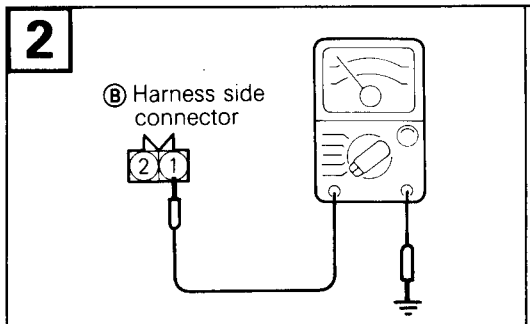
1



Check the fuel pump.
- Apply battery voltage to the fuel pump drive terminal and operate the pump.

OK → 4
NG → 2

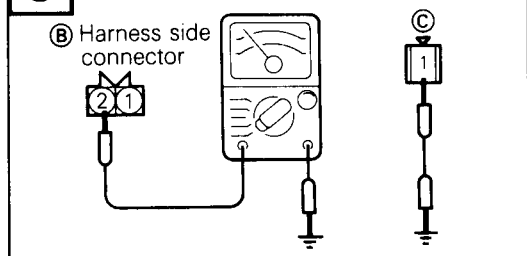
2



Check for continuity of the fuel pump earthing line.
- Fuel pump connector: Disconnected

OK → 3
NG → Repair the harness. (Ⓑ1 – Earth)

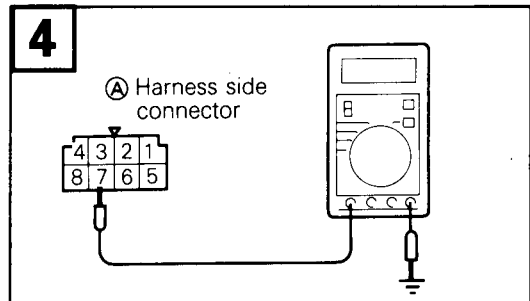
3



Check for open-circuit or short-circuit between the fuel pump and the fuel pump drive terminal.
- Fuel pump connector: Disconnected
- Control relay connector: Disconnected

OK → 4
NG → Repair the harness. (Ⓑ2 – Ⓒ1)

4

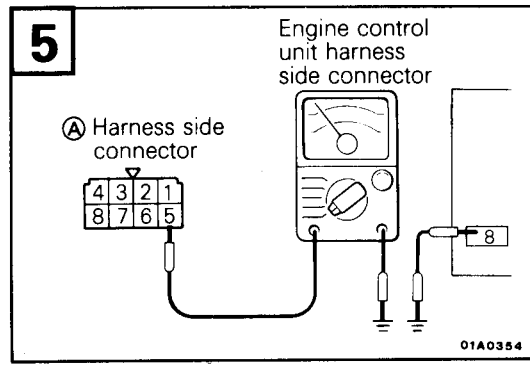


Measure the power supply voltage of the control relay.
- Control relay connector: Disconnected

Ignition switch	Voltage (V)
OFF	0 – 1
START	SV

OK → 5
NG → Repair the harness. (Ignition switch – Ⓐ7) or check for ignition switch.

5



Check for an open-circuit, or a short-circuit to earth between the control relay and the engine control unit.
- Control relay connector: Disconnected
- Engine control unit connector: Disconnected

OK → 6
NG → Repair the harness. (Ⓐ5 – 8)

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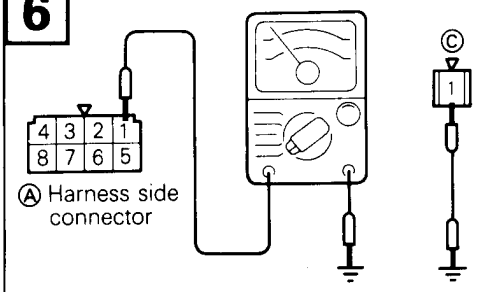
6



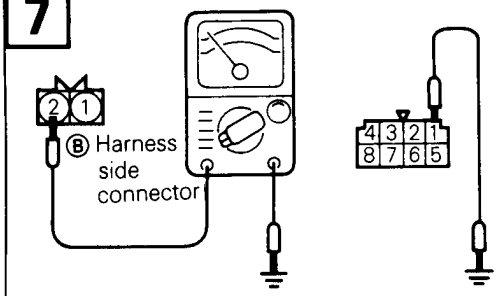
Check for continuity between the fuel pump drive terminal and the control relay.

- Control relay connector: Disconnected
- Fuel pump connector: Disconnected

OK → 7

NG → Repair the harness. (Ⓐ1 - Ⓒ1)

7



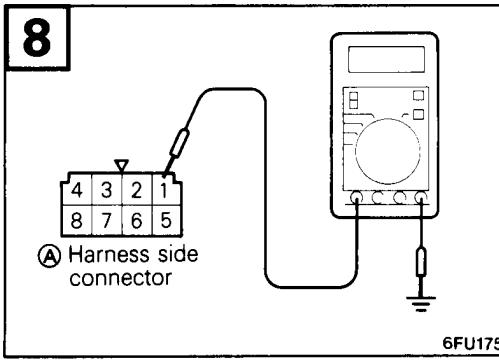
Check for an open-circuit, or a short-circuit to earth between the control relay and the fuel pump.

- Control relay connector: Disconnected
- Fuel pump connector: Disconnected

OK → 8

NG → Repair the harness. (Ⓐ1 - Ⓑ2)

8



Measure the power supply voltage of the fuel pump.

- Control relay connector: Connected
- Engine control unit connector: Connected

Engine	Voltage (V)
Cranking	8V or more
Racing	SV

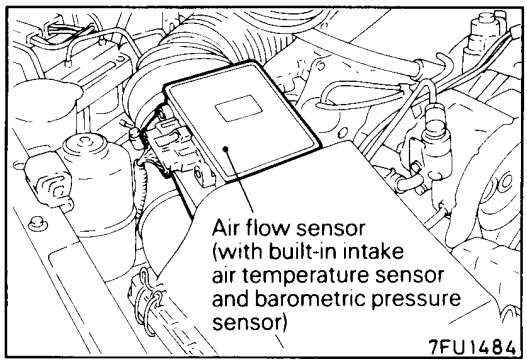
OK → STOP

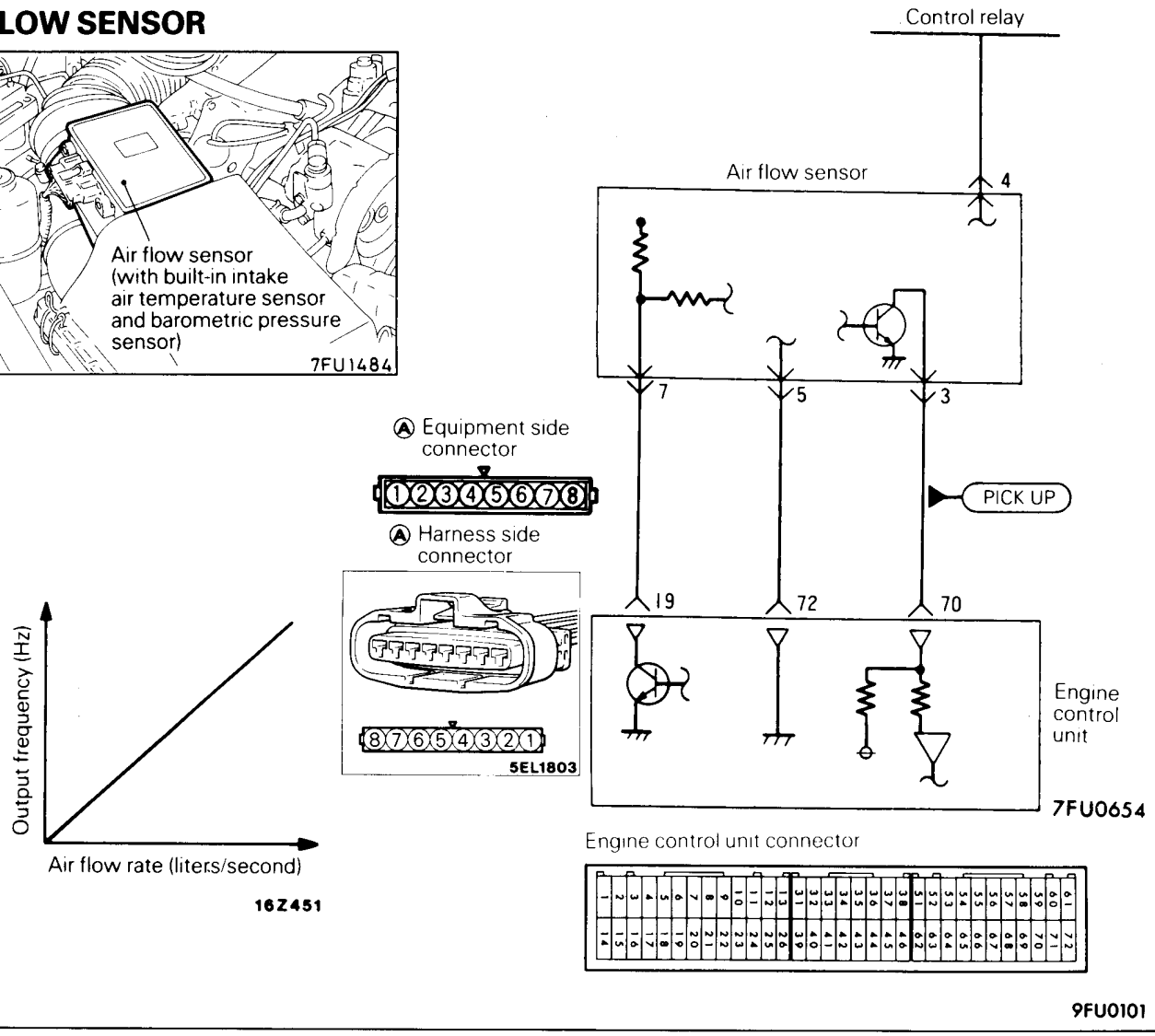
NG → Control relay or engine control unit is defective.

CONTROL RELAY INSPECTION

Refer to P.13-79-36.

AIR FLOW SENSOR





OPERATION

- The air flow sensor located in the air cleaner converts the engine intake air volume into a pulse signal of frequency proportional to the air volume and inputs it to the engine control unit, which then computes the fuel injection rate, etc. based on the input signal.
- The air flow sensor power is supplied from the control relay to the air flow sensor and is earthed in the engine control unit. The air flow sensor generates a pulse signal as it repeatedly opens and closes between the 5 V voltage supplied from the engine control unit and earth.

TROUBLESHOOTING HINTS

Hint 1: If the engine stalls occasionally, crank the engine and shake the air flow sensor harness. If the engine stalls, poor contact of the air flow sensor connector is suspected.

Hint 2: If the air flow sensor output frequency is other than 0 when the ignition switch is turned on (but not starting the engine), faulty air flow sensor or engine control unit is suspected.

Hint 3: If the engine can be run idle even though the air flow sensor output frequency is out of specification, troubles are often found in other than the air flow sensor itself.

[Examples]

(1) Disturbed air flow in the air flow sensor (Disconnected air duct, clogged air cleaner element)
(2) Poor combustion in the cylinder (Faulty ignition plug, ignition coil, injector, incorrect compression pressure, etc.)
(3) Air leaking into the intake manifold through gap of gasket, etc.
(4) Loose EGR valve seat

INSPECTION

Using MUT-II

<Air Flow Sensor>

Function	Item No.	Data display	Check condition	Engine state	Standard value
Data reading	12	Sensor air volume (frequency)	• Engine coolant temperature: 80–95°C (176–203°F) • Lamps and accessories: OFF • Transmission: Neutral	700 r/min (Idle)	25–51 Hz <SOHC> 27–53 Hz <DOHC>
				2500 r/min <SOHC>	74–114 Hz
				2000 r/min <DOHC>	60–100 Hz
				Racing	Frequency increases with racing

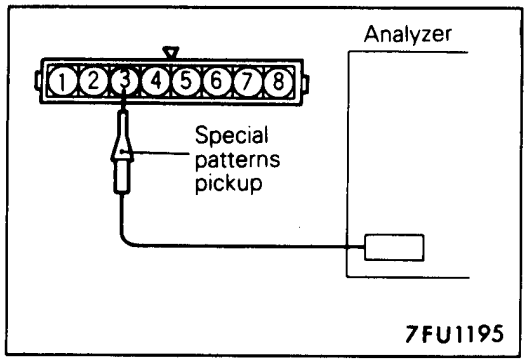
NOTE
When the vehicle is new [within initial operation of about 500 km (300 miles)] the air flow sensor output frequency may be about 10% higher.

<Air Flow Sensor Reset Signal>

Function	Item No.	Data display	Check condition	Engine state	Standard value
Data list	34	Reset signal condition	• Warm up the engine	700 r/min (Idle)	ON
				2500 r/min	OFF

<Volumetric Efficiency>

Function	Item No.	Data display	Check condition	Engine state	Standard value
Data list	37	Volumetric efficiency	• Engine coolant temperature: 80–95°C (176–203°F) • Lamps, accessory operation: OFF • Transmisson: Neutral	700 r/min (Idle)	15 – 35%
				2500 r/min	15 – 35%
				Sudden racing	Frequency increases with racing

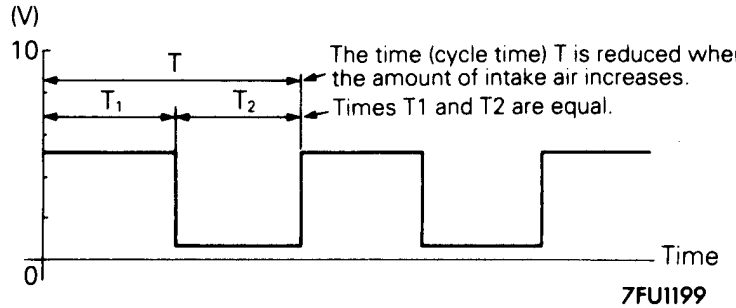


Wave Pattern Inspection Using an Analyzer

Measurement method

(1) Disconnect the air flow sensor connector, and connect the special tool (test harness: MB991348) in between. (All terminals should be connected.)
(2) Connect the analyzer special patterns pickup to terminal ③ of the air flow sensor connector.

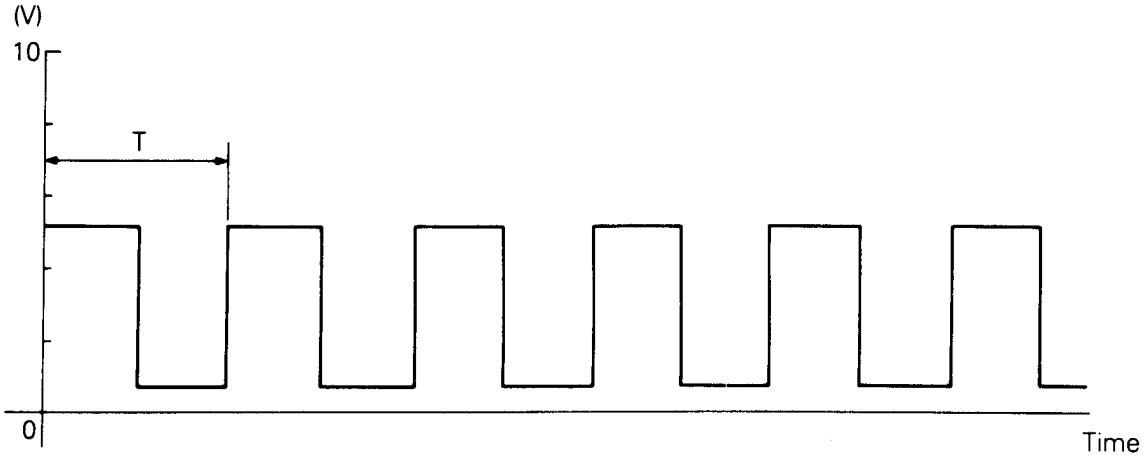
Standard wave pattern



Observation conditions

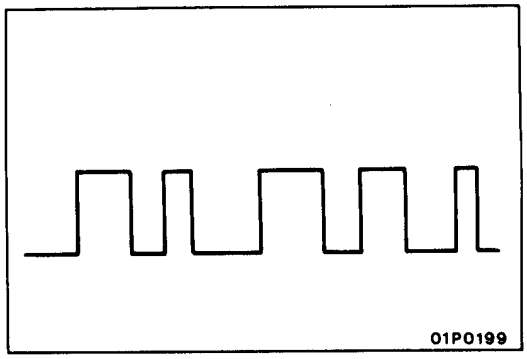
Function	Special patterns
Pattern height	Low
Pattern selector	Display
Engine r/min	Idle speed (700 r/min.)

Observation conditions (from conditions on above engine speed is increased by racing.)



Wave pattern observation points

Check that cycle time T becomes shorter and the frequency increases when the engine speed is increased.



Examples of abnormal wave patterns

- Example 1

  Cause of problem
  Sensor interface malfunction

  Wave pattern characteristics
  Rectangular wave pattern is output even when the engine is not started.

- Example 2

  Cause of problem
  Damaged rectifier or vortex generation column

  Wave pattern characteristics

  Unstable wave pattern with non-uniform frequency. However, when an ignition leak occurs during acceleration, the wave pattern will be distorted temporarily, even if the air flow sensor is normal.

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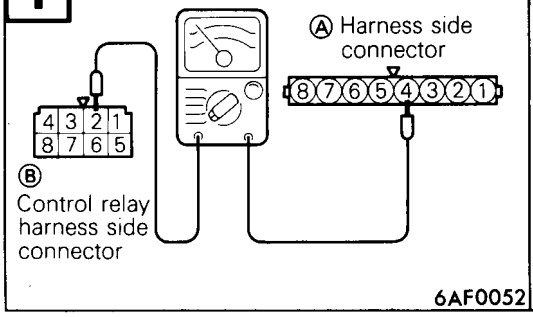
HARNESS INSPECTION

1



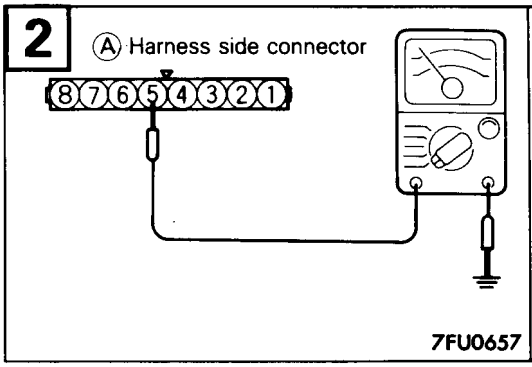
Check the continuity between the air flow sensor and the control relay.
- Control relay connector: Disconnected
- Air flow sensor connector: Disconnected

NOTE
Touch the circuit tester probes to both ends of the harness.

OK → 2

NG → Repair the harness. (Ⓐ4 - Ⓑ2)

2

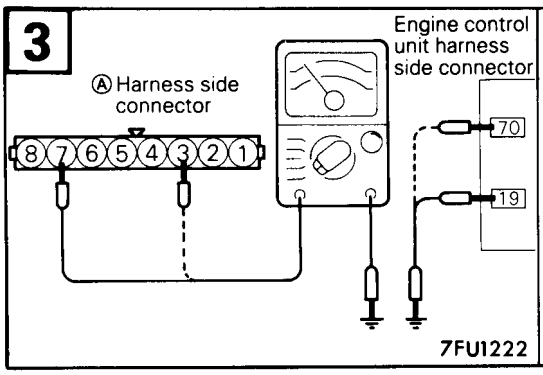


Check for continuity of the earth circuit.
- Connector: Disconnected

OK → 3

NG → Repair the harness. (Ⓐ5 - 72)

3

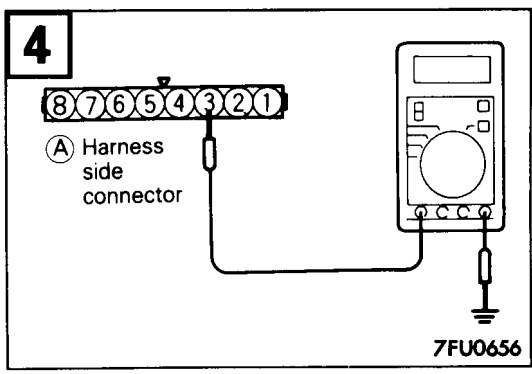


Check for open-circuit or short-circuit between the air flow sensor and the engine control unit.
- Air flow sensor connector: Disconnected
- Engine control unit connector: Disconnected

OK → 4

NG → Repair the harness. (Ⓐ3 - 70) (Ⓐ7 - 19)

4



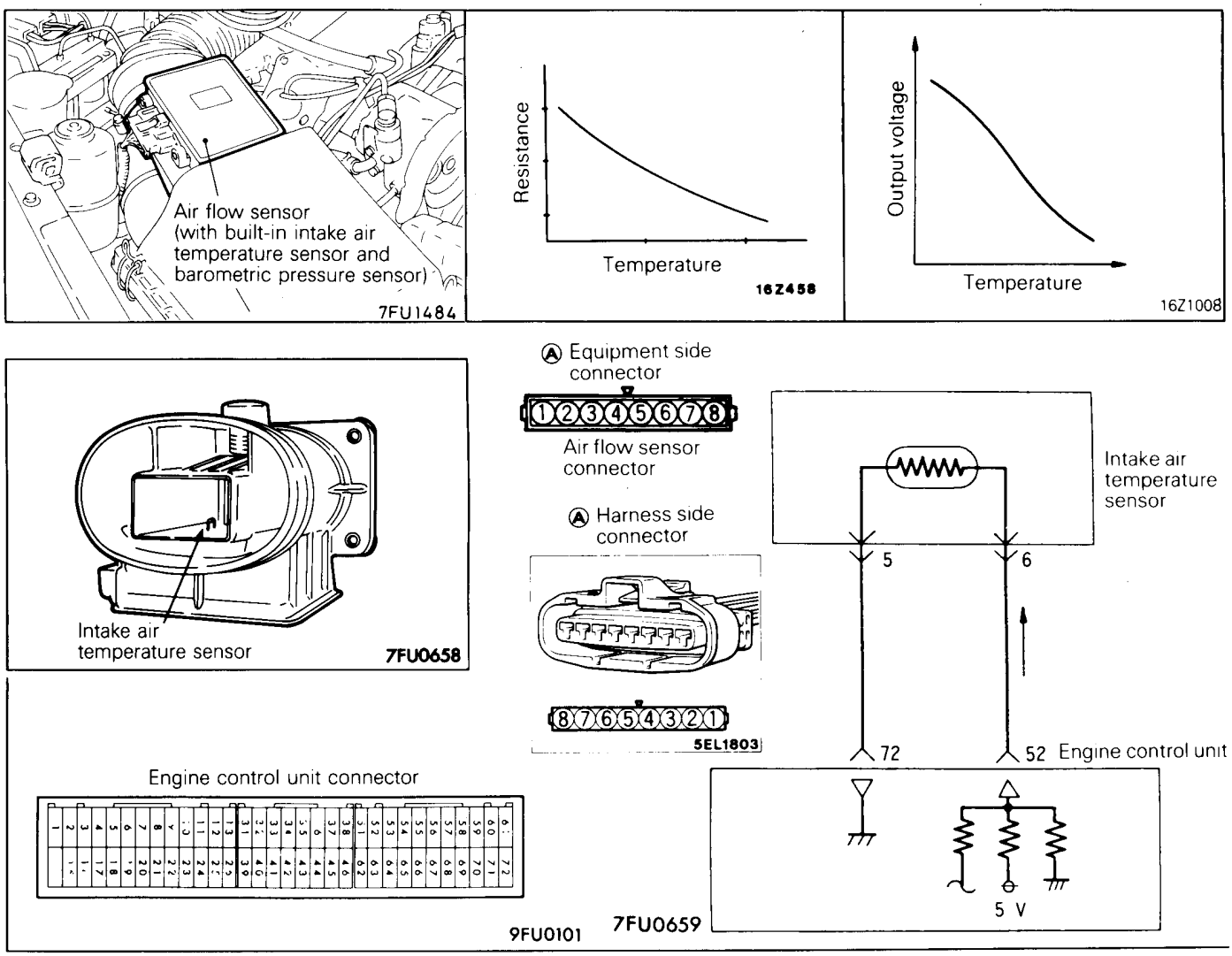
Measure the applied voltage.
- Air flow sensor connector: Disconnected
- Engine control unit connector: Connected
- Ignition switch: ON

Voltage (V)
4.8 – 5.2

OK → STOP

NG → Replace the engine control unit.

INTAKE AIR TEMPERATURE SENSOR



OPERATION

- The intake air temperature sensor converts the engine intake air temperature into a voltage and inputs it to the engine control unit, which then corrects the fuel injection rate, etc. based on the input signal.
- The 5 V power in the engine control unit is supplied via a resistor in the unit to the intake air temperature sensor. Via the sensor which is a kind of resistor, it is earthed in the engine control unit. The intake air temperature sensor resistor has such characteristic that its resistance decreases as the intake air temperature rises.
- The intake air temperature sensor terminal voltage increases or decreases as the sensor resistance increases or decreases. Therefore, the intake air temperature sensor terminal voltage changes with the intake air temperature, decreasing as the temperature rises.

TROUBLESHOOTING HINTS

The intake air temperature sensor senses the intake air temperature in the air cleaner so that it may indicate a temperature different from outside temperature depending on engine operating state.

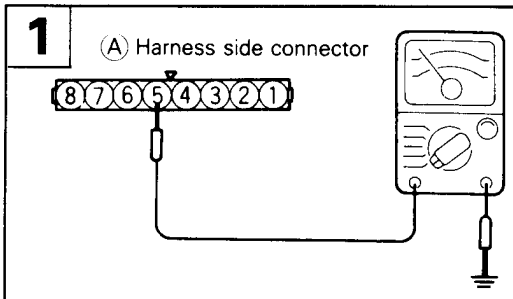
INSPECTION

Using MUT-II

Function	Item No.	Data display	Check condition	Intake air temperature °C (°F)	Standard value °C (°F)
Data reading	13	Sensor temperature	Ignition switch: ON or engine running	At –20 (–4)	–20 (–4)
				At 0 (32)	0 (32)
				At 20 (68)	20 (68)
				At 40 (104)	40 (104)
				At 80 (176)	80 (176)

HARNESS INSPECTION

1

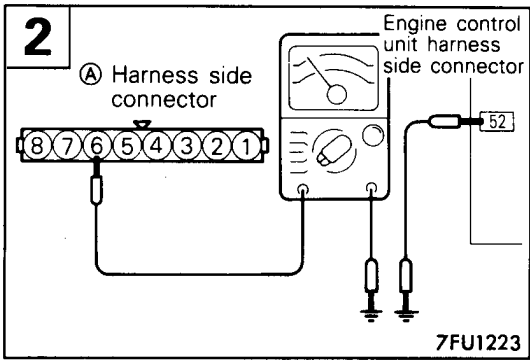


Check for continuity of the earth circuit.
- Connector: Disconnected

OK → 2

NG → Repair the harness. (Ⓐ 5 – 72)

2

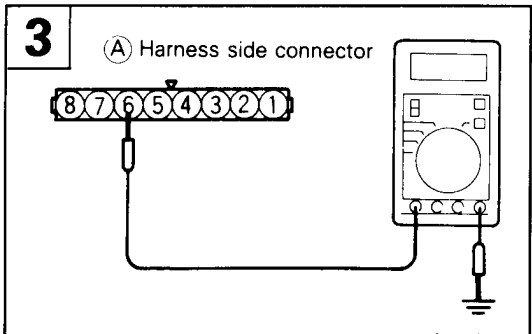


Check for open-circuit or short circuit between the intake air temperature sensor and the engine control unit.
- Air flow sensor connector: Disconnected
- Engine control unit connector: Disconnected

OK → 3

NG → Repair the harness. (Ⓐ 6 – 52)

3

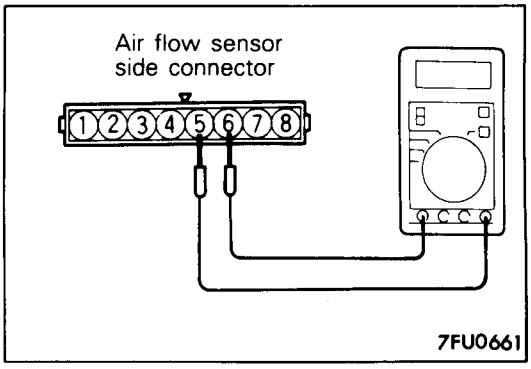


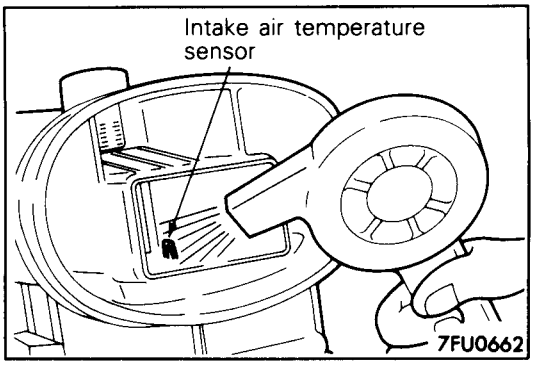
Measure the power supply voltage.
- Connector: Disconnected
- Ignition switch: ON

Voltage (V)
4.5 – 4.9

OK → STOP

NG → Repair the engine control unit





SENSOR INSPECTION

(1) Disconnect the air flow sensor connectors.
(2) Measure resistance between terminals ⑤ and ⑥.

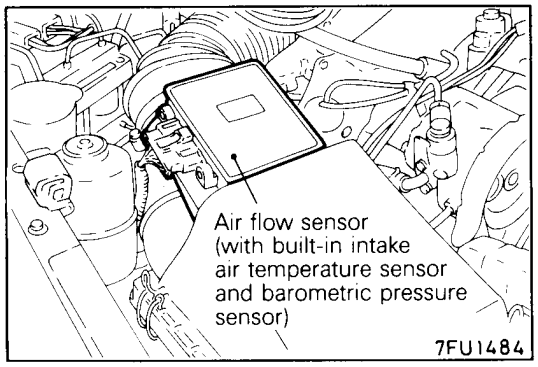
Temperature °C (°F)	Resistance kΩ
0 (32)	6.0
20 (68)	2.7
80 (176)	0.4

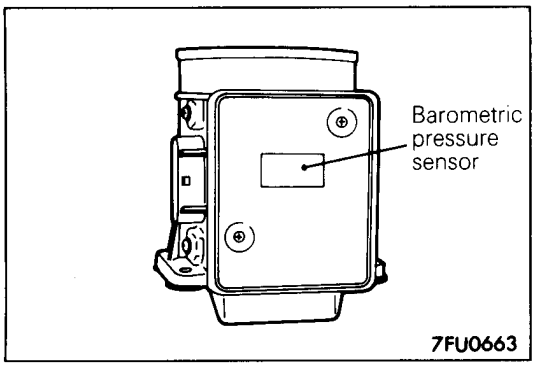
(3) Measure resistance while heating the sensor using a hair drier.

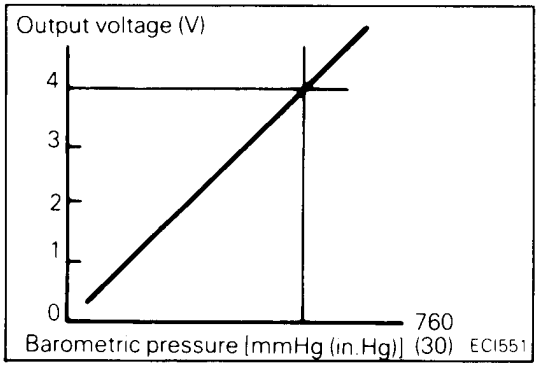
Temperature	Resistance
Higher	Smaller

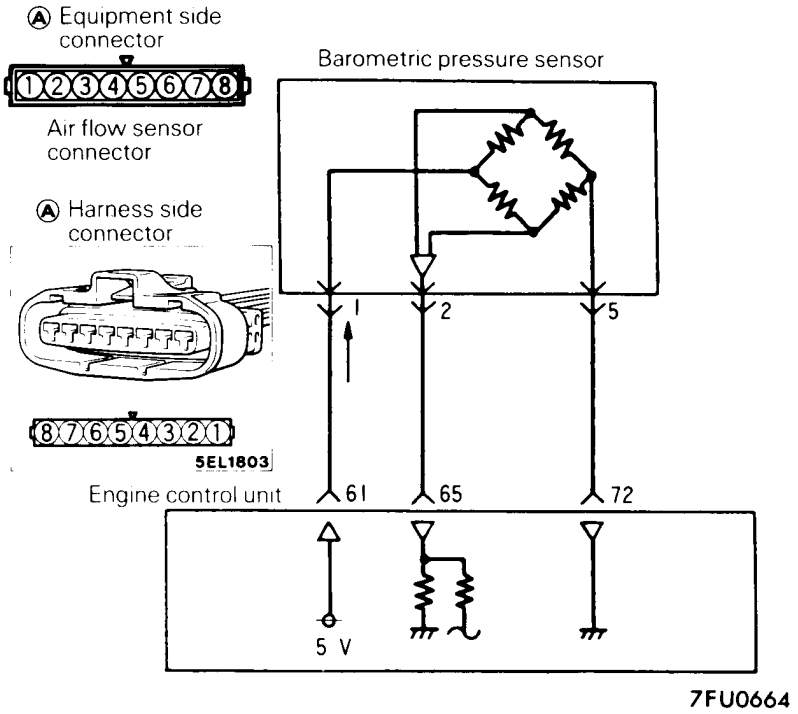
(4) If the value deviates from the standard value or the resistance remains unchanged, replace the air flow sensor assembly.

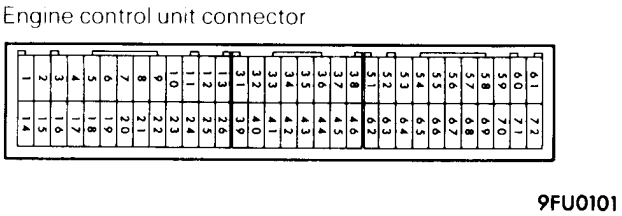
BAROMETRIC PRESSURE SENSOR











OPERATION

- The barometric pressure sensor converts the barometric pressure into a voltage and inputs it to the engine control unit, which then corrects the fuel injection rate, etc. based on the input signal.
- The 5 V power in the engine control unit is supplied to the barometric pressure sensor. Through the circuit in the sensor, it is earthed in the engine control unit.
- The barometric pressure sensor output voltage which is proportional to the barometric pressure (absolute pressure) is supplied to the engine control unit.

TROUBLESHOOTING HINTS

Hint 1: If the barometric pressure sensor is faulty, poor driveability is caused at high altitude, in particular.

Hint 2: If teh pressure indication of the barometric pressure sensor drops significantly during high speed driving, check the air cleaner for clogging.

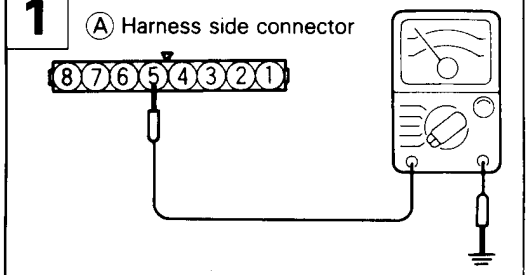
INSPECTION

Using MUT-II

Function	Item No.	Data display	Check condition	Altitude m (ft.)	Standard value kPa (kg/cm^2, psi)
Data reading	25	Sensor pressure	Ignition switch: ON	At 0 (0)	101 (103, 14.6)
				At 600 (1968.5)	95 (0.97, 13.8)
				At 1,200 (3937.0)	88 (0.90, 12.8)
				At 1,800 (5905.5)	81 (0.83, 11.7)

HARNESS INSPECTION

1

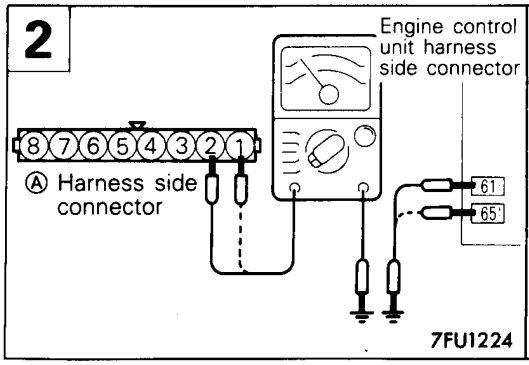


Check for continuity of the earth circuit.
- Connector: Disconnected

OK → 2

NG → Repair the harness. (Ⓐ 5 – 72)

2

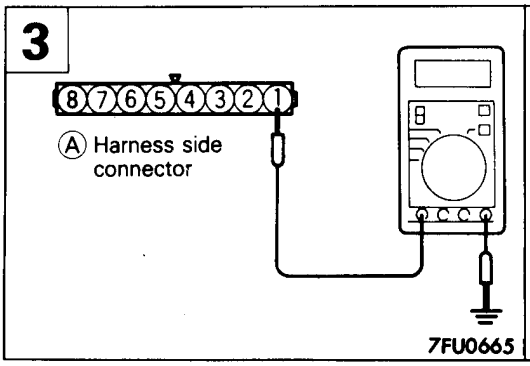


Check for an open-circuit, or a short-circuit to earth between the engine control unit and the barometric pressure sensor.
- Air flow sensor connector: Disconnected
- Engine control unit connector: Disconnected

OK → STOP

NG → Repair the harness. (Ⓐ 2 – 65) (Ⓐ 1 – 61)

3



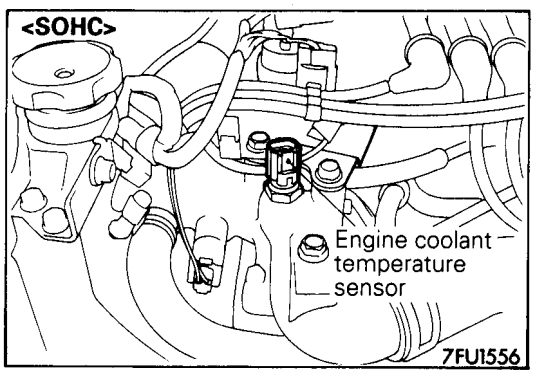
Measure the power supply voltage of the barometric pressure sensor.
- Air flow sensor connector: Disconnected
- Ignition switch: ON
- Engine control unit connector: Connected

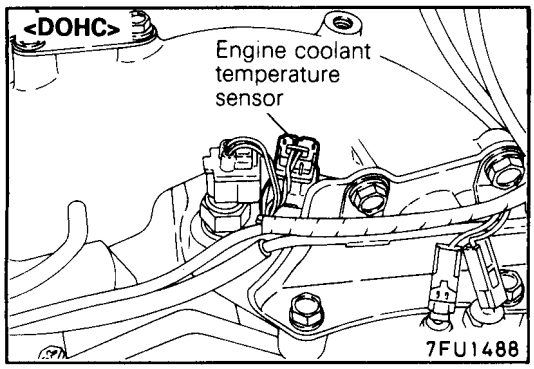
Voltage (V)
4.8 – 5.2

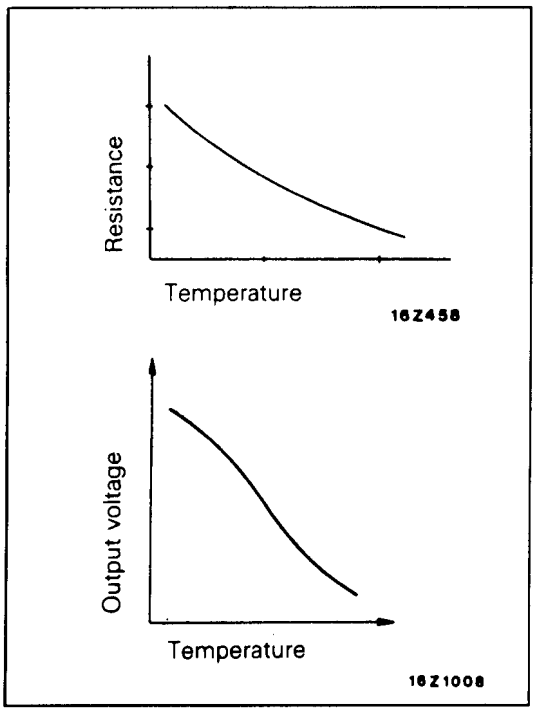
OK → 3

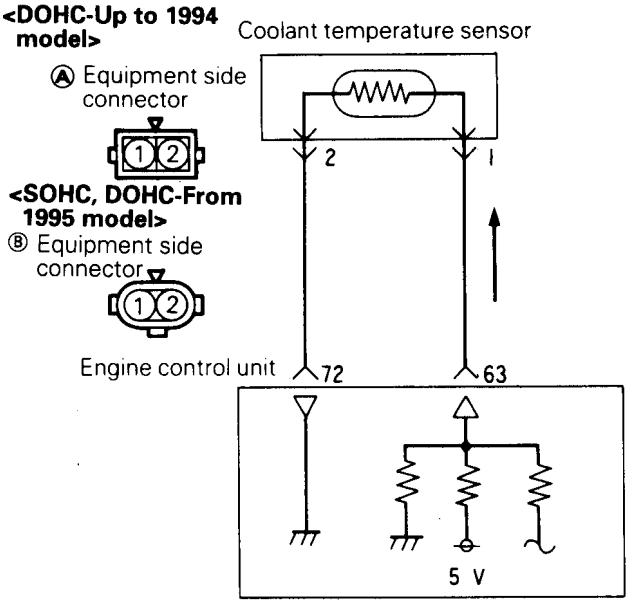
NG → Replace the engine control unit

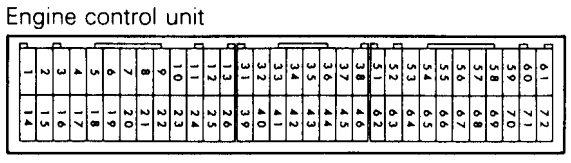
ENGINE COOLANT TEMPERATURE SENSOR











OPERATION

- The engine coolant temperature sensor converts the engine coolant temperature into a voltage and inputs it to the engine control unit, which then controls the fuel injection rate and fast idle speed when the engine is cold based on the input signal.
- The 5 V power in the engine control unit is supplied via a resistor in the unit to the engine coolant temperature sensor. Through the sensor
ness side
nector
ch is a kind of resistor, it is earthed in the engine control unit. The engine coolant temperature sensor resistor has such characteristic that its resistance decreases as the coolant temperature rises.
- The engine coolant temperature sensor terminal voltage increases or decreases as the sensor resistance increases or decreases. Therefore, the engine coolant temperature sensor terminal voltage changes with the coolant temperature, decreasing as the temperature rises.

TROUBLESHOOTING HINTS

If the fast idle speed is inadequate or the engine emits dark smoke during engine warm up operation, the engine coolant temperature sensor is often faulty.

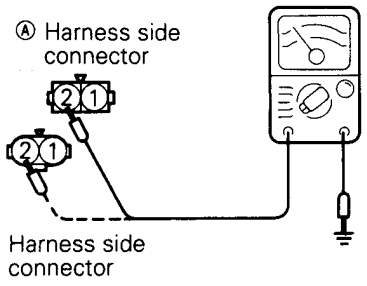
INSPECTION

Using MUT-II

Function	Item No.	Data display	Check condition	Coolant temperature °C (°F)	Standard value °C (°F)
Data reading	21	Sensor temperature	Ignition switch: ON or engine operating	At –20 (–4)	–20 (–4)
				At 0 (32)	0 (32)
				At 20 (68)	20 (68)
				At 40 (104)	40 (104)
				At 80 (176)	80 (176)

HARNESS INSPECTION

1



9FU0253

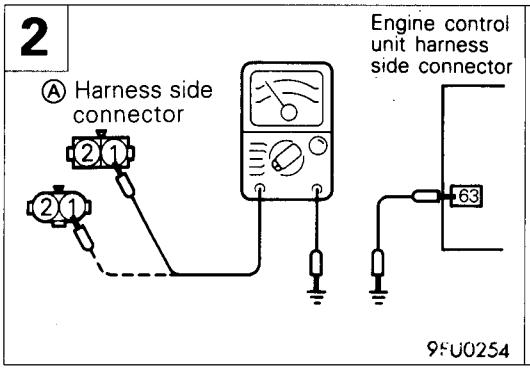
Check for continuity of the earth circuit.

- Connector: Disconnected

OK → 2

OK → Repair the harness. (Ⓐ2 – 72) (Ⓑ2 – 72)

2



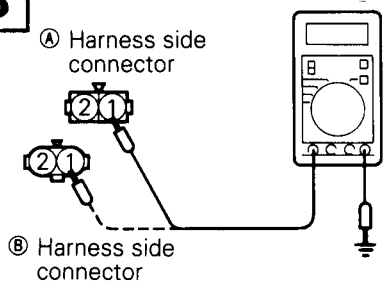
Check for open-circuit or short circuit between the engine coolant temperature sensor and the engine control unit.

- Engine coolant temperature sensor connector: Disconnected
- Engine control unit connector: Disconnected

OK → 3

NG → Repair the harness. (Ⓐ 1 – 63) (Ⓑ 1 – 63)

3



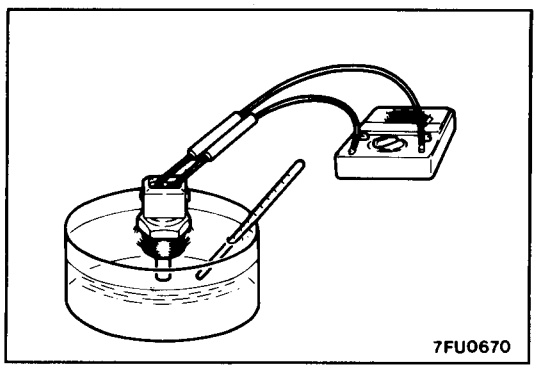
Measure the power supply voltage.

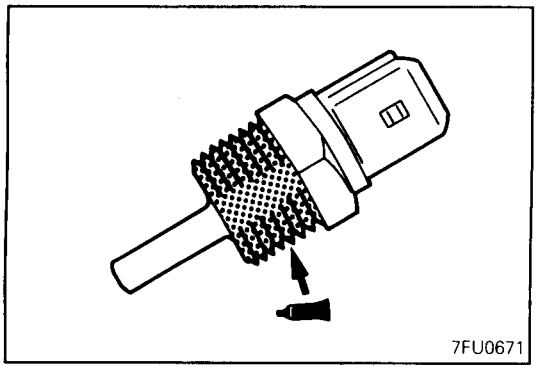
- Connector: Disconnected
- Ignition switch: ON

Voltage (V)
4.5 – 4.9

OK → STOP

NG → Replace the engine control unit





SENSOR INSPECTION

(1) Remove engine coolant temperature sensor from the intake manifold.

(2) With temperature sensing portion of engine coolant temperature sensor immersed in hot water, check resistance.

Temperature °C (°F)	Resistance kΩ
0 (32)	5.8
20 (68)	2.4
40 (104)	1.1
80 (176)	0.3

(3) If the resistance deviates from the standard value greatly, replace the sensor.

INSTALLATION

(1) Apply sealant to threaded portion.

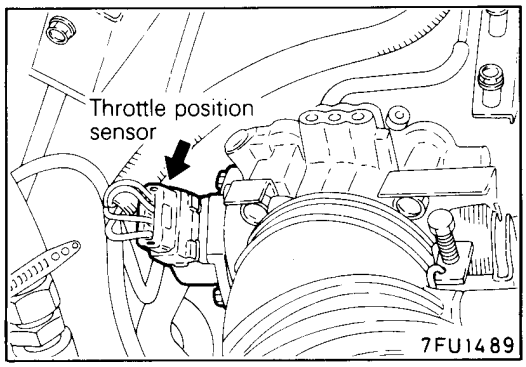
Specified sealant: 3M NUT locking Part No. 4171 or equivalent

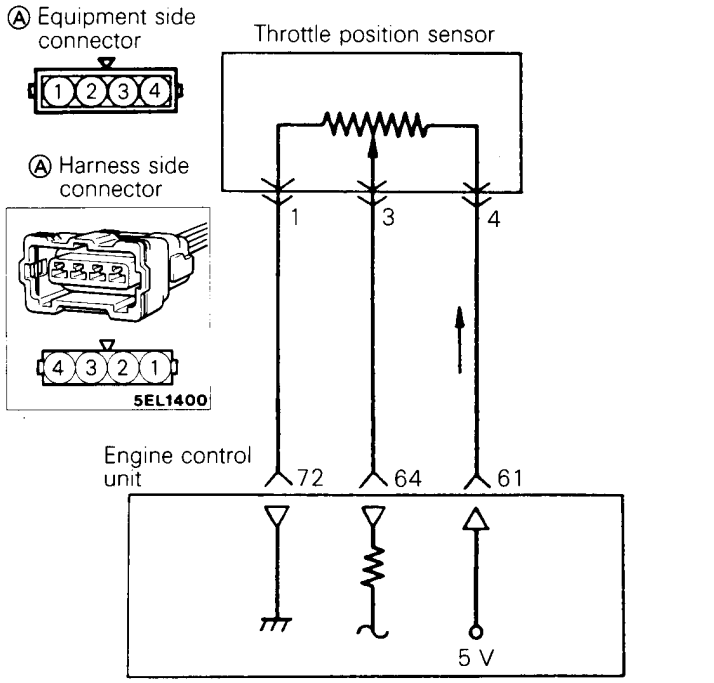
(2) Install engine coolant temperature sensor and tighten it to specified torque.

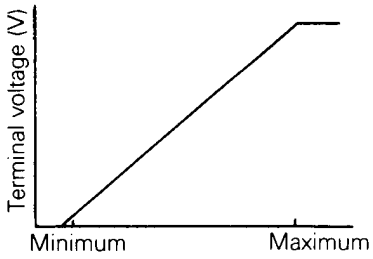
Sensor tightening torque: 29Nm (3.0 kgm, 22 ft.lbs)

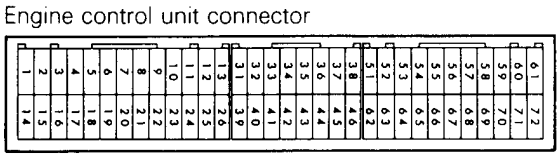
(3) Fasten harness connectors securely.

THROTTLE POSITION SENSOR









OPERATION

- The throttle position sensor converts the throttle position opening into a voltage and inputs it to the engine control unit, which then controls the fuel injection based on the input signal.
- The 5 V power in the engine control unit is supplied to the throttle position sensor. Through the resistor in the sensor, it is earthed in the engine control unit.
- As the throttle valve shaft rotates from the idle position to wide open position, the resistance between the variable resistor terminal of the throttle position sensor and the earth terminal increases. As a result, the voltage at the throttle position sensor variable resistance terminal also increases.

TROUBLESHOOTING HINTS

Hint 1: The throttle position sensor signal is more important in the control of automatic transmission than in the engine control. Shifting shock and other troubles will be caused if this sensor is faulty.

Hint 2: If the output voltage of the throttle position sensor is out of specification, adjust the sensor and check the voltage again. If there is an evidence of disturbed fixed SAS setting, adjust the fixed SAS.

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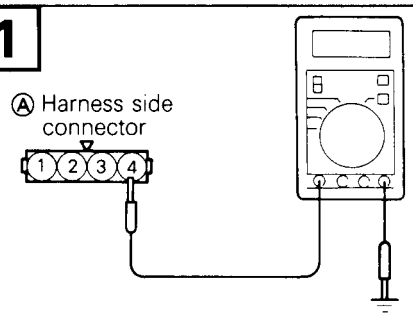
INSPECTION

Using MUT-II

Function	Item No.	Data display	Check conditions	Throttle valve	Standard value mV
Data reading	14	Sensor voltage	Ignition switch: left ON for 15 secondes or more	Set to idling position.	300 – 1,000
				Open gradually.	Becomes higher proportionally to valve opening
				Open fully.	4,500 – 5,500

HARNESS INSPECTION

1



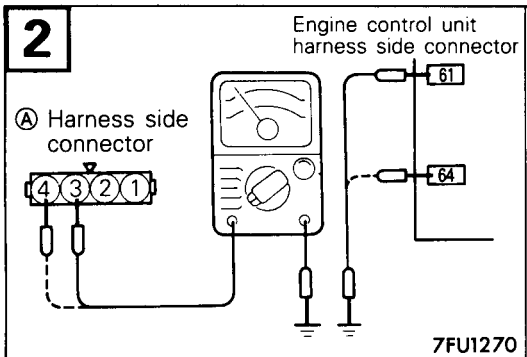
6FU1241

Check for continuity of the earth circuit.
- Throttle position sensor connector: Disconnected

OK → **2**

NO → Repair the harness. (Ⓐ1 – 72)

2



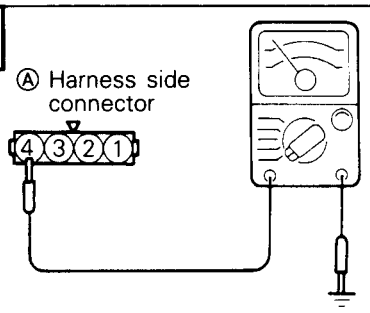
7FU1270

Check for an open-circuit, or a short-circuit to earth, between the engine control unit and the throttle position sensor.
- Throttle position sensor connector: Disconnected
- Engine control unit connector: Disconnected
- Disconnect all other control unit connectors which are connected to the throttle position sensor.

OK → **3**

NO → Repair the harness. (Ⓐ3 – 64) (Ⓐ4 – 61)

3



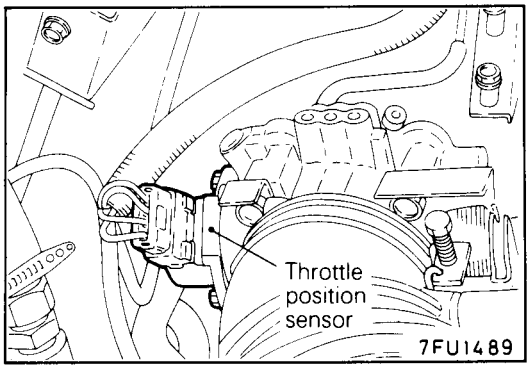
6FU1242

Measure the impressed voltage.
- Throttle position sensor connector: Disconnected
- Engine control unit connector: Connected
- Ignition switch: ON

Voltage (V)
4.8 – 5.2

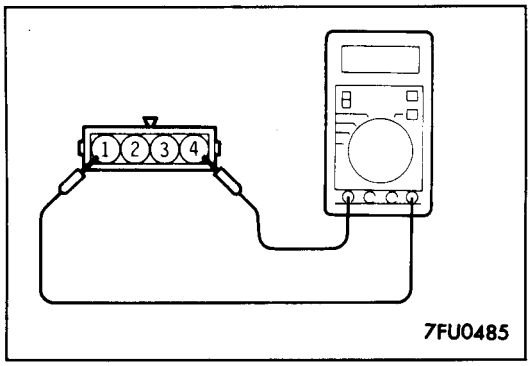
OK → STOP

NO → Replace the engine control unit.



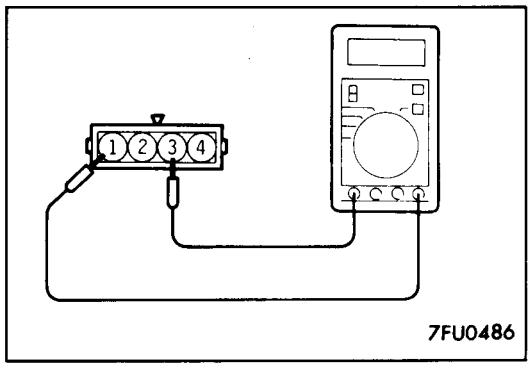
SENSOR INSPECTION

(1) Disconnect the throttle position sensor connector.



(2) Measure resistance between terminal ① (sensor earth) and terminal ④ (sensor power).

Standard value: 3.5 – 6.5 kΩ

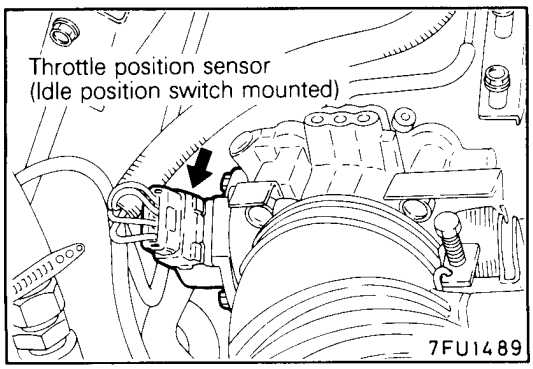


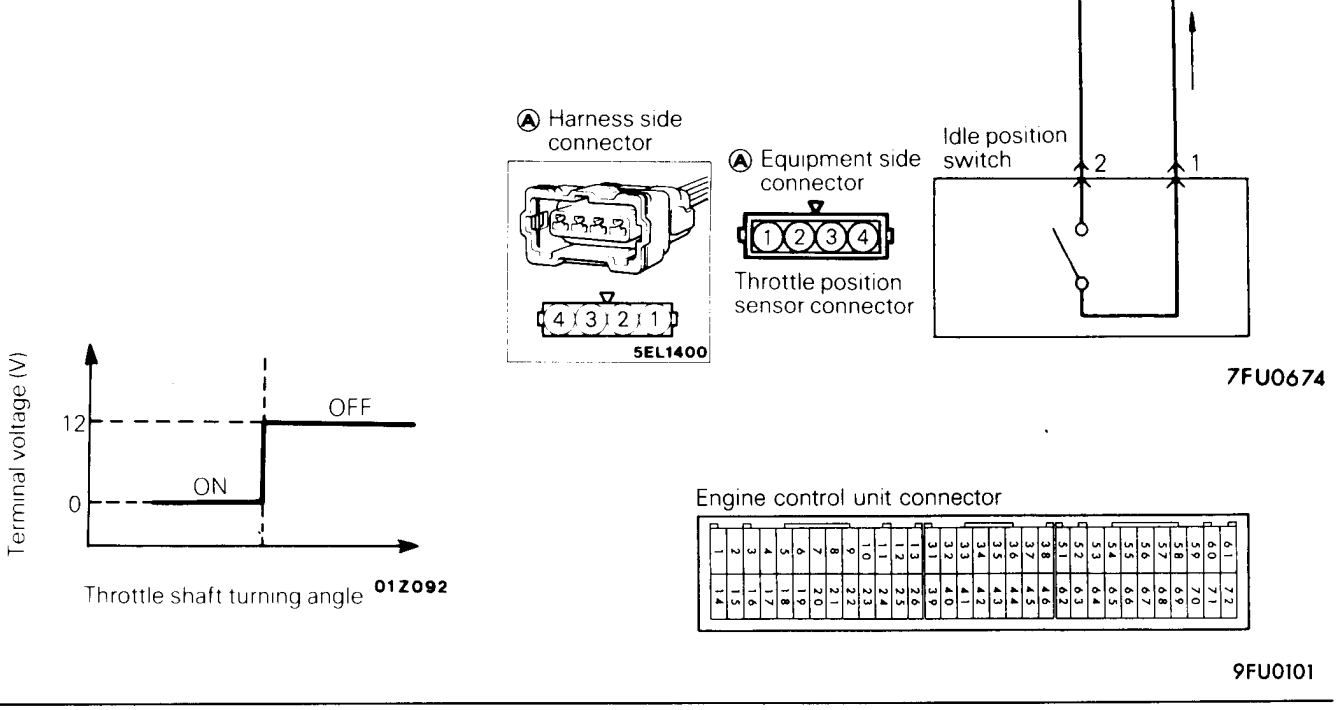
(3) Connect a pointer type ohmmeter between terminal ① (sensor earth) and terminal ③ (sensor output).
(4) Operate the throttle valve slowly from the idle position to the full open position and check that the resistance changes smoothly in proportion with the throttle valve opening angle.
(5) If the resistance is out of specification, or fails to change smoothly, replace the throttle position sensor.

TPS installation torque: 2.0 Nm (0.2 kgm, 1.5 ft.lbs)

For the idle position switch and throttle position sensor adjusting procedure, refer to P.13-79-22.

IDLE POSITION SWITCH





OPERATION

- The idle position switch senses whether the accelerator pedal is depressed or not, converts it into high/low voltage and inputs the voltage to the engine control unit, which then controls the idle speed control servo based on the input signal.
- The voltage in the engine control unit is applied to the idle position switch through a resistor. When the accelerator pedal is released, the idle position switch is turned on to conduct the voltage to earth. This causes the idle position switch terminal voltage to go low from high.

TROUBLESHOOTING HINTS

If the idle position switch harness and individual part check results are normal but the idle position switch output is abnormal, the following troubles are suspected.

(1) Poorly adjusted accelerator cable or auto-cruise control cable
(2) Poorly adjusted fixed SAS

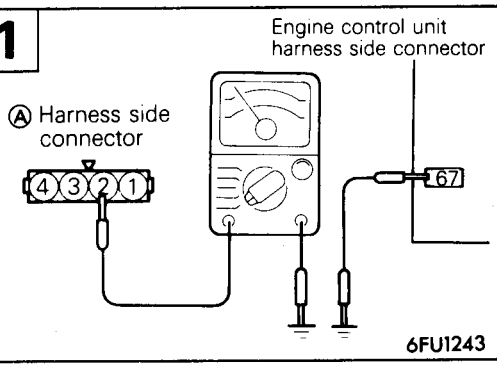
INSPECTION

Using MUT-II

Function	Item No.	Data display	Check condition	Throttle valve	Normal indication
Data reading	26	Switch state	Ignition switch: ON (check by operating accelerator pedal repeatedly)	At idle position	ON
				Open a little	OFF

HARNESS INSPECTION

1

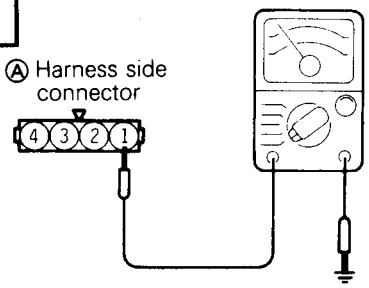


Check for open or short circuit between the idle position switch and the engine control unit.
- Engine control unit connector: Disconnected
- Throttle position sensor connector: Disconnected

OK → 2

NG → Repair the harness. (Ⓐ2 - 67)

2

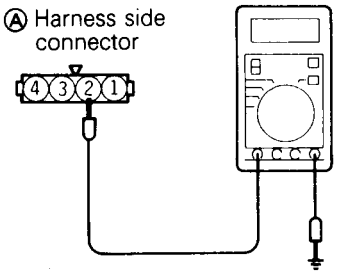


Check for continuity of the earth circuit.
- Throttle position sensor connector: Disconnected

OK → 3

NG → Repair the harness. (Ⓐ1 - 72)

3

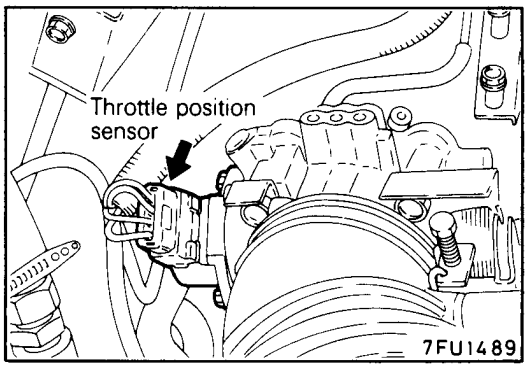


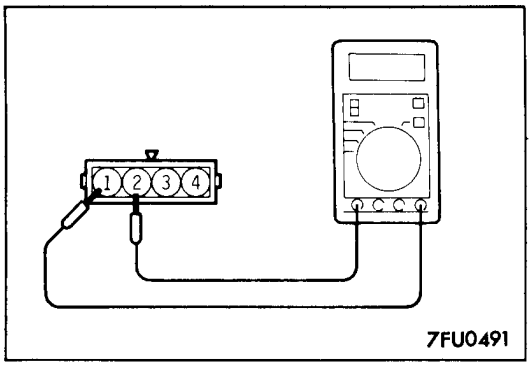
Measure the power supply voltage of the idle position switch.
- Throttle position sensor connector: Disconnected
- Engine control unit connector: Connected
- Ignition switch: ON

Voltage (V)
4 or higher

OK → STOP

NG → Replace the engine control unit.





SENSOR INSPECTION

(1) With the accelerator pedal released, check to be sure that the throttle valve lever or the fixed SAS is pushed.

NOTE
If it is not pushed, adjust the fixed SAS (Refer to P.13-79-23.)

(2) Disconnect the throttle position sensor connector.

(3) Check the continuity across the throttle position sensor connector terminal ① (Sensor earth) and ② (Idle position switch).

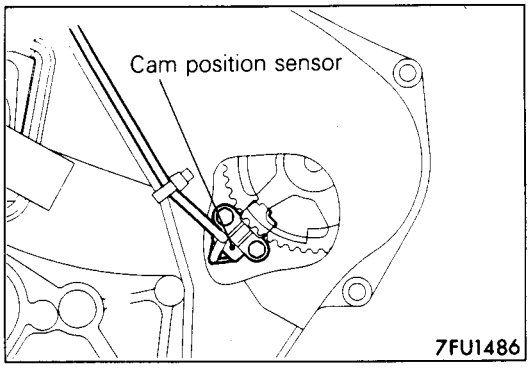
Accelerator pedal	Continuity
Depressed	Non-conductive (∞Ω)
Released	Conductive (0Ω)

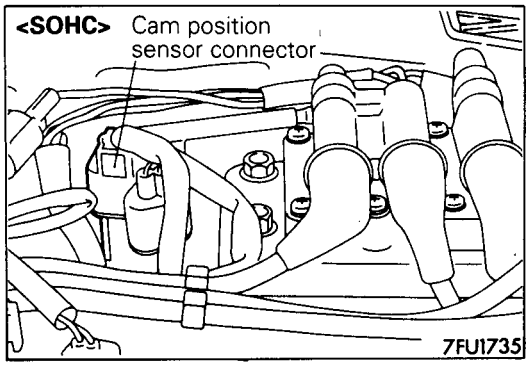
NOTE
If there is no continuity when the accelerator pedal is returned, loosen the throttle-position sensor installation screw; then, after turning all the way in the clockwise direction, check again.

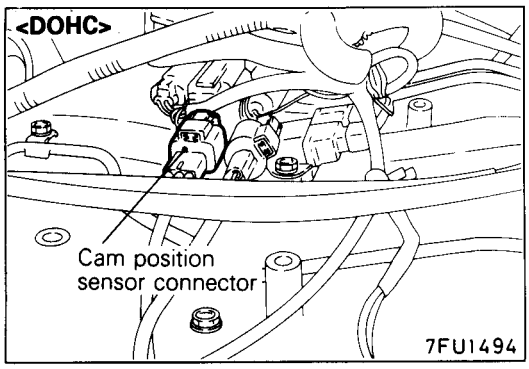
(4) Replace the throttle-position sensor (idle-position switch incorporated) if there is a malfunction.

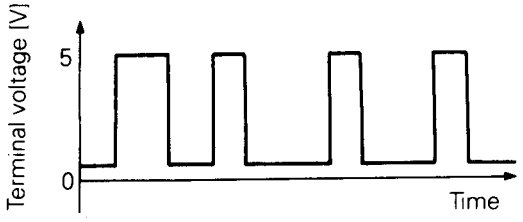
NOTE
For the idle position switch and throttle position sensor adjusting procedure, refer to P.13-79-22.

CAM POSITION SENSOR

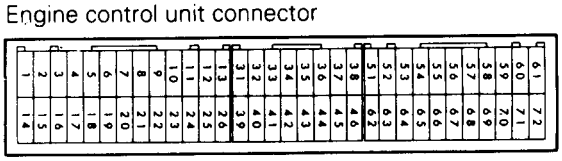






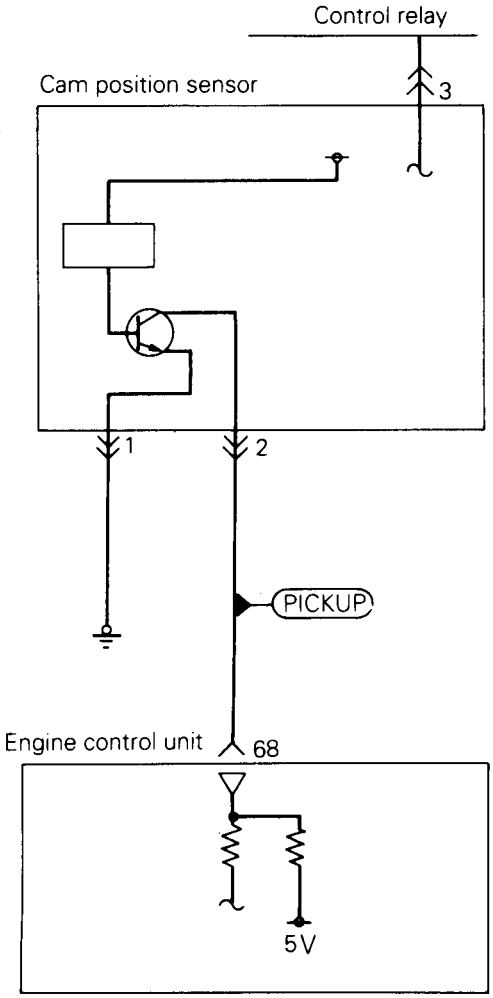


7FU0677



9FU0101

Ⓐ Equipment side connector



6AF0054

OPERATION

- The cam position sensor senses the top dead center on compression stroke, converts it into a pulse signal and inputs it to the engine control unit, which then computes the fuel injection sequence, etc. based on the input signal.
- Power to the cam position sensor is supplied from the control relay and is earthed to the body. The cam position sensor generates a pulse signal as it repeatedly connects and disconnects between 5 V voltage supplied from the engine control unit and earth.

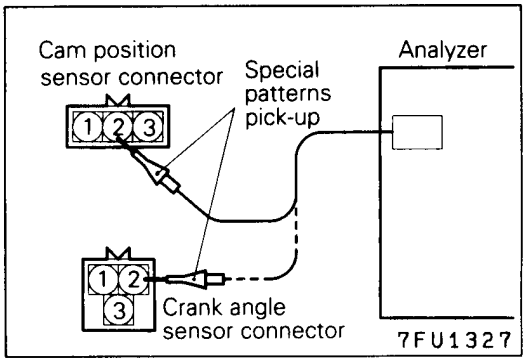
TROUBLESHOOTING HINTS

Hint 1: If the cam position sensor does not function correctly, correct sequential injection is not made so that the engine may stall, run irregularly at idle or fail to accelerate normally.

Hint 2: If the sensor outputs a pulse signal when the ignition switch is turned ON (with the engine no running), a faulty cam position sensor or engine control unit is suspected.

INSPECTION

Waveform inspection with analyzer



Measuring method

(1) Disconnect the connector of the cam position sensor, and connect the special tool (test harness: MB991348) across the disconnected connector parts. (Connect the tool to all terminals.)

(2) Connect the special patterns pick-up of the analyzer to the terminal ② of the cam position sensor connector (in order to inspect the signal waveform of the cam position sensor.)

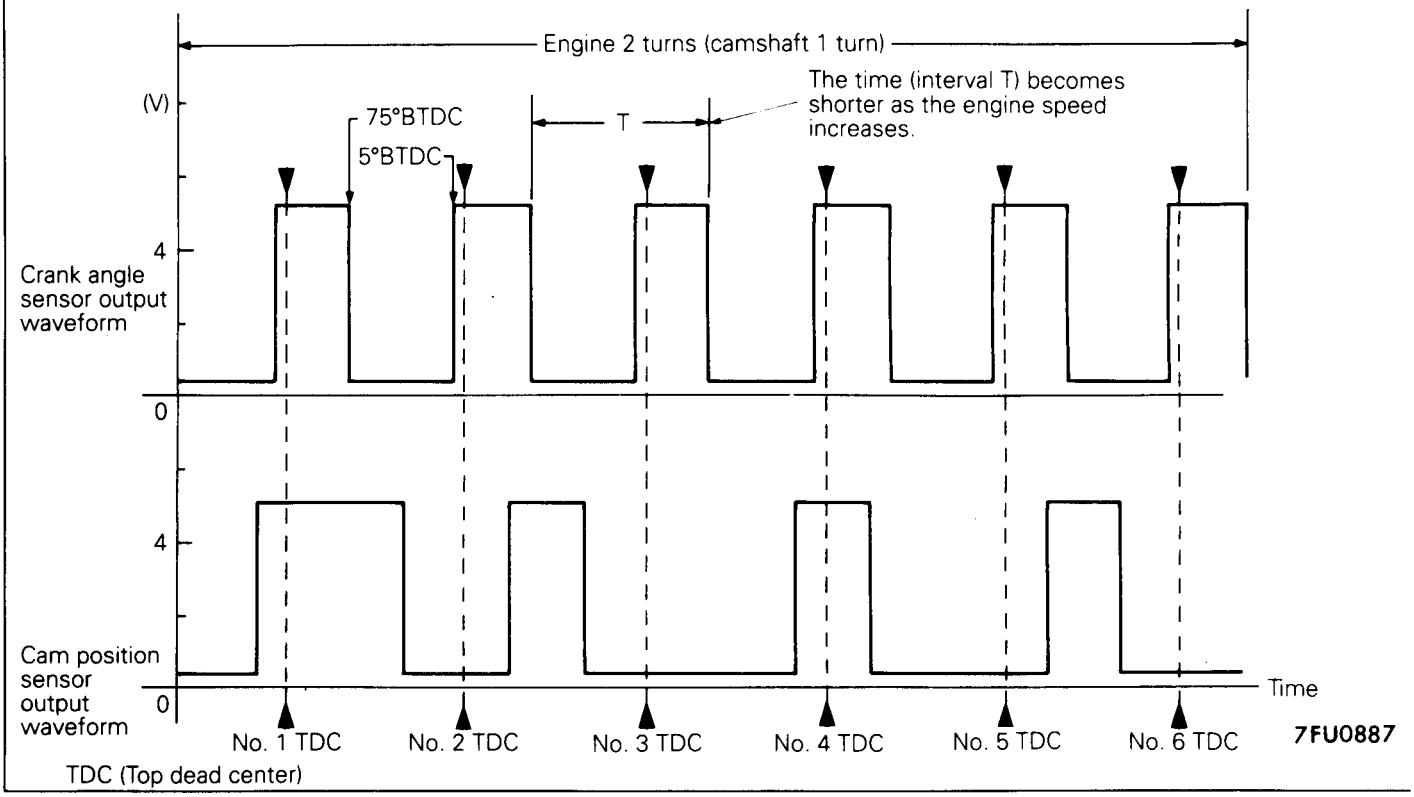
(3) Disconnect the connector of the crank angle sensor, and connect the special tool (test harness: MD998478) across the disconnected connector parts.

(4) Connect the special patterns pick-up of the analyzer to the terminal ② of the crank angle sensor connector (in order to inspect the signal waveform of the crank angle sensor).

Standard waveform

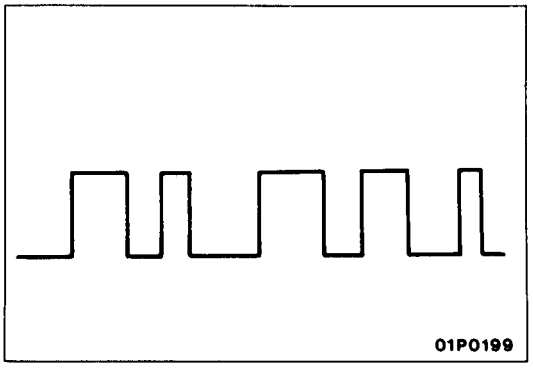
Observation conditions

Function	Special patterns
Pattern height	Low
Pattern selector	Display
Engine speed	Idling speed (700 r/min)



Waveform observing point

Confirm that cycle T becomes shorter as the engine speed increases.



Abnormal waveform example

- Example 1

  Trouble cause

  The sensor interface is troubled.

  Waveform feature

  The engine does not start, but the rectangular waveform is output.

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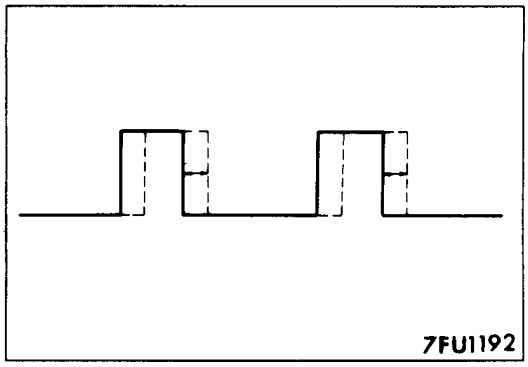

7FU1192

- Example 2

Trouble cause

The timing belt is loose.

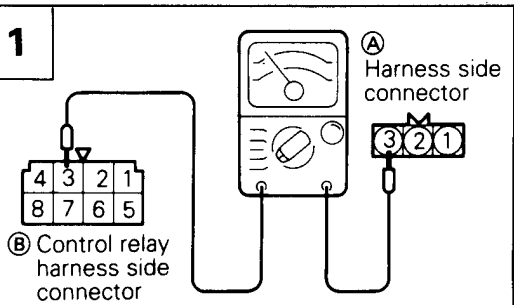
The sensor disc is abnormal.

Waveform feature

The waveform fluctuates fore and aft.

HARNESS INSPECTION

1



6AF0056

Check for continuity between the cam position sensor and control relay.

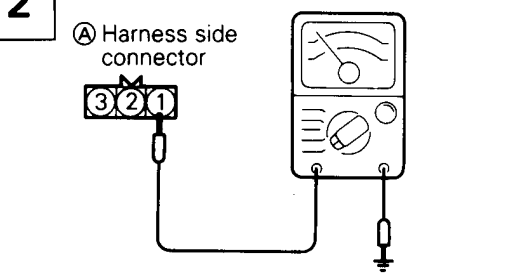
- Cam position sensor connector :Disconnected
- Control relay connector: Disconnected

NOTE
Touch ohmmeter probes to both ends of the harness.

OK → 2

NG → Repair the harness. (Ⓐ 3 — Ⓑ 3)

2



6AF0057

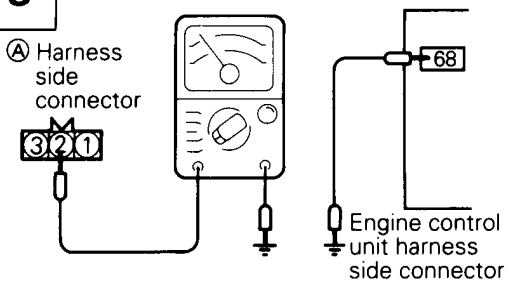
Check for continuity of the earth circuit.

- Cam position sensor connector: Disconnected

OK → 3

NG → Repair the harness. (Ⓐ 1 – Earth)

3



6AF0058

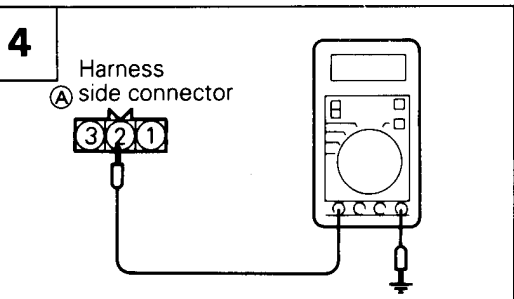
Check for an open-circuit, or a short-circuit to earth between the cam position sensor and the engine control unit.

- Engine control unit connector: Disconnected
- Cam position sensor connector: Disconnected

OK → 4

NG → Repair the harness. (Ⓐ 2 — 68)

4



6AF0059

Measure the impressed voltage

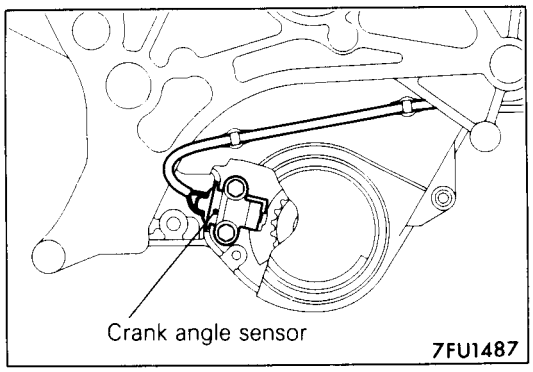
- Cam position sensor connector: Disconnected
- Engine control unit connector: Connected
- Ignition switch: ON

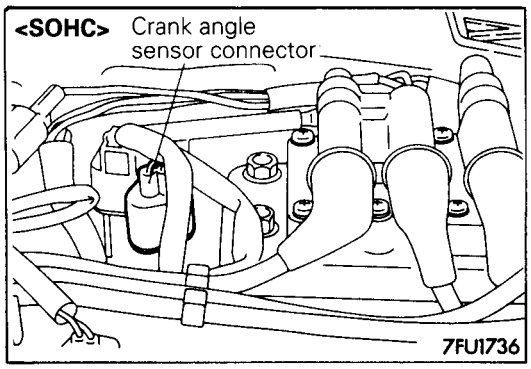
Voltage (V)
4.8 – 5.2

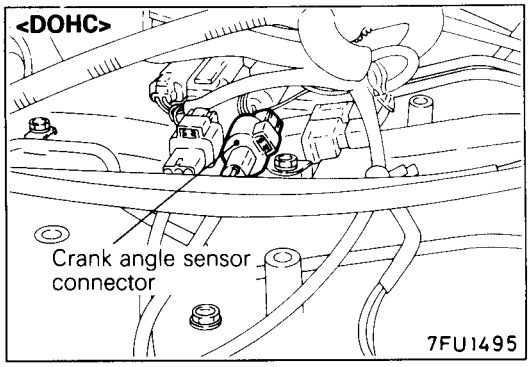
OK → STOP

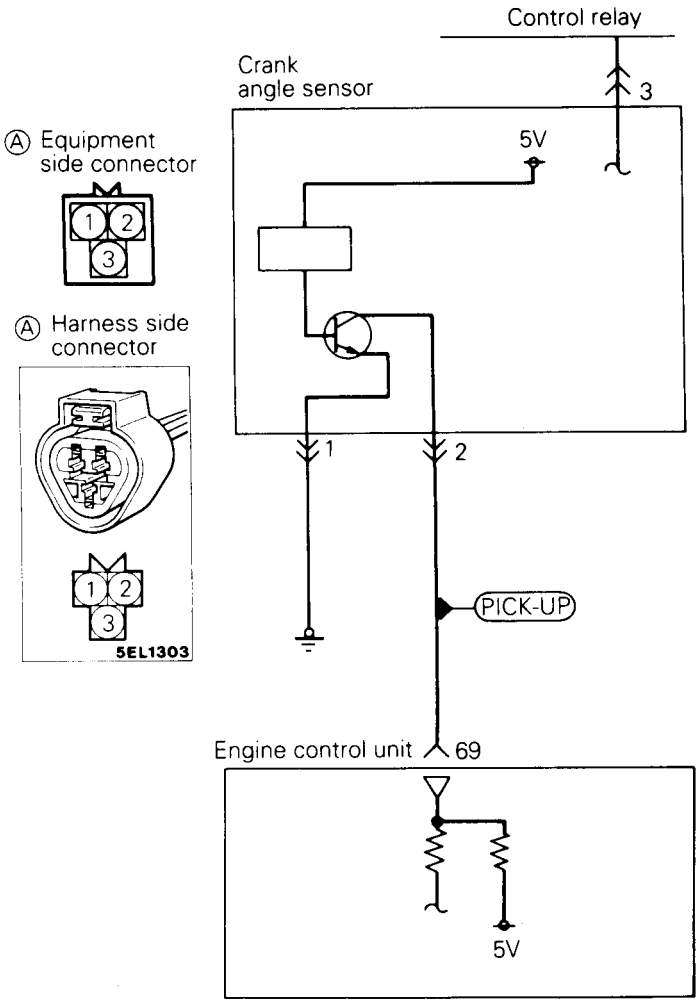
NG → Replace the engine control unit.

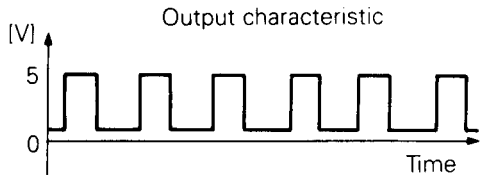
CRANK ANGLE SENSOR







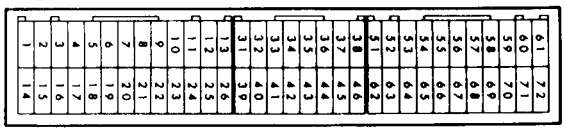




7FU0682

6AF0060

Engine control unit connector



9FU0101

OPERATION

- The crank angle sensor senses the crank angle (piston position) of each cylinder, converts it into a pulse signal and inputs it to the engine control unit, which then computes the engine speed and controls the fuel injection timing and ignition timing based on the input signal.
- Power to the crank angle sensor is supplied from the control relay and is earthed to the body. The crank angle sensor generates a pulse signal as it repeatedly connects and disconnects between 5 V voltage supplied from the engine control unit and earth.

TROUBLESHOOTING HINTS

Hint 1: If unexpected shocks are felt during driving or the engine stalls suddenly during idling, shake the crank angle sensor harness. If this causes the engine to stall, poor contact of the sensor connector is suspected.

Hint 2: If the crank angle sensor outputs a pulse signal when the ignition switch is turned ON (with the engine not running), a faulty crank angle sensor or engine control unit is suspected.

Hint 3: If the tachometer reads 0 r/min when the engine that has failed to start is cranked, faulty crank angle sensor or broken timing belt is suspected.

Hint 4: If the tachometer reads 0 r/min when the engine that has failed to start is cranked, the primary current of the ignition coil is not turned on and off. Therefore, troubles in the ignition circuit and ignition coil or faulty power transistor is suspected.

Hint 5: If the engine can be run at idle even though the crank angle sensor reading is out of specification, troubles are often in other than the crank angle sensor.

[Examples]
(1) Faulty engine coolant temperature sensor
(2) Faulty idle speed control servo
(3) Poorly adjusted reference idle speed

INSPECTION

Using MUT-II

Function	Item No.	Data display	Check condition	Check content	Normal state
Data reading	22	Cranking speed	• Engine cranking • Tachometer connected	Compare cranking speed and MUT-II reading	Indicated speed to agree

NOTE
(1) The tachometer indicates a third of the actual engine speed. Therefore, 3 times the tachometer indication is the actual engine speed.
(2) When the tachometer is set to the 2-cylinder range, it indicates actual engine speed.

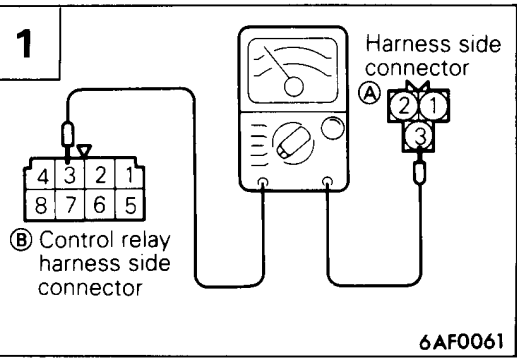
Function	Item No.	Data display	Check condition	Coolant temperature °C (°F)	tandard value r/min.
Data reading	22	Idle speed	• Engine: Running at idle • Idle position switch: ON	At –20 (–4)	1275–1475
				At 0 (32)	1225–1425
				At 20 (68)	1100–1300
				At 40 (104)	950–1150
				At 80 (176)	600–800

Waveform inspection with analyzer

Refer to cam position sensor section (P.13-79-60.)

HARNESS INSPECTION

1



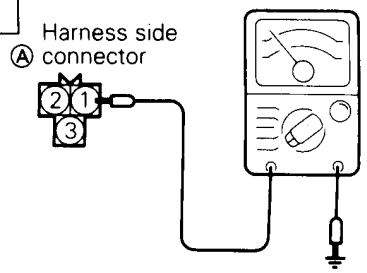
Check for continuity between the crank angle sensor and the control relay.
- Crank angle sensor connector: Disconnected
- Control relay connector: Disconnected

NOTE
Touch ohmmeter probes to both ends of the harness

OK → 2

NG → Repair the harness. (Ⓐ 3 – Ⓑ 3)

2

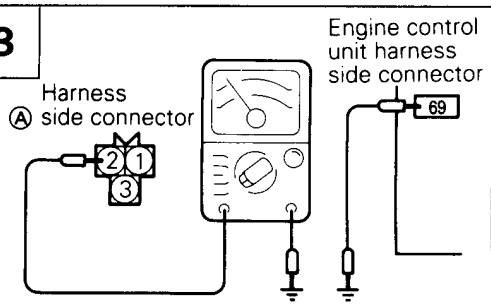


Check for continuity of the earth circuit.
- Crank angle sensor connector: Disconnected

OK → 3

NG → Repair the harness. (Ⓐ 1 – Earth)

3

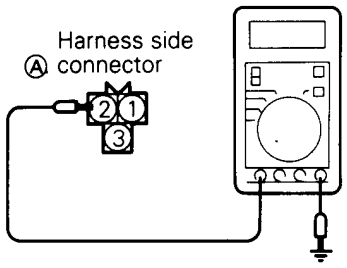


Check for an open-circuit, or a short-circuit to earth between the crank angle sensor and the engine control unit.
- Engine control unit connector: Disconnected
- Crank angle sensor connector: Disconnected

OK → 4

NG → Repair the harness. (Ⓐ 2 – 69)

4



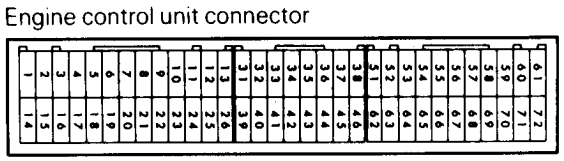
Measure the impressed voltage.
- Crank angle sensor connector: Disconnected
- Engine control unit connector: Connected
- Ignition switch: ON

Voltage (V)
4.8–5.2

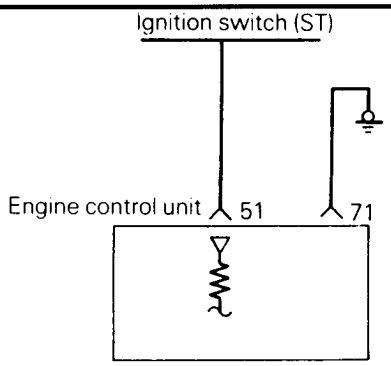
OK → STOP

NG → Replace the engine control unit.

IGNITION SWITCH-ST [M/T only]



9FU0101



1FU0638

OPERATION

- The ignition switch-ST inputs a high signal to the engine control unit while the engine is cranking. The engine control unit provides fuel injection control, etc., at engine startup based on this signal.
- When the ignition switch is set to START, the battery voltage at cranking is applied through the ignition switch to the engine control unit, which detects that the engine is cranking.

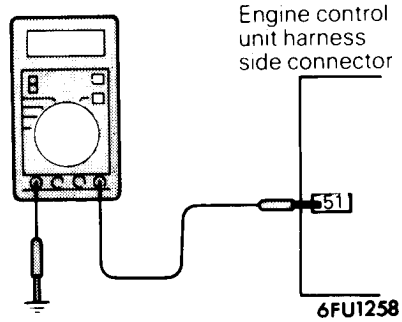
INSPECTION

Using MUT-II

Function	Item No.	Data display	Check condition	Engine	Normal indication
Data reading	18	Switch state	Ignition switch: ON	Stop	OFF
				Cranking	ON

HARNESS INSPECTION

1



6FU1258

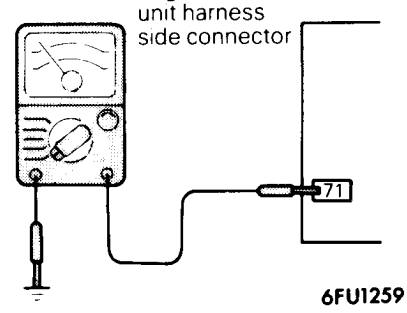
Measure the input voltage to the engine control unit.
- Engine control unit connector: Disconnected
- Ignition switch: START

Voltage (V)
8 or more

OK → 2

NG → Repair the harness. (51 – Ignition switch)

2



6FU1259

Check for continuity of the earth circuit.
- Engine control unit connector: Disconnected

OK → STOP

NG → Repair the harness. (71 – Earth)

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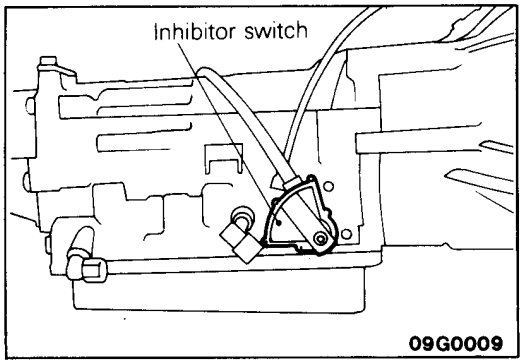
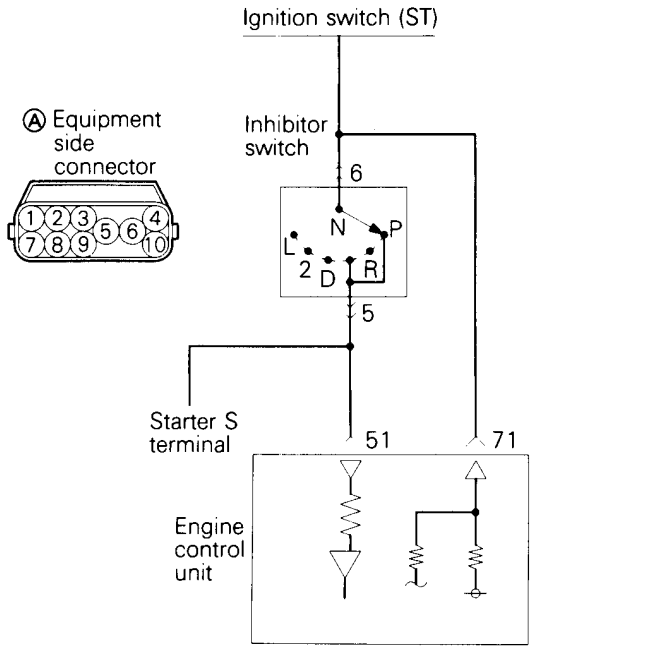
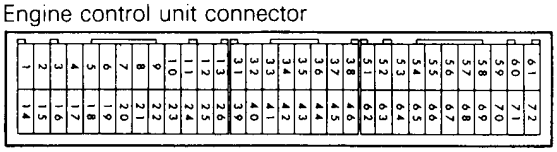
IGNITION SWITCH-ST AND INHIBITOR SWITCH [A/T only]





7FU1528

Engine control unit connector



9FU0101

OPERATION

- The ignition switch-ST inputs a high signal to the engine control unit while the engine is cranking. The engine control unit provides fuel injection control, etc., at engine startup based on this signal.
- When the ignition switch is set to START, the battery voltage at cranking is applied through the ignition switch and inhibitor switch to the engine control unit, which detects that the engine is cranking. In case the selector lever is in a position other than the P/N range, the battery voltage is not applied to the engine control unit.
- The inhibitor switch converts the selector lever position (whether it is at the P/N range or at others) into high/low voltage and inputs it to the engine control unit, which then controls the idle speed control servo based on this signal.
- The battery voltage in the engine control unit is applied through a resistor to the inhibitor switch. When the selector lever is set to the P/N range, continuity is produced between the inhibitor switch terminal of the engine control unit and earth through the starter motor, thereby making the terminal voltage go low.

TROUBLESHOOTING HINTS

If the inhibitor switch harness and individual part check have resulted normal but the inhibitor switch output is abnormal, poorly adjusted control cable is suspected.

INSPECTION

Using MUT-II

IGNITION SWITCH-ST

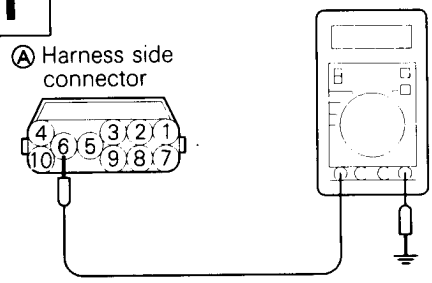
Function	Item No.	Data display	Check condition	Engine	Normal indication
Data reading	18	Switch state	Ignition switch: ON	Stop	OFF
				Cranking	ON

INHIBITOR SWITCH

Function	Item No.	Data display	Check condition	Select lever position	Normal indication
Data reading	29	Shift position	Ignition switch: ON	P or N	P or N
				D, 2, L or R	D, 2, L or R

HARNESS INSPECTION

1



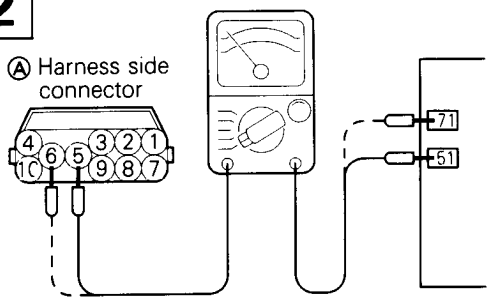
Measure the power supply voltage of the inhibitor switch
- Engine control unit connector: Disconnected
- Inhibitor switch connector: Disconnected
- Ignition switch: START

Voltage (V)
SV

OK → 2

NG → Check the power supply circuit.

2



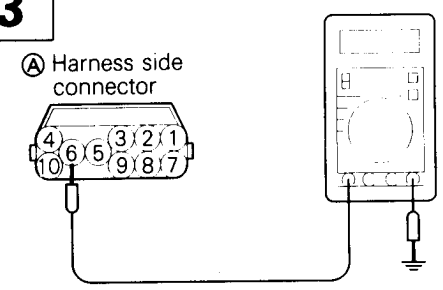
Check for continuity between the inhibitor switch and the engine control unit.
- Engine control unit connector: Disconnected
- Inhibitor switch connector: Disconnected

NOTE
Touch the ohmmeter probes to both ends of the harness.

OK → 3

NG → Repair the harness. (Ⓐ5 – 51) (Ⓐ6 – 71)

3



Measure the inhibitor switch terminal input voltage.
- Engine control unit connector: Connected
- Inhibitor switch connector: Disconnected
- Ignition switch: ON

Voltage (V)
SV

OK → STOP

NG → Repair the engine control unit.

INHIBITOR SWITCH INSPECTION

Refer to GROUP 23 – Service Adjustment Procedures.

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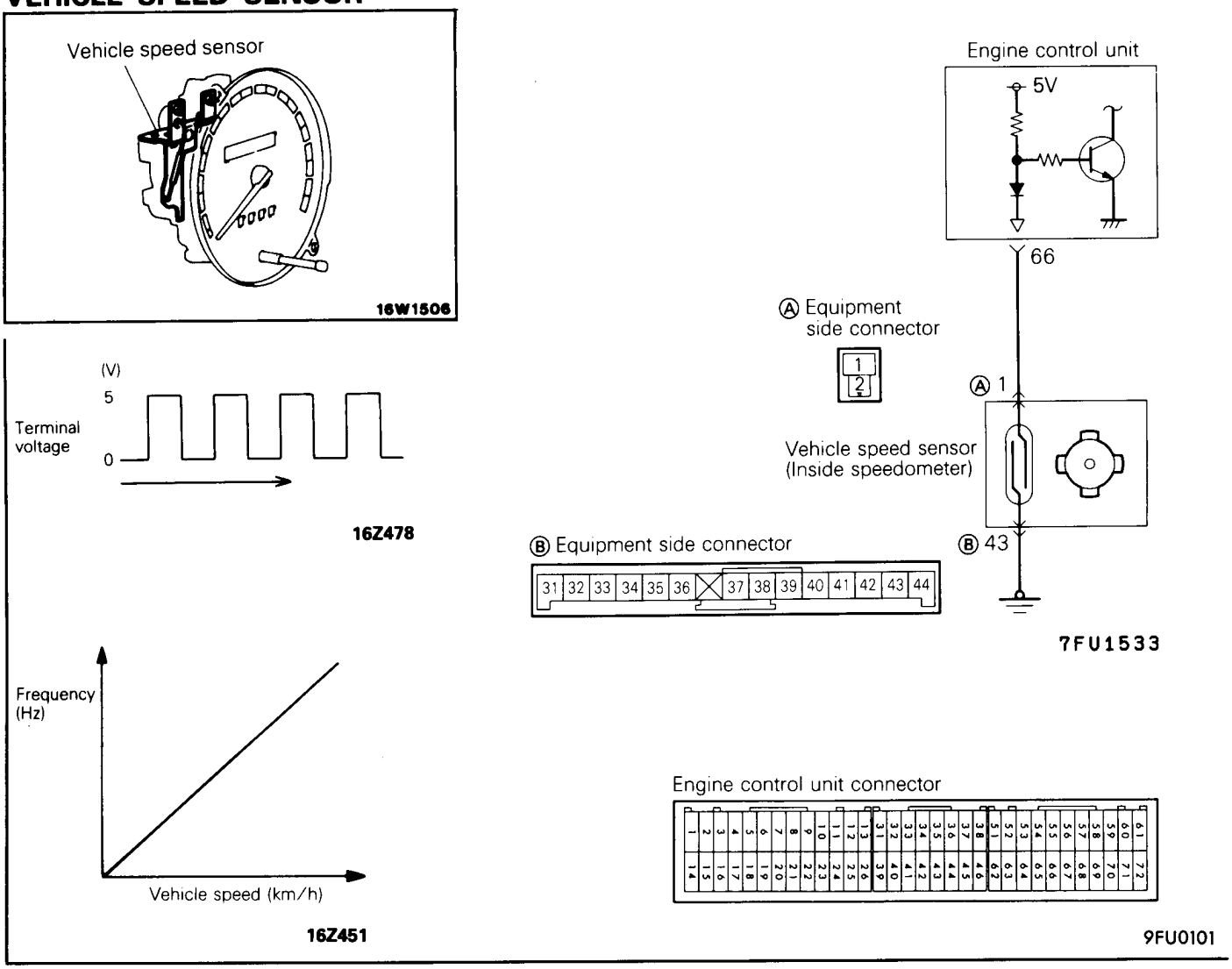
VEHICLE SPEED SENSOR



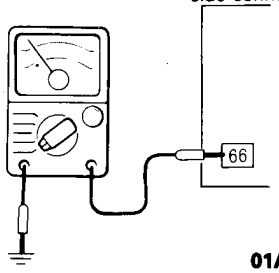
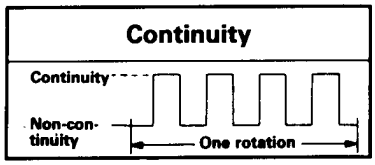
OPERATION

- The vehicle-speed sensor is incorporated within the speedometer; it converts vehicle-speed data to pulse signals and inputs those signals to the engine control unit. The engine control unit, based upon those signals, regulates the idle-speed servo, etc.
- The vehicle-speed sensor, by intermitting by the reed switch the flow (to earth) of the approximately 5V voltage applied from the engine control unit, produces vehicle-speed signals.

TROUBLESHOOTING HINTS

If there is damaged or disconnected wiring, or a short-circuit, of the vehicle-speed sensor signal circuit, the engine may stall when the vehicle speed is reduced and the vehicle is stopped.

HARNESS INSPECTION

1		Check the vehicle speed sensor output circuit for continuity. • Engine control unit connector: Disconnected. • Move the vehicle. 	OK → 4 NG → 2

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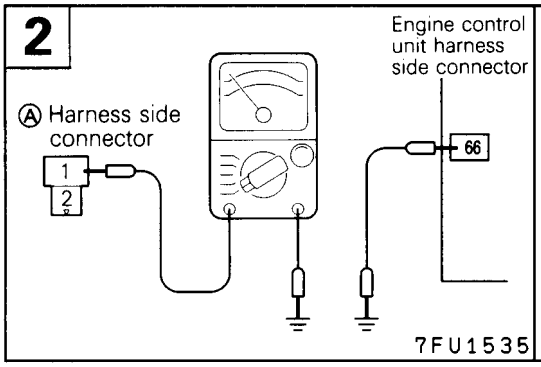
2



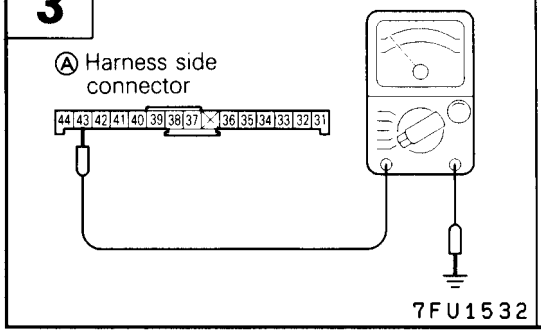
Check for an open-circuit or a short-circuit to earth, between the engine control unit and the vehicle speed sensor.

- Vehicle speed sensor connector: Disconnected
- Engine control unit connector: Disconnected

OK → 3

NG → Repair the harness. (Ⓐ1 – 66)

3



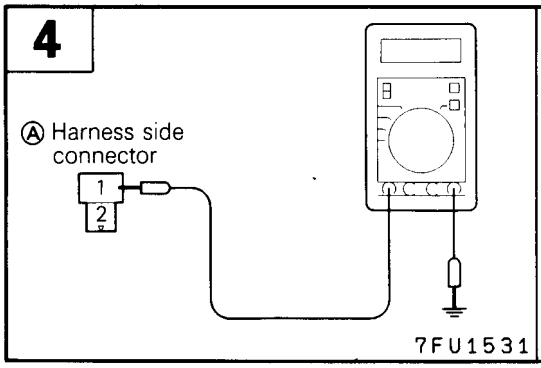
Check for continuity of the earth circuit.

- Vehicle speed sensor connector: Disconnected

OK → 4

NG → Repair the harness. (Ⓐ43 – Earth)

4



Measure the impressed voltage.

- Vehicle speed sensor connector: Disconnected
- Engine control unit connector: Connected
- Ignition switch: ON

Voltage (V)
4.5 – 4.9

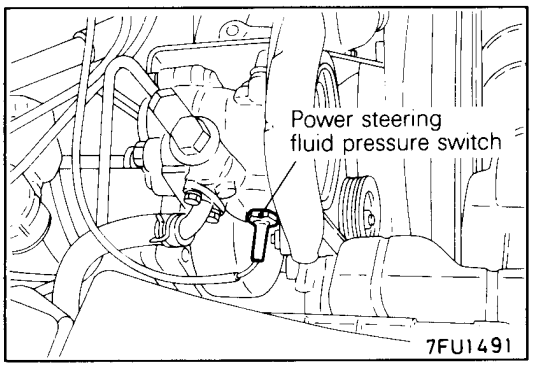
OK → STOP

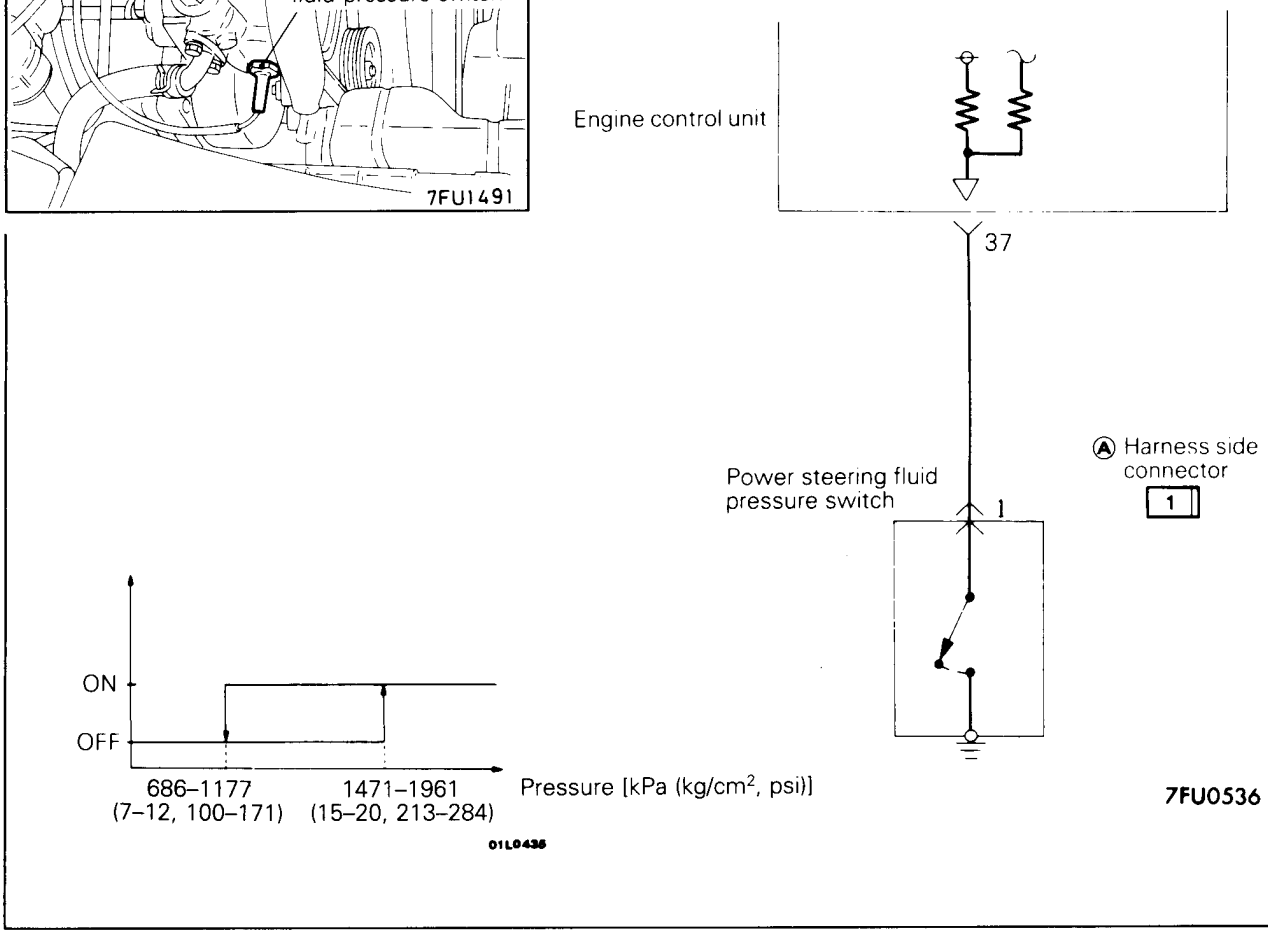
NG → Replace the engine control unit.

SENSOR INSPECTION

Refer to GROUP 54 – Meters and Gauges.

POWER STEERING FLUID PRESSURE SWITCH





OPERATION

- The power steering fluid pressure switch converts presence/absence of power steering load into low/high voltage and inputs it to the engine control unit, which then controls the idle speed control servo based on this signal.
- The battery voltage in the engine control unit is applied through a resistor to the power steering fluid pressure switch. Steering operation causes the power steering fluid pressure to increase, turning the switch on. As a result, continuity is produced between the battery voltage applied and earth. This causes the power steering fluid pressure terminal voltage to go from high to low.

INSPECTION

Using MUT-II

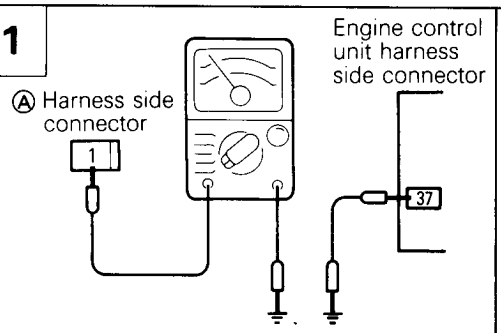
Function	Item No.	Data display	Check condition	Steering wheel	Normal indication
Data reading	27	Switch state	Engine: Idling	Steering wheel neutral position (wheels straight-ahead direction)	OFF
				Steering wheel half turn	ON

Checking Fluid Pressure

Steering wheel		Fluid pump delivery pressure (ref. value)
Straight forward	kPa (kg/cm², psi)	686–1,177 (7–12, 100–171)
Turned	kPa (kg/cm², psi)	1,471–1,961 (15–20, 213–284)

HARNESS INSPECTION

1

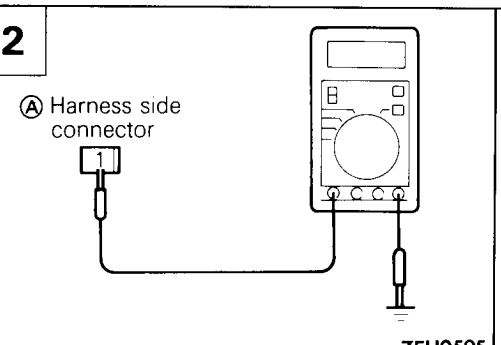


Check for open-circuit or short circuit between the power steering fluid pressure switch and the engine control uit.
- Power steering fluid pressure switch connector: Disconnected
- Engine control unit connector: Disconnected

OK → 2

NG → Repair the harness. (Ⓐ1 – 37)

2



Measure the applied voltage.
- Power steering fluid pressure switch connector: Disconnected
- Engine control unit connector: Connected
- Ignition switch: ON

Voltage (V)
5V

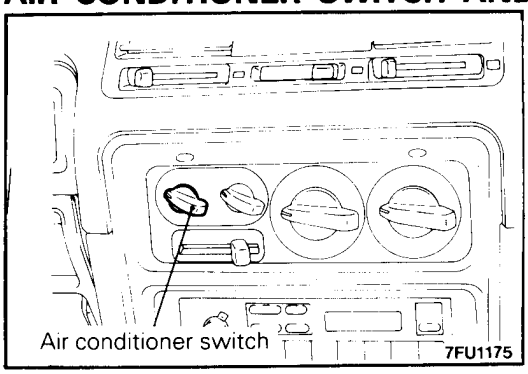
OK → STOP

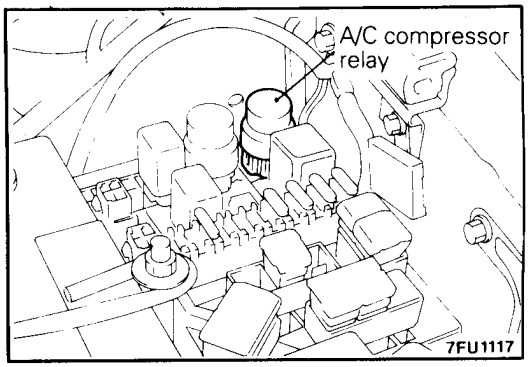
NG → Replace the engine control unit.

SENSOR INSPECTION

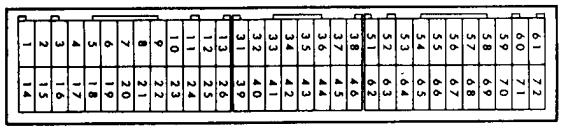
Refer to GROUP 37 – Service Adjustment Procedures.

AIR CONDITIONER SWITCH AND POWER RELAY

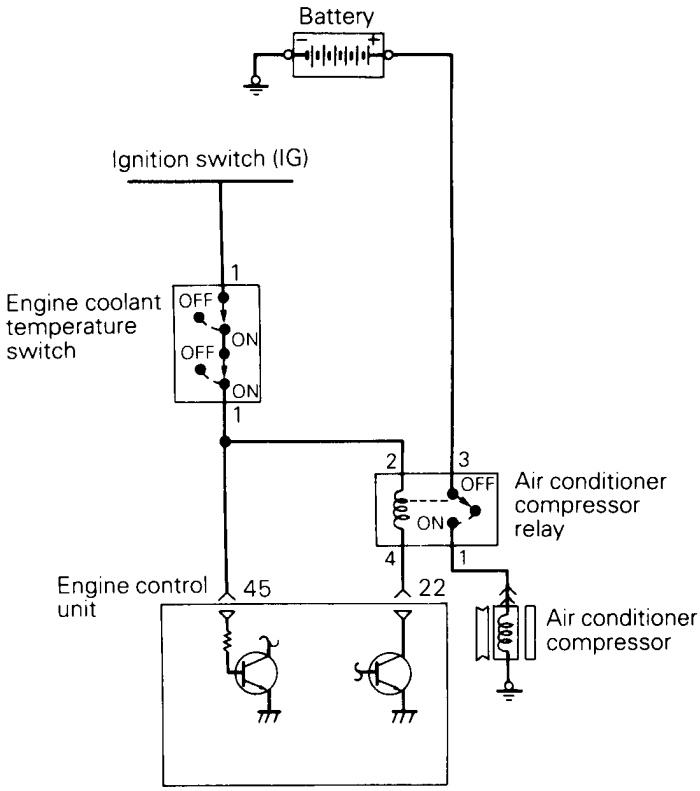




Engine control unit connector



9FU0101



7FU0821

OPERATION

- The air conditioner switch applies battery voltage to the engine control unit when the air conditioner is switched ON.
- When the air conditioner signals are input, the engine control unit activates the idle-speed control servo, and also switches ON the power transistor. As a result, current flows to the power relay coil and the relay switch is switched ON; the air conditioner compressor's magnetic clutch is activated.

TROUBLESHOOTING HINTS

If the air conditioner compressor's magnetic clutch is not activated when the air conditioner switch is switched ON during idling, it is probable that the cause is a malfunction of the air conditioner control system.

INSPECTION

Using MUT-II

Air conditioner switch

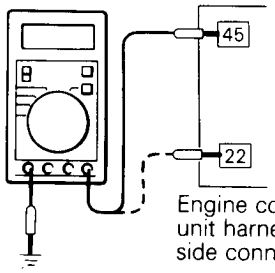
Function	Item No.	Data display	Check conditions	Air conditioner switch	Normal display
Data reading	28	Switch status	• Engine idling (The air conditioner compressor should be activated when the air conditioner switch is switched ON.)	OFF	OFF
				ON	ON

Air conditioner power relay

Function	Item No.	Data display	Check conditions	Air conditioner switch	Normal display
Data reading	49	Air conditioner power relay status	• Engine: idling after warm up	OFF	OFF (Compressor clutch non-activation)
				ON	ON (Compressor clutch activation)

HARNESS INSPECTION

1



Measure the power supply voltage of the air conditioner circuit.
- Engine control unit connector: Disconnect
- Ignition switch: ON
- Air conditioner switch: ON

Voltage (V)
5V

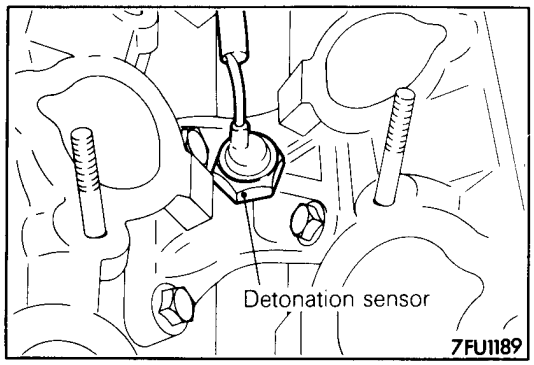
OK → STOP

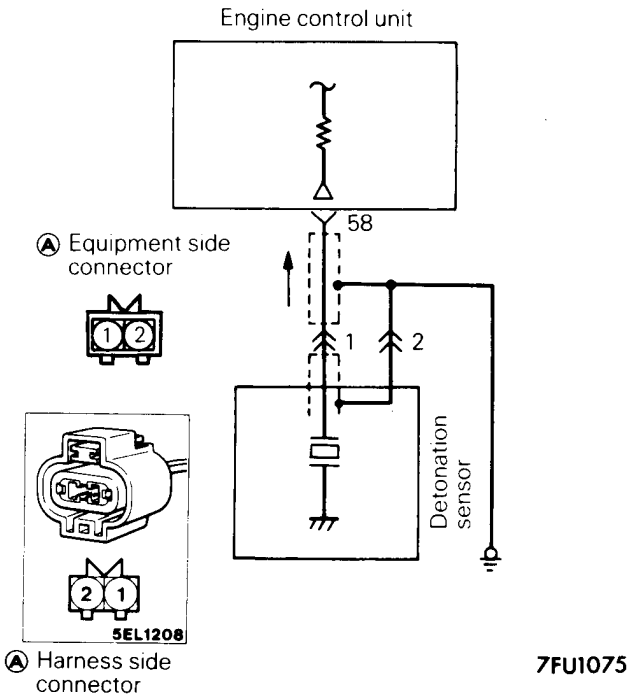
NG → Check the Air conditioner circuit.

AIR CONDITIONER INSPECTION

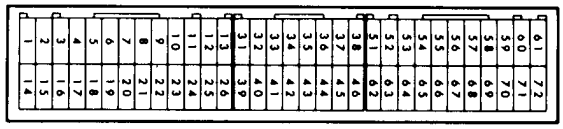
Refer to GROUP 55.

DETONATION SENSOR <DOHC>





Engine control unit connector



9FU0101

OPERATION

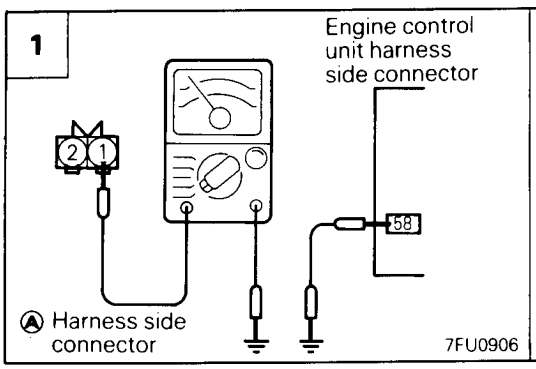
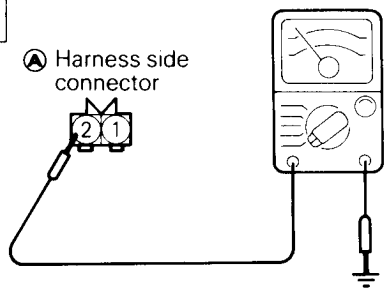
The detonation sensor generates a voltage proportional to the magnitude of cylinder block vibration due to knocking and inputs it to the engine control unit. Based on this signal, the engine control unit provides retard control of the ignition timing.

TROUBLESHOOTING HINTS

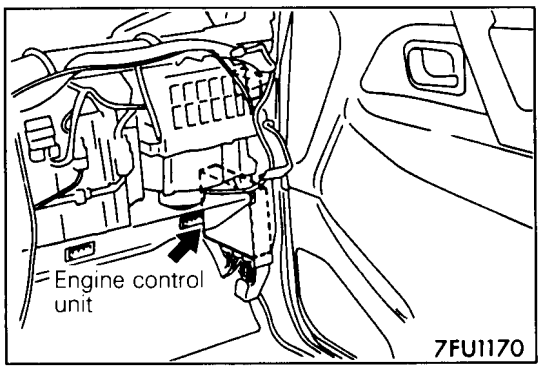
When knocking occurs while driving under high-load conditions, the following problems are suspected in addition to the detonation sensor itself.

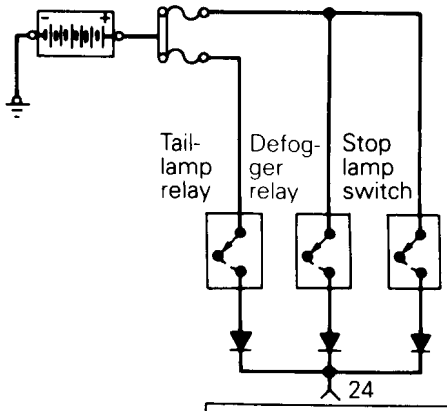
(1) Inappropriate ignition plug heat range
(2) Inappropriate gasoline
(3) Incorrectly adjusted reference ignition timing

HARNESS INSPECTION

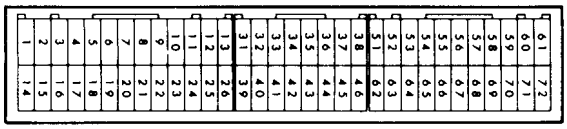
1 	Check for an open-circuit or a short-circuit to earth, between the engine control unit and detonation sensor. • Detonation sensor connector: Disconnected • Engine control unit connector: Disconnected	OK →	2
		NG →	Repair the harness. (Ⓐ1 – 58)
2 	Check for continuity of the earth circuit. • Connector: Disconnected	OK →	STOP
		NG →	Repair the harness. (Ⓐ2 – Earth)

ELECTRICAL LOAD SWITCH <DOHC>

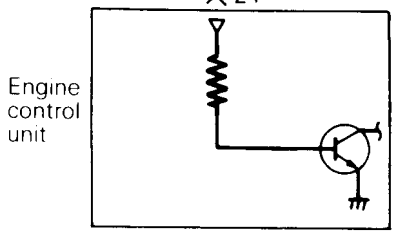




Engine control unit connector



9FU0101



7FU0688

OPERATION

- The electrical load switch inputs ON/OFF state of the switch of equipment that consumes much power during idling, namely, equipment with a large electrical load, to the engine control unit. Based on this signal, the engine control unit controls the idle-speed control servo.
- When the switch of equipment with a large electrical load is turned ON, the battery voltage is applied to the engine control unit to indicate that the equipment switch is turned ON.

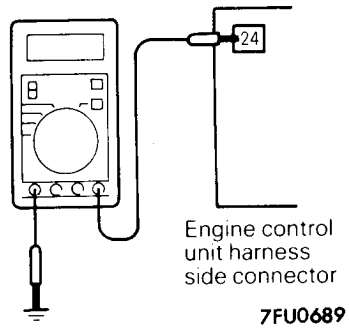
INSPECTION

Using MUT-II

Function	Item No.	Data display	Check condition	Equipment state	Normal display
Data reading	33	Switch state	Operation of equipment: OFF	Lighting switch only: OFF → ON	OFF → ON
				Rear defogger switch only: OFF → ON	OFF → ON
				Brake pedal only: depressed → Released	ON → OFF

HARNESS INSPECTION

1



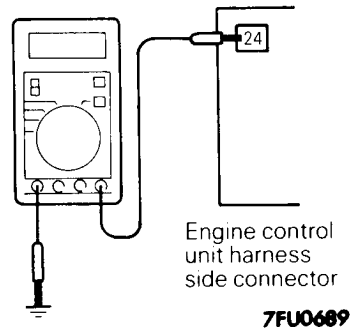
Measure the input voltage of engine control unit.
- Engine control unit connector: Disconnected
- Lighting switch: ON (Tail lamp relay ON)

Voltage (V)
SV

OK → 2

NG → Check circuit related to tail lamp relay

2



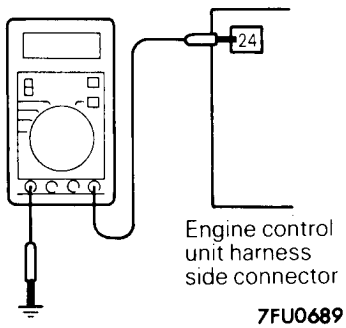
Measure the input voltage of engine control unit.
- Engine control unit connector: Disconnected
- Defogger switch: ON (Defogger relay ON)

Voltage (V)
SV

OK → 3

NG → Check circuit related to defogger relay

3



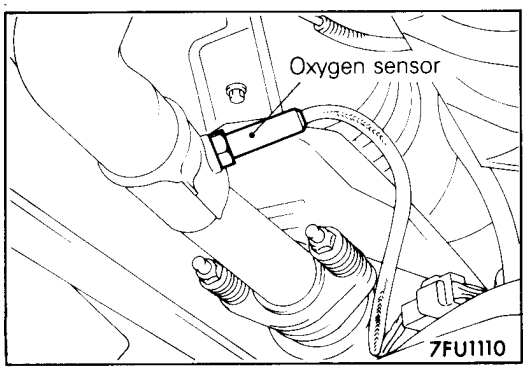
Measure the input voltage of engine control unit.
- Engine control unit connector: Disconnected
- Brake pedal: Depressed (Stop lamp switch ON)

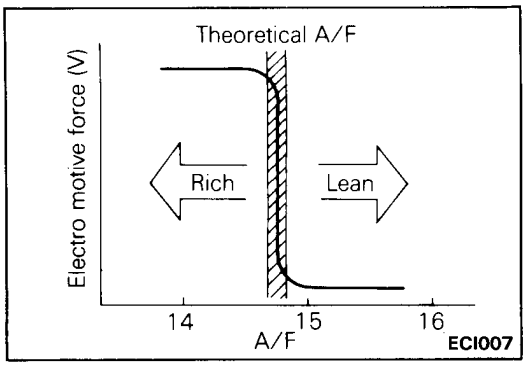
Voltage (V)
SV

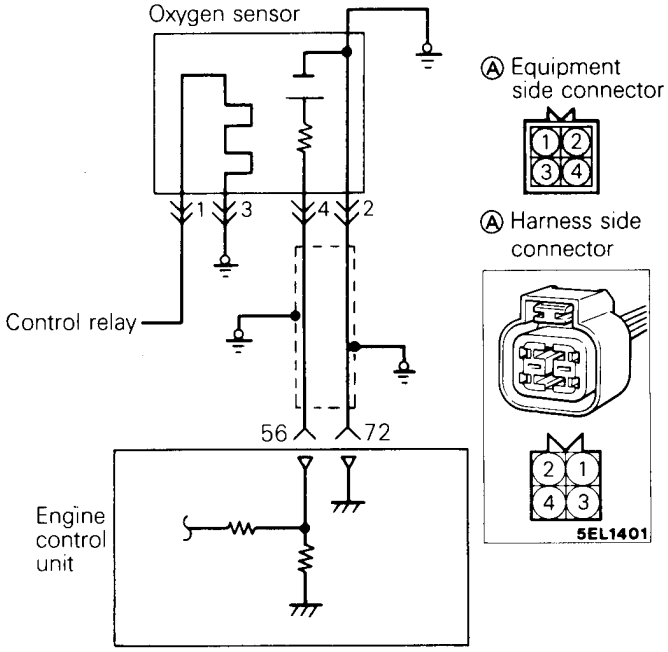
OK → STOP

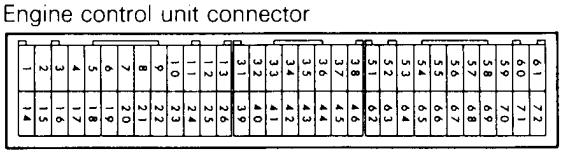
NG → Check circuit related to stop lamp relay

OXYGEN SENSOR









OPERATION

- The oxygen sensor functions to detect the concentration of oxygen in the exhaust gas; it converts those data to voltage, and inputs the resulting signals to the engine control unit.
- If the air/fuel mixture ratio is richer than the theoretical air/fuel mixture ratio (i.e., if the concentration of oxygen in the exhaust gas is sparse), a voltage of approximately 1V is output; if the air/fuel mixture ratio is leaner than the theoretical air/fuel mixture ratio (i.e., if the concentration is dense), a voltage of approximately 0V is output.
- The engine control unit, based upon those signals, regulates the amount of fuel injection so that the air/fuel mixture ratio becomes the theoretical air/fuel mixture ratio.
- Battery power supply is applied, by way of the control relay, to the oxygen sensor heater. As a result, the sensor element is heated by the heater, so that the oxygen sensor shows excellent response even if the temperature of the exhaust gas is low.

TROUBLESHOOTING HINTS

Hint 1: The exhaust gas purification performance will worsen if there is a malfunction of the oxygen sensor.

Hint 2: If the oxygen sensor output voltage deviates from the standard value even though the results of the checking of the oxygen sensor are normal, the cause is probably a malfunction of a component related to air/fuel mixture ratio control.

[Examples]
(1) Malfunction of an injector.
(2) Air leakage into the intake manifold from a leaking gasket.
(3) Malfunction of the air-flow sensor, the intake air temperature sensor, the barometric-pressure sensor, or the engine coolant temperature sensor.

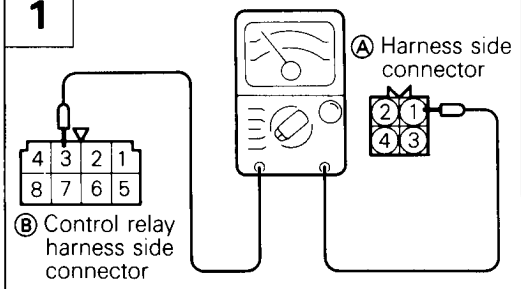
INSPECTION

Using MUT-II

Function	Item No.	Data display	Check conditions	Engine condition r/min.	Standard value mV
Data reading	11	Sensor detection voltage	• Engine: warm-up (Make the mixture lean by engine speed reduction, and rich by racing.)	When sudden deceleration from 4,000	200 or lower
				When engine is suddenly raced	600 – 1,000
			• Engine: warm up using the oxygen sensor signal, check the air/fuel mixture ratio, and also check the condition of control by the engine control unit	700 (Idling)	400 or lower ↕ (changes) 600 – 1,000
				2,000	

HARNESS INSPECTION

1



6AF0077

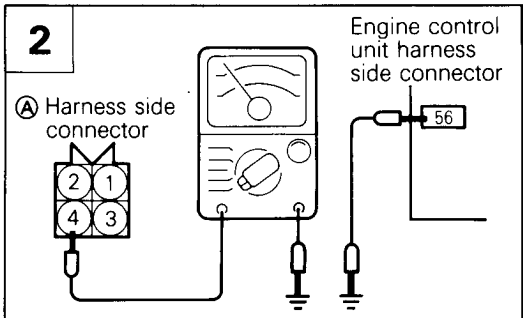
Check for continuity between the oxygen sensor and the control relay.
- Control relay connector: Disconnected
- Oxygen sensor connector: Disconnected

NOTE
Touch the ohmmeter probes to both ends of the harness.

OK → 2

NG → Repair the harness. (Ⓐ1 – Ⓑ3)

2



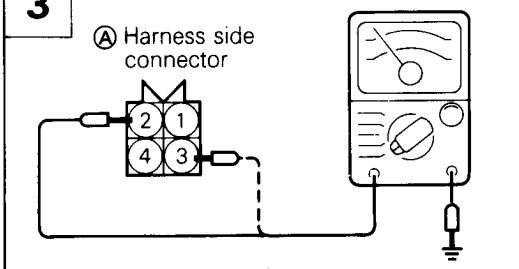
7FU1132

Check for an open-circuit, or a short-circuit to earth, between the engine control unit and the oxygen sensor.
- Oxygen sensor connector: Disconnected
- Engine control unit connector: Disconnected

OK → 3

NG → Repair the harness. (Ⓐ4 – 56)

3

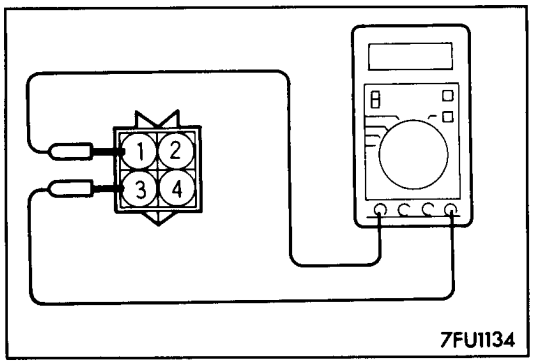


7FU1133

Check for continuity of the earth circuit.
- Oxygen sensor connector: Disconnected
- Engine control unit connector: Disconnected

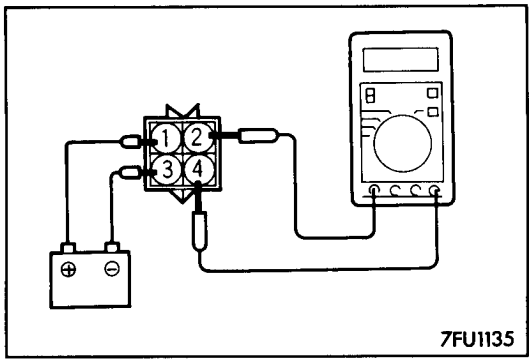
OK → STOP

NG → Repair the harness. (Ⓐ2 – 72) (Ⓐ3 – Earth)



SENSOR INSPECTION

(1) Disconnect the oxygen sensor connector.
(2) Check that there is continuity [approx. 20 Ω at 20°C (68°F)] between oxygen sensor connector terminal ① and terminal ③.
(3) If there is no continuity, replace the oxygen sensor.



(4) Warm the engine until the engine coolant temperature reaches 80°C (176°F) or more.
(5) Use the jumper leads to connect the oxygen sensor terminal ① (connect (+) terminal) and terminal ③ (connect (–) terminal) to the battery (+) and (–) terminals respectively.

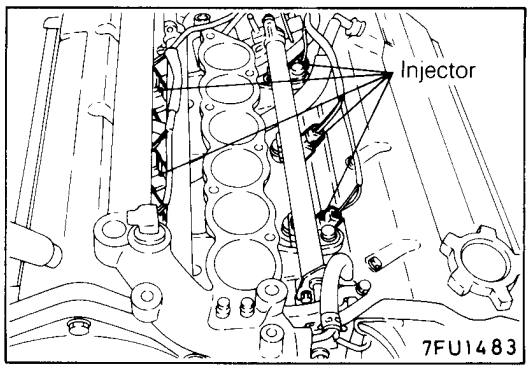
Caution
Be careful when connecting the jumper leads, as connecting the terminals incorrectly will damage the oxygen sensor.

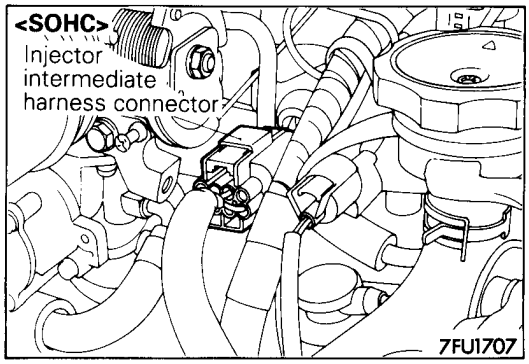
(6) Connect a digital-type voltmeter to terminal ② and terminal ④.
(7) While repeatedly racing the engine, measure the oxygen sensor output voltage.

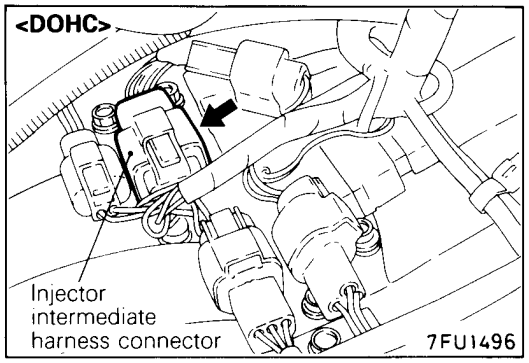
Engine	Oxygen sensor output voltage	Notes
When racing the engine	0.6–1.0V	When the air/fuel mixture ratio is enriched by racing the engine repeatedly, a normal oxygen sensor will output a voltage of 0.6–1.0V.

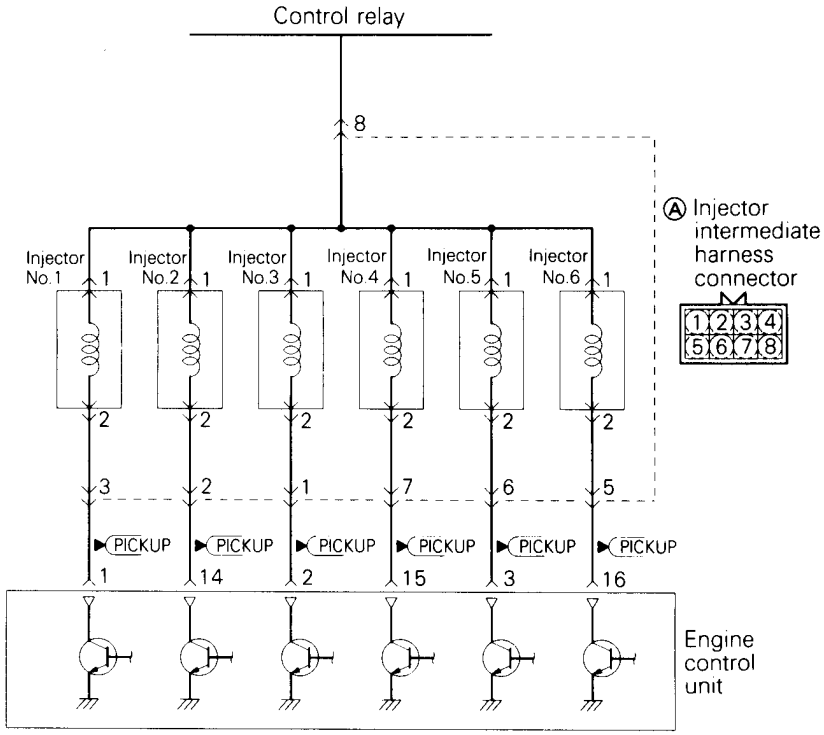
NOTE
For removal and installation of the oxygen sensor, refer to GROUP 15 – Exhaust Pipe, Main Muffler and Catalytic Converter.

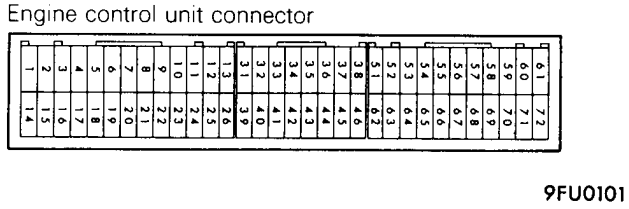
INJECTORS











OPERATION

- The injectors are electromagnetic-valve-equipped injection nozzles that function to inject fuel based upon injection signals from the engine control unit.
- Because the surface area of the injection ports is fixed and because the pressure of the fuel relative to the pressure within the manifold is also regulates to a fixed pressure, the amount of fuel injection by injectors is determined by the length of time that the needle valve is open, or, in other words, by the length of time of current flow to the solenoid coil.
- Battery power supply is supplied, by way of the control relay, to the injectors. When the engine control unit switches ON the power transistor within the unit and current flows to the solenoid coil, the injectors open and fuel is injected.

TROUBLESHOOTING HINTS

Hint 1: If there is a problem with starting while the engine is warm, perform the combustion test and check for leakage of the injectors.

Hint 2: If the engine can't be started, and the injectors are not activated during cranking, the cause is probably a malfunction such as described below, not with the injectors.

(1) Malfunction of the circuit for supply of power to the engine control unit, or of the earth circuit.
(2) Malfunction of the control relay.
(3) Malfunction of the crank-angle sensor and/or the top dead center sensor.

Hint 3: If there is a cylinder for which the idling condition does not change when, during idling, the fuel injection of the injectors is cut off in sequence, check that cylinder as described below.
(1) Check the injector and harness.
(2) Check the spark plugs and the high-tension cable.
(3) Check the compression pressure.

Hint 4: If the injector activation time deviates from the standard value even though the results of the checking of the injector's harness and of the injector itself are normal, the cause may be presumed to be one of the following.
(1) Incomplete combustion within the cylinder. (Malfunction of the spark plugs, the ignition coil, the compression pressure, etc.)
(2) Improper adhesion of EGR valve seat.
(3) Increased engine resistance.

INSPECTION

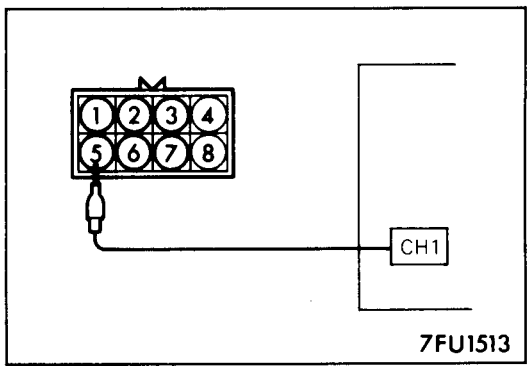
Using MUT-II

Function	Item No.	Data Display	Check conditions	Engine coolant temperature °C (°F)	Standard value ms
Data reading	41	Activation time*1	Engine cranking	When 0*2 (32)	15.5–19 <SOHC> 15–18 <DOHC>
				When 20 (68)	38–46.5 <SOHC> 42–51 <DOHC>
				When 80 (176)	10–12 <SOHC> 9–11 <DOHC>

Function	Item No.	Data Display	Check conditions	Engine condition r/min.	Standard value ms
Data reading	41	Activation time*3	• Engine coolant temperature: 89–95°C (185–205°F) • Lamps and accessories: OFF • Transmission: neutral (P range for vehicles with A/T) • Steering wheel: neutral position	700 (idling)	2.6–3.8 <SOHC> 2.3–3.5 <DOHC>
				2,500 <SOHC>	2.3–3.5
				2,000 <DOHC>	2.0–3.2
				When raced suddenly	Increases

NOTE
*1 : Indicates the injector-activation time when the power source voltage is 11V and the cranking speed is 250 r/min or less.
*2: At a coolant temperature of 0°C (32°F), there is synchronous injection for all six cylinders.
*3: For a new vehicle [driven approximately 500 km (300 miles) or less)] the injector-activation may be about ten percent longer than indicated above.

Function	Item No.	Drive content	Check condition	Normal condition
Actuator test	01	No. 1 injector shut off	Engine: Idling after warm-up (Shut off the injectors in sequence during after engine warm-up, check the idling condition)	Idle state to change further (becoming less stable or stalling)
	02	No. 2 injector shut off		
	03	No. 3 injector shut off		
	04	No. 4 injector shut off		
	05	No. 5 injector shut off		
	06	No. 6 injector shut off		

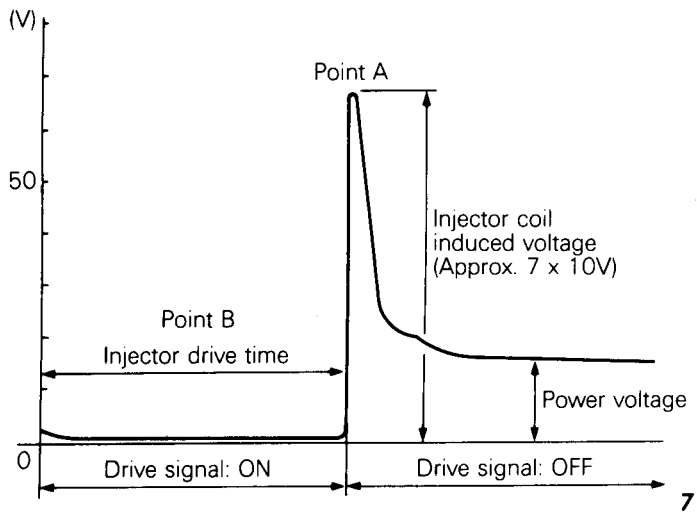


Wave Pattern Inspection Using An Analyzer

(1) Remove the injector intermediate connector and connect the special tool (harness connector: MD998474).
(2) Connect the probe of an osciloscope as follows.

	No. 1 cylinder	No. 2 cylinder	No. 3 cylinder	No. 4 cylinder	No. 5 cylinder	No. 6 cylinder
Male connector terminal No.	3	2	1	7	6	5
Clip colour (lead wire)	Green (Green/ black)	White (White)	Blue (Blue)	Yellow (Yellow)	Red (Red)	Black (Black)

Standard wave pattern



Observation conditions

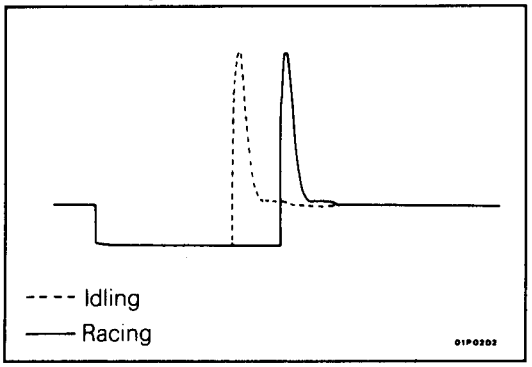
Function	Special patterns
Pattent height	Variable
Variable knob pattern selector	Display
Engine r/min.	Idle speed (700 r/min.)

Wave pattern observation points

(Point A): Height of back electromotive force in the solenoid coil

Contrast with standard wave pattern	Probable cause
Solenoid coil back electromotive force is low or doesn't appear at all.	Short in the injector solenoid

(Point B): Injector drive time



- The injector drive timing will synchronized with the MUT-II display.
- When the engine is suddenly raced, the drive time will be greatly extended at first, but the drive time will soon match the engine speed.

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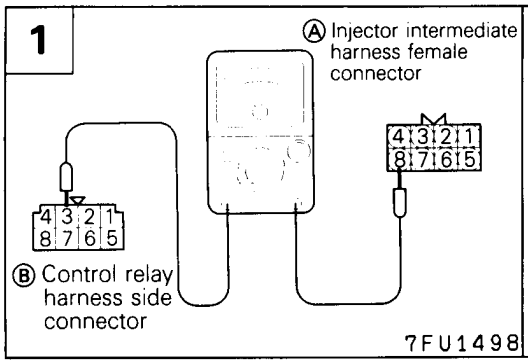
HARNESS INSPECTION

1



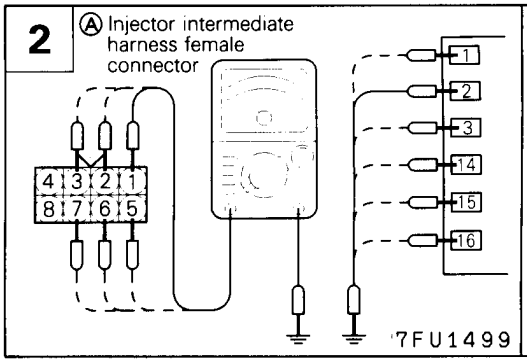
Check for continuity between the injectors and the control relay.
- Injector intermediate connector: Disconnected
- Control relay connector: Disconnected

NOTE
Touch the ohmmeter probes to both ends of the harness.

OK → 2

OK → Repair the harness. (Ⓐ8 - Ⓑ3)

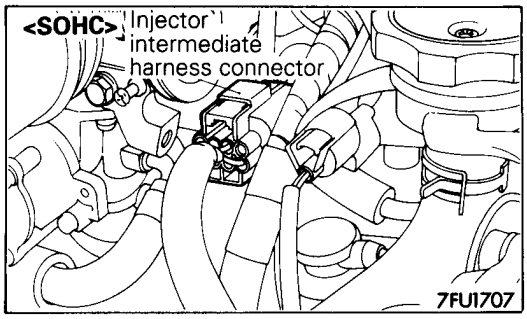
2

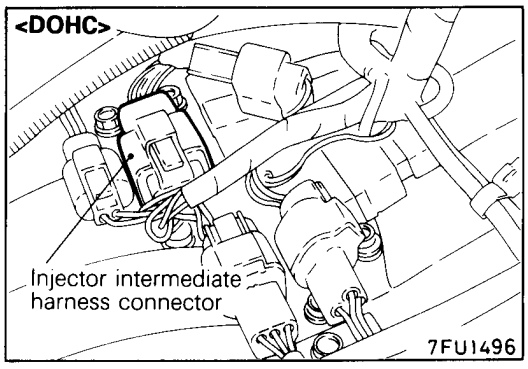


Check for an open-circuit, or a short-circuit to earth, between the engine control unit and the injector.
- Engine control unit connector: Disconnected
- Injector intermediate connector: Disconnected

OK → STOP

OK → Repair the harness.
(Ⓐ1 - 2)
(Ⓐ2 - 14)
(Ⓐ3 - 1)
(Ⓐ5 - 16)
(Ⓐ6 - 3)
(Ⓐ7 - 15)

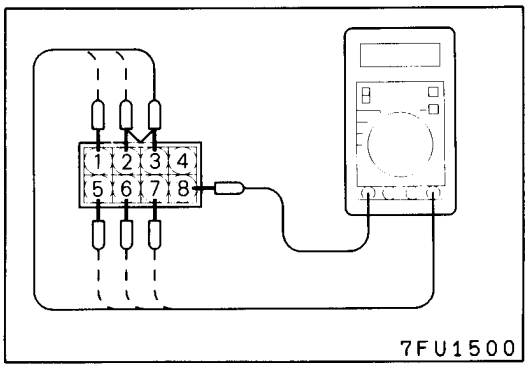




ACTUATOR INSPECTION

Measuring Resistance Between Terminals

(1) Disconnect the injector intermediate harness connector.



(2) Measure resistance value between terminals.

Injector	Terminals	Resistance value
No. 1	8 – 3	13 – 16 Ω
No. 2	8 – 2	
No. 3	8 – 1	
No. 4	8 – 7	
No. 5	8 – 6	
No. 6	8 – 5	

(3) Connect the injector intermediate harness connector.

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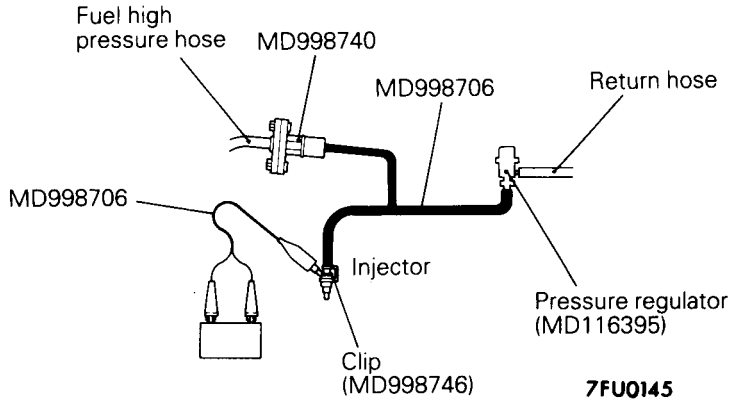
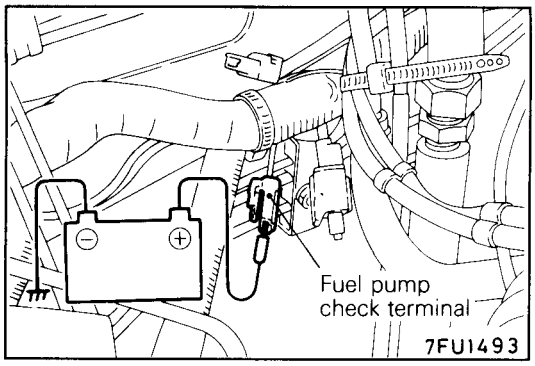
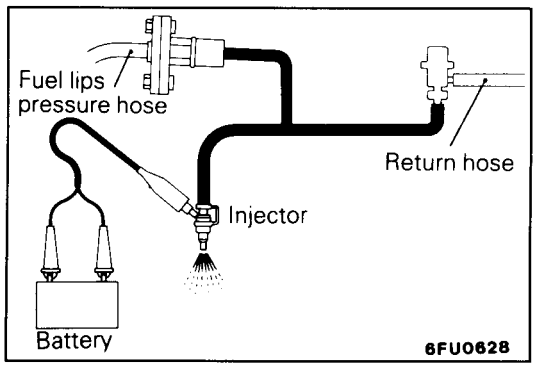
Checking the Injection Condition

(1) Following the steps below, bleed out the residual pressure within the fuel pipe line to prevent flow of the fuel. (Refer to P.13-79-16.)
(2) Remove the injector.
(3) Arrange the special tool (injector test set), adaptor, fuel pressure regulator and clips as shown in the illustration below.

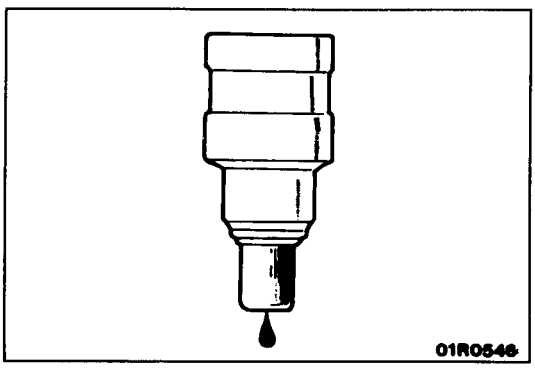




(4) Connect the battery's negative (–) terminal.
(5) Apply battery voltage to the fuel pump check terminal and activate the fuel pump.



(6) Activate the injector and check the atomized spray condition of the fuel. The condition can be considered satisfactory unless it is extremely poor.



(7) Stop the actuation of the injector, and check for leakage from the injector's nozzle.

Standard value: 1 drop or less per minute

(8) Activate the injector without activating the fuel pump; then, when the spray emission of fuel from the injector stops. disconnect the special tool and restore it to its original condition.

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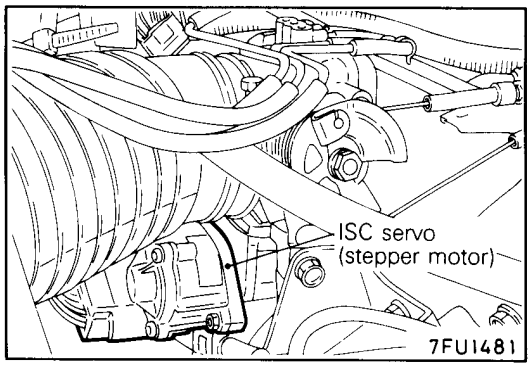
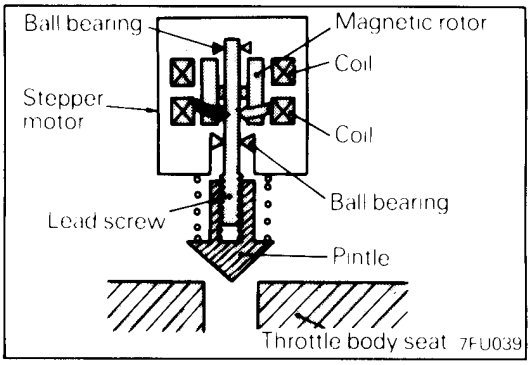
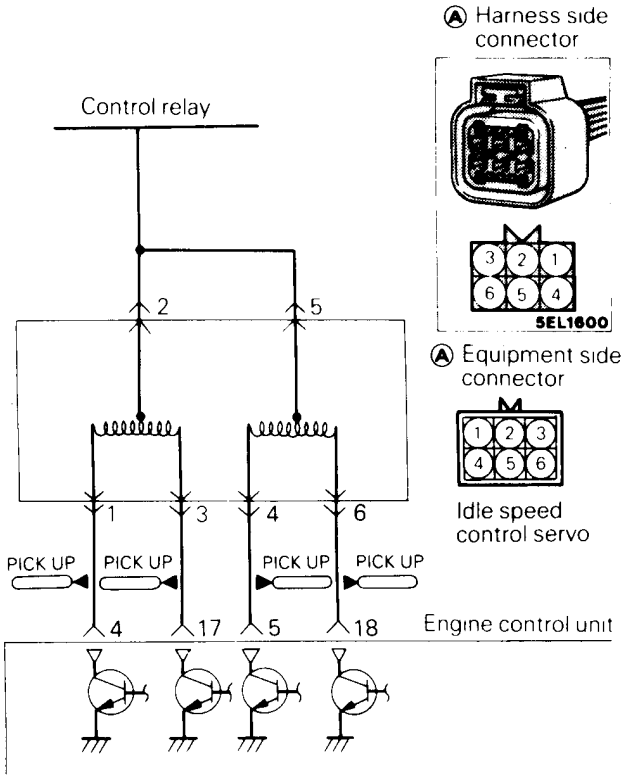
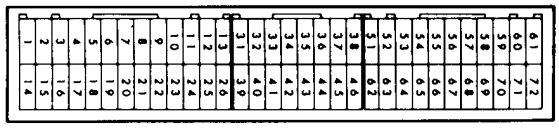
IDLE SPEED CONTROL SERVO (STEPPER MOTOR TYPE)









OPERATION

- The intake air volume during idling is controlled by opening or closing the servo valve provided in the air path that bypasses the throttle valve.
- The servo valve is opened or closed by operating the stepper motor in the speed control servo in normal or reverse direction.
- The battery power is supplied to the stepper motor through the control relay. As the engine control unit turns on power transistors in the unit one after another, the stepper motor coil is energized and the motor rotates in normal or reverse direction.

TROUBLESHOOTING HINTS

Hint 1: If the stepper motor step increases to 100 to 120 steps or decreases to 0 step, faulty stepper motor or open circuit in the harness is suspected.

Hint 2: If the idle speed control servo harness and individual part checks have resulted normal but the stepper motor steps are out of specification, the following faults are suspected.

(1) Poorly adjusted reference idle speed
(2) Deposit on the throttle valve
(3) Air leaking into the intake manifold through gasket gap
(4) Loose EGR valve seat
(5) Poor combustion in the cylinder (faulty ignition plug, ignition coil, injector, low compression pressure, etc.)

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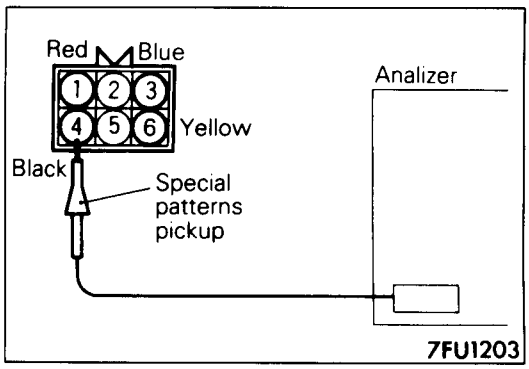
INSPECTION

Using MUT-II

Function	Item No.	Data display	Check condition	Load state	Standard value
Data reading	45	Stepper motor steps	• Engine coolant temperature: 80–95°C (176–205°F) • Lamps, accessory units: All OFF • Transmission: Neutral • Idle position switch: ON (compressor clutch to be ON if air conditioner switch is ON) • Engine: Idling	Air conditioner switch: OFF	2–25 steps
				Air conditioner switch: ON	Increase by 10–70 steps

NOTE
When the vehicle is new [within initial operation of about 500 km (300 miles)], the stepper motor steps may be about 30 steps more than standard.



Wave Pattern Inspection Using an Analyzer

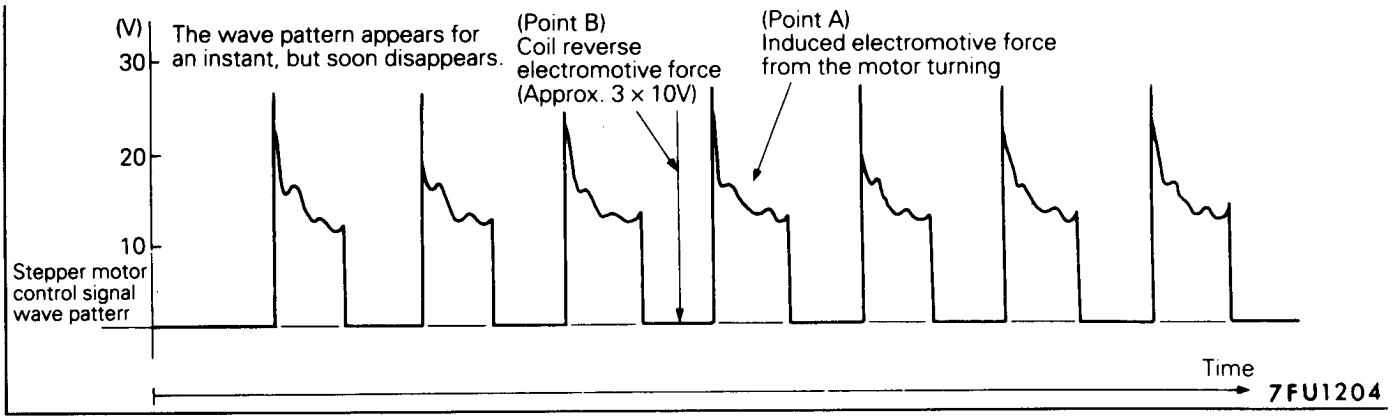
Measurement method

(1) Disconnect the stepper motor connector, and connect the special tool (test harness: MB998463) in between.
(2) Connect the analyzer special patterns pickup to the stepper motor-side connector terminal ① (red clip on the special tool), terminal ③ (blue clip), terminal ④ (black clip) and terminal ⑥ (yellow clip) respectively.

Standard wave pattern

Observation conditions

Function	Special patterns
Pattern height	High
Pattern selector	Display
Engine condition	Turn the ignition switch from OFF to ON (without starting the engine).
	While the engine is idling, turn the air conditioner switch to ON.
	Immediately after starting the warm engine (approx. 1 minute).



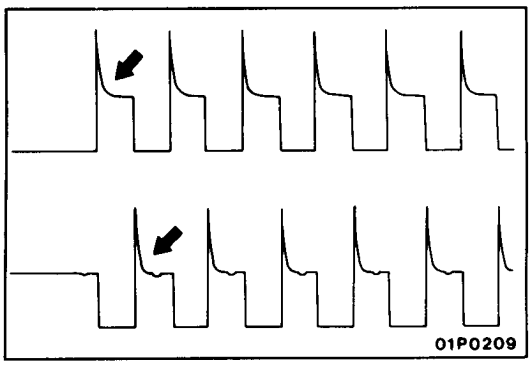
Wave pattern observation points

Check that the standard wave pattern appears when the stepper motor is operating.
(Point A): Presence or absence of induced electromotive force from the motor turning. (Refer to the abnormal wave pattern.)

Contrast with standard wave pattern	Probable cause
Induced electromotive force does not appear or is extremely small.	Motor is malfunctioning

(Point B): Height of coil reverse electromotive force

Contrast with standard wave pattern	Probable cause
Coil reverse electromotive force does not appear or is extremely small.	Short in the coil



Abnormal wave pattern

Cause of problem

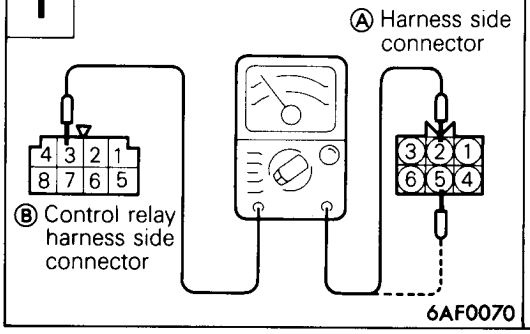
Motor is malfunctioning. (Motor is not operating.)

Wave pattern characteristics

Induced electromotive force from the motor turning does not appear.

HARNESS INSPECTION

1



Check for continuity between the idle speed control seryo and the control relay.

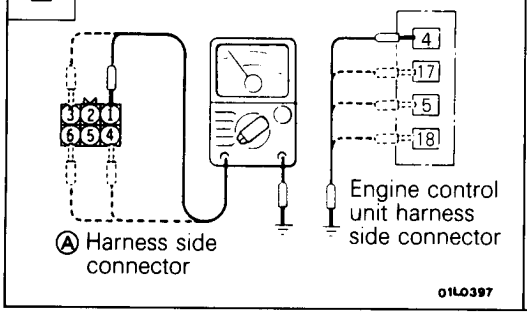
- Idle speed control servo connector: Disconnected
- Control relay connector: Disconnected

NOTE
Touch the ohmmeter probes to both ends of the harness.

OK → 2

NO → Repair the harness. (Ⓐ2 5 – Ⓑ3)

2

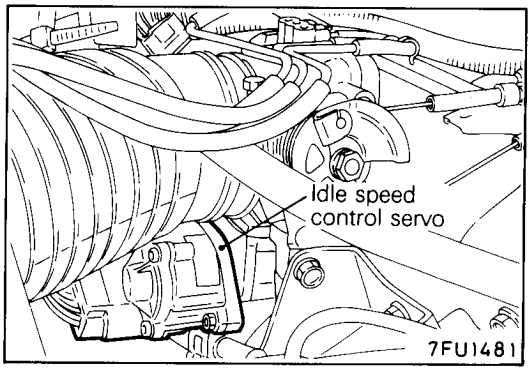


Check for an open-circuit, or a short-circuit to earth between the engine control unit and the idle speed control servo.

- Engine control unit connector: Disconnected
- Idle speed control servo connector: Disconnected

OK → STOP

NO → Repair the harness.
(Ⓐ1 – 4)
(Ⓐ3 – 17)
(Ⓐ4 – 5)
(Ⓐ6 – 18)



ACTUATOR INSPECTION

Checking the Operation Sound

(1) Check that the operation sound of the stepper motor can be heard after the ignition is switched ON (but without starting the motor).
(2) If the operation sound cannot be heard, check the stepper motor's activation circuit.
If the circuit is normal, it is probable that there is a malfunction of the stepper motor or of the engine control unit.

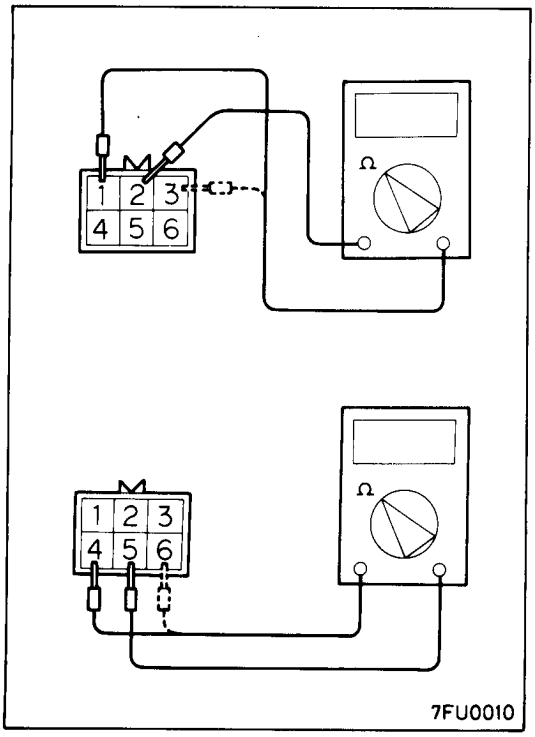
Checking the Coil Resistance

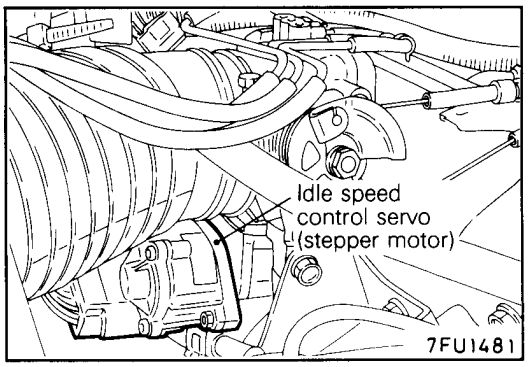
(1) Disconnect the idle speed control servo connector and connect the special tool (test harness).
(2) Measure the resistance between terminal ② (white clip of the special tool) and either terminal ① (red clip) or terminal ③ (blue clip) of the connector at the idle speed control servo side.

Standard value: 28–33 Ω [at 20°C (68°F)]

(3) Measure the resistance between terminal ⑤ (green clip of the special tool) and either terminal ⑥ (yellow clip) or terminal ④ (black clip) of the connector at the idle speed control servo side.

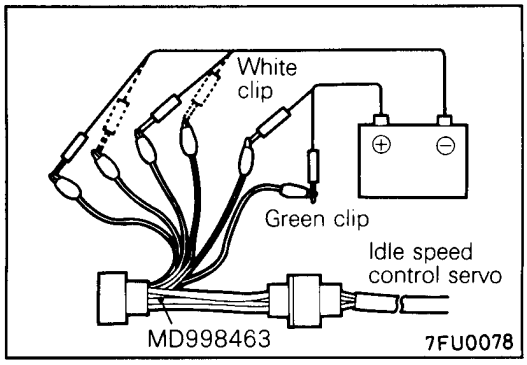
Standard value: 28–33 Ω [at 20°C (68°F)]



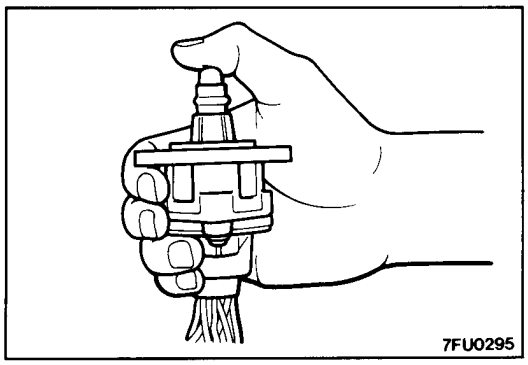


Operation Check

(1) Remove the throttle body.
(2) Remove the stepper motor.

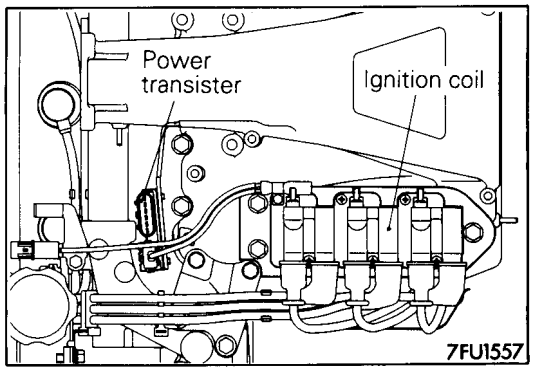


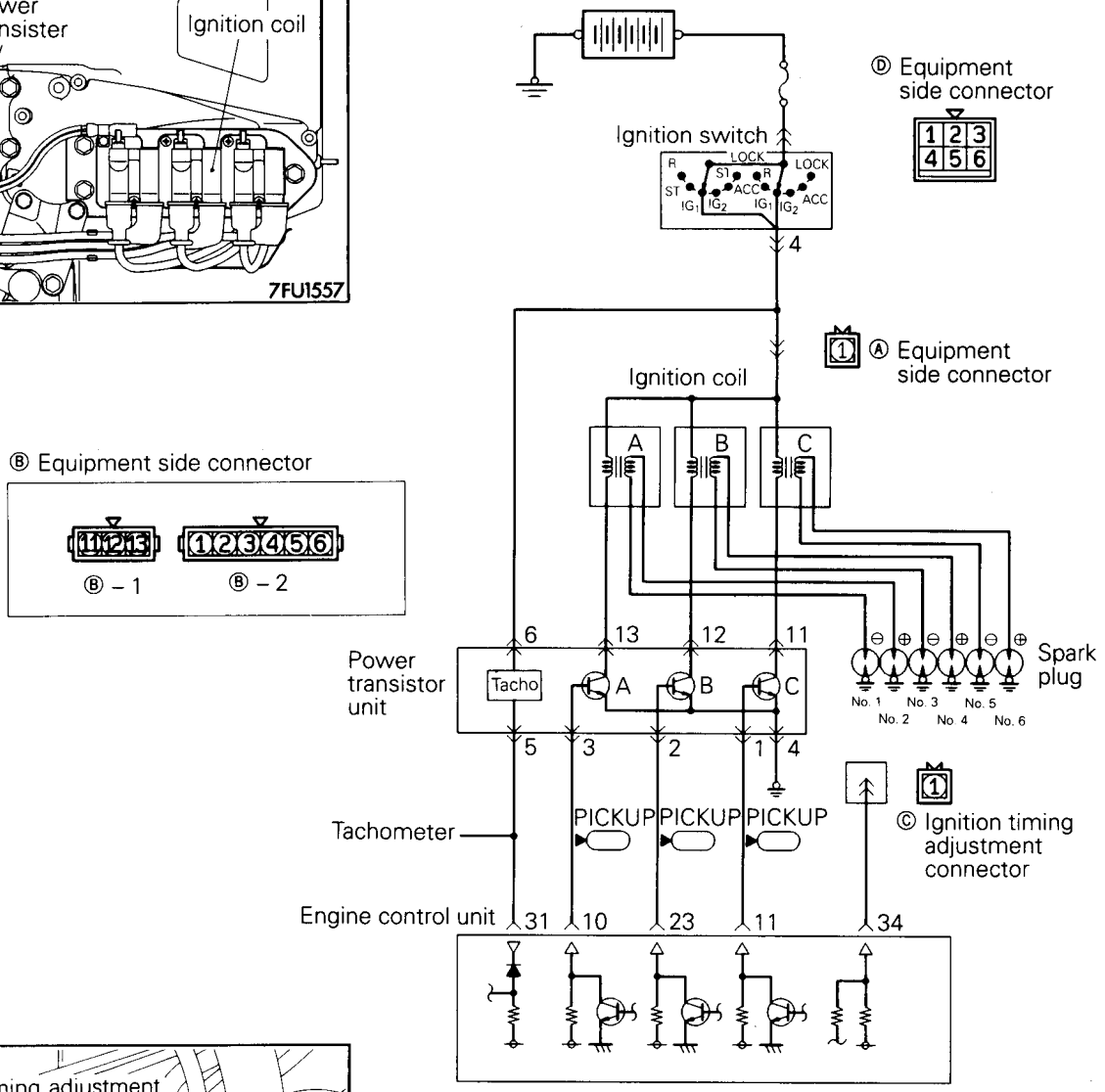
(3) Connect the special tool (test harness) to the idle speed control servo connector.
(4) Connect the positive ⊕ terminal of a power supply (approx. 6 V) to the white clip and the green clip.

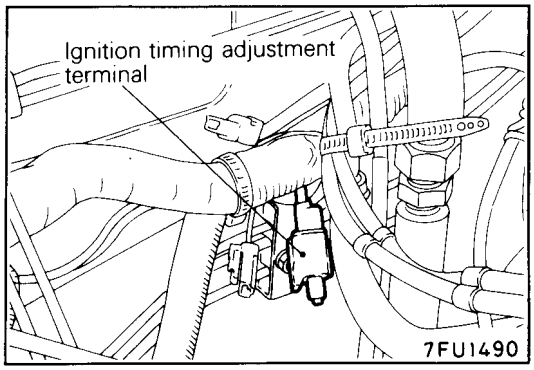


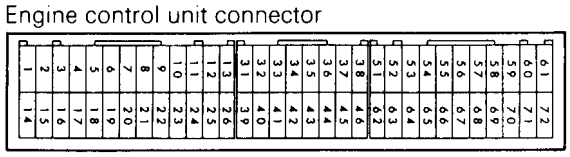
(5) With the idle speed control servo as shown in the illustration, connect the negative ⊖ terminal of the power supply to each clip as described in the following steps, and check whether or not a vibrating feeling (a feeling of very slight vibration of the stepper motor) is generated as a result of the activation of the stepper motor.
   ① Connect the negative ⊖ terminal of the power supply to the red and black clip.
   ② Connect the negative ⊖ terminal of the power supply to the blue and black clip.
   ③ Connect the negative ⊖ terminal of the power supply to the blue and yellow clip.
   ④ Connect the negative ⊖ terminal of the power supply to the red and yellow clip.
   ⑤ Connect the negative ⊖ terminal of the power supply to the red and black clip.
   ⑥ Repeat the tests in sequence from ⑤ to ①.
(6) If, as a result of these tests, vibration is detected, the stepper motor can be considered to be normal.

IGNITION COIL AND IGNITION POWER TRANSISTOR <SOHC>









OPERATION

- When the power transistor unit A is turned ON by the signal from the engine control unit, primary current flows to the ignition coil A. When the power transistor unit A is turned OFF, the primary current is shut off and a high voltage is induced in the secondary coil A, causing the ignition plugs of No. 1 and No. 4 cylinders to spark. When the power transistor unit B is turned OFF, the ignition plugs of No. 2 and No. 5 cylinders spark. In addition, when the power transistor unit C is turned OFF, the ignition plugs of No. 3 and No. 6 cylinders spark.
- When the engine control unit turns OFF the transistor in the unit, the battery voltage in the unit is applied to the power transistor unit to turn it ON. When the engine control unit turns ON the transistor in the unit, the power transitor unit is turned OFF.

INSPECTION

Using MUT-II

<Spark Advance>

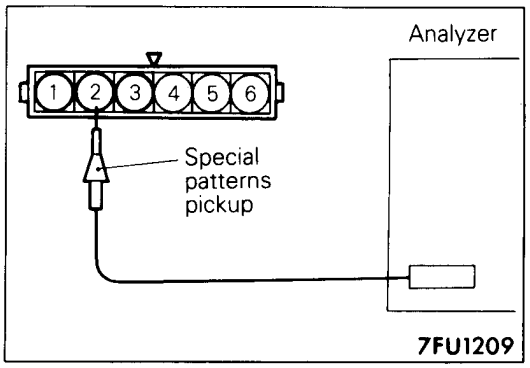
Function	Item No.	Data display	Check condition	Engine state	Standard value
Data reading	44	Ignition advance	• Engine: Warming up • Timing lamp: Set (set timing lamp to check actual ignition timing)	700 r/min (Idle)	7–23° BTDC
				2,500 r/min	27–47° BTDC

<Ignition Timing Adjustment Mode>

Function	Item No.	Data display	Check condition	Terminal condition	Standard value
Data list	36	Continuity present or not present between ignition timing adjustment terminal and earth	• Engine: Idling	Ignition timing adjustment terminal is earthed	ON
				Ignition timing adjustment terminal is disconnected from earth	OFF

<Standard Ignition Timing>

Function	Item No.	Drive	Check condition	Normal condition
Actuator test	17	Set to ignition timing adjustment mode	• Engine: idling • Timing lamp: set	5° BTDC ± 3°



Wave Pattern Inspection Using an Analyzer

- Ignition coil primary signal
  Refer to GROUP 16 – Ignition System.
- Power transistor control signal.

<Measurement method>

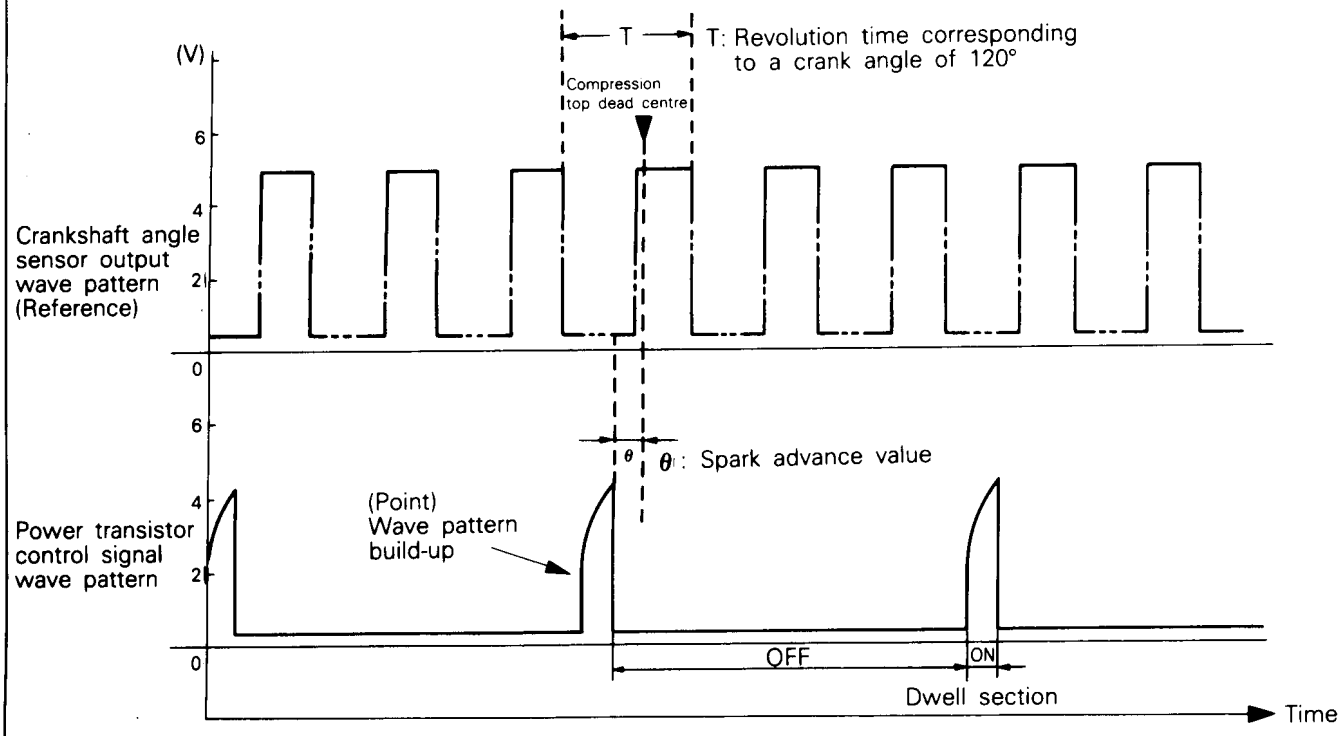
(1) Disconnect the power transistor connector, and connect the special tool (test harness: MB991348) in between. (All terminals should be connected.)

(2) Connect the analyzer special patterns pickup to the connector terminals ① (No.3 – No.6), ② (No. 2 – No. 5) and ③ (No.1 – No. 4) in that order.

Standard wave pattern

Observation conditions

Function	Special patterns
Pattern height	Low
Pattern selector	Display
Engine revolutions	Approx. 1,200 r/min.

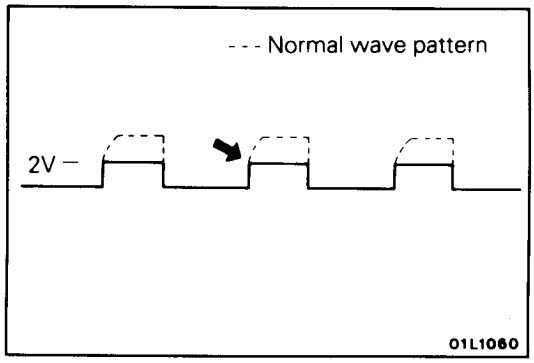


7FU1210

Wave pattern observation points

(Point): Condition of wave pattern build-up and maximum voltage (Refer to abnormal wave pattern examples 1 and 2.)

Condition of wave pattern build-up and maximum voltage	Probable cause
Rise to the right to approximately 4.5V from around 2V.	Normal
Becomes a rectangular wave at approx. 2V	Broken wire in ignition primary circuit
Becomes a rectangular wave at power voltage	Malfunction of the power transistor



Examples of abnormal wave patterns

- Example 1

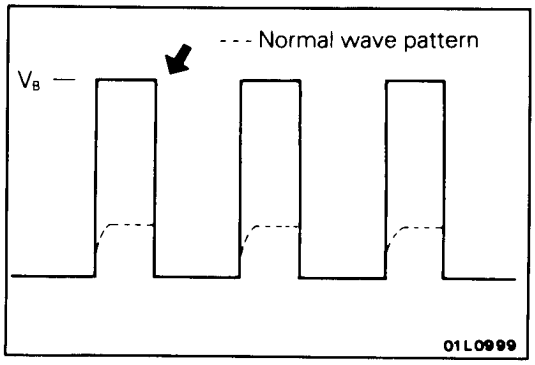
Wave pattern during engine cranking

Cause of problem

Broken wire in ignition primary circuit

Wave pattern characteristics

Top-right part of the build-up section cannot be seen, and voltage value is approximately 2V too low.



- Example 2

Wave pattern during engine cranking

Cause of problem

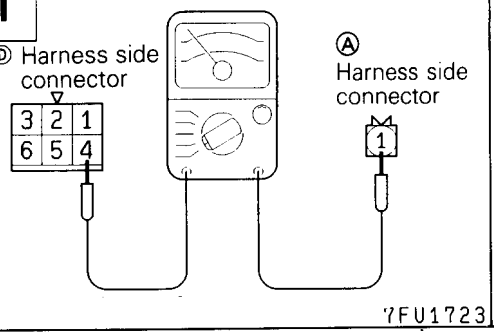
Malfunction in power transistor

Wave pattern characteristics

Power voltage results when the power transistor is ON.

HARNESS INSPECTION

1



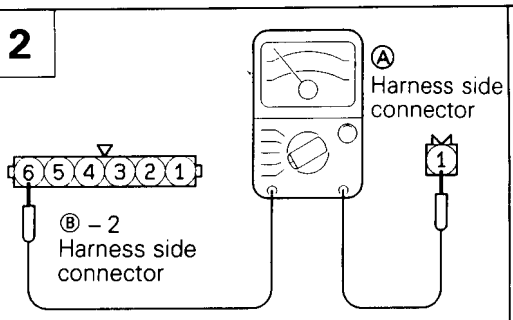
Check for continuity between the ignition coil and the ignition switch [IG].
- Ignition switch connector: Disconnected
- Ignition coil connector: Disconnected

NOTE
Touch the ohmmeter probes to both ends of the harness.

OK → 2

NG → Repair the harness. (Ⓓ4 - Ⓐ1)

2

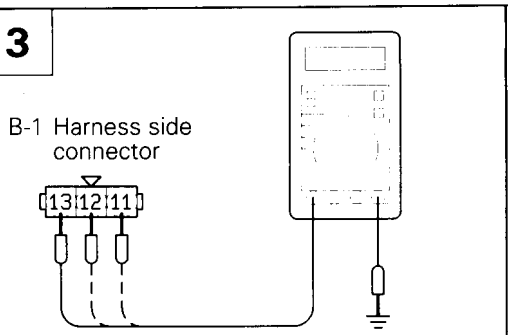


Check for continuity between the power transistor unit and ignition coil.
- Ignition coil connector: Disconnected
- Power transistor connector: Disconnected

OK → 3

NG → Repair the harness. (Ⓑ6 - Ⓐ1)

3



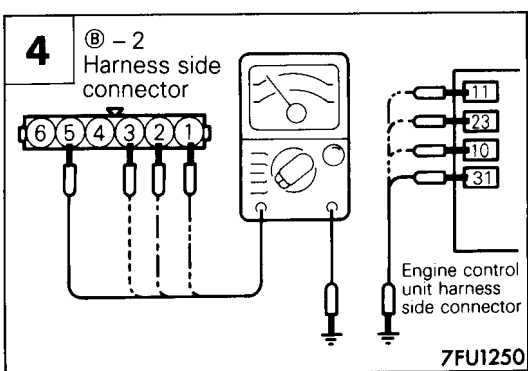
Measure the power supply voltage of the ignition coil
- Power transistor connector: Disconnected
- Ignition switch: ON

Voltage (V)
SV

OK → 4

NG → Repair the harness. (Ⓑ11, Ⓑ12, Ⓑ13 – Ignition coil)

4

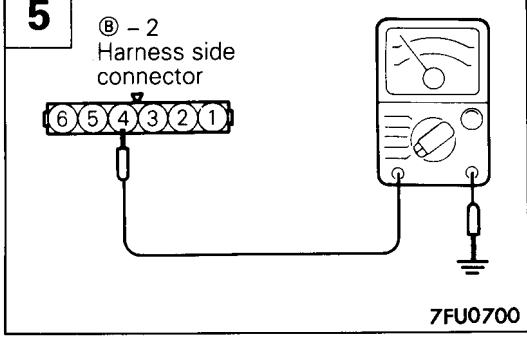


Check for open-circuit or short-circuit to earth between the power transistor and engine control unit.
- Power transistor connector: Disconnected
- Engine control unit connector: Disconnected

OK → 5

NG → Repair the harness.
(Ⓑ1 - 11)
(Ⓑ2 - 23)
(Ⓑ3 - 10)
(Ⓑ5 - 31)

5

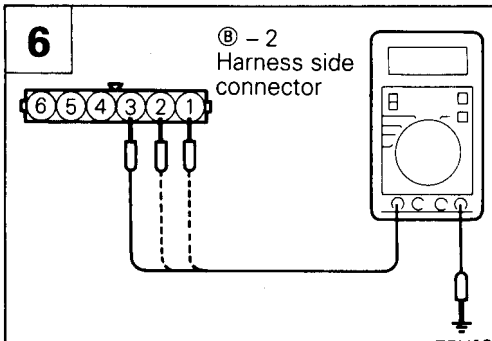


Check for continuity of the earth circuit of the ignition power transistor.
- Power transistor connector: Disconnected

OK → 6

NG → Repair the harness. (Ⓑ4 - Earth)

6



Measure the power transistor control signal voltage.

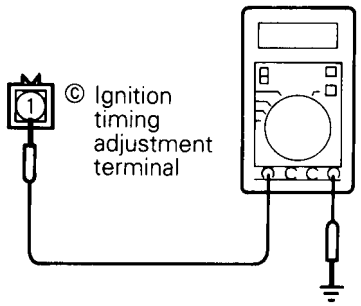
- Power transistor connector: Disconnected
- Ignition switch: START Disconnected

Voltage (V)
0.5 – 4.0

OK → 7

NO → Repair the harness. (Ⓑ 1 – 11) (Ⓑ 2 – 23) (Ⓑ 3 – 10)

7



Measure the terminal voltage of the ignition timing adjustment terminal.

- Ignition switch: ON

Voltage (V)
4.0 – 5.2

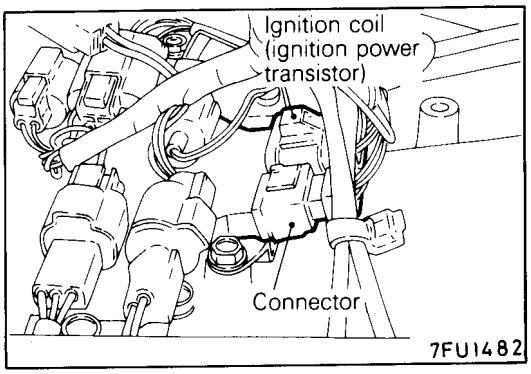
OK → STOP

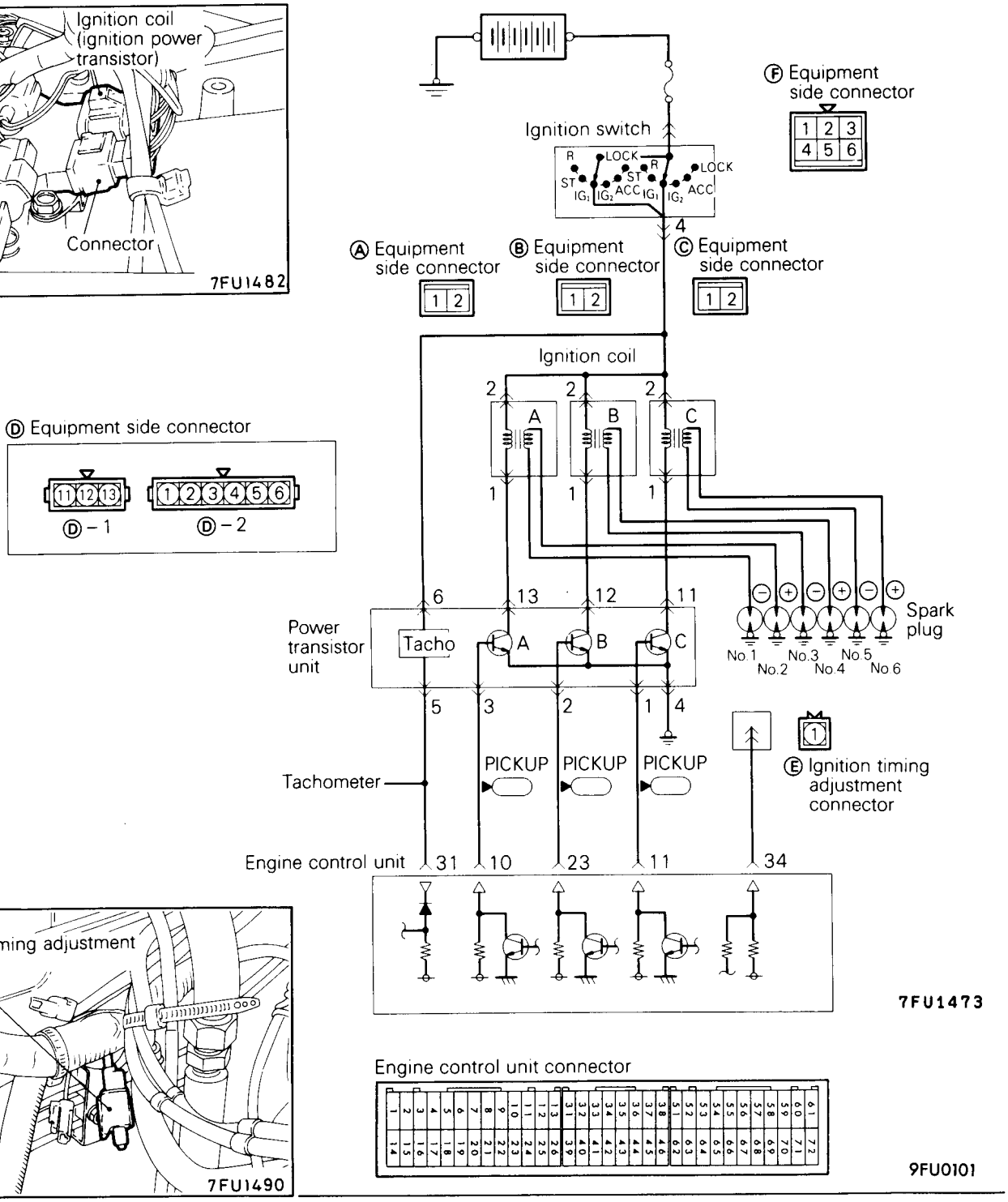
NO → Repair the harness. (© 1 – 34)

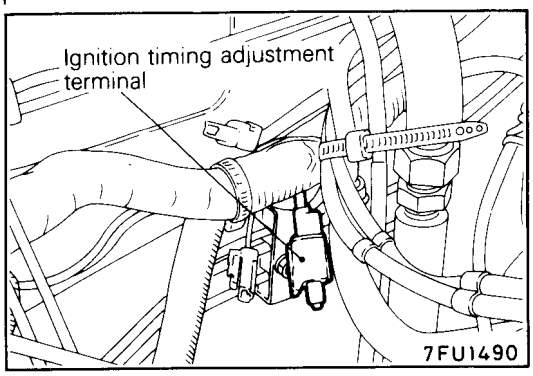
ACTUATOR INSPECTION

Refer to GROUP 16 – Ignition System.

IGNITION COIL AND IGNITION POWER TRANSISTOR <DOHC>







Engine control unit connector

OPERATION

Refer to P.13-79-93.

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INSPECTION

Using MUT-II

<Spark Advance>

Function	Item No.	Data display	Check condition	Engine state	Standard value
Data reading	44	Ignition advance	• Engine: Warming up • Timing lamp: Set (set timing lamp to check actual ignition timing)	700 r/min (Idle)	2 – 18° BTDC
				2,000 r/min	18 – 38° BTDC

<Ignition Timing Adjustment Mode>

Function	Item No.	Data display	Check condition	Terminal condition	Standard value
Data list	36	Continuity present or not present between ignition timing adjustment terminal and earth	• Engine: Idling	Ignition timing adjustment terminal is earthed	ON
				Ignition timing adjustment terminal is disconnected from earth	OFF

<Standard Ignition Timing>

Function	Item No.	Drive	Check condition	Normal condition
Actuator test	17	Set to ignition timing adjustment mode	• Engine: idling • Timing lamp: set	5° BTDC ± 3°

Wave Pattern Inspection Using an Analyzer

Refer to P.13-79-94.

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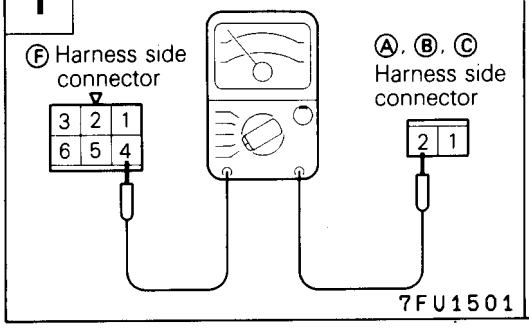
HARNESS INSPECTION

1



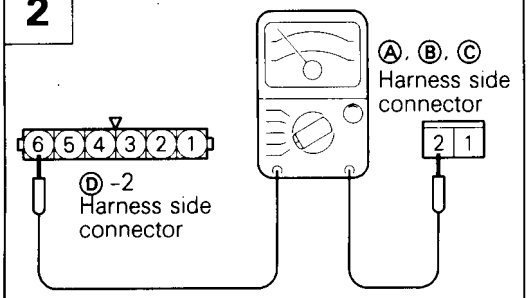
Check for continuity between the ignition coil and the ignition switch [IG].
- Ignition switch connector: Disconnected
- Ignition coil connector: Disconnected

NOTE
Touch the ohmmeter probes to both ends of the harness.

OK → 2

NO → Repair the harness.
(Ⓐ2 – Ⓕ4)
(Ⓑ2 – Ⓕ4)
(Ⓒ2 – Ⓕ4)

2

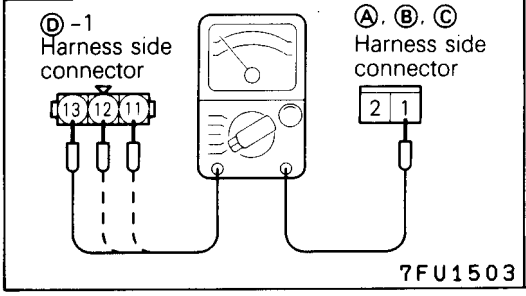


Check for continuity between the power transistor unit and ignition coil.
- Ignition coil connector: Disconnected
- Power transistor connector: Disconnected

OK → 3

NO → Repair the harness.
(Ⓐ2 – Ⓓ6)
(Ⓑ2 – Ⓓ6)
(Ⓒ2 – Ⓓ6)

3

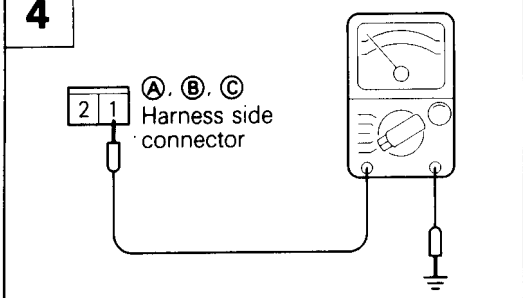


Check for continuity between the power transistor and ignition coil.
- Ignition coil connector: Disconnected
- Power transistor connector: Disconnected

OK → 4

NO → Repair the harness.
(Ⓐ2 – Ⓓ6)
(Ⓐ2 – Ⓓ6)
(Ⓐ2 – Ⓓ6)

4

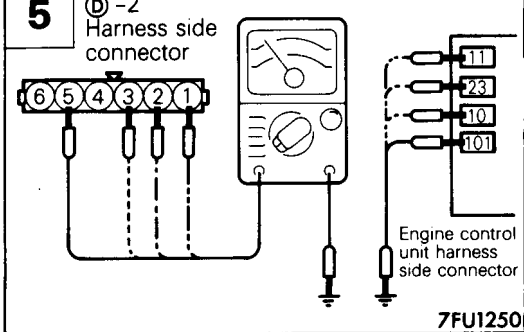


Check for short-circuit to earth between the power transistor and ignition coil.
- Ignition coil connector: Disconnected
- Power transistor connector: Disconnected

OK → 5

NO → Check the primary circuit of the ignition coil for short-circuit.

5

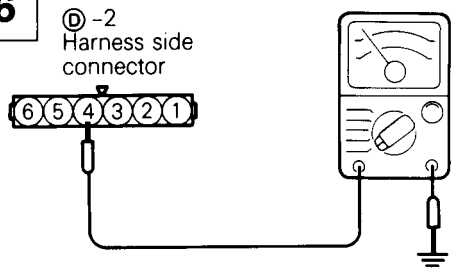


Check for open-circuit or short-circuit to earth between the power transistor and engine control unit.
- Power transistor connector: Disconnected
- Engine control unit connector: Disconnected

OK → 6

NO → Repair the harness.
(Ⓓ1 – 11)
(Ⓓ2 – 23)
(Ⓓ3 – 10)
(Ⓓ5 – 31)

6



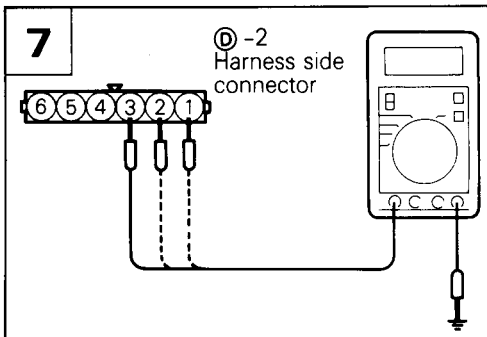
Check for continuity of the earth circuit of the ignition power transistor.

- Power transistor connector: Disconnected

OK → 7

NG → Repair the harness. (Ⓓ4 - Earth)

7



Measure the power transistor control signal voltage.

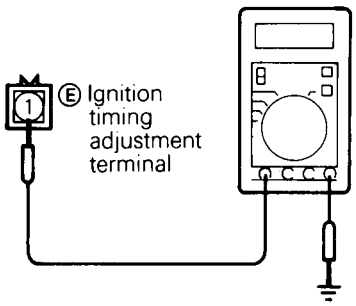
- Power transistor connector: Disconnected
- Ignition switch: START Disconnected

Voltage (V)
0.5 – 4.0

OK → 8

NG → Repair the harness. (Ⓓ1 - 11) (Ⓓ2 - 23) (Ⓓ3 - 10)

8



Measure the terminal voltage of the ignition timing adjustment terminal.

- Ignition switch: ON

Voltage (V)
4.0 – 5.2

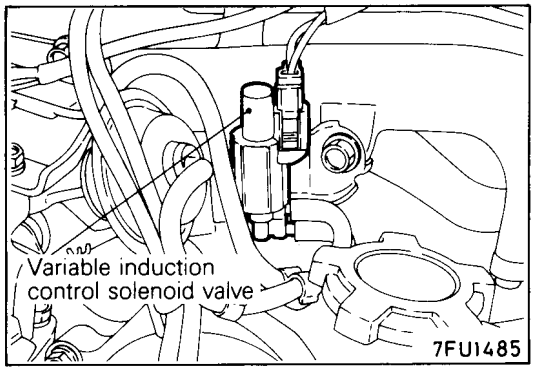
OK → STOP

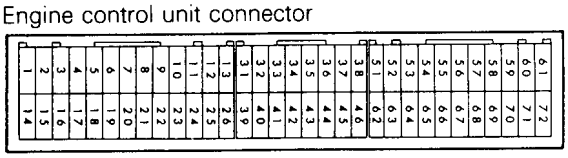
NG → Repair the harness. (Ⓔ1 - 34)

ACTUATOR INSPECTION

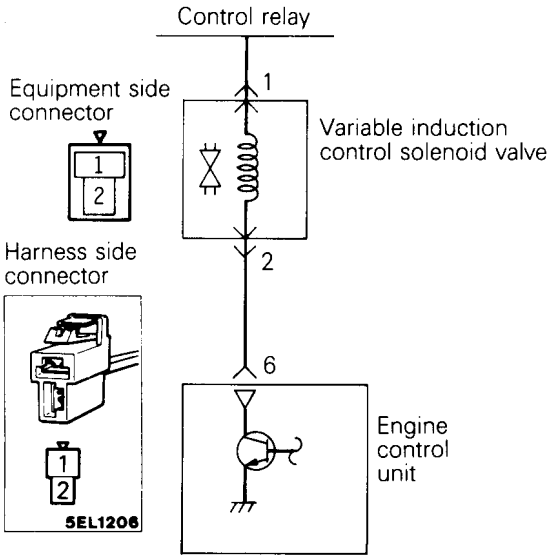
Refer to GROUP 16 – Ignition System.

VARIABLE INDUCTION CONTROL SOLENOID VALVE <DOHC>





9FU0101



OPERATION

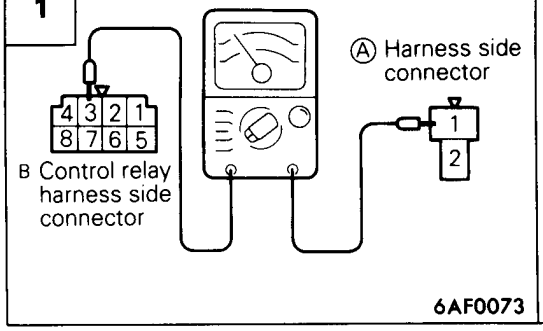
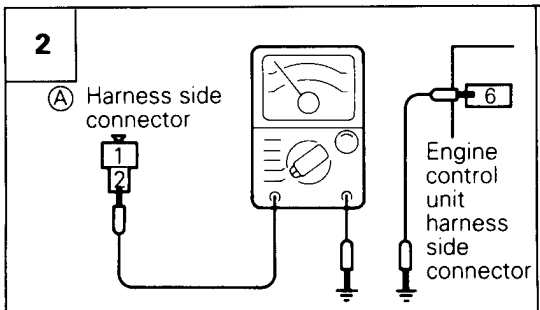
- The variable induction control solenoid valve is an ON-OFF type of solenoid valve, and converts the vacuum motor pressure into the intake manifold pressure or atmospheric pressure inside the vacuum tank.
- Battery voltage is supplied to the variable induction control valve via the control relay. When the engine control unit turns the power transistor inside the unit ON, current flows to introduce the intake manifold vacuum into the vacuum motor. This causes the vacuum motor to operate. Thus, the control valve will close.

INSPECTION

Using MUT-II

Function	Item No.	Drive contents	Check condition	Normal condition
Actuator test	11	Solenoid valve is switched from OFF to ON.	• Ignition switch: ON	Operating noise is heard when driven

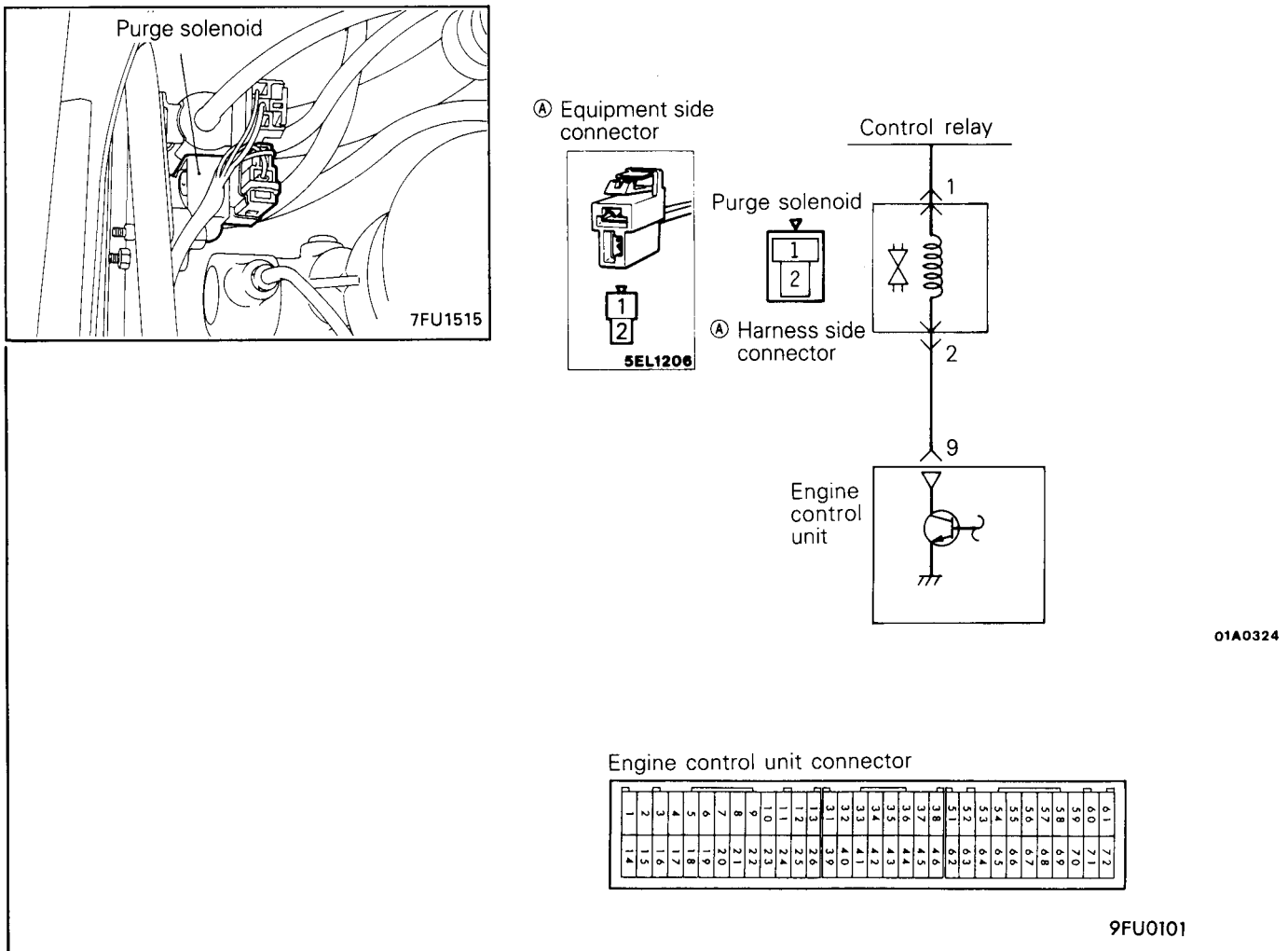
HARNESS INSPECTION

1 	Check for continuity between variable induction control solenoid valve and control relay. • Variable induction control solenoid valve connector: Disconnected • Control relay connector: Disconnected NOTE Touch the ohmmeter probes to both ends of the harness.	OK →	2
		NG →	Repair the harness. (Ⓐ1 – Ⓑ3)
2 	Check for an open-circuit, or a short-circuit to earth, between the variable induction control solenoid valve and the engine control unit. • Variable induction control solenoid valve connector: Disconnected • Engine control unit connector: Disconnected	OK →	STOP
		NG →	Repair the harness. (Ⓐ2 – 6)

ACTUATOR INSPECTION

Refer to GROUP 15 – Service Adjustment Procedures.

PURGE SOLENOID



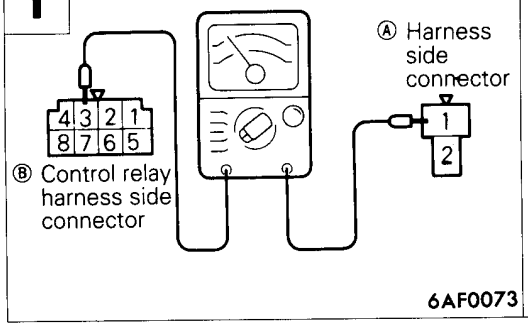
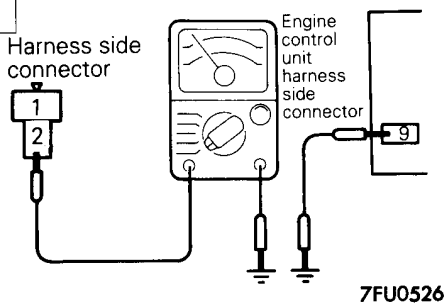
OPERATION

- The purge solenoid is an ON/OFF type of solenoid valve; it functions to regulate the introduction of purge air from the canister to the intake manifold plenum.
- Battery power supply is supplied, by way of the control relay, to the purge solenoid. When the engine control unit switches ON the ignition power transistor within the unit, current flows to the coil, and purge air is introduced.

INSPECTION

Using MUT-II

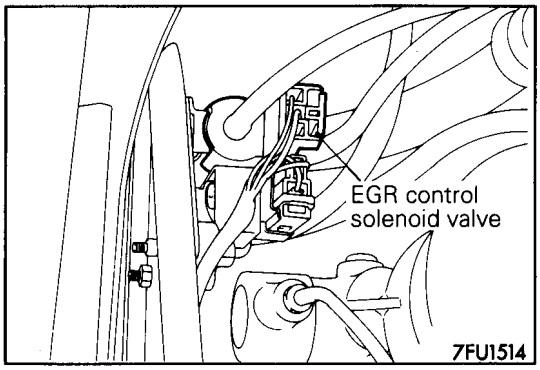
Function	Item No.	Drive contents	Check condition	Normal condition
Actuator test	08	Solenoid valve is switched from OFF to ON.	• Ignition switch: ON	Operating sound is heard when driven

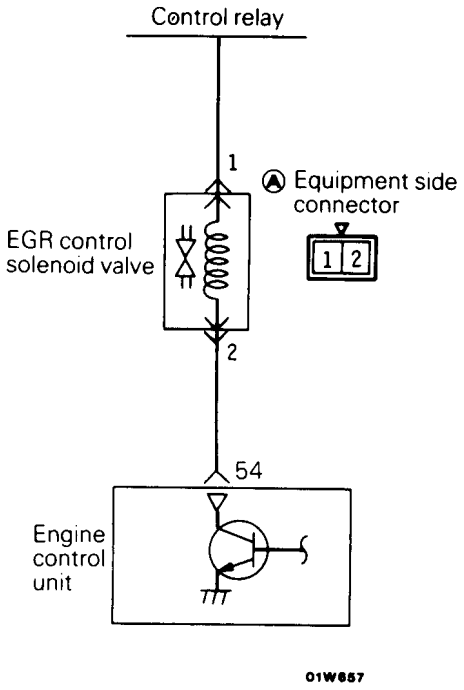
1  6AF0073	Check for continuity between the purge solenoid and the control relay. ● Purge solenoid connector: Disconnected ● Control relay connector: Disconnected NOTE ● Touch the ohmmeter probes to both ends of the harness.	OK →	2
		NG →	Repair the harness. (Ⓐ1 – Ⓑ3)
2  7FU0526	Check for an open-circuit, or a short-circuit to earth, between the purge solenoid and the engine control unit. ● Purge solenoid connector: Disconnected ● Engine control unit connector: Disconnected	OK →	STOP
		NG →	Repair the harness. (Ⓐ2 – 9)

ACTUATOR INSPECTION

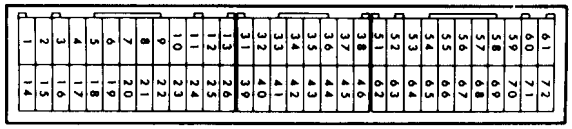
Refer to GROUP 17 – Service Adjustment Procedures.

EGR CONTROL SOLENOID VALVE





Engine control unit connector



9FU0101

OPERATION

- The EGR control solenoid valve is a duty control type solenoid valve. It makes control by leaking EGR valve operating negative pressure to the throttle body A port.
- Power supply from the battery is sent through the control relay to the EGR control solenoid valve. When the engine control unit turns off the power transistor inside the unit, current no more flows through the coil and EGR valve operating negative pressure leaks.

TROUBLESHOOTING HINTS

If the results of EGR control solenoid valve on-vehicle and off-vehicle inspections are normal but the self-diagnosis code for EGR system failure is displayed, check the EGR valve, vacuum hose and EGR passage for blocking.

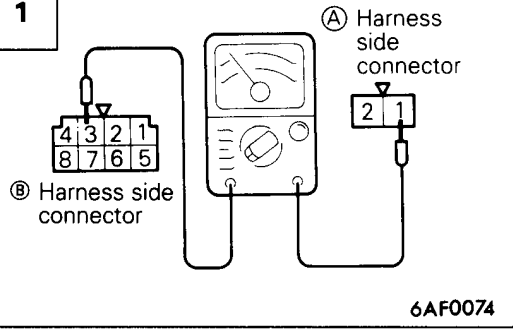
INSPECTION

Using MUT-II

Function	Item No.	Drive content	Check condition	Normal state
Actuator test	10	Change solenoid valve from OFF to ON state	Ignition switch: ON	Operating sound is heard when driven

HARNESS INSPECTION

1



Check for continuity between EGR control solenoid valve and control relay

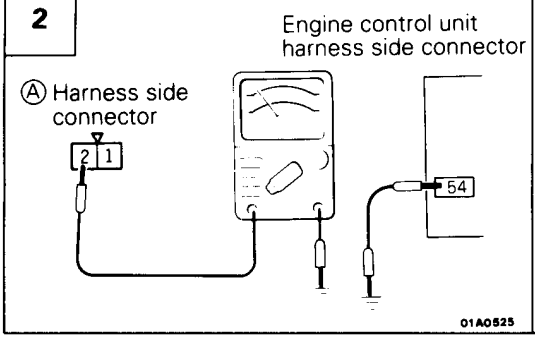
- EGR control solenoid valve connector: Disconnected
- Control relay connector: Disconnected

NOTE
Touch the ohmmeter probes to both ends of the harness

OK → 2

NG → Repair the harness. (Ⓐ1 – Ⓑ3)

2



Check for an open-circuit, or a short-circuit to earth, between the EGR control solenoid valve and the engine control unit.

- EGR control solenoid valve connector: Disconnected
- Engine control unit connector: Disconnected

OK → STOP

NG → Repair the harness. (Ⓐ2 – 54)

ACTUATOR INSPECTION

Refer to GROUP 17 – Exhaust Gas Recirculation (EGR)System.

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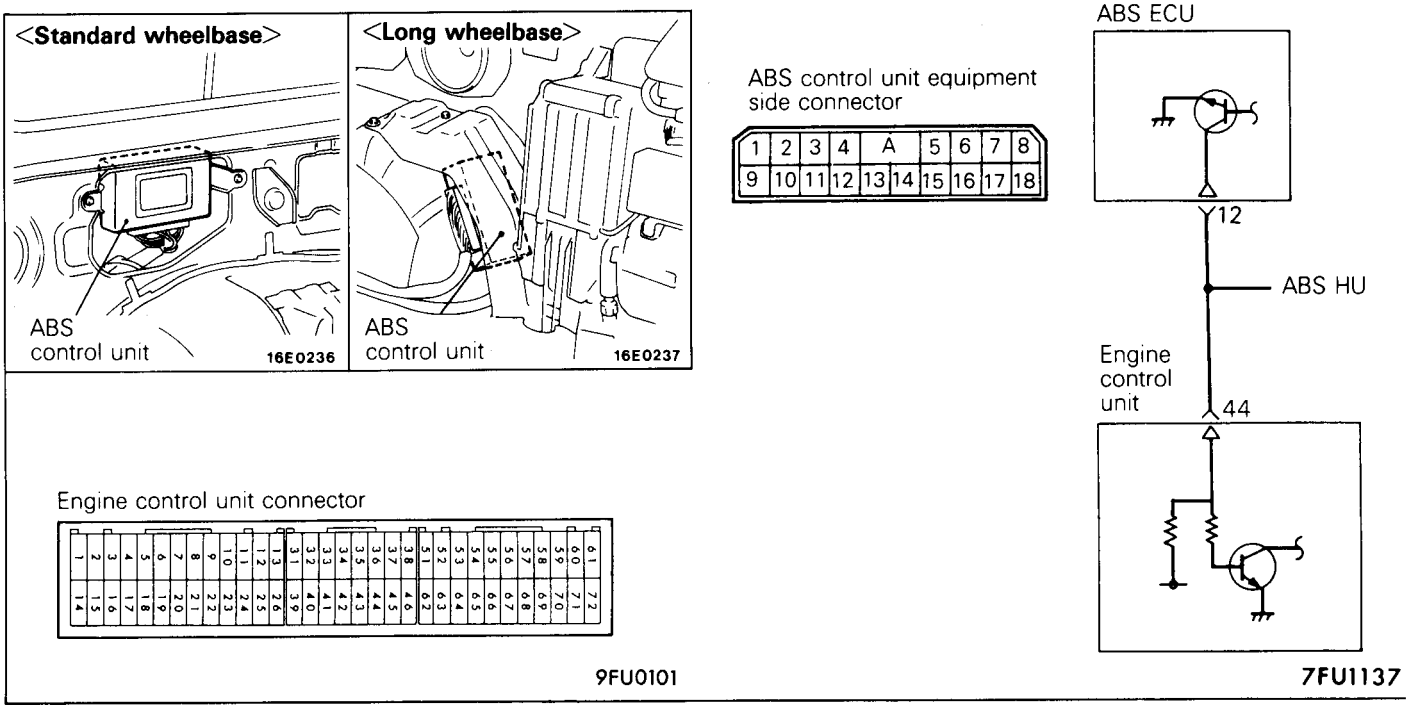
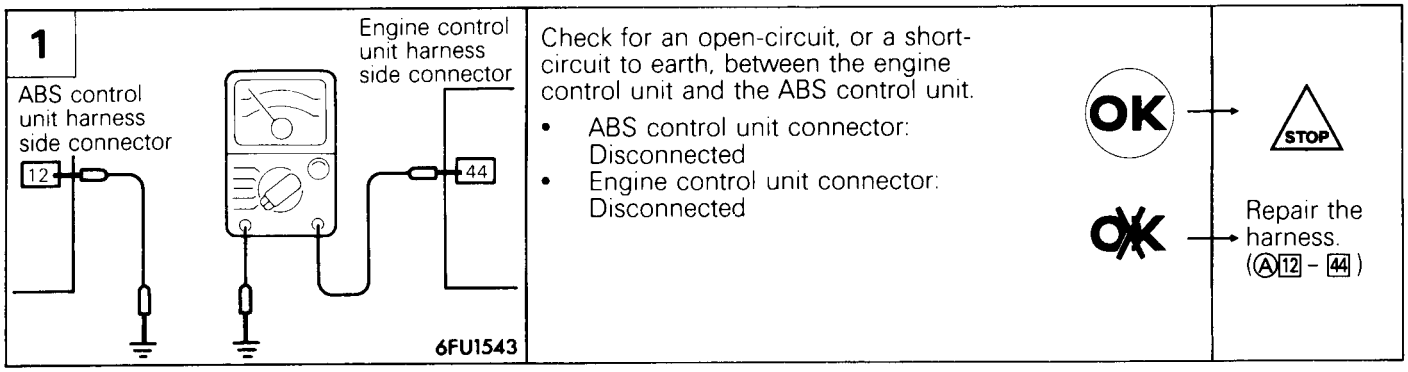
ANTI-SKID BRAKE SIGNAL



OPERATION

- The anti-skid braking signal is output by the anti-skid braking system (ABS) control unit to the engine control unit as a signal to indicate whether the motor relay is being driven or not. The engine control unit controls the idle speed control servo by means of this signal, and gives accurate anti-skid braking effectiveness.
- The ABS control unit turns the power transistor ON when the motor relay is being driven, and the output terminal which has battery voltage applied is shorted to the earth. This causes the anti-skid braking signal to change from HIGH to LOW.

HARNESS INSPECTION



FUEL PRESSURE

HOW TO REDUCE THE INTERNAL PRESSURE

Refer to P.13-79-21.

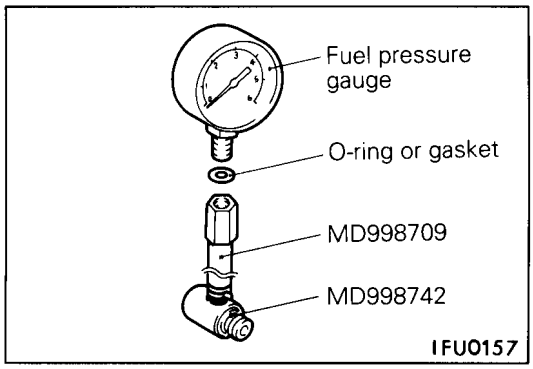
FUEL PUMP OPERATION CHECK

Refer to P.13-79-21.

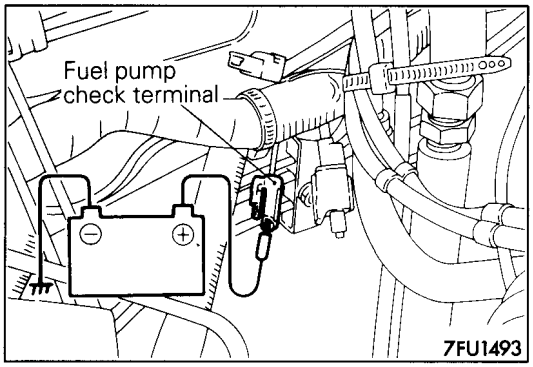
FUEL PRESSURE TEST <SOHC>

(1) Reduce the internal pressure of the fuel pipes and hoses.
(2) Remove the fuel pressure regulator at the delivery pipe side.

Caution
Cover the fuel pressure regulator with rags to prevent splash of fuel that could be caused by some residual pressure in the fuel pipe line.

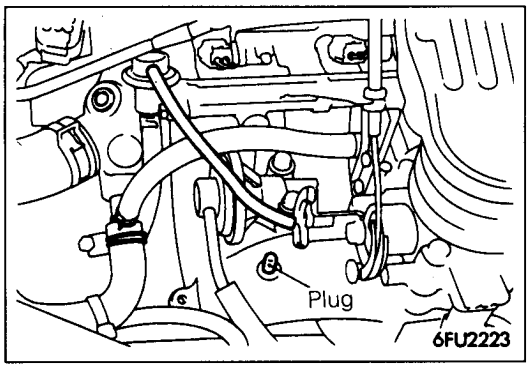


(3) Set a fuel pressure gauge on the special tool, placing an adequate O-ring or gasket between the gauge end special tool to prevent fuel leaks.
(4) Install the special tool set in the step (3) between the delivery pipe and the fuel pressure gauge.



(5) Connect a jumper wire to the terminal for activation of the fuel pump and to the positive (+) terminal of the battery to activate the fuel pump. With fuel pressure applied, check to be sure that there is no fuel leakage from the fuel pressure gauge and the special tool connection part.
(6) Disconnect the jumper wire from the terminal for activation of the fuel pump to stop the fuel pump.
(7) Start the engine and let it idle.
(8) Measure the fuel pressure during idling.

Standard value: Approx. 270 kPa (38 psi) at curb idle



(9) Disconnect the vacuum hose (blue stripe) from the intake manifold and plug the nipple. Then measure fuel pressure.

Standard value: 330–370 kPa (3.3–3.5 kg/cm^2, 47–53 psi) at curb idle speed

(10) Check to be sure that the fuel pressure during idling does not decrease even after the engine is raced a few times.

(11) Use a finger to gently press the fuel return hose while repeatedly racing the engine, and check to be sure that there is fuel pressure in the return hose also.

NOTE
There will be no fuel pressure in the return hose if there is insufficient fuel flow.

(12) If the fuel pressure measured in steps (8) to (11) deviates from the standard value range, check for the probable cause by referring to the table below, and then make the appropriate repair.

Condition	Probable cause	Remedy
• Fuel pressure is too low. • Fuel pressure drops during racing. • No fuel pressure in fuel return hose.	Fuel filter is clogged.	Replace the fuel filter.
	Malfunction of the valve seat within the fuel pressure regulator, or fuel leakage to return side caused by spring deterioration.	Replace the fuel pressure regulator.
	Fuel pump low discharge pressure.	Replace the fuel pump.
Fuel pressure is too high	The valve within the fuel pressure regulator is sticking.	Replace the fuel pressure regulator.
	Clogging of the fuel return hose and/or the pipe.	Clean or replace the hose and/or pipe.
No change of the fuel pressure when vacuum hose is connected and when not connected.	Damaged vacuum hose or nipple clogging.	Replace the vacuum hose, or clean the nipple.

(13)Stop the engine and check for a change of the value indicated by the fuel pressure gauge. The condition is normal if there is no decrease of the indicated value within two minutes.
If there is a decrease of the indicated value, monitor the speed of the decrease, and, referring to the table below, determine the cause of the problem and make the appropriate repair.

Condition	Probable cause	Remedy
After the engine is stopped, the fuel pressure drops gradually.	Injector leakage.	Replace the injector.
	Leakage at the fuel pressure regulator valve seat.	Replace the fuel pressure regulator.
There is a sudden sharp drop of the fuel pressure immediately after the engine is stopped.	The check valve (within the fuel pump) is not closed.	Replace the fuel pump.

(14)Remove all remaining pressure from inside the fuel pipe. (Refer to P. 13-16.)
(15)Disconnect the fuel pressure gauge and the special tool from the delivery pipe.

Caution
Because there will be a slight amount of remaining pressure in the fuel pipe line, use rags to cover so that fuel doesn't splatter.

(16)Replace the O-ring at the end of the fuel high-pressure hose with a new one.
(17)After connecting the fuel high-pressure hose to the delivery pipe, tighten the installation bolt at the specified torque.

Tightening torque: 5 Nm (0.5 kmg, 3.6 ft.lbs)

(18)Check to be sure that there is no fuel leakage.
① Apply battery voltage to the terminal for activation of the fuel pump so as to activate the fuel pump.
② With fuel pressure applied, check for leakage of the fuel line.

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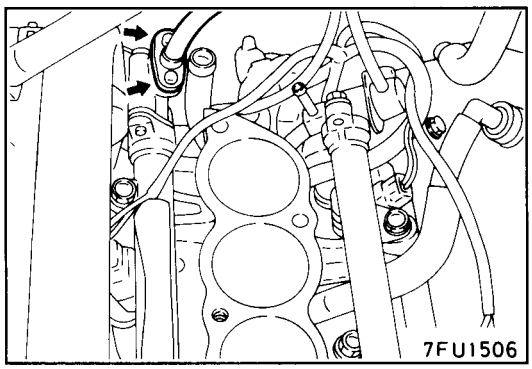
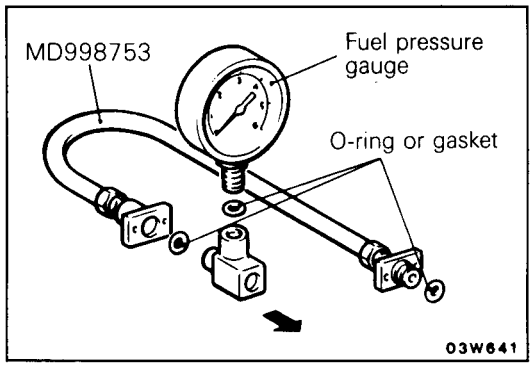


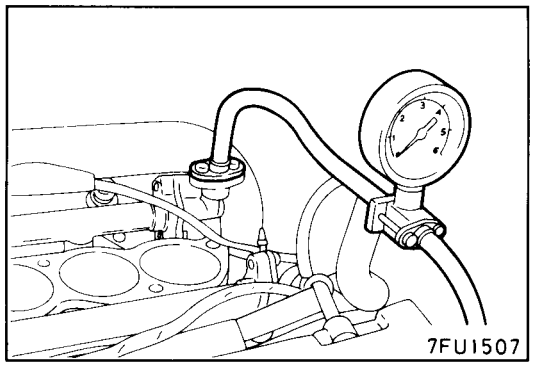
FUEL PRESSURE TEST <DOHC>

(1) Reduce the internal pressure of the fuel pipes and hoses.
(2) Remove the intake air plenum.
(3) Disconnect the fuel high pressure hose at the delivery pipe side.

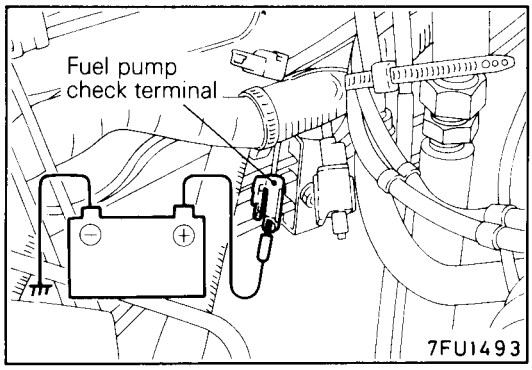
Caution
Cover the hose connection with rags to prevent splash of fuel that could be caused by some residual pressure in the fuel pipe line.



(4) Set a fuel pressure gauge on the special tool, placing an adequate O-ring or gasket between the gauge end special tool to prevent fuel leaks.



(5) Attach the special tool set in step (3) to the delivery pipe.



(6) Connect a jumper wire to the terminal for activation of the fuel pump and to the positive (+) terminal of the battery to activate the fuel pump. With fuel pressure applied, check to be sure that there is no fuel leakage from the fuel pressure gauge and the special tool connection part.

(7) Measure the fuel pressure.

Standard value: 324–343 kPa (3.3–3.5 kg/cm^2, 47–50 psi)

(8) If the fuel pressure measured in step (7) deviates from the standard value range, check for the probable cause by referring to the table on the next page, and then make the appropriate repair.

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Condition	Probable cause	Remedy
Fuel pressure is too low.	Fuel filter is clogged.	Replace the fuel filter.
	Malfunction of the valve seat within the fuel pressure regulator, or fuel leakage to return side caused by spring deterioration.	Replace the fuel pressure regulator.
	Fuel pump low discharge pressure.	Replace the fuel pump.
Fuel pressure is too high.	The valve within the fuel pressure regulator is sticking	Replace the fuel pressure regulator.
	Clogging of the fuel return hose and/or the pipe.	Clean or replace the hose and/or pipe.

(9) Disconnect the lead wire from the fuel pump activating terminal (black) to stop the fuel pump and check for a change of the value indicated by the fuel pressure gauge. The condition is normal if there is no decrease of the indicated value within two minutes.
If there is a decrease of the indicated value, monitor the speed of the decrease, and, referring to the table below, determine the cause of the problem and make the appropriate repair.

Condition	Probable cause	Remedy
After the fuel pump is stopped, the fuel pressure drops gradually.	Injector leakage.	Replace the injector.
	Leakage at the fuel pressure regulator valve seat.	Replace the fuel pressure regulator.
There is a sudden sharp drop of the fuel pressure immediately after the fuel pump is stopped.	The check valve (within the fuel pump) is not closed.	Replace the fuel pump.

(10) Connect a hand vacuum pump to the fuel pressure regulator and apply vacuum of 80 kPa (600 mmHg, 23.6 in.Hg) to remove all remaining pressure from inside the fuel line.
(11) Disconnect the fuel pressure gauge and the special tool from the delivery pipe.

Caution
Because there will be a slight amount of remaining pressure in the fuel pipe line, use rags to cover so that fuel doesn't splatter.

(12) Replace the O-ring at the end of the fuel high-pressure hose with a new one.
(13) After connecting the fuel high-pressure hose to the delivery pipe, tighten the installation bolt at the specified torque.

Tightening torque: 5 Nm (0.5 kgm, 3.6 ft.lbs.)

(14) Check to be sure that there is no fuel leakage.
① Apply battery voltage to the terminal for activation of the fuel pump so as to activate the fuel pump.
② With fuel pressure applied, check for leakage of the fuel line.

(15) Install the intake air plenum.

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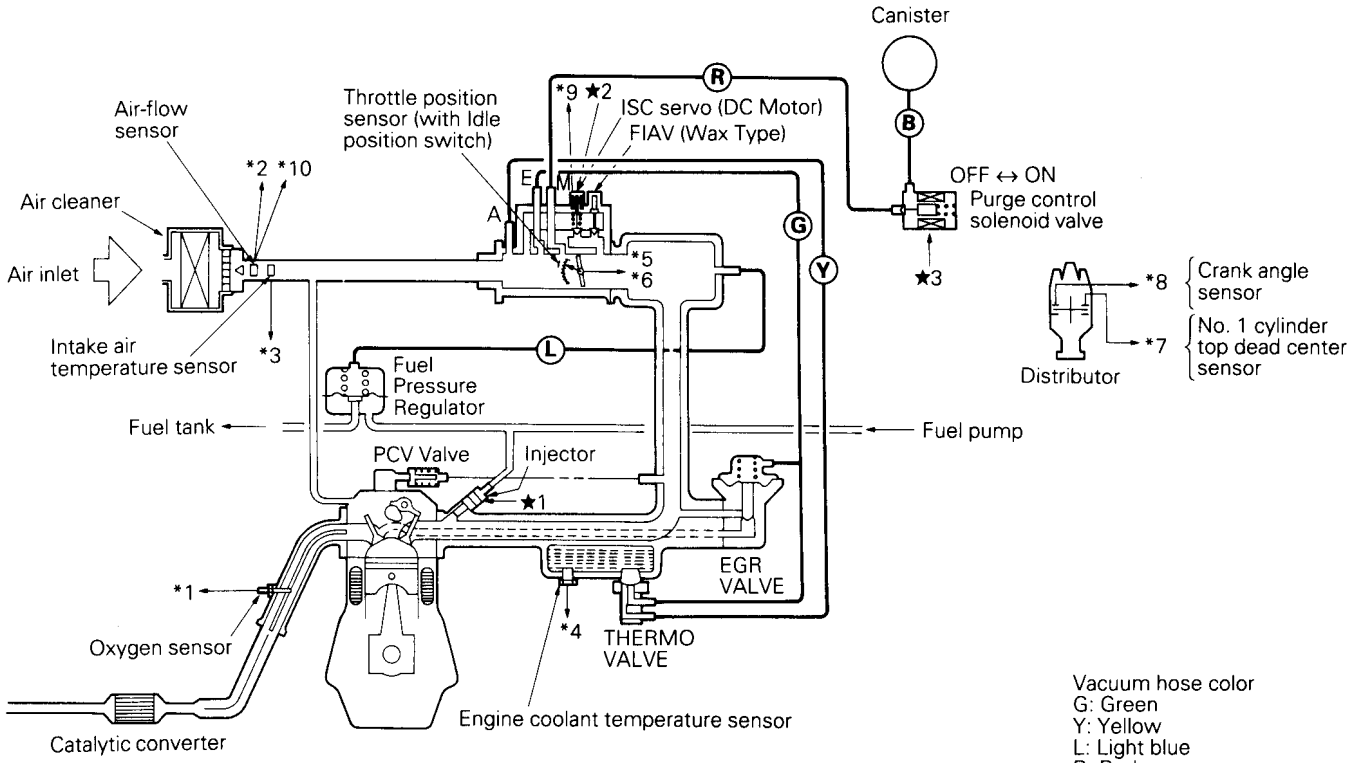
FUEL SYSTEM <4G64 Engine>

GENERAL INFORMATION

E13BBAH

MULTI POINT INJECTION SYSTEM DIAGRAM

*1 Oxygen sensor *2 Air-flow sensor *3 Intake air temperature sensor *4 Engine coolant temperature sensor *5 Throttle position sensor *6 Idle position switch *7 No. 1 cylinder top dead center sensor *8 Crank angle sensor *9 Motor position sensor	*10 Barometric pressure sensor • Ignition switch – ST • Power supply • Vehicle-speed sensor • Air conditioner switch	Engine control unit → ★1 Injector ★2 Idle speed control servo ★3 Purge control solenoid valve • Fuel pump control (control relay) • Air conditioner power relay • Ignition timing control • Self-diagnosis output • Engine warning lamp



PCV: Positive Crankcase Ventilation
ISC: Idle Speed Control

6FU1695

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SPECIFICATIONS

GENERAL SPECIFICATIONS

E13CA-B

Items	Specifications
Fuel	
Tank capacity dm^3 (U.S.gal., Imp.gal.)	
Standard Wheelbase	75 (19.8, 16.5)
Long Wheelbase	92 (24.3, 20.2)
Fuel pump	
Type	Electrical, in-tank type
Driven by	Electric motor
Throttle body	
Throttle bore mm (in.)	50 (1.968)
Throttle position sensor	Variable resistor type
Idle speed control servo	Electric motor
Idle position switch	Contact type, within throttle position sensor
Motor position sensor	Variable resistor type
Engine control unit	
Identification model No.	E2T37771
Input sensor	
Air flow sensor	Karman vortex type
Barometric pressure sensor	Semiconductor type
Intake air temperature sensor	Thermistor type
Engine coolant temperature sensor	Thermistor type
Oxygen sensor	Zirconia type
Vehicle speed sensor	Reed switch type
No. 1 cylinder top dead center sensor	Photo interruptor type
Crank angle sensor	Photo interruptor type
Actuators	
Control relay type	Contact switch type
Injector type and number	Electromagnetic 4
Purge control solenoid valve	ON/OFF type solenoid valve
Fuel pressure regulator	
Regulated pressure kPa (kg/cm^2, psi)	335 (3.35, 47.6)

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SERVICE SPECIFICATIONS

E13CB-B

Items		Specifications
Standard value		
Accelerator cable play	mm (in.)	1–2 (0.04–0.08)
Basic ignition timing		5°±2° BTDC at curb idle
Curb idle speed	r/min.	750±100
Idle speed when air conditioner ON	r/min.	900 at neutral position
Basic idle speed	r/min.	750±50
Throttle position sensor output voltage	V	0.48–0.52 at curb idle
Throttle position sensor resistance	kΩ	3.5–6.5
Idle speed control servo coil resistance [at 20°C (68°F)]	Ω	5–35
Motor position sensor resistance	kΩ	4–6
Intake air temperature sensor resistance [at 20°C (68°F)]	kΩ	2.7
Engine coolant temperature sensor resistance	kΩ	
20°C (68°F)		2.4
80°C (176°F)		0.3
Fuel pressure regulator pressure	kPa (kg/cm^2, psi)	
Vacuum hose disconnection		330–350 (3.3–3.5, 47–50)
Vacuum hose connection		Approx. 270 (2.7, 38)
Injector coil resistance [at 20°C (68°F)]	Ω	13–16

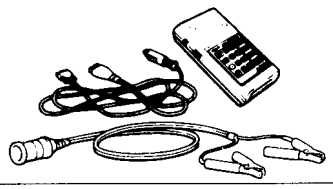
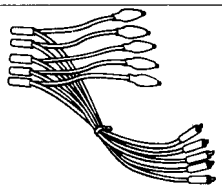
SEALANT

E13CE-B

Items	Specified sealant	Quantity
Engine coolant temperature sensor threaded portion	3M Nut locking Part No. 4171 or equivalent	As required

SPECIAL TOOLS

E13DA-B

Tool	Number	Name	Use
	MB991341	Multi-use tester assembly	• Reading diagnosis code • MPI system inspection
	MB991419	ROM pack (for multi-use tester)	• Reading diagnosis code • MPI system inspection
	MB991348	Test harness set	• Adjustment of throttle position sensor • Inspection with oscilloscope

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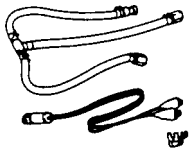
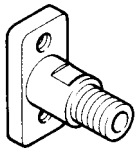
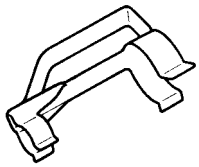
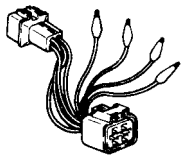
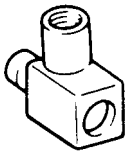
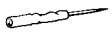
Tool	Number	Name	Use
	MD998706	Injector test set	• Checking injection condition of injector
	MD998740	Injector test adaptor	
	MD998746	Clip	
	MD998464	Harness connector (4P, square)	• Inspection with oscilloscope
	MD998700	Hose adapter	• Measurement of fuel pressure
Red harness (for DLI) White harness (for LC) 	MB991223	Inspection harness set connector • Pin contact pressure inspection harness • Marketing tester connection probe (for general connectors)	• Measurement of terminal voltages

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TROUBLESHOOTING

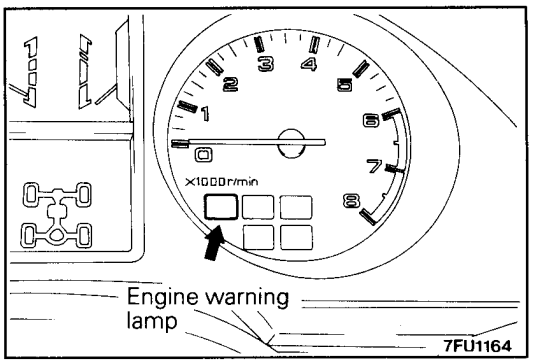
E13EFAK

EXPLANATION OF TROUBLESHOOTING PROCEDURES

Refer to P.13-7.

EXPLANATION AND PRECAUTION RELATED TO HARNESS CHECKING

Refer to P.13-8.



ENGINE WARNING LAMP (CHECK ENGINE LAMP)

Among the self-diagnosis items, a engine warning lamp comes on to notify the driver of the emission control items when an irregularity is detected.
However, when an irregular signal returns to normal and the engine control unit judges that it has returned to normal, the engine warning lamp goes out.
Moreover, when the ignition switch is turned off, the lamp goes out. Even if the ignition switch is turned on again, the lamp does not come on until the irregularity is detected.
Here, immediately after the ignition switch is turn on, the lamp engine warning lamp is lit for 5 seconds to indicated that the engine warning lamp operates normally.

Item indicated by the lightening engine warning lamp

Engine control unit	Crank angle sensor
Oxygen sensor	No. 1 cylinder top dead center sensor
Air flow sensor	Barometric pressure sensor
Engine coolant temperature sensor	Ignition timing adjustment signal
Intake air temperature sensor	Injector
Throttle position sensor	Fuel pump

Caution
Engine warning lamp will come on when the line of terminal for ignition timing adjustment is short-circuited. Therefore, the lamp will come on even when the terminal for ignition timing adjustment is earthed at the time of adjusting ignition timing. In this case, however, it is not abnormal.

ENGINE WARNING LAMP INSPECTION

Refer to P.13-10.

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SELF-DIAGNOSIS

The engine control unit monitors the input/output signals (some signals at all times and the others under specified conditions) of the engine control unit.
When it is noticed that an irregularity has continued for a specified time or longer from when the irregular signal is initially monitored, passing a certain number, the engine control unit judges that an irregularity has occurred, memorizes the malfunction code, and outputs the signal to the self-diagnosis output terminals.
There are 15 diagnosis items, including the normal state, and the diagnosis results can be read out with a multi-use tester.
Moreover, since memorization of the malfunction codes is backed up directly by the battery, the diagnosis results are memorized even if the ignition key is turned off. The malfunction codes will, however, be erased when the battery terminal or the engine control unit connector is disconnected.
The malfunction codes are also erased by setting the ignition switch to the "ON" position and then sending the malfunction-code-erase signal from the multi-use tester to the engine control unit.

Caution
If the sensor connector is disconnected while the ignition switch is ON, the malfunction code is memorized. In this instance, either send the malfunction-code-erase signal from the multi-use tester to the engine control unit, the diagnosis memory will be erased.

The 15 diagnosis items are provided as follows, and if plural items are activated, they are all indicated sequentially from the smallest code number.

Caution
Ignition timing adjustment signal malfunction code is output when the ignition timing adjustment terminal line is short-circuited to the earth. Therefore, the malfunction code is output when the ignition timing adjustment terminal is earthed, however, this is not a malfunction.

DIAGNOSIS CHART

Output preference order	Diagnosis item	Diagnosis code		Check item (Remedy)
		No.	Memory	
1	Engine control unit	–	–	(Replace engine control unit)
2	Oxygen sensor	11	Retained	• Harness and connector • Oxygen sensor • Fuel pressure • Injectors (Replace if defective.) • Intake air leaks
3	Air flow sensor	12	Retained	• Harness and connector (If harness and connector are normal, replace air flow sensor assembly)
4	Intake air temperature sensor	13	Retained	• Harness and connector • Intake air temperature sensor
5	Throttle position sensor	14	Retained	• Harness and connector • Throttle position sensor • Idle position switch

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Output preference order	Diagnosis item	Diagnosis code		Check item (Remedy)
		No.	Memory	
6	Engine coolant temperature sensor	21	Retained	• Harness and connector • Engine coolant temperature sensor
7	Crank angle sensor	22	Retained	• Harness and connector (If harness and connector are normal, replace distributor assembly.)
8	Top dead center sensor (No. 1 cylinder)	23	Retained	• Harness and connector (If harness and connector are normal, replace distributor assembly.)
9	Vehicle speed sensor (reed switch)	24	Retained	• Harness and connector • Vehicle speed sensor (reed switch)
10	Barometric pressure sensor	25	Retained	• Harness and connector (If harness and connector are normal, replace barometric pressure sensor assembly.)
11	Ignition timing adjustment signal	36	–	• Harness and connector
12	Injector	41	Retained	• Harness and connector • Injector coil resistance
13	Fuel pump	42	Retained	• Harness and connector • Control relay
14	Servo valve position sensor	55	Retained	• Harness and connector • ISC servo (If harness and connector are normal, replace ISC servo assembly.)
15	Normal state	–	–	–

NOTE
Replace the engine control unit if a malfunction code is output although the inspection reveals that there is no problem with the check items.

READ OUT OF MALFUNCTION CODE

Refer to P.13-11.

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CHECK CHART CLASSIFIED BY PROBLEM SYMPTOMS

Problem symptoms / Check Items	Starting		Idling stability			Driving						Stopping	Reference page
	Will not start	Starting problem	Idling instability (Rough idling)	Incorrect idling speed	Improper idling continuity	Hesitation, sag	Poor acceleration	Stumble	Shock	Surge	Knocking	Run-on (Dieseling)	
Power Supply	① 1												P.13- 98
Engine Control Unit Power Earth	② 2												P.13-100
Fuel Pump	③ 3	① 1			① 1	① 1	① 1						P.13-101
Air Flow Sensor					⑫	⑧ 8		⑤ 5	⑥ 6		③ 3		P.13-104
Intake Air Temperature Sensor			⑥			④ 4	④ 4				① 1		P.13-108
Barometric Pressure Sensor			⑧			⑦ 7	⑥ 6				② 2		P.13-110
Engine Coolant Temperature Sensor		3	⑦ 6	① 1	⑥ 6	⑥ 6	⑤ 5	④ 4		③ 3			P.13-111
Throttle Position Sensor						⑤ 5		③ 3	④ 4				P.13-112
Idle Position Switch			④ 4	② 2	⑤ 5								P.13-114
Servo Valve Position Sensor			③ 3	④ 3	④ 4				⑤ 5				P.13-116
Top Dead Center Sensor	⑤ 5	⑥ 7			⑨ 8				② 2				P.13-118
Crank Angle Sensor	⑥ 6	⑦ 8			⑩ 9				③ 3				P.13-121
Ignition Switch – ST	④ 4	③ 4											P.13-123
Vehicle Speed Sensor					⑦				⑦				P.13-123
Air Conditioner Switch and Power Relay				③									P.13-123
Oxygen Sensor			⑩										P.13-124
Injectors	⑧ 8	② 2	② 2		③ 3	② 2	② 2	① 1		① 1		①	P.13-126
Idle Speed Control Servo (DC Motor)		④ 5	① 1	⑤ 4	② 2				⑧ 7				P.13-131
Ignition Coil and Power Transistor	⑦ 7				⑪ 10		⑦ 7		① 1		④ 4		P.13-133
Purge Control Solenoid Valve			⑨										P.13-137
Fuel Pressure		⑤ 6	⑤ 5		⑧ 7	③ 3	③ 3	② 2		② 2			P.13-138

○: Warm engine (figures inside the ○ indicate the checking sequence.)
□: Cold engine (figures inside the □ indicate the checking sequence.)

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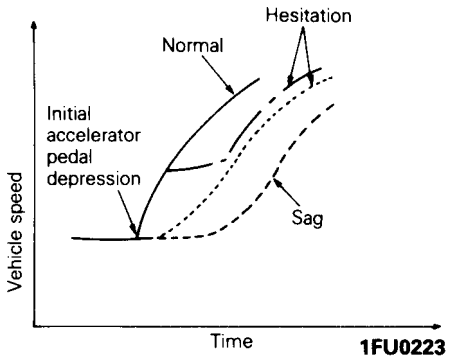
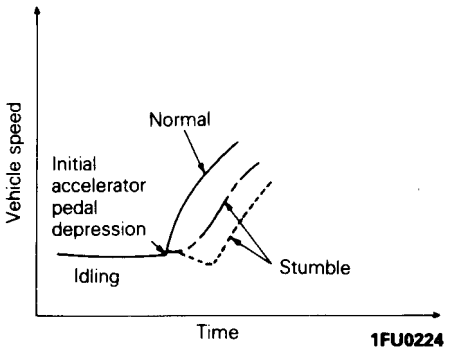
PROBLEM SYMPTOMS TABLE (FOR YOUR INFORMATION)

Item		Symptom
Starting	Won't start (no initial combustion)	The starter is used to crank the engine, but there is no combustion within the cylinders, and the engine won't start.
	Starting problem (initial combustion, then stall)	There is combustion within the cylinders, but then the engine soon stalls.
	(Starting takes a long time.)	Engine won't start quickly.
Idling Stability	Idling instability (Rough idling)	Engine speed doesn't remain constant; changes during idling. Usually, a judgement can be based upon the movement of the tachometer pointer, and the vibration transmitted to the steering wheel, shift lever, body, etc. This is called rough idling.
	Incorrect idling speed	The engine doesn't idle at the usual correct speed.
	Improper idling continuity Die out Pass out	This non-continuity of idling includes the following elements. (1) Die out ..... The engine stalls when the foot is taken from the accelerator pedal, regardless of whether the vehicle is moving or not. (2) Pass out ..... The engine stalls when the accelerator pedal is depressed or while it is being used.
Driving	Hesitation Sag	"Hesitation" is the delay in response of the vehicle speed (engine r/min.) that occurs when the accelerator is depressed in order to accelerate from the speed at which the vehicle is now traveling, or a temporary drop in vehicle speed (engine r/min.) during such acceleration. Serious hesitation is called "sag". 
	Poor acceleration	Poor accleration is inability to obtain an acceleration corresponding to the degree of throttle opening, even though acceleration is smooth, or the inability to reach maximum speed.
	Stumble	Engine r/min. response is delayed when the accelerator pedal is initially depressed for acceleration from the stopped condition. 
	Shock	The feeling of a comparatively large impact or vibration when the engine is accelerated or decelerated.
	Surge	This is repeated surging ahead during constant speed travel or during variable speed travel.
	Knocking	A sharp sound like a hammer striking the cylinder walls during driving and which adversely affects driving.

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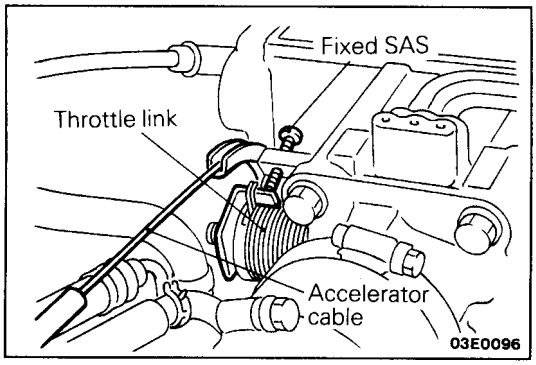
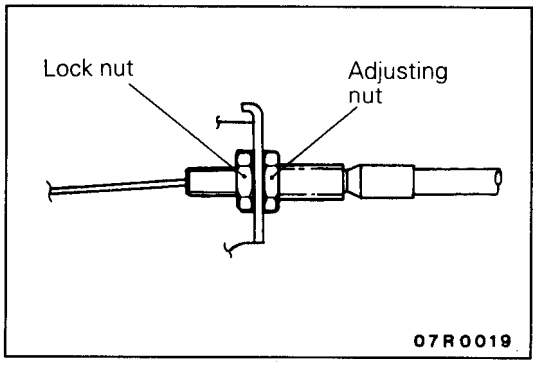
Item		Symptom
Driving	Surge	This is repeated surging ahead during constant speed travel or during variable speed travel.
	Knocking	A sharp sound like a hammer striking the cylinder walls during driving and which adversely affects driving.
Stopping	Run-on (Dieseling)	The engine continues to run even after the switch is turned OFF. This is called dieseling.





SERVICE ADJUSTMENT PROCEDURES

ACCELERATOR CABLE INSPECTION AND ADJUSTMENT E13FCAZZ

(1) Check that there are no sharp bends in the accelerator cable.
(2) Check that the engine idling speed is at the normal value.
(3) Turn the ignition switch to OFF to stop the engine.

(4) Check that the throttle link is touching the fixed SAS stopper.
(5) Move the plate so that the inner cable play is at the standard value, and tighten the adjusting bolt.

Standard value: 1–2 mm (0.04–0.08 in.)

FUEL FILTER REPLACEMENT E13FZAM

Refer to P.13-14.

FUEL GAUGE UNIT REPLACEMENT E13FDAD

Refer to P.13-15.

2-WAY VALVE REPLACEMENT E13FFAD

Refer to P.13-15.

FUEL PUMP OPERATION CHECK E13FGCF

Refer to P.13-15.

HOW TO REDUCE THE FUEL LINE INTERNAL PRESSURE E13HABH

Refer to P.13-16.

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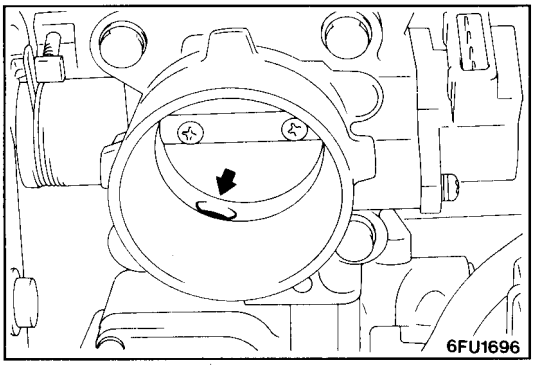

THROTTLE BODY (THROTTLE VALVE AREA) CLEANING

E13HAJB2

(1) Start the engine and warm it up until the temperature of the engine coolant reaches 80°C (176°F) or higher; then stop the engine.
(2) Disconnect the air intake hose at the throttle body side.
(3) Plug the bypass intake port inlet in the throttle body.

Caution
Never let cleaning liquid get into the bypass intake.

(4) Spray cleaning liquid (from the intake port of the throttle body) onto the valve, and then leave as is for about five minutes.
(5) Start the engine and race it a few times; then let it run at idle speed for about one minute.

NOTE
The engine idling speed is unstable (or the engine stalls), let the engine run with the throttle valve slightly open.

(6) If deposits are not removed from the throttle valve, repeat steps (4) and (5).
(7) Remove the plug from the bypass intake port inlet in the throttle body.
(8) Connect the air intake hose.
(9) Using the multi-use tester, erase the self-diagnosis code.
(10) Adjust the basic idle speed. (Refer to P.13-93.)

NOTE
If hunting of the idling engine occurs after adjusting the basic idling speed, remove the battery (–) cable from the battery terminal for more than 10 seconds, and then idle the engine again.

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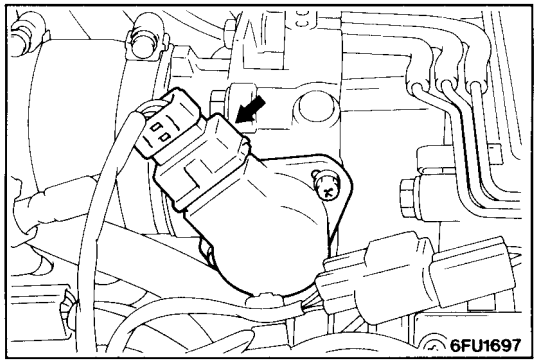
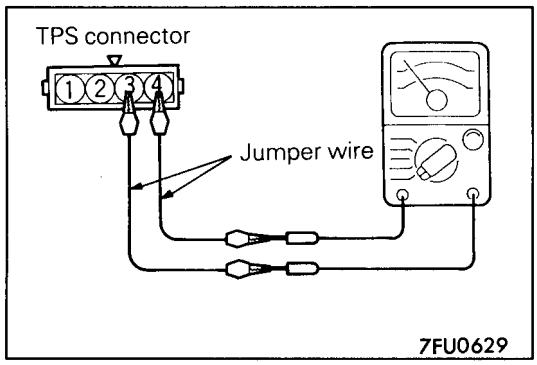
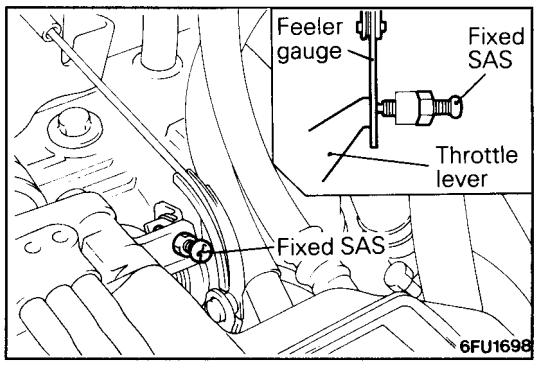


IDLE POSITION SWITCH AND THROTTLE POSITION SENSOR ADJUSTMENT E13HAKD2

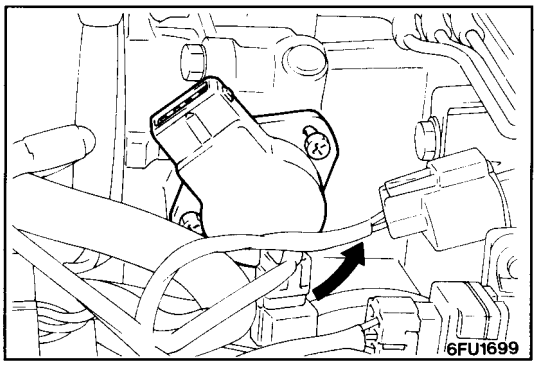
(1) Disconnect the connector of the throttle position sensor.



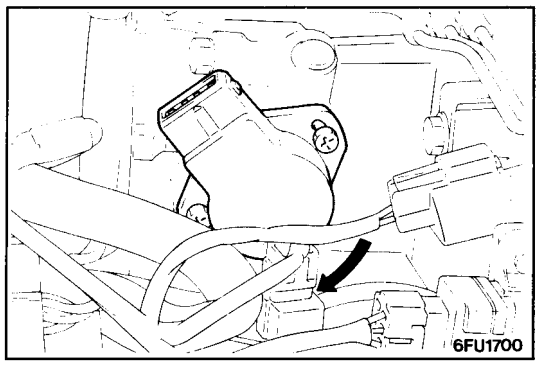
(2) Using jumper wires, connect an ohmmeter across terminal ③ (idle position switch) and terminal ④ (sensor earth) of the throttle position sensor.



(3) Insert a 0.65 mm (0.0256 in.) thick feeler gauge between the fixed SAS and throttle lever.



(4) Loosen the throttle position sensor mounting bolts and turn the throttle position sensor body fully counterclockwise.
(5) In this condition, check that there is continuity across terminals ③ and ④.



(6) Slowly turn the throttle position sensor clockwise until you find a point at which there is no continuity across terminals ③ and ④. Then, tighten the throttle position sensor mounting bolt securely.
(7) Connect the throttle position sensor connector.

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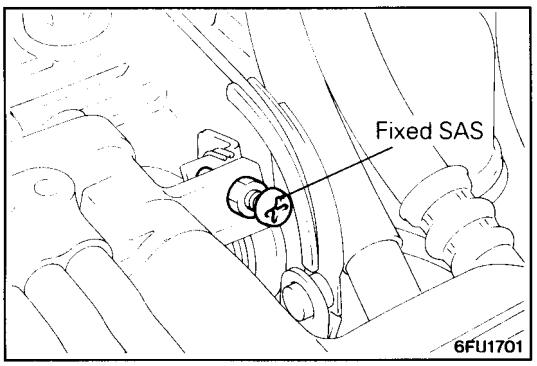
(8) Connect the multi use tester (MUT) to the diagnosis connector.
(9) Turn the ignition switch ON (but do not start the engine).
(10) Using the MUT, select item No. 14 and read the throttle position sensor output voltage.

Standard value: 400–1,000 mV

(11) If the voltage is out of specification, check the throttle position sensor and associated harnesses.
(12) Remove the feeler gauge.
(13) Turn the ignition switch OFF.



FIXED SAS ADJUSTMENT E13HAMC2

NOTE
1. The fixed SAS has been factory-adjusted. Never attempt to move it.
2. Should it be out of proper adjustment, adjust by following the procedure given below.

(1) Sufficiently slacken the accelerator cable.
(2) Loosen the lock nut on the fixed SAS.
(3) Sufficiently loosen the fixed SAS by turning it counterclockwise to fully close the throttle valve.
(4) Tighten the fixed SAS slowly to find a point at which it contacts the throttle lever (where the throttle valve starts opening). From that point, tighten the fixed SAS further 1 1/4 turns.
(5) Holding the fixed SAS to prevent it from turning, tighten the lock nut securely.
(6) Adjust the accelerator cable tension. (Refer to P.13-89.)
(7) Adjust the basic idle speed. (Refer to P.13-93.)
(8) Adjust the idle position switch and throttle position sensor (TPS). (Refer to P.13-91.)

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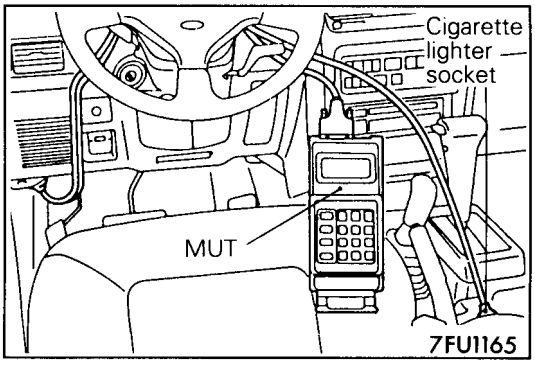
BASIC IDLE SPEED ADJUSTMENT E13HANE

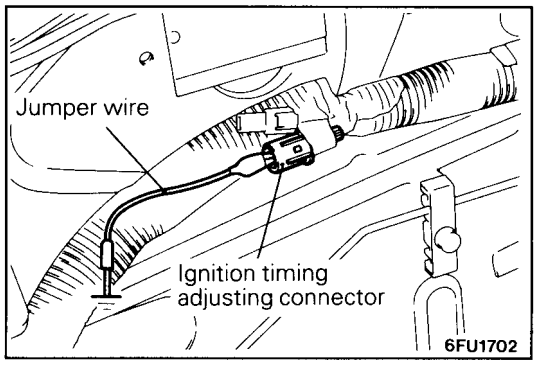
NOTE
1. The basic idle speed has been factory-adjusted with the speed adjusting screw (SAS) and does not normally require adjustment.
2. If the adjustment is required, first check that the ignition plug, injector, ISC servo, and compression pressure are normal.

(1) Before starting the inspection and adjustment procedures, set the vehicle in the following conditions:
- Engine coolant temperature: 80 to 95°C (176 to 203°F)
- Lights, electric cooling fan, accessories: OFF
- Transmission: Neutral
- Steering wheel: Straightforward position



(2) Connect the multi use tester (MUT) to the diagnosis connector.

NOTE
When the multi-use tester is connected, the diagnosis control terminal will be earthed.



(3) Remove the waterproof female connector from the ignition timing adjusting connector (brown).
(4) Using a jumper wire, earth the ignition timing adjusting terminal.

(5) Start the engine and run at idle.
(6) Check the basic idle speed.
Using the MUT, select item No. 22 and read the idle speed.

Standard value: 750 ± 50 r/min.

NOTE
1. The engine speed may be low by 20 to 100 r/min. while the vehicle is new [distance driven approx. 500 km (300 miles) or less], but no adjustment is necessary.
2. If the engine stalls or speed is low despite a sufficient distance driven [approx. 500 km (300 miles) or more], it is probably due to deposits on the throttle valve. In this case, clean the throttle valve. (Refer to P.13-90.)

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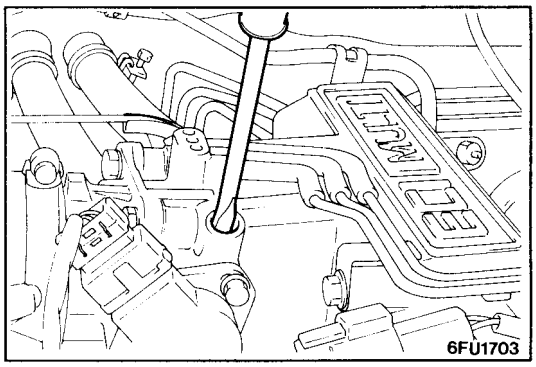

(7) If the basic idle speed is out of specification, adjust by turning the speed adjusting screw (SAS).

NOTE
If the idle speed is higher than the standard value even with SAS fully tightened, check to see if there is evidence of the fixed SAS being moved. If the fixed SAS seems to have been moved, adjust it. If it does not seem to have been moved, there may be a leak caused by deteriorated fast idle air valve (FIAV). In such a case, replace the throttle body.

(8) Turn the ignition switch OFF.
(9) Remove the jumper wire from the ignition timing adjusting terminal and replace the connector back again.
(10) Start the engine again and run at idle for 10 minutes to make sure that the engine runs at proper idle speed.

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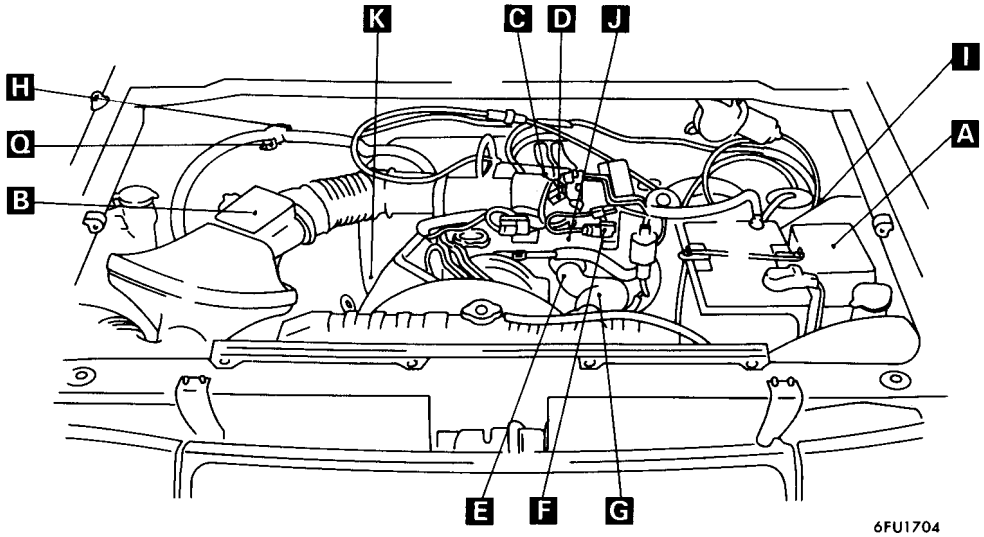
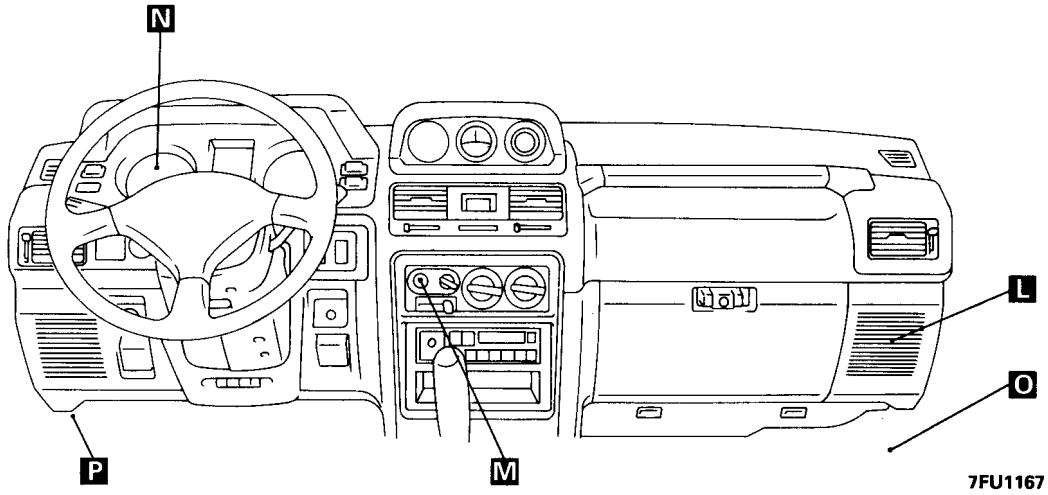
ON-VEHICLE INSPECTION OF MPI COMPONENTS

E13QAAD

COMPONENT LOCATION





Name	Symbol	Name	Symbol
Air conditioner relay	A	Ignition timing adjustment terminal	Q
Air conditioner switch	M	Injector	J
Air flow-sensor (incorporating intake air temperature sensor and barometric pressure sensor)	B	Idle speed control servo (incorporating servo, valve position sensor)	C
		Oxygen sensor	K
Crank angle sensor and No. 1 cylinder top dead center sensor	G	Purge control solenoid valve	I
Engine control relay	L	Self-diagnosis connector	P
Engine control unit	O	Throttle position sensor (incorporating idle position switch)	D
Engine coolant temperature sensor	E	Vehicle-speed sensor (reed switch)	N
Fuel pump check terminal	H		
Ignition coil (power transistor)	F		

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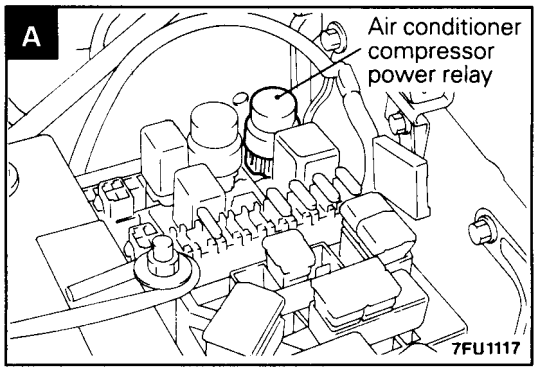
A



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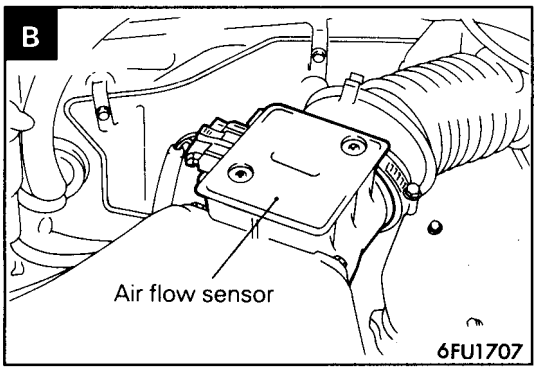

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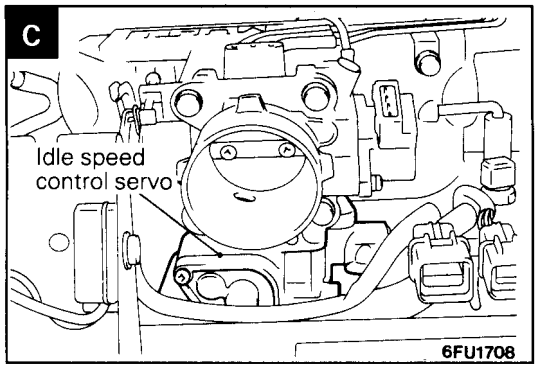

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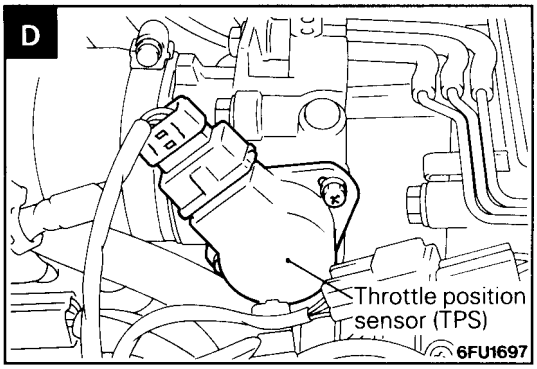

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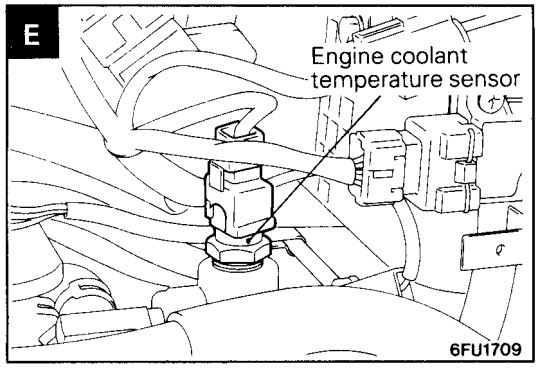

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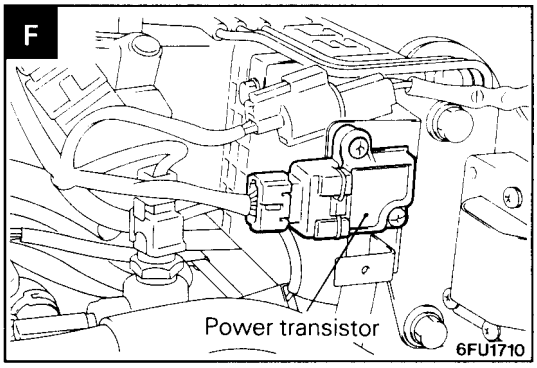

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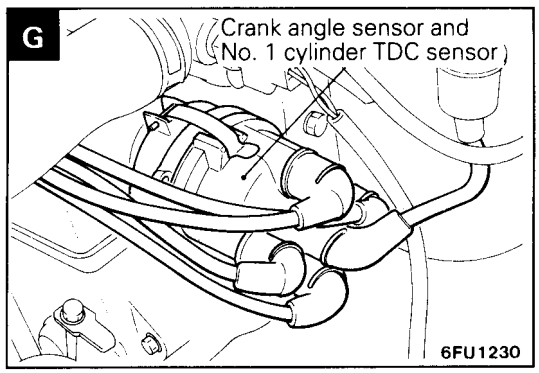

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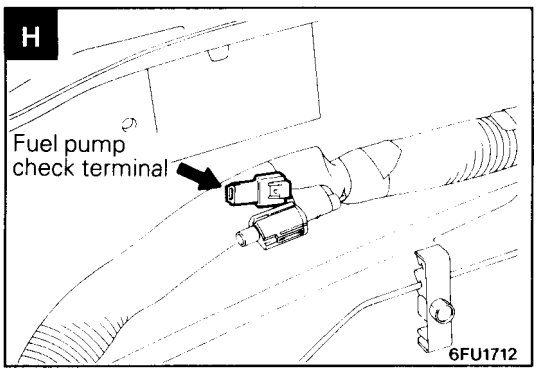

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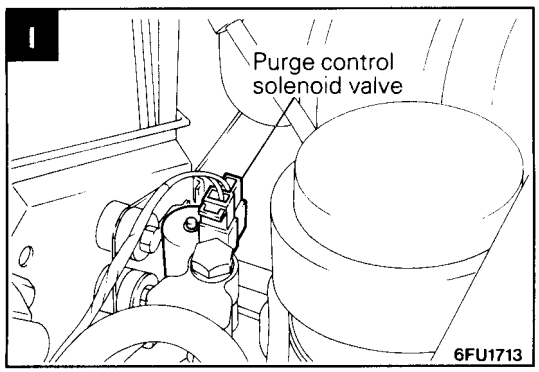

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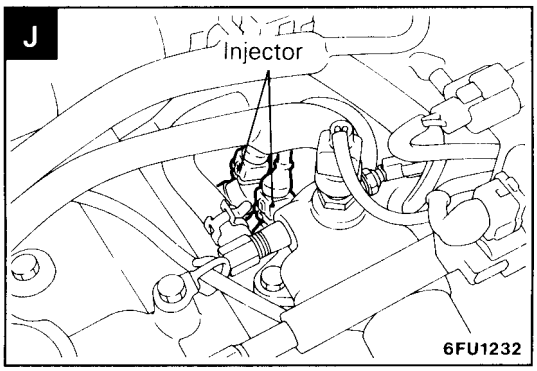

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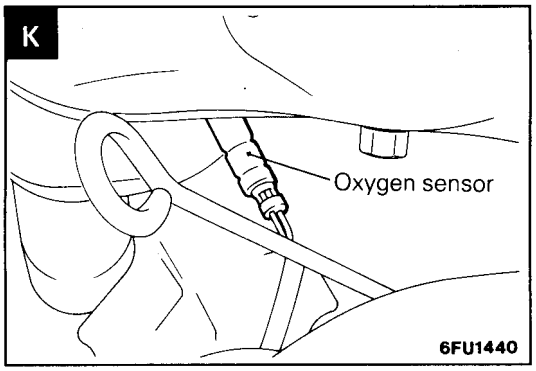

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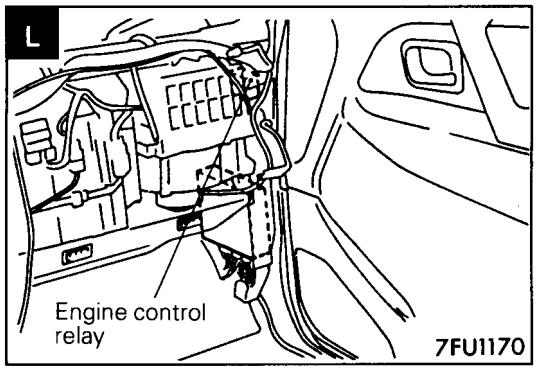

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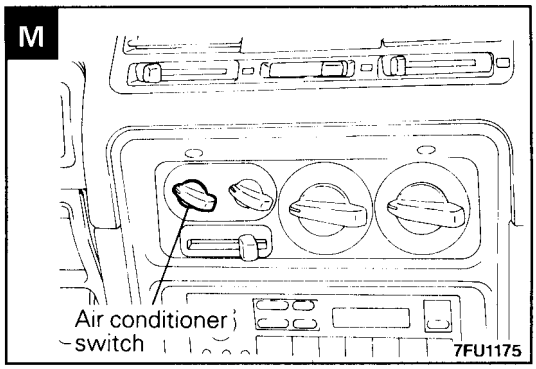

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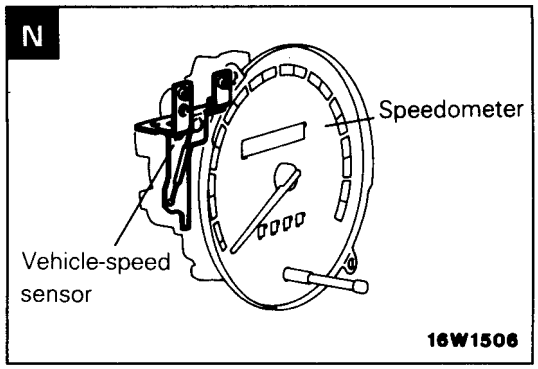

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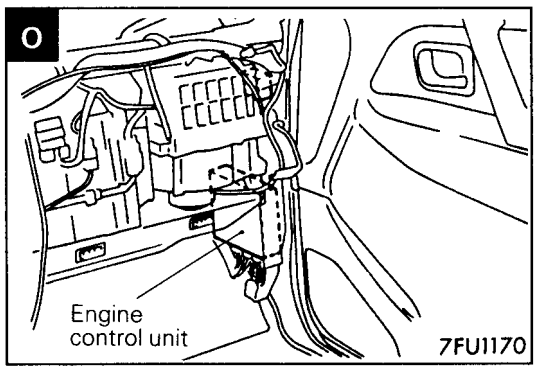
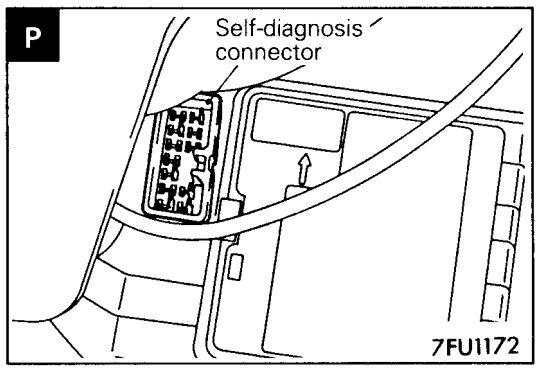


P



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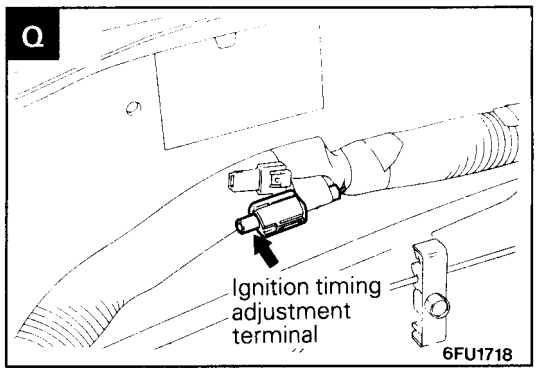

COMPONENT INSPECTION PROCEDURE

USING MULTI USE TESTER

Refer to P.13-22.

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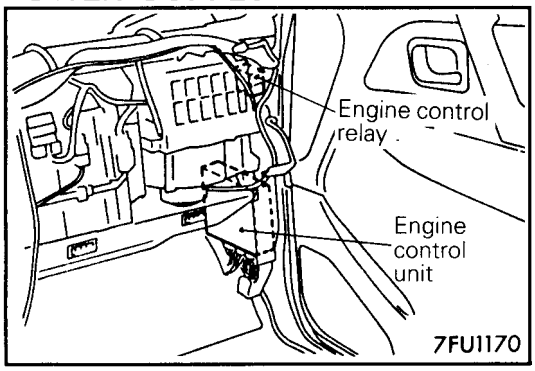
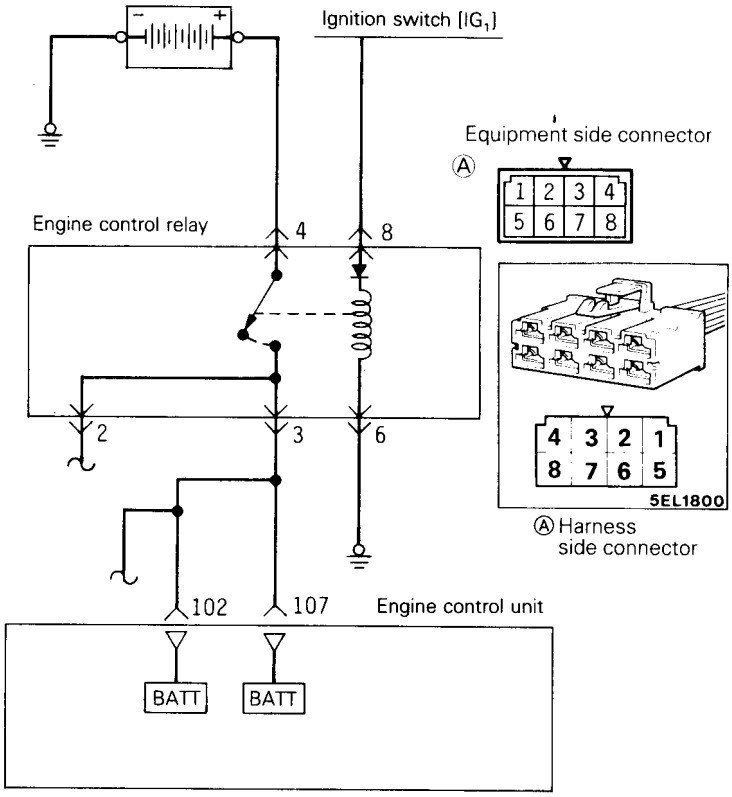
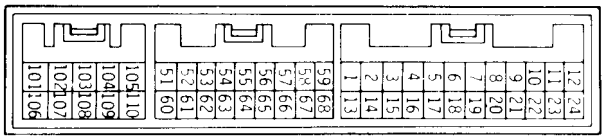
POWER SUPPLY





Engine control unit connector



01L0838

OPERATION

- While the ignition switch is ON, battery power supply is supplied to the engine control unit, injectors, air-flow sensor, etc.
- Turning the ignition switch to the ON position causes current to flow from the ignition switch through the control relay coil to earth. This turns the control relay switch on and supplies power from the battery to the engine control unit via the control relay switch.

INSPECTION

Using Multi-use tester (MUT)

Function	Item No.	Data display	Check conditions	Standard value
Data reading	16	Engine control unit power-supply voltage	Ignition switch:ON	SV

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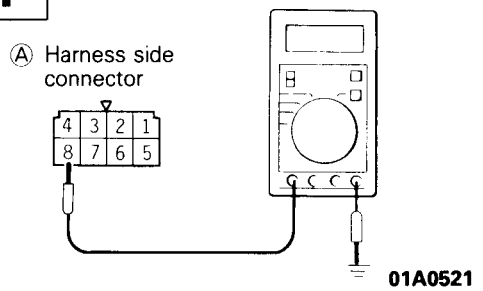
HARNESS INSPECTION

1

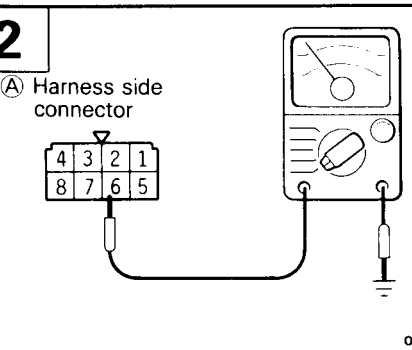


Measure the power supply voltage of the engine control relay.
- Engine control relay: Disconnected
- Ignition switch: ON

Voltage (V)
SV

OK → 2
Repair the harness. (Ignition switch – Ⓐ 8)

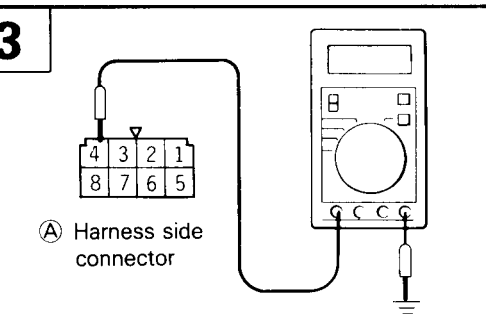
2



Check for continuity of the earth circuit
- Engine control relay connector: Disconnected

OK → 3
Repair the harness. (Ⓐ 6 – Earth)

3

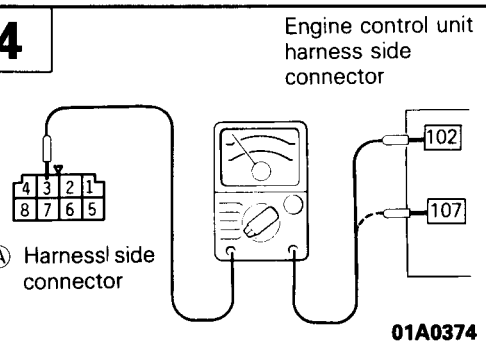


Measure the power supply voltage of the engine control relay.
- Engine control relay connector: Disconnected

Voltage (V)
SV

OK → 4
Repair the harness. (Battery – Ⓐ 4)

4



Check for open-circuit, or short-circuit to earth, between the engine control unit and the engine control relay.
- Engine control unit connector: Disconnected
- Engine control relay connector: Disconnected.

OK → STOP
Repair the harness (102 – Ⓐ 3) (107 – Ⓐ 3)

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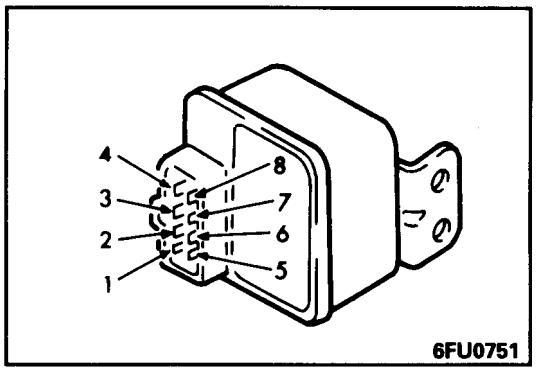

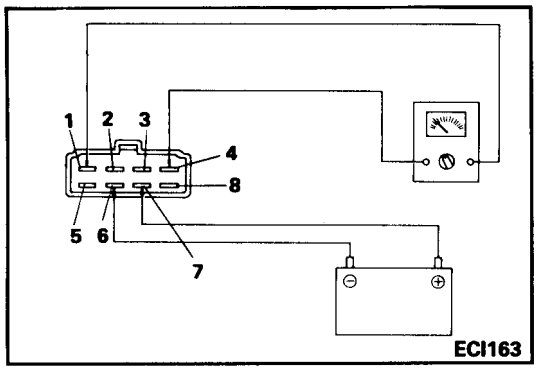

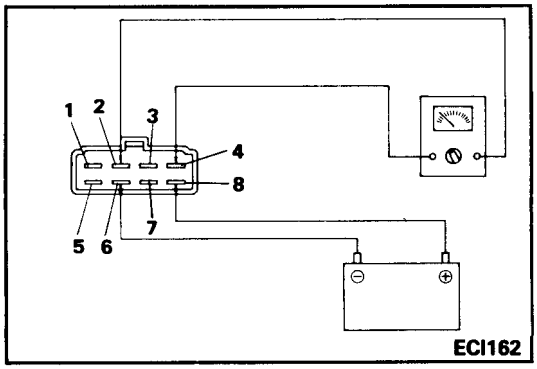

ENGINE CONTROL RELAY INSPECTION

Caution

When applying battery voltage directly, make sure that it is applied to correct terminal. Otherwise, the relay could be damaged.

(1) Check the continuity of the engine control relay coil.

Measured Terminals	Continuity
③ – ⑤	Yes (approx. 95Ω)
② – ⑤	
⑥ – ⑦	Yes (approx. 35Ω)
⑥ – ⑧	Yes One direction only

(2) Check the continuity between terminals 1 and 4 of the engine control relay contacts.

Relay Coil (Between terminals ⑥–⑦)	Continuity
When not energized	No (∞Ω)
When energized	Yes (0Ω)

(3) Check the continuity between terminals 2 and 4 of the engine control relay contacts.

Relay Coil (Between terminals ⑧–⑥)	Continuity
When not energized	No (∞Ω)
When energized	Yes (0Ω)

(4) If the control relay is faulty, replace it.

ENGINE CONTROL UNIT POWER EARTH

Refer to P.13-26.

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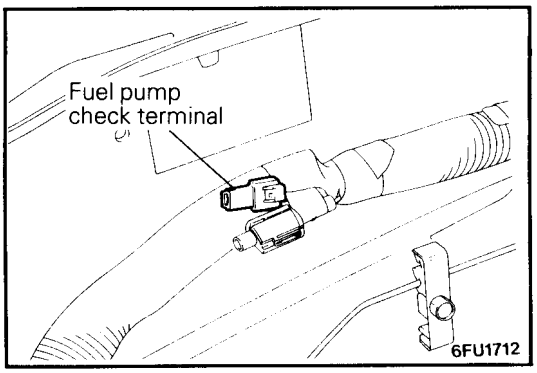
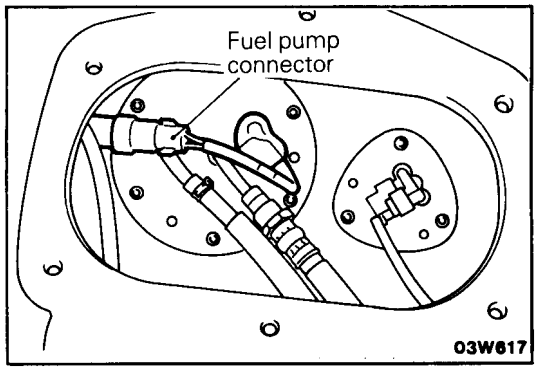
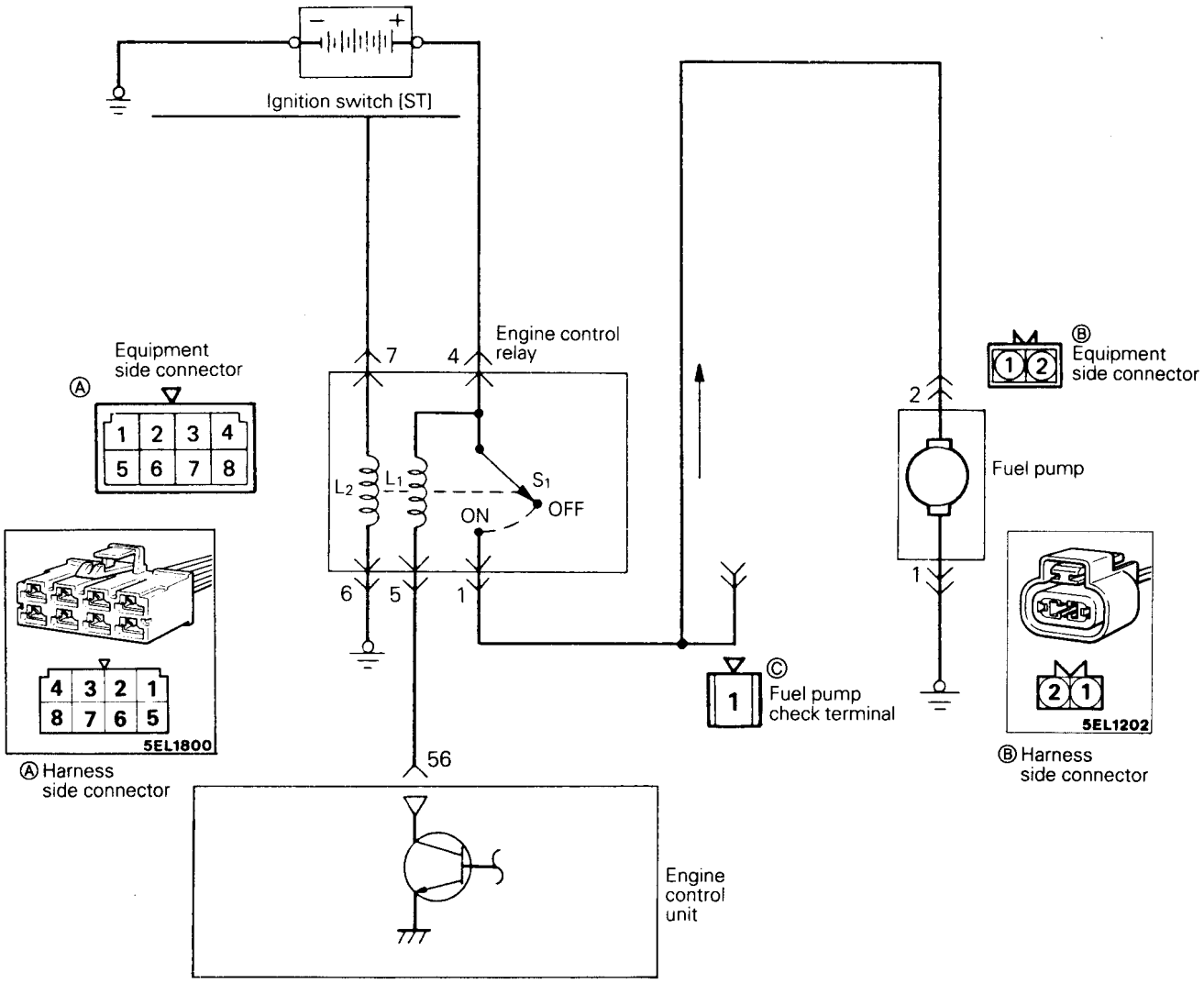
FUEL PUMP

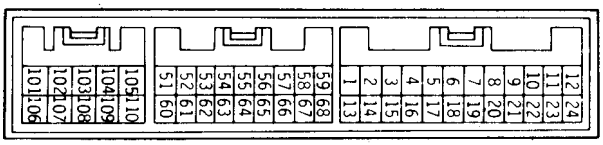






6FU1720

Engine control unit connector



01L0838

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OPERATION

- Activates the fuel pump during engine cranking and while the engine is running.
- When the ignition switch is set to the START position, current flows, by way of the control relay coil, from the ignition switch to earth. As a result, the control relay switch is switched ON, and the power for activation of the fuel pump is supplied, by way of the control relay switch, from the battery to the fuel pump.
- While the engine is running, the engine control unit switches ON the power transistor, after which current flows to the control relay coil, and the power for activation of the fuel pump is supplied to the fuel pump.
- When the control relay switch is switched ON, battery voltage is also applied to the engine control unit, and so the engine control unit detects the fact that the power for activation of the fuel pump is being supplied to the fuel pump.

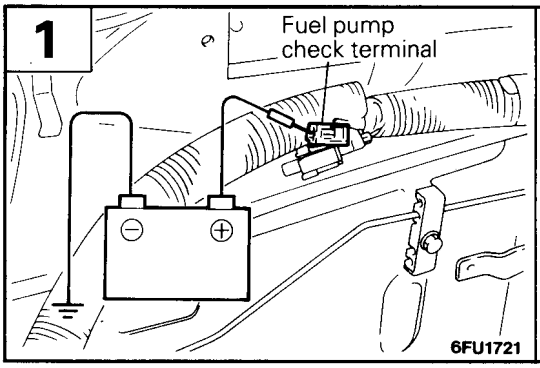
INSPECTION

Using Multi-use tester (MUT)

Function	Item No.	Activation	Check conditions	Check description	Normal condition
Actuater test	07	Activates fuel pump and circulates fuel.	• Engine cranking • Fuel pump forced activation Make the check under both of the above conditions.	Pinch the return hose and feel the pulsations of the fuel flow.	Pulsations can be felt.
				Listen (close to the fuel tank) for pump sounds.	Sounds can be heard.

HARNESS INSPECTION

1

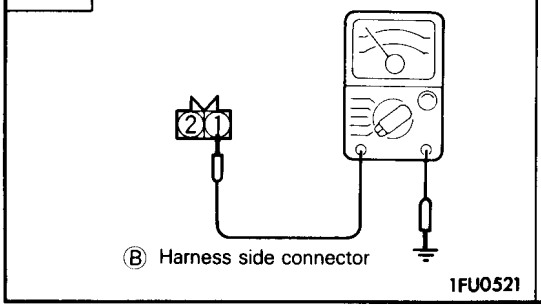


Check the fuel pump.
- Apply battery voltage to the checking terminal and operate the pump.

OK → 4

NG → 2

2

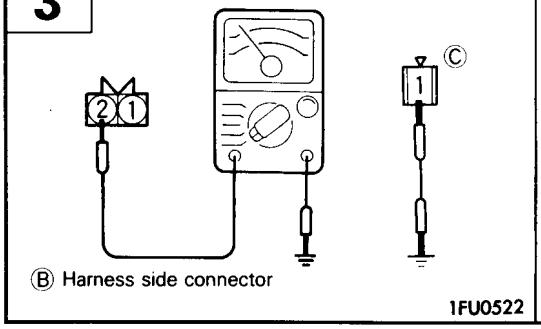


Check for continuity of the earth circuit.
- Fuel pump connector: Disconnected

OK → 3

NG → Repair the harness. (Ⓑ 1 – Earth)

3



Check for continuity between the fuel pump and the checking terminal.
- Fuel pump connector: Disconnected

OK → 4

NG → Repair the harness. (Ⓑ 2 – Ⓒ 1)

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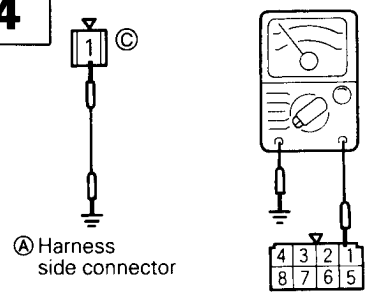
4



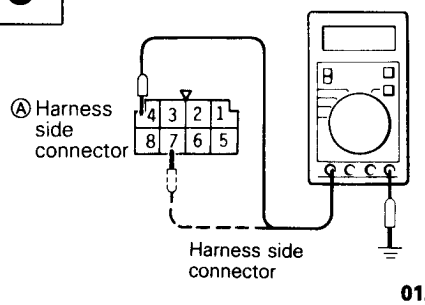
8FU0308

Check for continuity between the checking terminal; and between the engine control relay terminals.
- Engine control relay connector: Disconnected
- Fuel pump connector: Disconnected

OK → 5

NG → Repair the harness. (Ⓐ 1 – © 1) (© 1 – 109)

5



01A0504

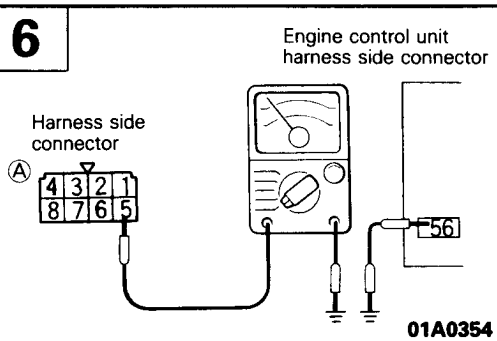
Measure the power supply voltage of the engine control relay.
- Engine control relay connector: Disconnected
- Ignition switch: START (when checking Ⓐ 7)

Voltage (V)
8 or higher

OK → 6

NG → Repair the harness. (Ⓐ 4 – Battery) (Ⓐ 7 – Ignition switch)

6



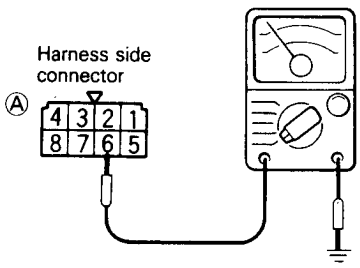
01A0354

Check for an open-circuit, or a short-circuit to earth between the engine control relay and the engine control unit.
- Engine control relay connector: Disconnected
- Engine control unit connector: Disconnected

OK → 7

NG → Repair the harness. (Ⓐ 5 – 56)

7



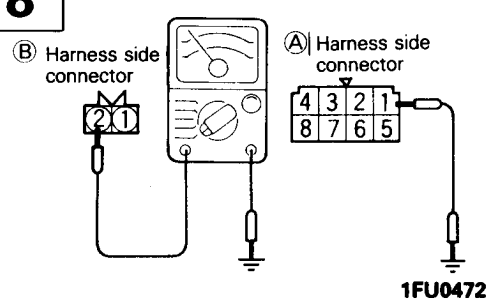
01A0351

Check for continuity, of the earth circuit.
- Engine control relay connector: Disconnected.

OK → 8

NG → Repair the harness. (Ⓐ 6 – Earth)

8



1FU0472

Check for an open-circuit, or a short-circuit to earth between the engine control relay and the fuel pump.
- Engine control relay connector: Disconnected
- Fuel pump connector: Disconnected

OK → STOP

NG → Repair the harness. (Ⓐ 1 – Ⓑ 2)

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FUEL PUMP INSPECTION

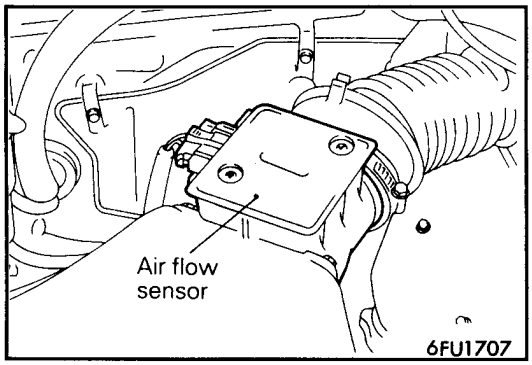
Refer to P.13-15.

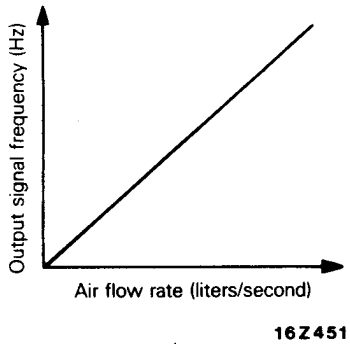
ENGINE CONTROL RELAY INSPECTION

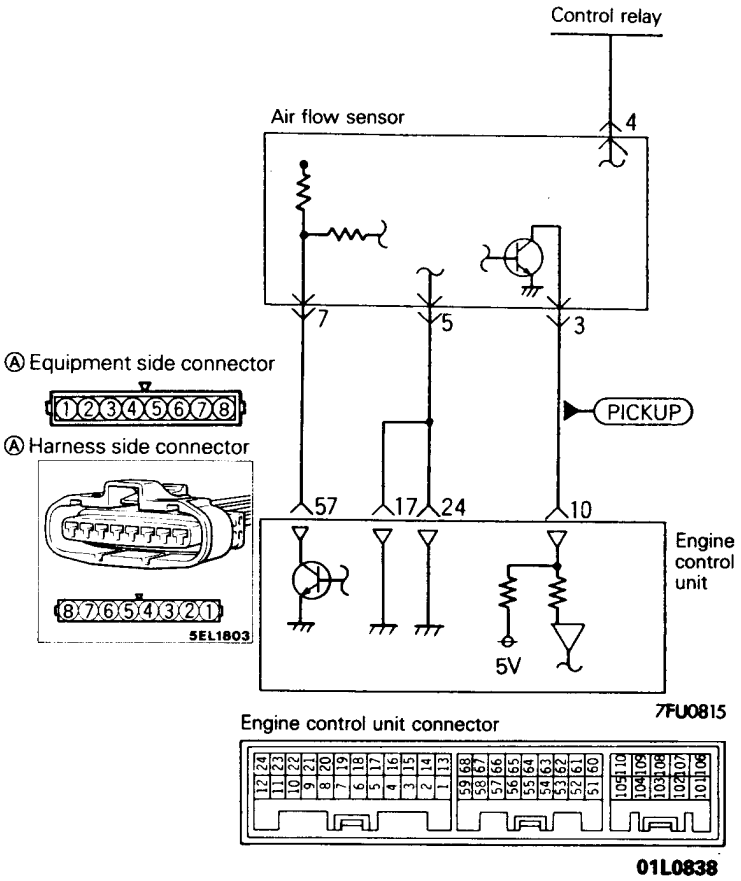
Refer to P.13-100.

AIR FLOW SENSOR

M13YFAA1







OPERATION

- The air-flow sensor is incorporated within the cleaner; it functions to convert the amount of engine air intake to pulse signals of a frequency proportional to the amount of engine air intake, and to input those signals to the engine control unit.
  The engine control unit then, based upon those signals, calculates the amount of fuel injection, etc.
- The power for the air flow sensor is supplied from the control relay to the air flow sensor, and is earthed at the engine control unit. The air flow sensor, by intermitting the flow of the 5V voltage applied from the engine control unit produces pulse signals.

Hint 1:
If the engine sometimes stalls, try starting the engine and shaking the air flow sensor harness.
If the engine then stalls, incorrect or improper contact of the air flow sensor connector is the probable cause.

Hint 2:
If, when the ignition switch is switched ON (but the engine is not started), the air flow sensor output frequency is any value other than zero, a malfunction of the air flow sensor or of the engine control unit is the probable cause.

Hint 3:
If idling is possible even though the air flow sensor output frequency is deviated from the standard value, the cause is usually a malfunction other than of the air flow sensor.

[Examples]
(1) The flow of air within the air flow sensor is disturbed. (Air duct disconnection or clogged air cleaner element.)
(2) Incomplete combustion within a cylinder. (Malfunction of spark plugs, ignition coil, injectors, compression pressure, etc.)
(3) Air is taken into the intake manifold through a leaking gasket, etc.
(4) EGR valve
Improper adhesion of valve sheet.

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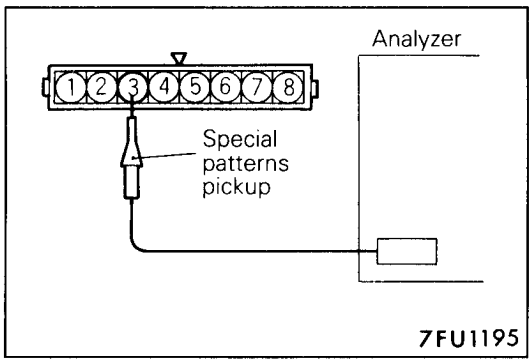
INSPECTION

Using Multi-use tester (MUT)

Function	Item No.	Data display	Check conditions	Engine conditions r/min.	Standard value Hz
Data reading	12	Sensor detection air flow (frequency)	• Engine coolant temperature: 80–95°C (176–205°F) • Lights and accessories: OFF • Transmission: neutral • Steering wheel: neutral position	750 (idling)	37–63
				2,000	75–115
				Racing	Frequency increases by racing.

NOTE
When the vehicle is new [driven approximately 500 km (300 miles) or less], the air-flow sensor output frequency may be approximately 10% higher than indicated above.

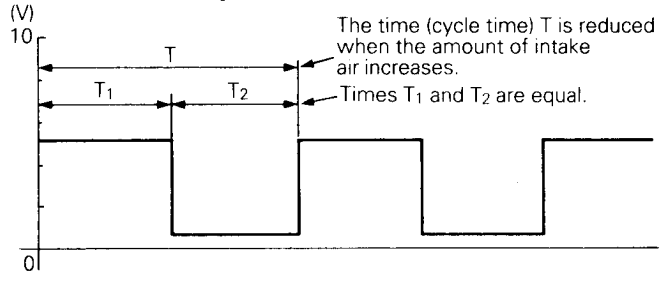


Wave Pattern Inspection Using an Analyzer

Measurement Method

(1) Disconnect the air flow sensor connector, and connect the special tool (test harness: MB991348) in between. (All terminals should be connected.)
(2) Connect the analyzer special patterns pickup to terminal ③ of the air flow sensor connector.

Standard wave pattern

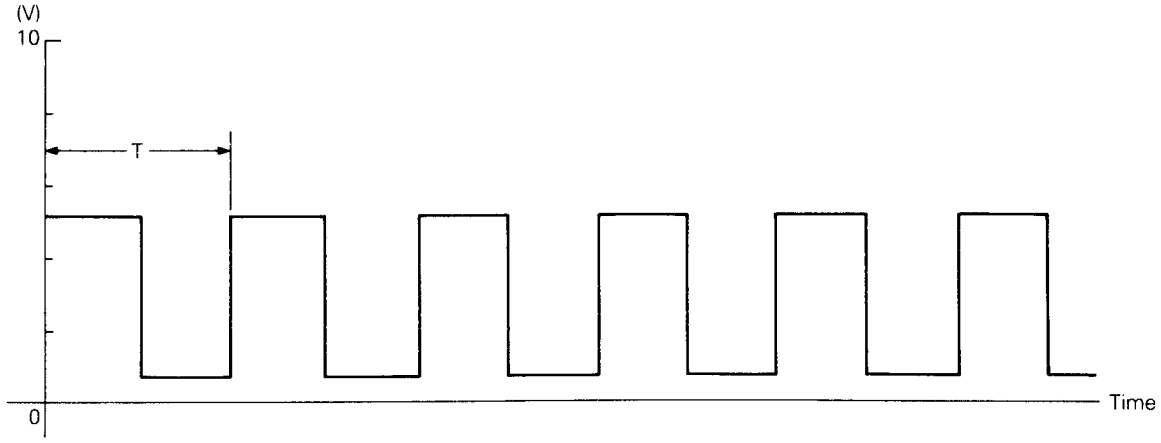


Observation conditions

Function	Special patterns
Pattern height	Low
Pattern selector	Display
Engine r/min.	Idle r/min. (750/min.)

Observation conditions

(from conditions on previous page, engine speed is increased by racing.)



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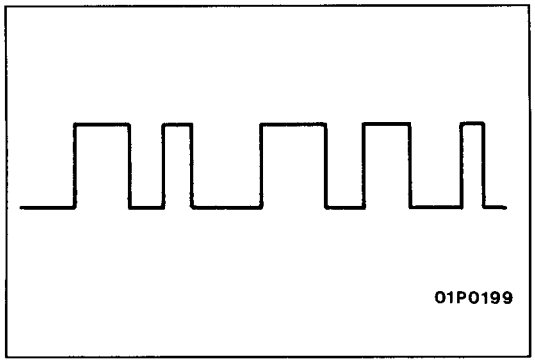
Wave pattern observation points

Check that cycle time T becomes shorter and the frequency increases when the engine speed is increased.



Examples of abnormal wave patterns

- Example 1

  Cause of problem

  Sensor interface malfunction

  Wave pattern characteristics

  Short wave pattern is output even when the engine is not started.

- Example 2

  Cause of problem

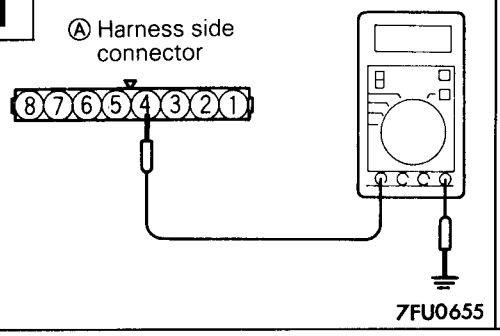
  Damaged rectifier or vortex generation column

  Wave pattern characteristics

  Unstable wave pattern with non-uniform frequency. However, when an ignition leak occurs during acceleration, the wave pattern will be distorted temporarily, even if the air flow sensor is normal.

HARNESS INSPECTION

1



Measure the power supply voltage.

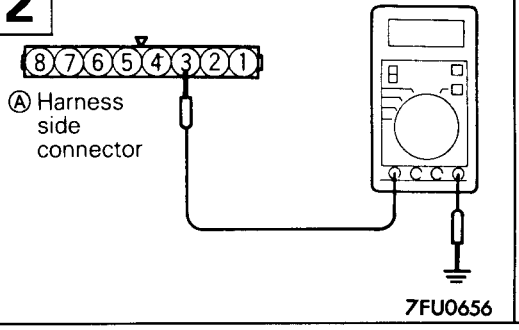
- Connector: Disconnected
- Ignition switch: ON

Voltage (V)
5V

OK → 2

NG → Repair the harness. (Ⓐ4 – Control relay) or check the control relay

2



Measure the terminal voltage.

- Connector: Disconnected
- Ignition switch: ON

Voltage (V)
4.8–5.2

OK → 3

NG → Repair the harness. (Ⓐ3 – 10)

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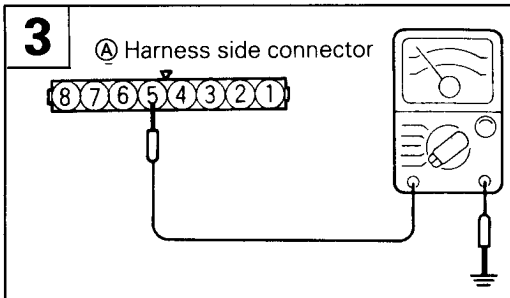
3



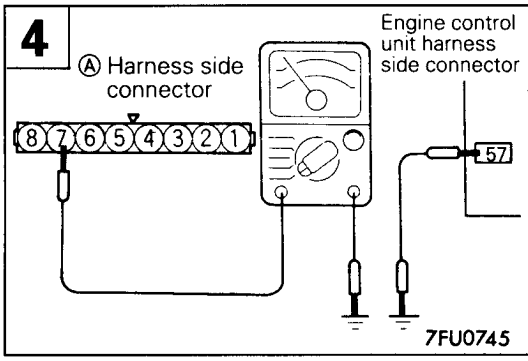
Check for continuity of the earth circuit.

- Connector: Disconnected

OK → 4

NO → Repair the harness. (Ⓐ5 – 17, 24)

4



Check for continuity between the air flow sensor and the engine control unit.

- Air-flow sensor connector: Disconnected
- Engine control unit connector: Disconnected

OK → STOP

NO → Repair the harness. (Ⓐ7 – 57)

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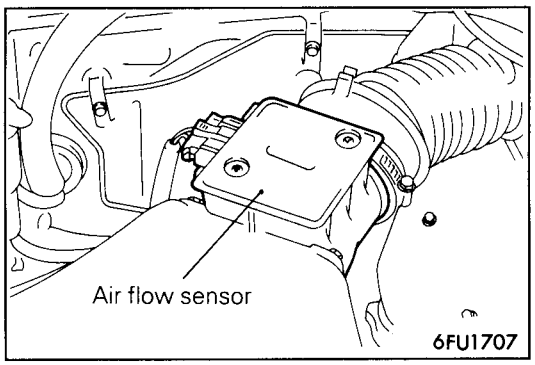
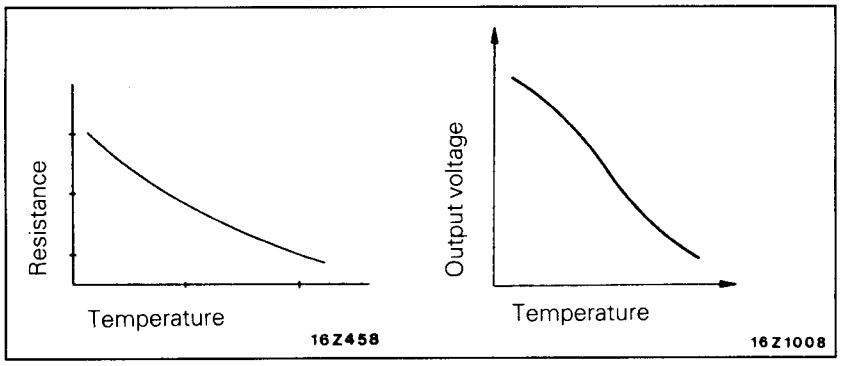
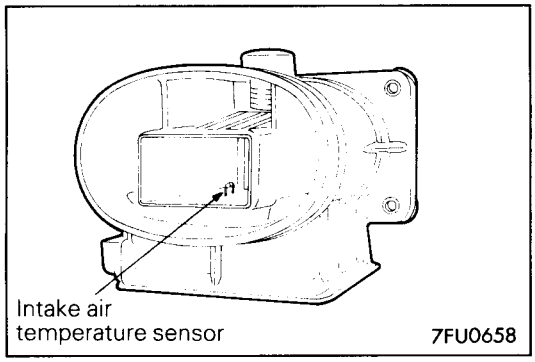
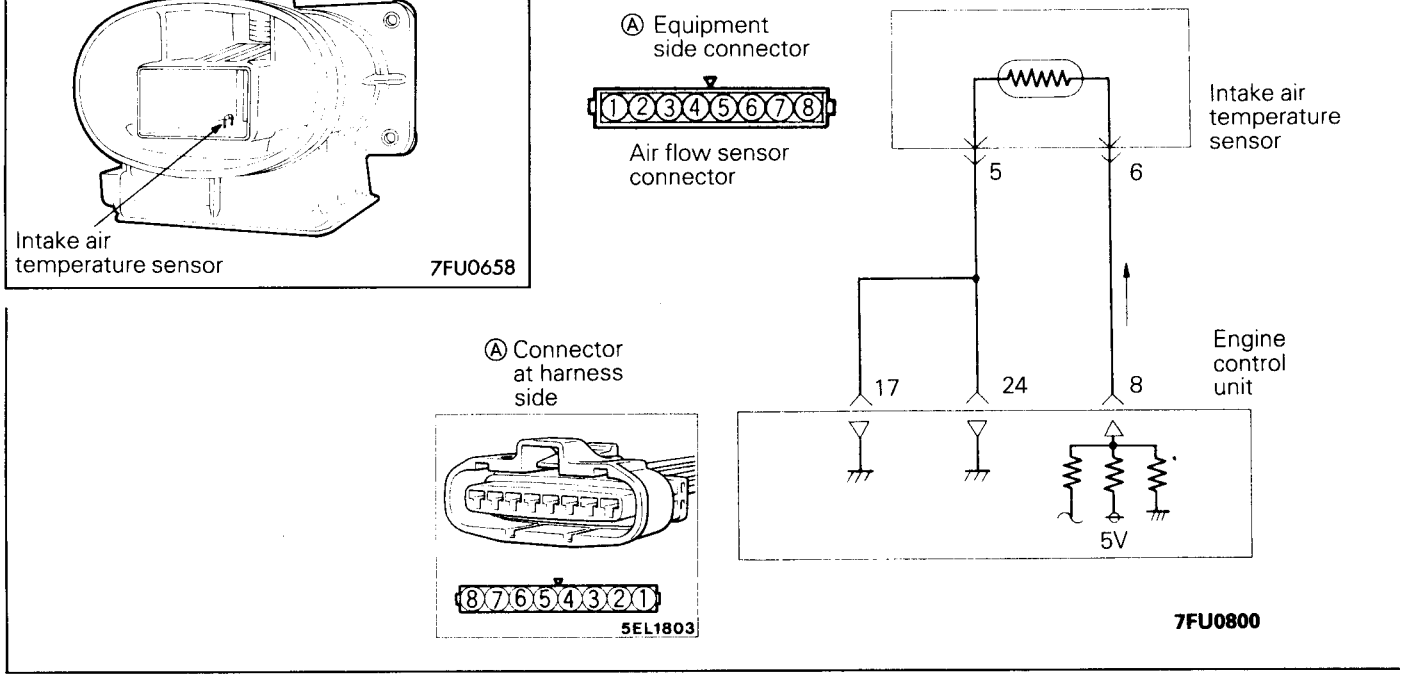
INTAKE AIR TEMPERATURE SENSOR









OPERATION

TROUBLESHOOTING HINTS

INSPECTION

Using Multi-use tester (MUT)

FUEL SYSTEM <6G72 Engine> – Refer to Intake Air Temperature Sensor (P.13-34).

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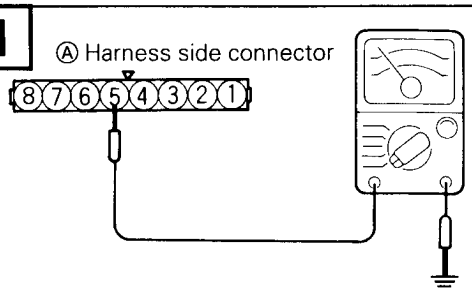
1

Ⓐ Harness side connector



7FU0657

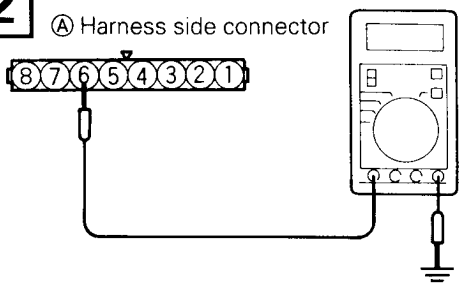
Check for continuity of the earth circuit.

OK → 2

NG → Repair the harness. (Ⓐ5 – 17, 24)

2

Ⓐ Harness side connector



7FU0660

Measure the power supply voltage.

- Connector: Disconnected
- Ignition switch: ON

Voltage (V)
4.5 – 4.9

OK → STOP

NG → Repair the harness. (Ⓐ6 – 8)

SENSOR INSPECTION

FUEL SYSTEM <6G72 Engine> – Refer to Intake Air Temperature Sensor (P.13-35).

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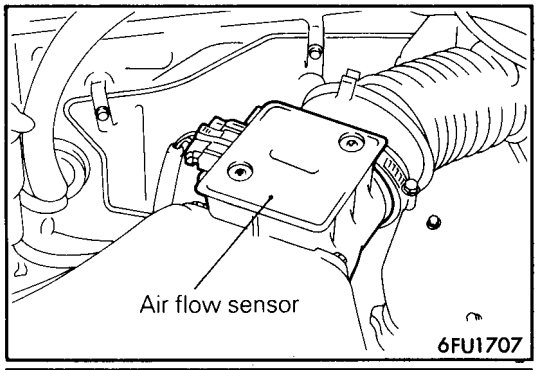
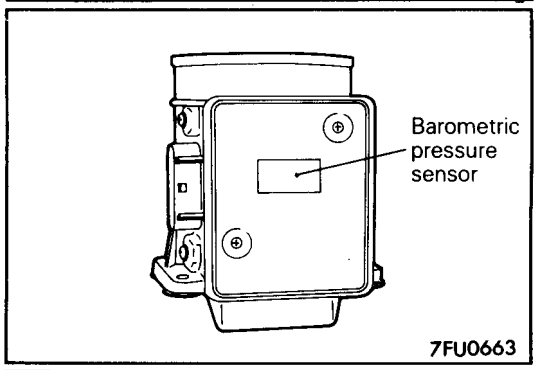
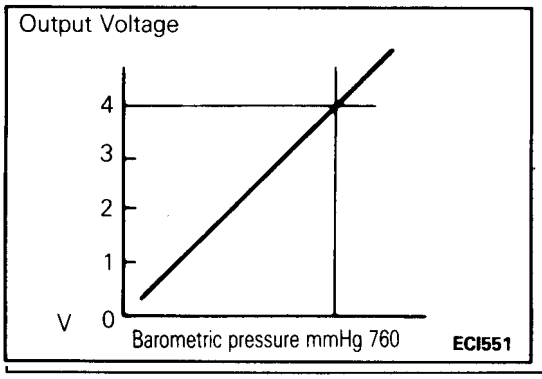
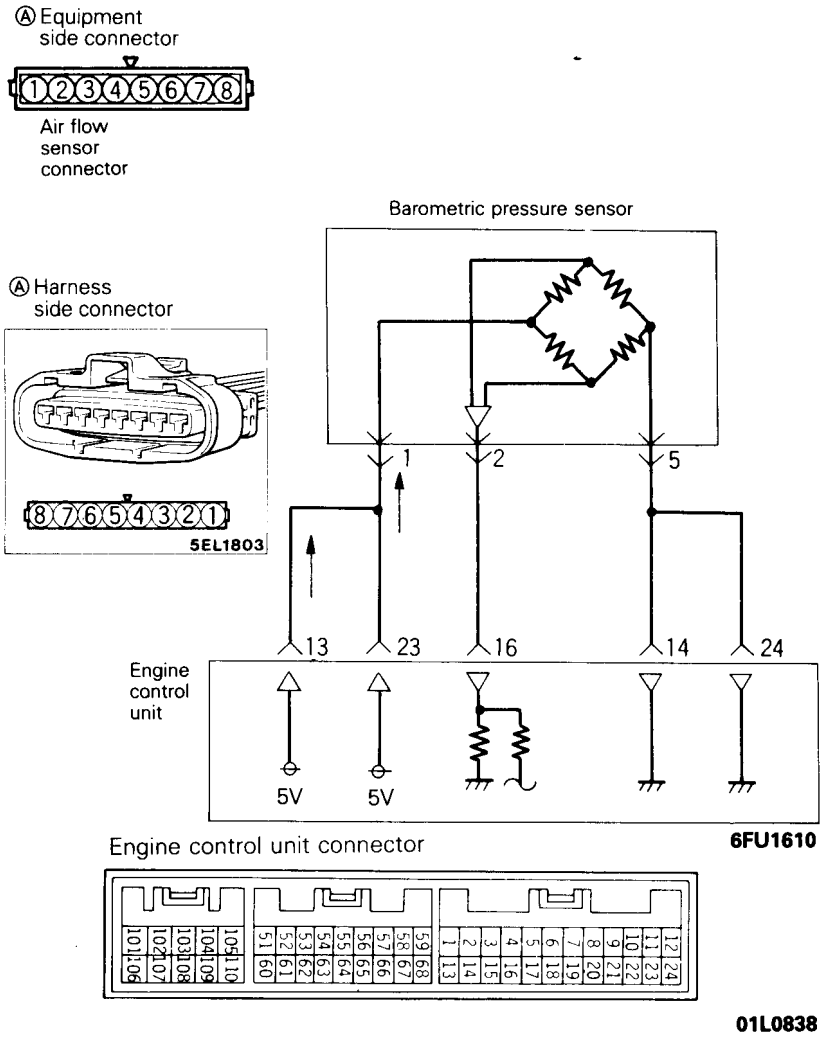
BAROMETRIC PRESSURE SENSOR

M13YHAA1









OPERATION

TROUBLESHOOTING HINTS

INSPECTION

Using Multi-use tester (MUT)

FUEL SYSTEM <6G72 Engine> – Refer to Barometric Pressure Sensor (P.13-36).

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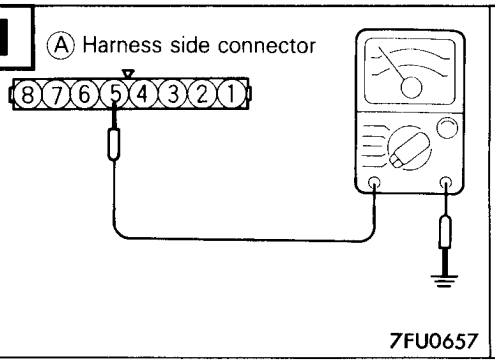
HARNESS INSPECTION

1

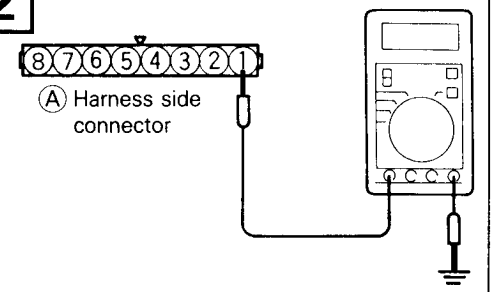


Check for continuity of the earth circuit.
- Connector: Disconnected

OK → 2

NG → Repair the harness. (Ⓐ 5 – 17, 24)

2



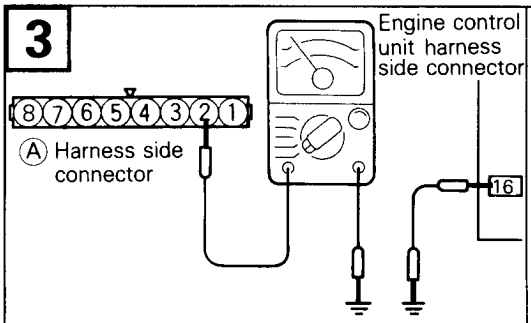
Measure the power supply voltage of the barometric pressure sensor.
- Connector: Disconnected
- Ignition switch: ON

Voltage (V)
4.8 – 5.2

OK → 3

NG → Repair the harness. (Ⓐ 1 – 13, 23)

3

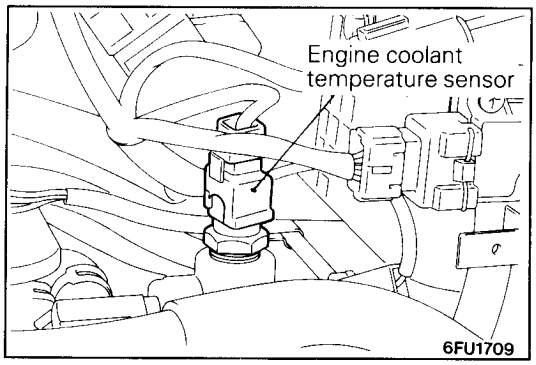


Check for an open-circuit or a short-circuit to earth, between the engine control unit and the barometric pressure sensor.
- Air flow sensor connector: Disconnected
- Engine control unit connector: Disconnected

OK → STOP

NG → Repair the harness. (Ⓐ 2 – 16)

ENGINE COOLANT TEMPERATURE SENSOR



OPERATION

TROUBLESHOOTING HINTS

INSPECTION

Using Multi-use tester (MUT)

HARNESS INSPECTION

SENSOR INSPECTION

FUEL SYSTEM <6G72 Engine> – Refer to Engine Coolant Temperature Sensor (P.13-38, 39).

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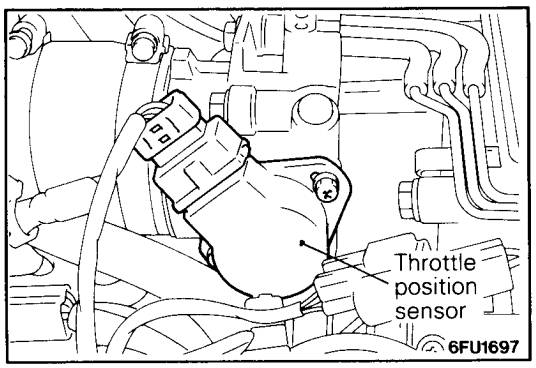
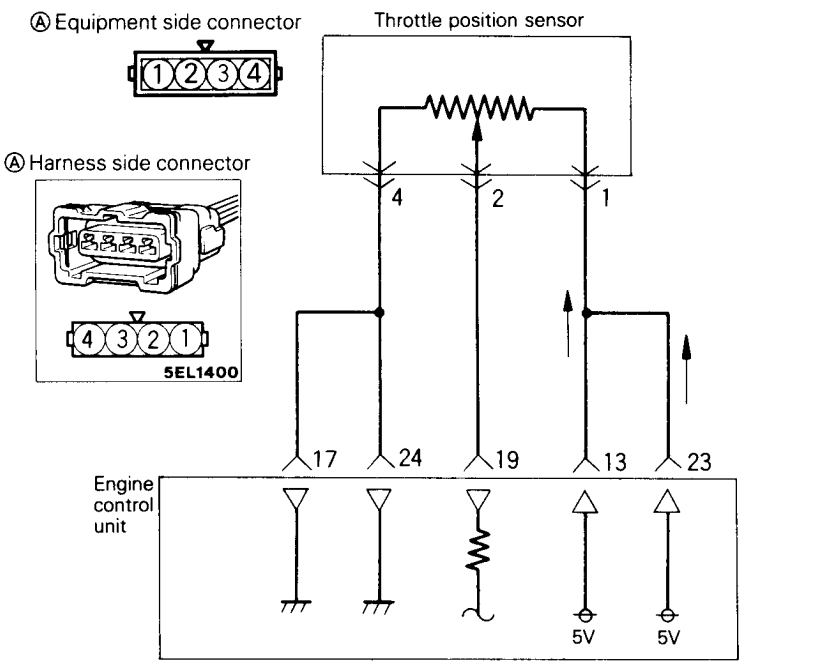
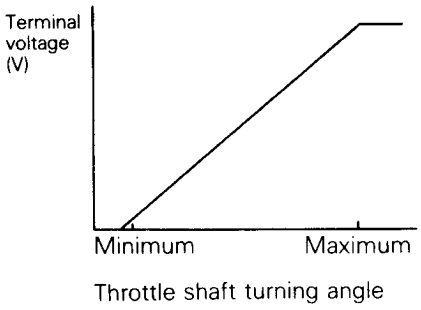
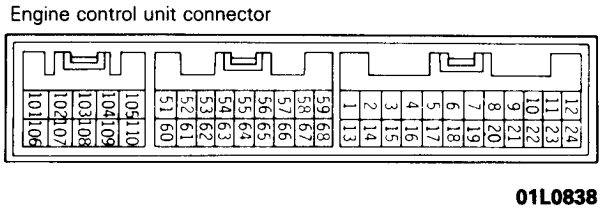
THROTTLE POSITION SENSOR

M13YJAB









OPERATION

TROUBLESHOOTING HINTS

FUEL SYSTEM <6G72 Engine> – Refer to Throttle Position Sensor (P.13-40).

INSPECTION

Using Multi-use tester (MUT)

Function	Item No.	Data display	Check conditions	Throttle valve	Standard value mV
Data reading	14	Sensor detection voltage	Ignition switch: left ON for 15 secondes or more	Set to idling position.	450 – 550
				Open gradually.	Becomes higher proportionally to valve opening
				Open fully.	4,500 – 5,500

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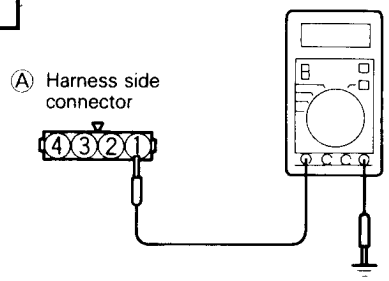
HARNESS INSPECTION

1



6FU1241

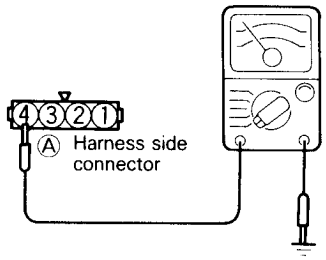
Measure the power supply voltage of the throttle position sensor.
- Connector: Disconnected
- Ignition switch: ON

Voltage (V)
4.8 – 5.2

OK → 2

NG → Repair the harness. (Ⓐ 4 – 17, 24)

2



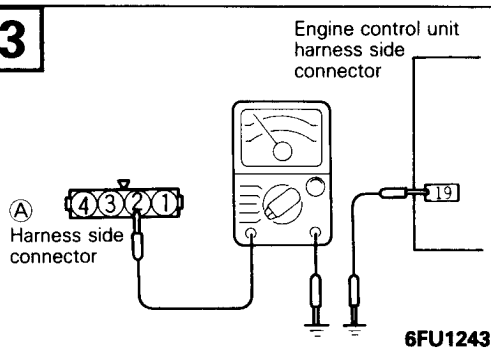
6FU1242

Check for continuity of the earth circuit.
- Connector: Disconnected

OK → 3

NG → Repair the harness. (Ⓐ 4 – 17, 24)

3

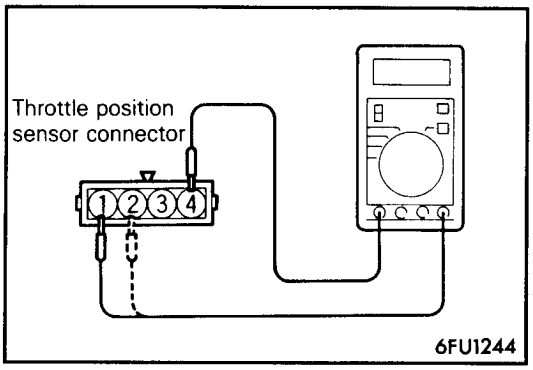


6FU1243

Check for an open-circuit, or a short-circuit to earth, between the engine control unit and the throttle position sensor.
- Throttle position sensor connector: Disconnected
- Engine control unit connector: Disconnected

OK → STOP

NG → Repair the harness. (Ⓐ 2 – 19)



6FU1244

SENSOR INSPECTION

(1) Disconnect the throttle position sensor connector.
(2) Measure resistance between terminal ④ (sensor earth) and terminal ① (sensor power).

Standard value: 3.5–6.5 kΩ

(3) Connect a pointer type ohmmeter between terminal ④ (sensor earth) and terminal ② (sensor output).
(4) Operate the throttle, valve slowly from the idle position to the full open position and check that the resistance changes smoothly in proportion with the throttle valve opening angle.
(5) If the resistance is out of specification, or fails to change smoothly, replace the throttle position sensor.

TPS installation torque: 2.0 Nm (0.2 kgm, 1.5 ft.lbs.)

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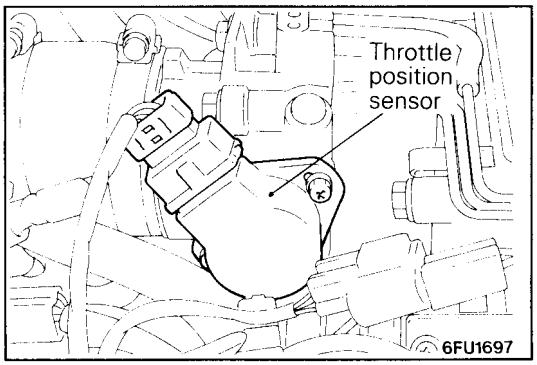
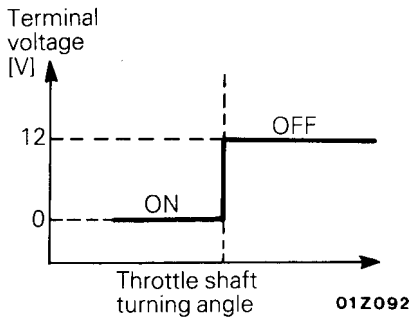
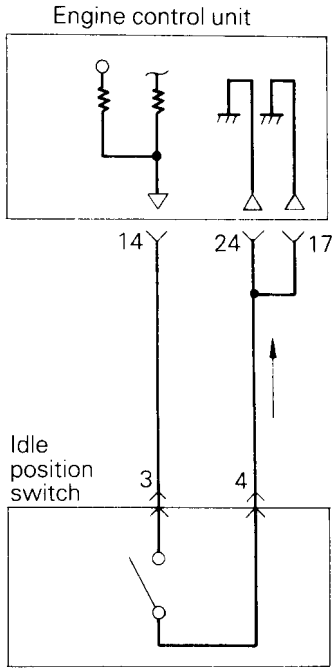
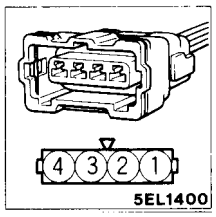
IDLE POSITION SWITCH









7FU0488

OPERATION

TROUBLESHOOTING HINTS

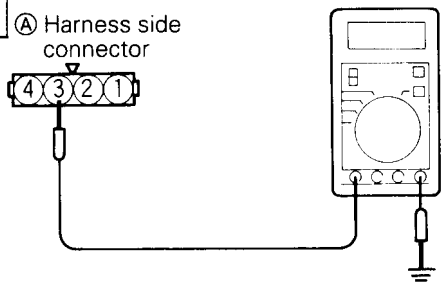
INSPECTION

Using Multi-use tester (MUT)

FUEL SYSTEM <6G72 Engine> – Refer to Idle Position Switch (P.13-43).

HARNESS INSPECTION

1



Measure the power supply voltage of the idle position switch.

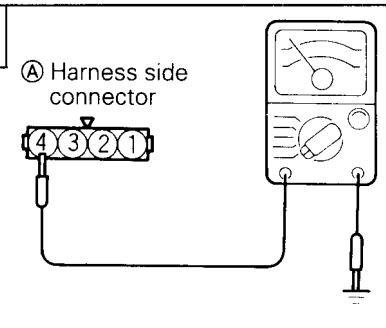
- Connector: Disconnected
- Ignition switch: ON

Voltage (V)
4 or higher

OK → 2

NO → Repair the harness. (Ⓐ3 – 14)

2



Check for continuity of the earth circuit.

- Connector: Disconnected

OK → STOP

NO → Repair the harness. (Ⓐ4 – 17, 24)

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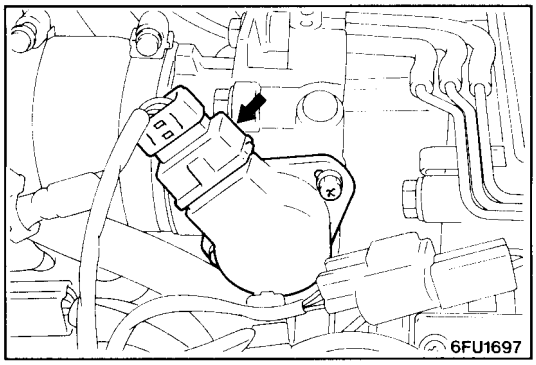
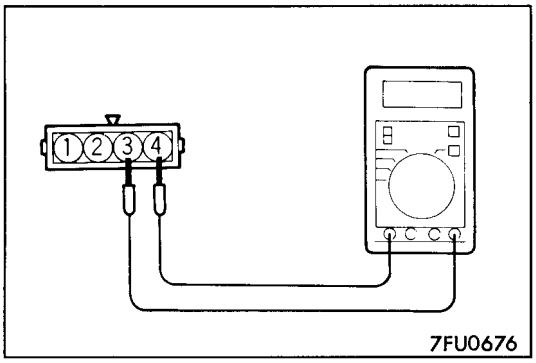


SENSOR INSPECTION

(1) Disconnect the throttle position sensor connector.



(2) Check the continuity between the throttle position sensor connector terminal ③ and terminal ④.

Accelerator pedal	Continuity
Depressed	No continuity
Released	Continuity

(3) If there is a malfunction, replace the throttle position sensor.

NOTE

- After replacement, the idle position switch and throttle position sensor should be adjusted. (Refer to P.13-91.)

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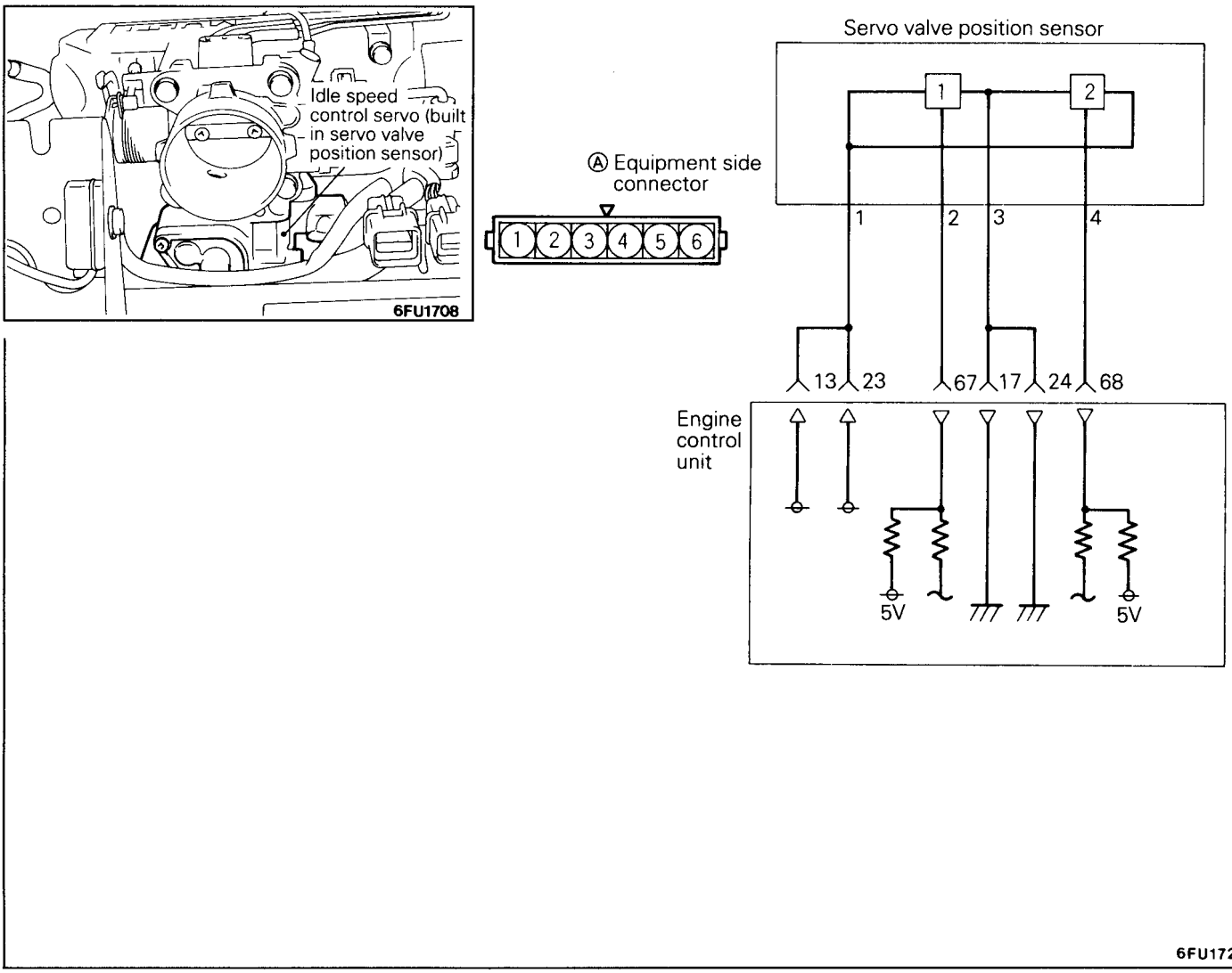
SERVO VALVE POSITION SENSOR



OPERATION

- The servo valve position sensor converts the changes (increase or decrease) in the valve position of the engine idling speed control servo (ISC) into pulse signals and inputs these signals to the engine control unit. The engine control unit determines the valve position from these signals, and controls the engine idling speed control servo.
- 5V power is supplied to the servo valve position sensor from the engine control unit, and the earth connection is made from the engine control unit.
- 5V power is applied to the two servo valve position sensor output terminals. When the servo valve position is changed (increased or decreased) by the DC motor inside the servo, the servo valve position sensor generates a signal from the opening and closing between the output terminal and the earth.

TROUBLESHOOTING

The servo valve position sensor is the most important sensor for controlling the engine idling speed. If a malfunction develops when the engine is idling and the electrical load is varied by turning the air conditioner switch to ON and OFF, etc., this sensor is probably defective.

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INSPECTION

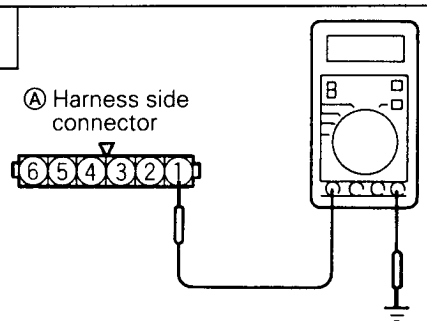
Using Multi-use tester (MUT)

Function	Item No.	Data display	Check conditions	Load conditions	Standard value
Data reading	55	Servo valve position steps	• Engine coolant temperature: 80–95°C (176–203°F) • Lights and accessories: OFF • Transmission: neutral • Steering wheel: neutral position • Idle-position switch: ON (The compressor clutch should be actived when the air conditioner switch is switched ON.) • Engine: idling	• Air conditioner switch: OFF	2–20 STP
				• Air conditioner switch: ON	8–50 STP Increases

NOTE
When the vehicle is new [driven approximately 500 km (300 miles) or less] the number of steps may be about 30 steps greater than the standard value indicated above.

HARNESS INSPECTION

1



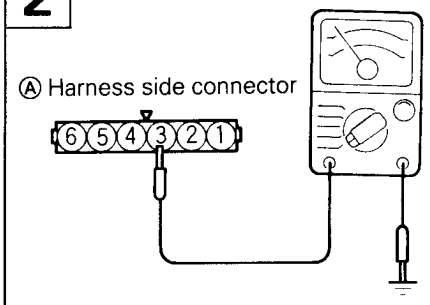
Measure the power supply voltage of the air intake control valve position sensor.
- Connector: Disconnected
- Ignition switch: ON

Voltage (V)
4.8–5.2

OK → 2

NO → Repair the harness. (Ⓐ1 – 13, 23)

2

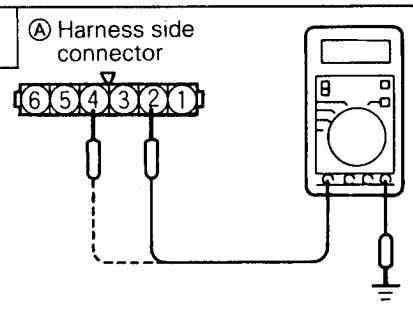


Check for continuity of the earth circuit.
- Connector: Disconnected

OK → 3

NO → Repair the harness. (Ⓐ3 – 17, 24)

3



Measure the terminal voltage.
- Connector: Disconnected
- Ignition switch: ON

Voltage (V)
4.8–5.2

OK → STOP

NO → Repair the harness. (Ⓐ2 – 67) (Ⓐ4 – 68)

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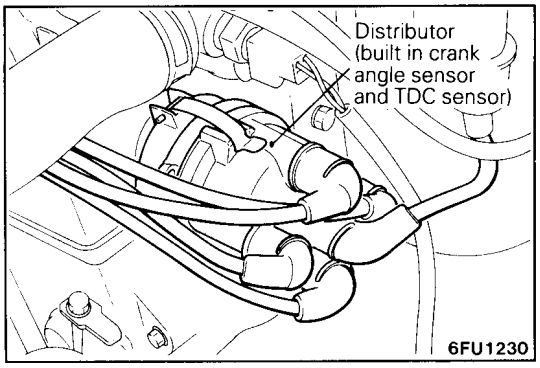
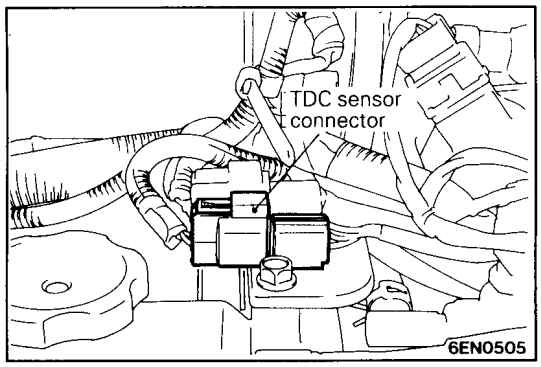
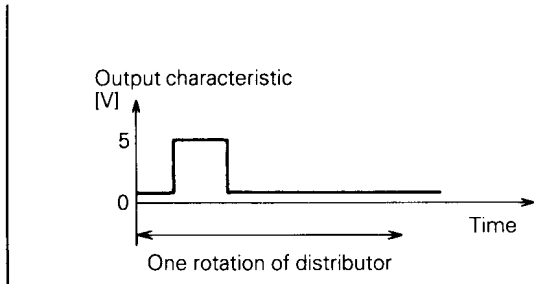
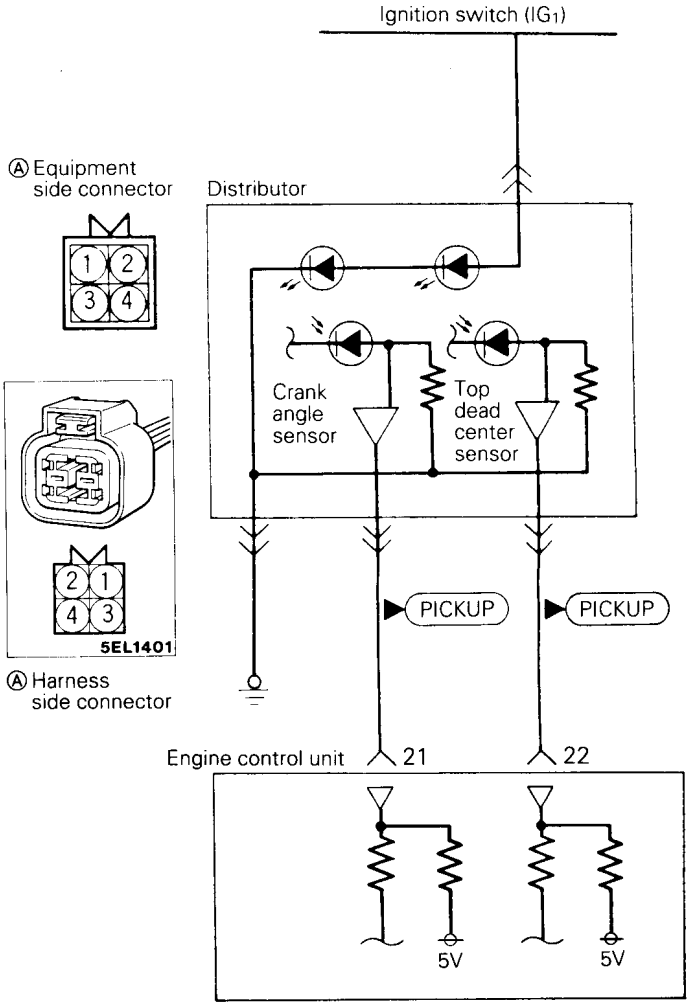
TOP DEAD CENTER SENSOR









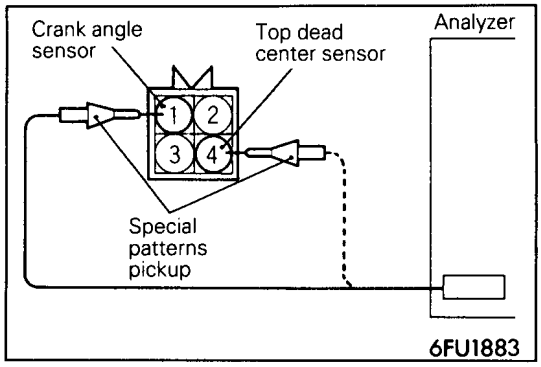
OPERATION

TROUBLESHOOTING HINTS

FUEL SYSTEM <6G72 Engine> – Top Dead Center Sensor (P.13-44).

INSPECTION

Wave Pattern Inspection Using an Analyzer



Measurement method

(1) Disconnect the crankshaft angle sensor connector and connect the special tool (test harness: MB998464) in between.
(2) Connect the analyzer special patterns pickup to terminal ④ (white clip) of the crankshaft angle sensor connector. (When inspecting the TDC sensor signal wave pattern.)
(3) Connect the analyzer special patterns pickup to terminal ① (red clip) of the crankshaft angle sensor connector. (When inspecting the crankshaft angle sensor signal wave pattern.)

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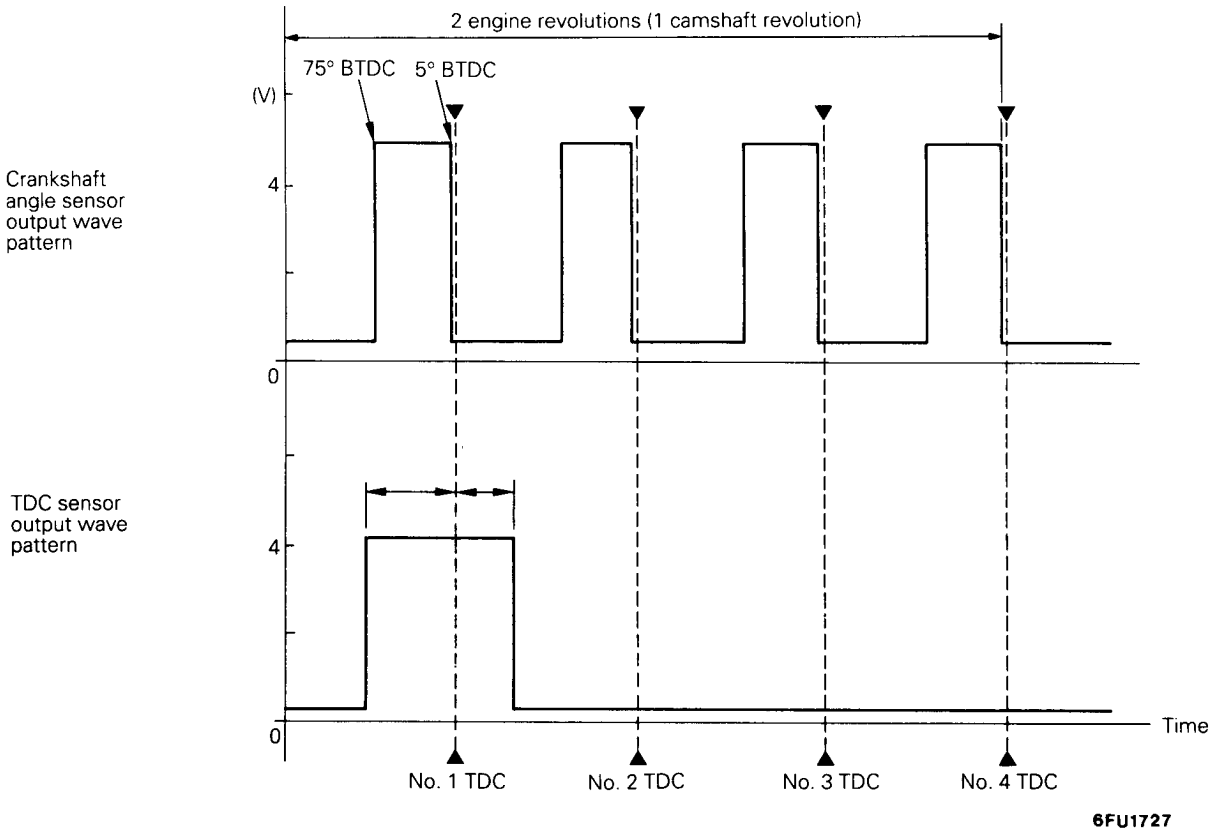
Standard wave pattern

Observation conditions

Function	Special patterns
Pattern height	Low
Pattern selector	Display
Engine r/min.	Idle r/min. (750 r/min.)



Wave pattern observation points

Check that cycle time T becomes shorter and the frequency increases when the engine speed is increased.

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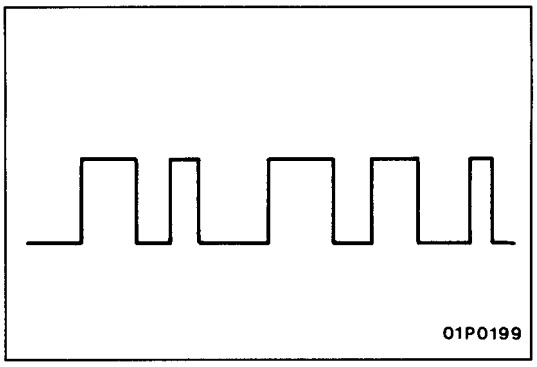


Examples of abnormal wave patterns

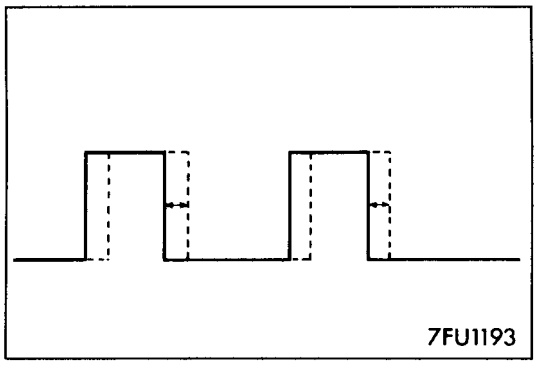
- Example 1

Cause of problem

Sensor interface malfunction

Wave pattern characteristics

Short wave pattern is output even when the engine is not started.



- Example 2

Cause of problem

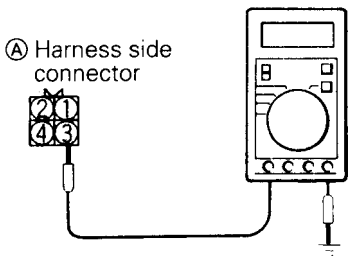
Loose timing belt
Abnormality in sensor disk

Wave pattern characteristics

Wave pattern is displaced to the left or right.

HARNESS INSPECTION

1



Measure the power supply voltage.

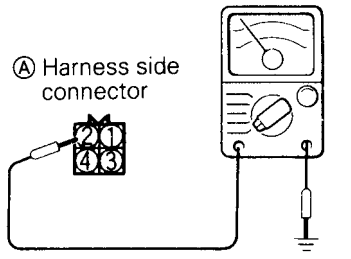
- Connector: Disconnected
- Ignition switch: ON

Voltage (V)
5V

OK → 2

NG → Repair the harness. (Ⓐ3 – ignition switch)

2



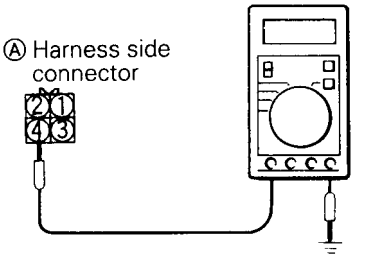
Check for continuity of the earth circuit.

- Connector: Disconnected

OK → 3

NG → Repair the harness. (Ⓐ2 – Earth)

3



Check the voltage of the output circuit.

- Connector: Disconnected
- Ignition switch: ON

Voltage (V)
4.8–5.2

OK → STOP

NG → Repair the harness. (Ⓐ4 – 22)

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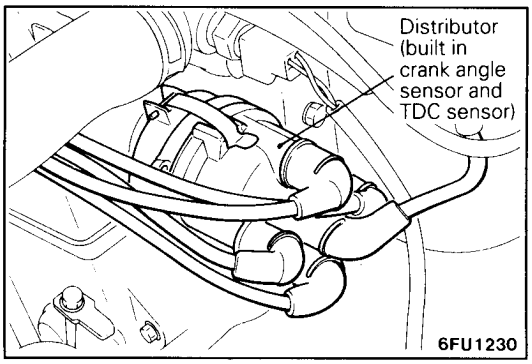
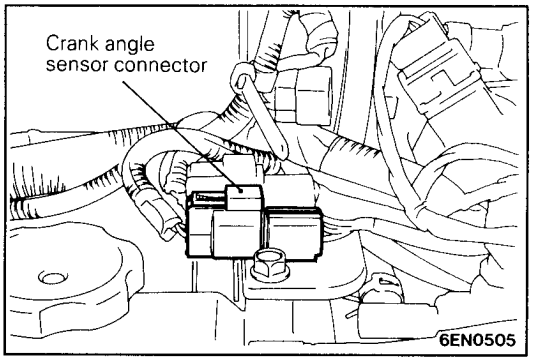
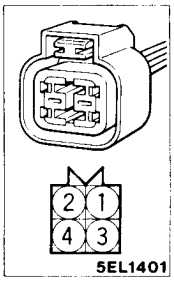
CRANK ANGLE SENSOR

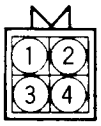


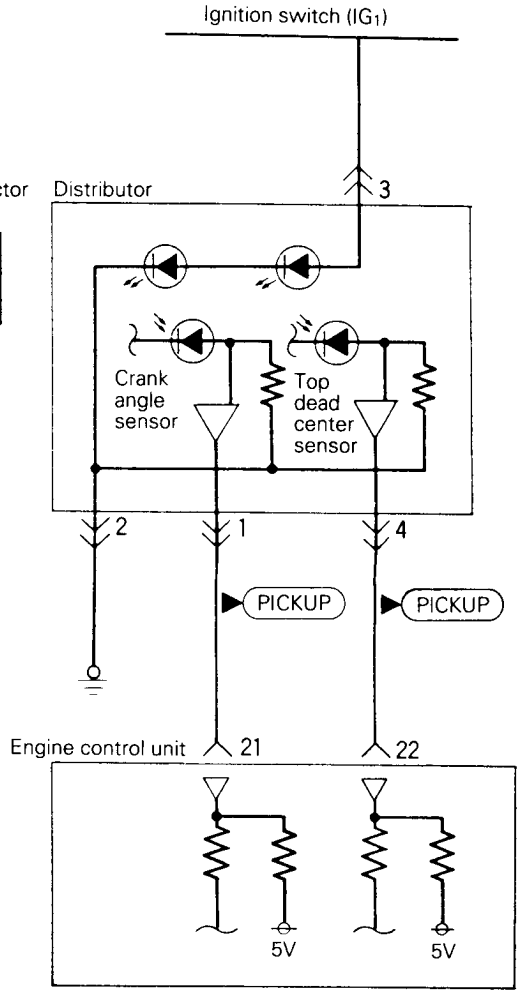


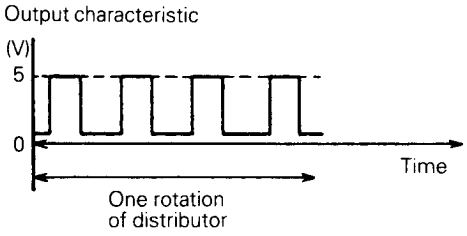


Ⓐ Harness side connector

Ⓐ Equipment side connector







6FU1745

OPERATION

TROUBLESHOOTING HINTS

FUEL SYSTEM <6G72 Engine> – Refer to Crank Angle Sensor (P.13-48.)

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INSPECTION

Using Multi-use tester

Function	Item No.	Data display	Check conditions	Check description	Normal condition
Data reading	22	Cranking r/min.	• Engine is being cranked. • Tachometer connected. (The tachometer is used to check the intermittent pulsation of the ignition coil's primary current.)	Compare the cranking rpm and the rpm indicated by the multi-use tester.	Both agree.

Function	Item No.	Data display	Check conditions	Engine coolant temperature °C (°F)	Standard value r/min.
Data reading	22	Idling r/min.	• Engine: idling • Idle-position switch: ON	When –20 (–4)	1,300–1,500
				When 0 (32)	1,300–1,500
				When 20 (68)	1,150–1,350
				When 40 (104)	950–1,150
				When 80 (176)	650–850

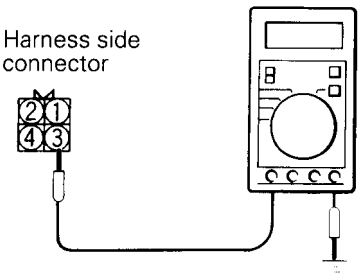
Wave Pattern Inspection Using an Analyzer

Refer to the top dead center sensor section (P.13-118).

HARNESS INSPECTION

1

Ⓐ Harness side connector



01L0411

Measure the power supply voltage.
- Connector: Disconnected
- Ignition switch: ON

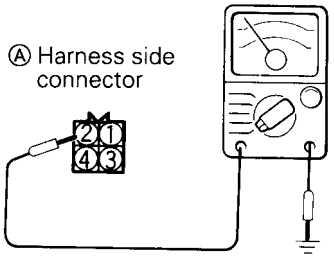
Voltage (V)
5V

OK → 2

NG → Repair the harness. (Ⓐ3 – ignition switch)

2

Ⓐ Harness side connector



01A0270

Check for continuity of the earth circuit.
- Connector: Disconnected

OK → 3

NG → Repair the harness. (Ⓐ2 – Earth)

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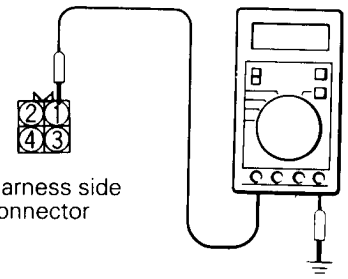
3		Check the voltage of the output circuit. • Connector: Disconnected • Ignition switch: ON Voltage (V): 4.8–5.2	OK → STOP NG → Repair the harness. (Ⓐ1 – 21)

IGNITION SWITCH – ST

Refer to P.13-50.

VEHICLE SPEED SENSOR

Refer to P.13-54.

AIR CONDITIONER SWITCH AND POWER RELAY

Refer to P.13-56.

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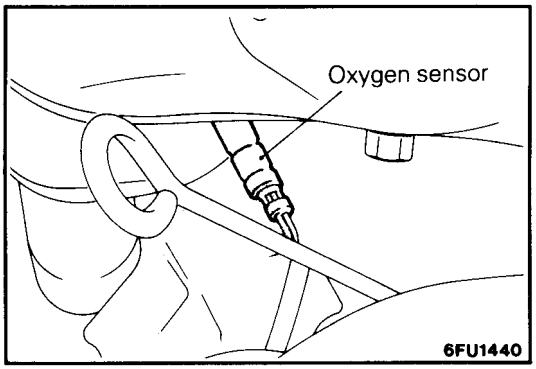
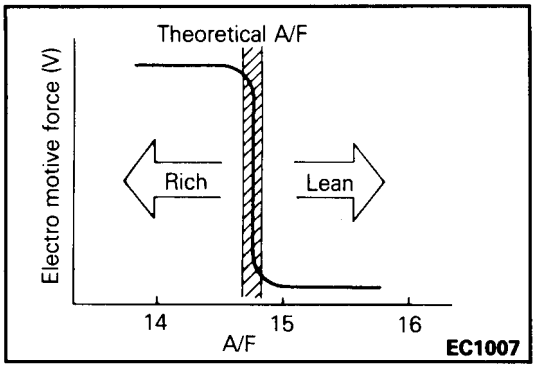
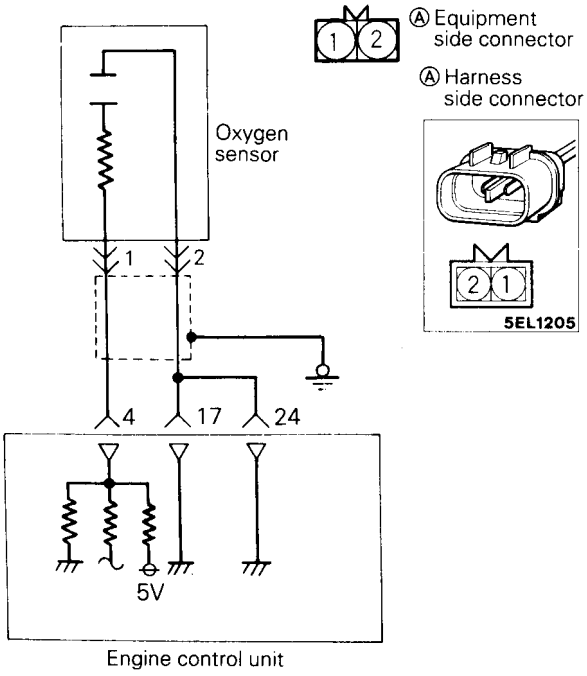
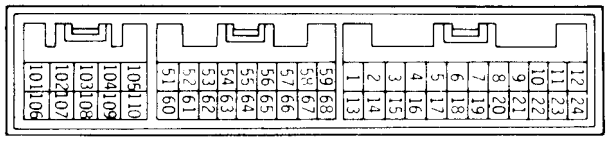
OXYGEN SENSOR







Engine control unit connector



OPERATION

- The oxygen sensor functions to detect the concentration of oxygen in the exhaust gas; it converts those data to voltage, and inputs the resulting signals to the engine control unit.
- If the air/fuel mixture ratio is richer than the theoretical air/fuel mixture ratio (i.e., if the concentration of oxygen in the exhaust gas is sparse), a voltage of approximately 1V is output; if the air/fuel mixture ratio in leaner than the theoretical air/fuel mixture ratio (i.e., if the concentration is dense), a voltage of approximately 0V is output.
- The engine control unit, based upon those signals, regulates the amount of fuel injection so that the air/fuel mixture ratio becomes the theoretical air/fuel mixture ratio.

TROUBLESHOOTING HINTS

Hint 1:
The exhaust gas purification performance will worsen if there is a malfunction of the oxygen sensor.
Hint 2:
If the oxygen sensor output voltage deviates from the standard value even though the results of the checking of the oxygen sensor are normal, the cause is probably a malfunction of a component related to air/fuel mixture ratio control.

[Examples]
(1) Malfunction of an injector.
(2) Air leakage into the intake manifold from a leaking gasket.
(3) Malfunction of the air-flow sensor, the intake air temperature sensor, the barometric-pressure sensor, or the Engine coolant temperature sensor.

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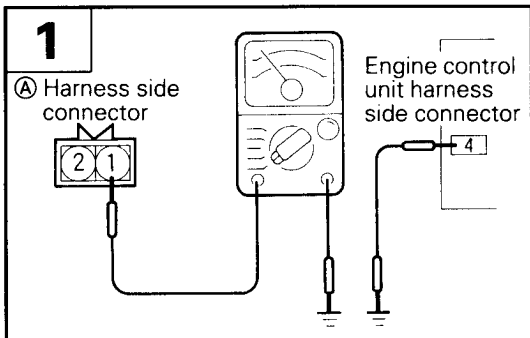
INSPECTION

Using Multi-use tester (MUT)

Function	Item No.	Data display	Check conditions	Engine condition r/min.	Standard value mV
Data reading	11	Sensor detection voltage	• Engine: warm-up (Make the mixture lean by engine speed reducion, and rich by racing.)	When sudden deceleration from 4,000	200 or lower
				When engine is suddenly raced	600 – 1,000
			• Engine: warm up using the oxygen sensor signal, check the air/fuel mixture ratio, and also check the condition of control by the engine control unit	750 (Idling)	400 or lower ↕ (changes) 600 – 1,000
				2,000	

HARNESS INSPECTION

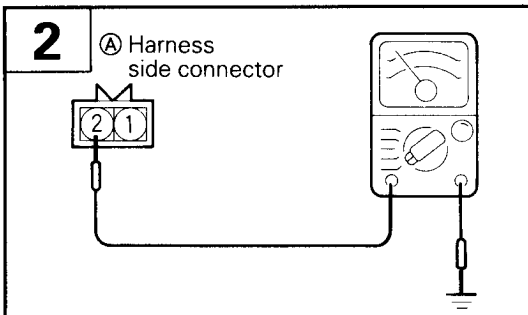
1



Check for an open-circuit or a short-circuit to earth, between the engine control unit and the oxygen sensor.
- Oxygen sensor connector: Disconnected
- Engine control unit connector: Disconnected

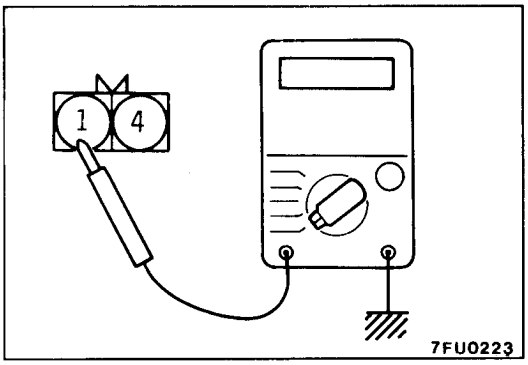
OK → 2
Repair the harness. (A 1 – 4)

2



Check for continuity of the earth circuit.
- Connector: Disconnected

OK → STOP
Repair the harness. (Ⓐ 2 – Earth)



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SENSOR INSPECTION

Caution

1. **Before checking, warm up the engine until engine coolant temperature reaches 80 to 95°C (176 to 205°F).**
2. **Use an accurate digital voltmeter.**

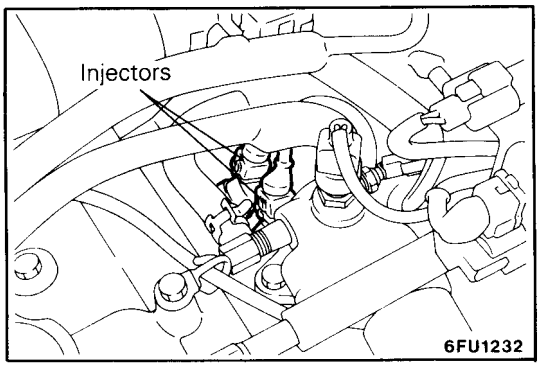
(1) Disconnect the oxygen sensor connector and connect a volt-meter to the oxygen sensor connector.
(2) While repeating engine racing, measure the oxygen sensor output voltage.

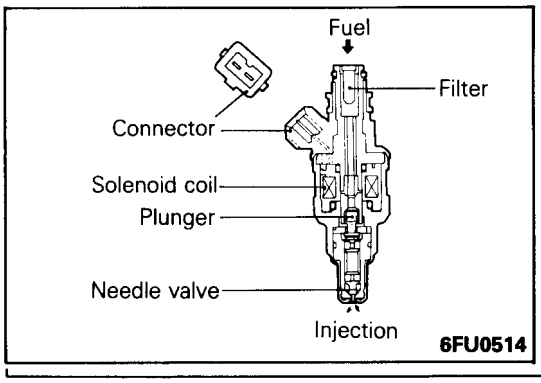
Engine	Oxygen sensor output voltage	Remarks
Race	0.6 – 1.0 V	Make air-fuel mixture rich by accelerator operation

PWJE9086

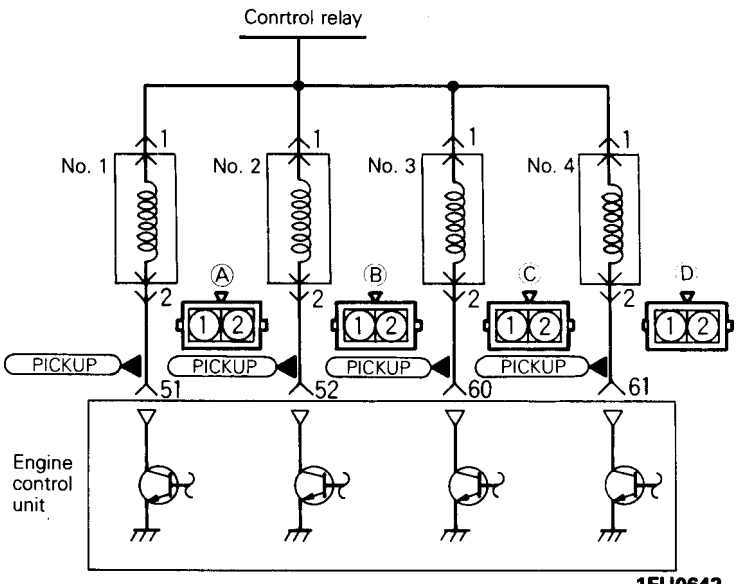
NOTE
For removal and installation of the oxygen sensor, refer to GROUP 15 – Exhaust Manifold.

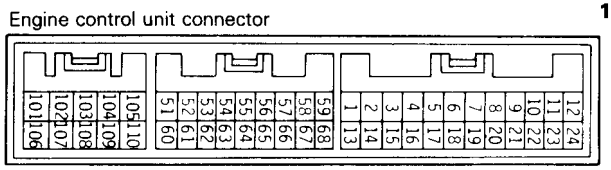
INJECTORS





M13YTAB





OPERATION

- The injectors are electromagnetic-valve-equipped injection nozzles that function to inject fuel based upon injection signals from the engine control unit.
- Because the surface area of the injection ports is fixed and because the pressure of the fuel relative to the pressure within the manifold is also regulates to a fixed pressure, the amount of fuel injection by injectors is determined by the length of time that the needle valve is open, or, in other words, by the length of time of current flow to the solenoid coil.
- Battery power supply is supplied, by way of the control relay, to the injectors. When the engine control unit switches ON the power transistor within the unit and current flows to the solenoid coil, the injectors open and fuel is injected.

TROUBLESHOOTING HINTS

Hint 1:
If there is a problem with starting while the engine is warm, perform the combustion test and check for leakage of the injectors.
Hint 2:
If the engine can't be started, and the injectors are not activated during cranking, the cause is probably a malfunction such as described below, not with the injectors.

(1) Malfunction of the circuit for supply of power to the engine control unit, or of the earth circuit.
(2) Malfunction of the control relay.
(3) Malfunction of the crank-angle sensor and/or the top dead center sensor.

Hint 3:
If there is a cylinder for which the idling condition does not change when, during idling, the fuel injection of the injectors is cut off in sequence, check that cylinder as described below.
(1) Check the injector and harness.
(2) Check the spark plugs and the high-tension cable.
(3) Check the compression pressure.

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Hint 4:
If the injector activation time deviates from the standard value even though the results of the checking of the injector's harness and of the injector itself are normal, the cause may be presumed to be one of the following.

(1) Incomplete combustion within the cylinder. (Malfunction of the spark plugs, the ignition coil, the compression pressure, etc.)
(2) Improper adhesion of EGR valve sheet.
(3) Increased engine resistance.

INSPECTION

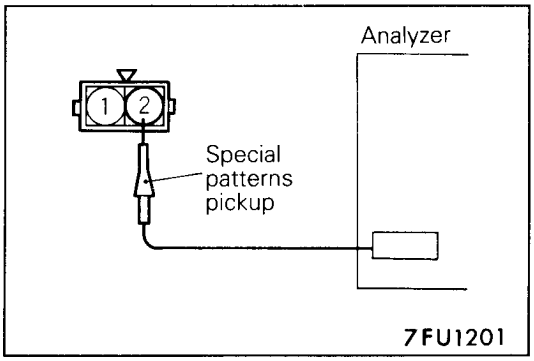
Using Multi-use tester

Function	Item No.	Data display	Check conditions	Engine coolant temperature °C (°F)	Standard value ms
Data reading	41	Activation time*1	Engine cranking	When 0 (32)*2	Approx. 20
				When 20 (68)	Approx. 41
				When 80 (176)	Approx. 10

Function	Item No.	Data display	Check conditions	Engine condition r/min.	Standard value ms
Data reading	41	Activation time *3	• Engine coolant temp: 80–95°C (176–203°F) • Lights and accessories: OFF • Transmission: neutral • Steering wheel: neutral position	750 (idling)	2.9–4.1
				2,000	2.0–3.2
				When raced suddenly	Increases.

NOTE
*1: Indicates the injector-activation time when the power source voltage is 11V and the cranking speed is 250 rpm or less.
*2: At a coolant temperature of 0°C (32°F), there is synchronous injection for all four cylinders.
*3: For a new vehicle [driven approximately 500 km (300 miles) or less] the injector-activation may be about ten percent longer then indicated above.

Function	Item No.	Activation description	Check conditions	Normal condition
Actuator test	01	No. 1 injector shut-off	• Engine: idling after warm-up (shut off the injectors in sequence during after engine warm-up, check the idling condition)	Idling condition changes more (Becomes more unstable, or the engine stalls.)
	02	No. 2 injector shut-off		
	03	No. 3 injector shut-off		
	04	No. 4 injector shut-off		



Wave Pattern Inspection Using an Analyzer

Measurement method

(1) Disconnect the injector connector, and connect the special tool (test harness: MB991348) in between. (The power side and the ECU side terminals should both be connected.)
(2) Connect the analyzer special patterns pickup to the ECU test harness clip.

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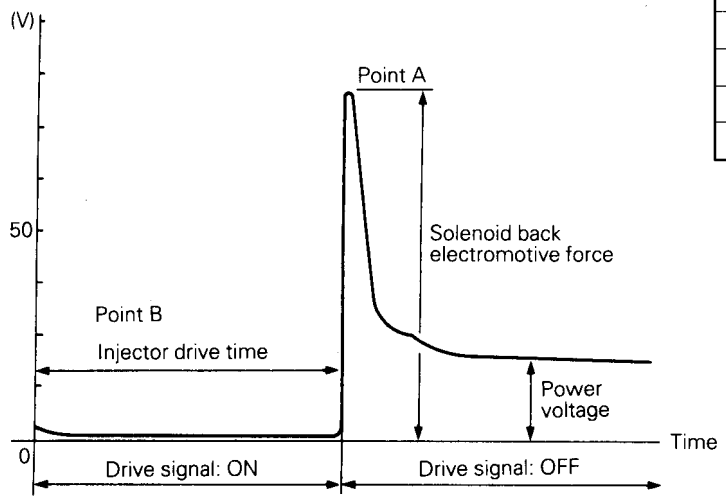
Standard wave pattern



7FU1202

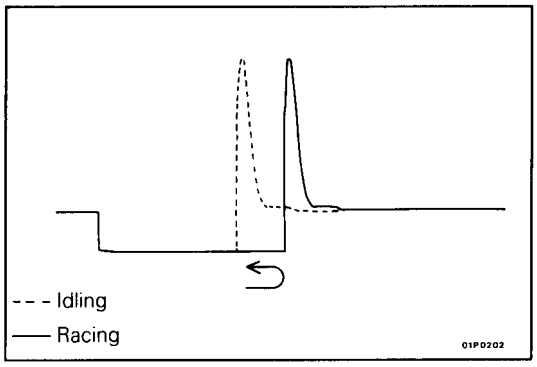
Observation conditions

Function	Special patterns
Pattern height	Variable
Variable knob	Adjust by monitoring wave
Pattern selector	Display
Engine r/min.	Idle r/min. (750 r/min.)

Wave pattern observation points

(Point A): Height of back electromotive force in the solenoid coil

Contrast with standard wave pattern	Probable cause
Solenoid coil back electromotive force is low or doesn't appear at all.	Short in the injector solenoid



(Point B): Injector drive time

- The injector drive timing will synchronized with the multi-use tester display.
- When the engine is suddenly raced, the drive time will be greatly extended at first, but the drive time will soon match the engine speed.

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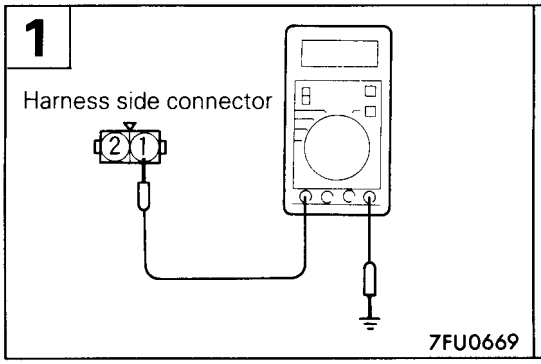
HARNESS INSPECTION

1



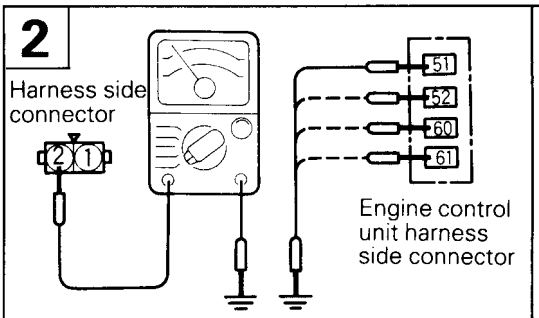
Measure the power supply voltage of the injector.
- Connector: Disconnected
- Ignition switch: ON

Voltage (V)
5V

OK → 2

NO → Repair the harness. (ⒶⒷⒸⒹ1 – Control relay) Check the power supply.

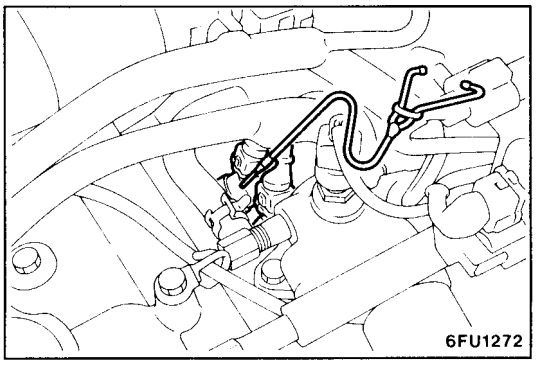
2



Check for an open-circuit, or a short-circuit earth, between the engine control unit and the injector.
- Engine control unit connector: Disconnected
- Injector connector: Disconnected

OK → STOP

NO → Repair the harness. (ⒶⒷⒸⒹ2 – 51, 52, 60, 61)



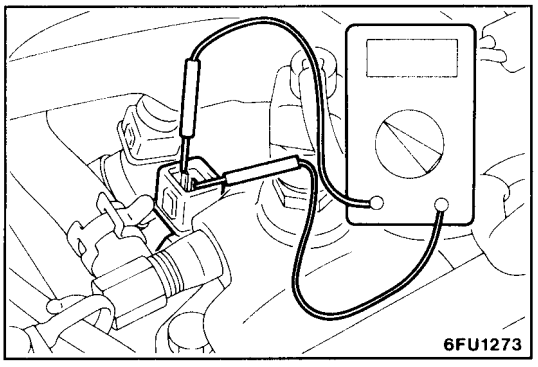
ACTUATOR INSPECTION

Checking Operation Sound

Using a sound scope, check the operation sound ("chi-chi-chi") of injectors during idling or during cranking.
Check that as the rotating speed increases, the frequency of the operating sound also increases.

Caution
Note that even if the injector you are checking is not operating, you will hear the operating sound of the other injectors.

NOTE
If no operating sound is heard from the injector that is being checked, check the injector drive circuit. If there is nothing wrong with the circuit, a defective injector or engine control unit is suspected.



Measureing Resistance Between Terminals

(1) Remove the injector connector.
(2) Measure the resistance between the terminals.
Standard value: 13–16 Ω [at 20°C (68°F)]
(3) Install the injector connector.

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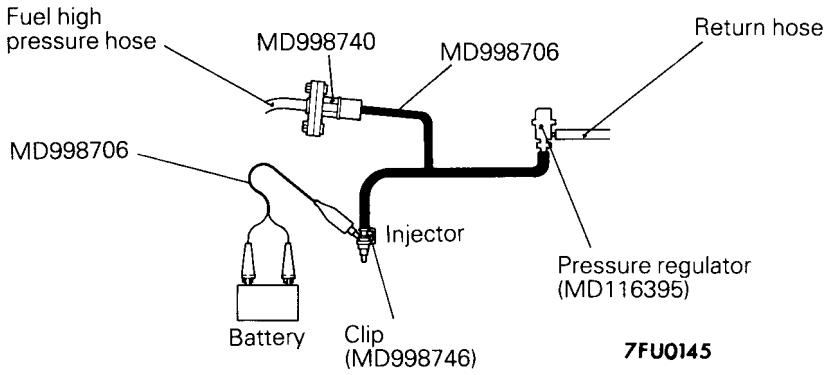
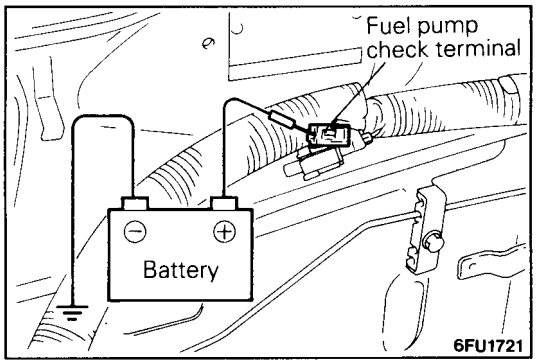
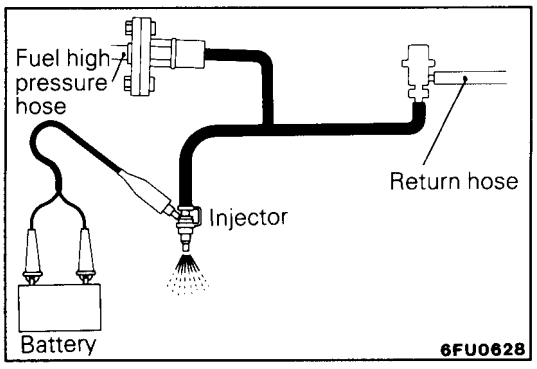
Checking the Injection Condition

(1) Following the steps below, bleed out the residual pressure within the fuel pipe line to prevent flow of the fuel. (Refer to P.13-89.)
(2) Remove the injector.
(3) Arrange the special tool (injector test set), adaptor, fuel pressure regulator and clips as shown in the illustration below.

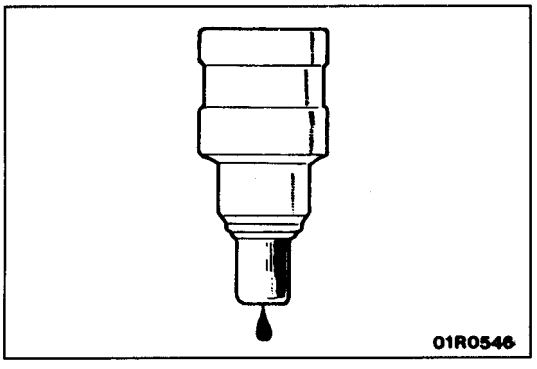




(4) Connect the battery's negative (–) terminal.
(5) Apply battery voltage to the fuel pump check terminal and activate the fuel pump.



(6) Activate the injector and check the atomized spray condition of the fuel.
The condition can be considered satisfactory unless it is extremely poor.



(7) Stop the actuation of the injector, and check for leakage from the injector's nozzle.

Standard value: 1 drop or less per minute

(8) Activate the injector without activating the fuel pump; then, when the spray emission of fuel from the injector stops, disconnect the special tool and restore it to its original condition.

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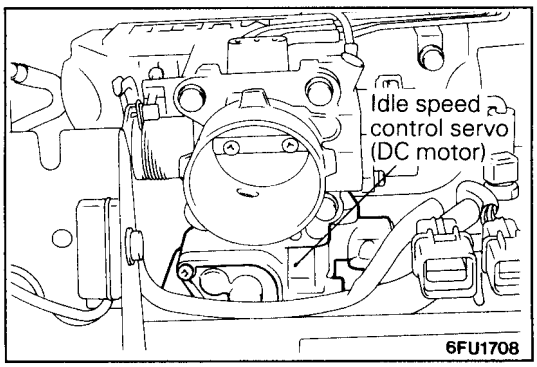
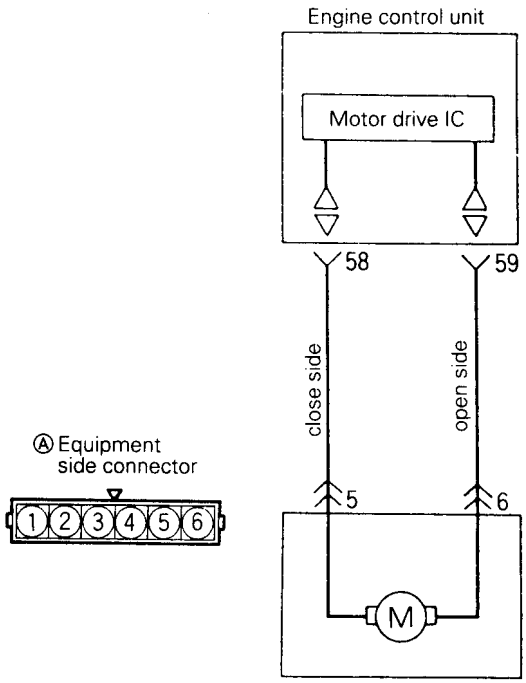
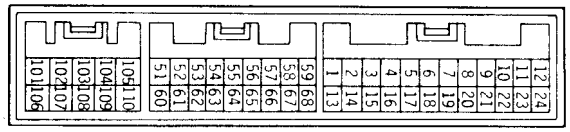
IDLE SPEED CONTROL SERVO (DC MOTOR)





6FU1734

Engine control unit connector



OPERATION

- The volume of intake air during engine idling is controlled by the opening and closing of the servo valve for bypassing the throttle valve, located at the air intake port.
- The servo valve opens and closes depending on whether the DC motor inside the engine idling speed control servo is turning clockwise or anti-clockwise.
- The DC motor turns clockwise or anti-clockwise according to the change in the direction of current in the motor drive IC inside the engine control unit.

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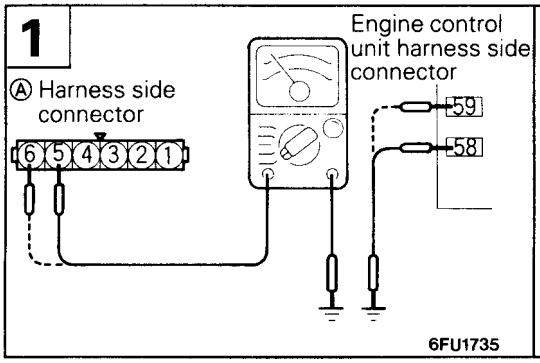
TROUBLESHOOTING HINTS

Hint 1: While the engine is idling, if the engine idling speed and servo valve position (step) change when the air conditioner switch is turned to ON and OFF, it can be assumed that the engine idling speed control servo and the servo valve position sensor are operating normally.

Hint 2: If the servo valve position (step) is outside the standard position, the malfunction is probably one of the following:
(1) Basic engine idling speed adjustment is wrong.
(2) Some deposit is adhering to the throttle valve.
(3) Air is being drawn into the air intake manifold through a defective gasket seal.
(4) Fuel injection malfunction inside a cylinder.
(Spark plug, ignition coil, injector or compression pressure is defective.)

HARNESS INSPECTION

1  	Check for an open-circuit, or a short-circuit to earth, between the engine control unit and the idle speed control servo.	OK →	STOP
		NO →	Repair the harness. (Ⓐ5 – 58 Ⓐ6 – 59)

ACTUATOR INSPECTION

Use a sound scope to check if the sound of the ISC servo operating can be heard immediately after the ignition switch is turned to "ON".

NOTE
If the sound of the servo operating cannot be heard, inspect the motor drive circuit and the ISC servo motor.

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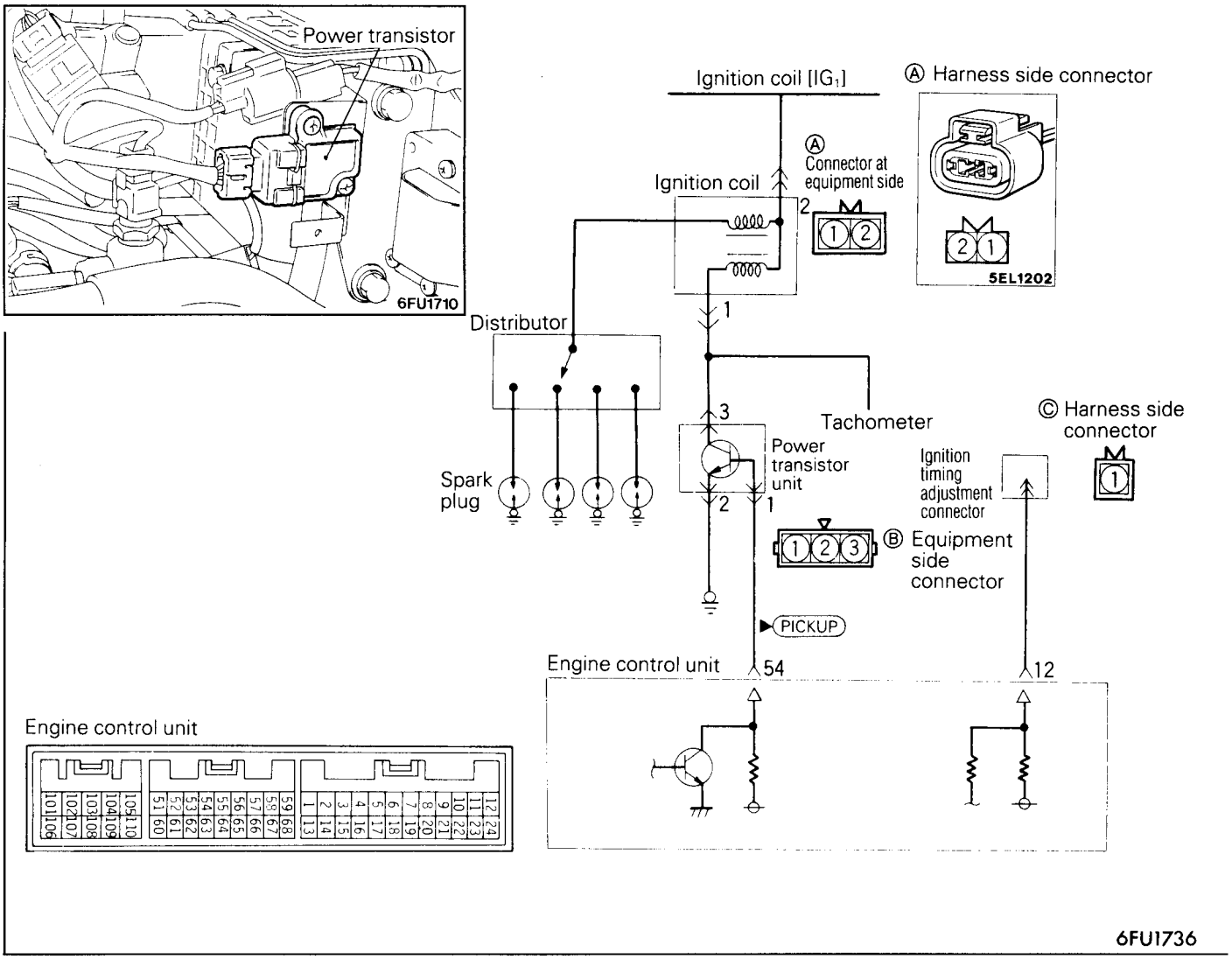
IGNITION COIL AND POWER TRANSISTOR



OPERATION

FUEL SYSTEM <6G72 Engine> – Refer to Ignition Coil and Power Transistor (P.13-71).

INSPECTION

Using Multi-use tester

Function	Item No.	Data display	Check conditions	Engine condition r/min.	Standard value °BTDC
Data reading	44	Spark advance	• Engine: warm • Timing light: set (The timing light is set so as to check the actual ignition timing.)	750 (Idling)	2–16
				2,000	30–50

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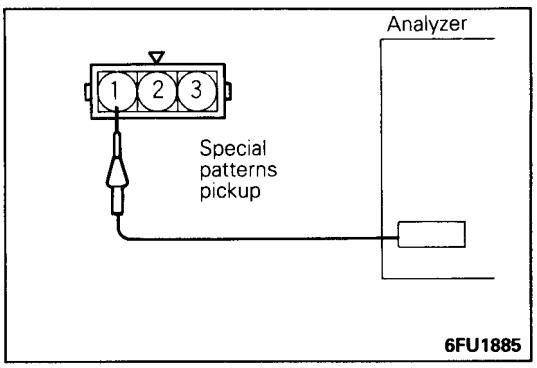


Wave Pattern Inspection Using an Analyzer

- Ignition coil primary signal
  Refer to GROUP 16 – Ignition System.
- Power transistor control signal

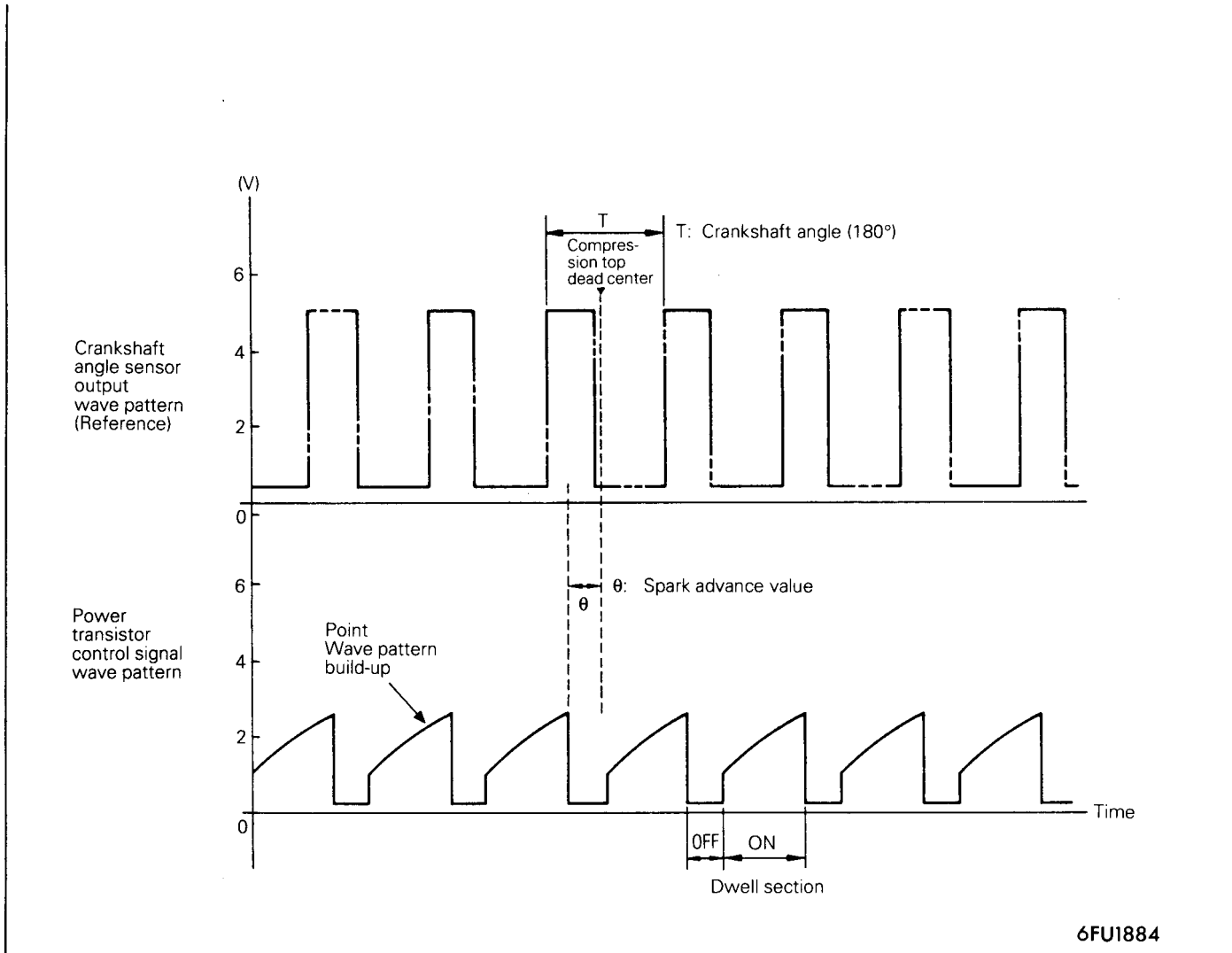
<Measurement method>

(1) Disconnect the power transistor connector, and connect the special tool (test harness: MB991348) in between. (All terminals should be connected.)
(2) Connect the analyzer special patterns pickup to the power transistor connector terminal (3).

<Standard wave pattern>

Observation conditions

Function	Special patterns
Pattern height	Low
Pattern selector	Display
Engine r/min.	Approx. 2,000 r/min.



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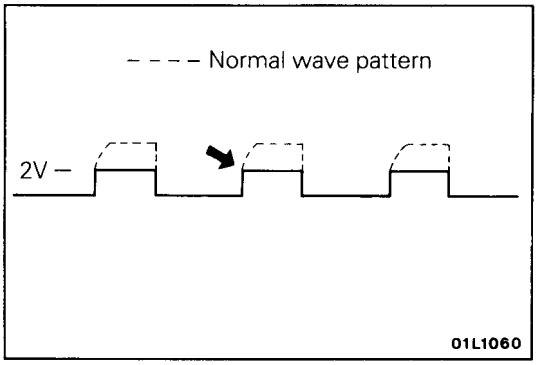
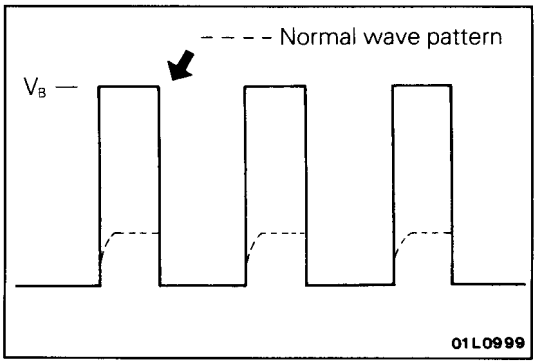




Wave pattern observation points

(Point): Condition of wave pattern build-up and maximum voltage (Refer to abnormal wave pattern examples 1 and 2.)

Examples of abnormal wave patterns

- Example 1

  Wave pattern during engine cranking

  Cause of problem

  Broken wire in ignition primary circuit

  Wave pattern characteristics

  Top-right part of the build-up section cannot be seen, and voltage value is approximately 2V too low.

- Example 2

  Wave pattern during engine cranking

  Cause of problem

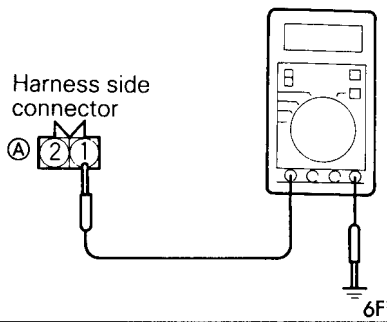
  Malfunction in power transistor

  Wave pattern characteristics

  Power voltage results when the power transistor is ON.

HARNESS INSPECTION

1



Measure the power supply voltage of the ignition coil.

- Connector: Disconnected
- Ignition switch: ON

Voltage (V)
5V

OK → 2

NG → Repair the harness. (Ⓐ1 – Ignition switch)

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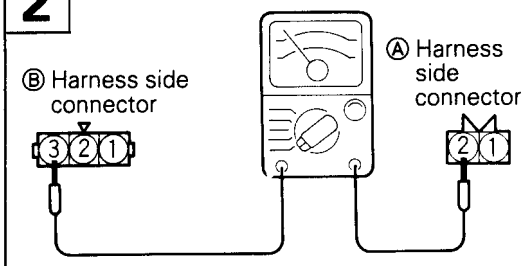
2



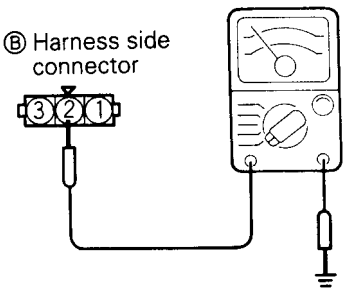
6FU1739

Check for an open-circuit, or a short-circuit to earth, between the power transistor and ignition coil.
- Ignition coil connector: Disconnected
- Power transistor connector: Disconnected

OK → 3

NG → Repair the harness. (Ⓐ2 – Ⓑ3)

3



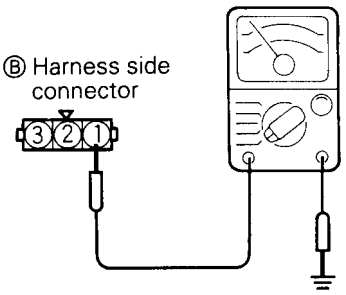
7FU0837

Check for continuity of the earth circuit.
- Connector: Disconnected

OK → 4

NG → Repair the harness. (Ⓑ2 – Earth)

4



7FU0838

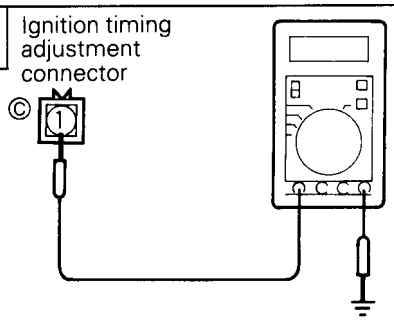
Measure the voltage of the control signal circuit of the power transistor.
- Connector: Disconnected
- Ignition switch: START

Voltage (V)
2–6

OK → 5

NG → Repair the harness. (Ⓑ1 – 54)

5



7FU1060

Measure the voltage of the ignition timing adjustment terminal.
- Ignition switch: ON

Voltage (V)
4.0–5.2

OK → STOP

NG → Repair the harness. (Ⓒ1 – 12)

ACTUATOR INSPECTION

Refer to GROUP 16.

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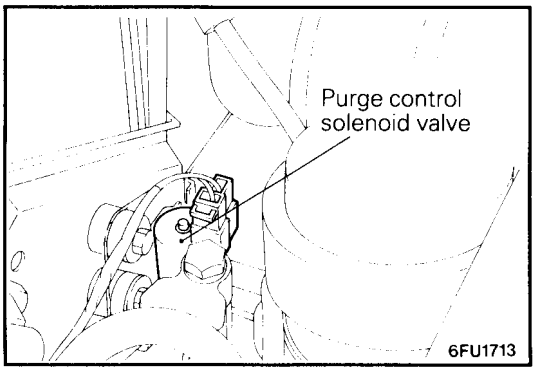
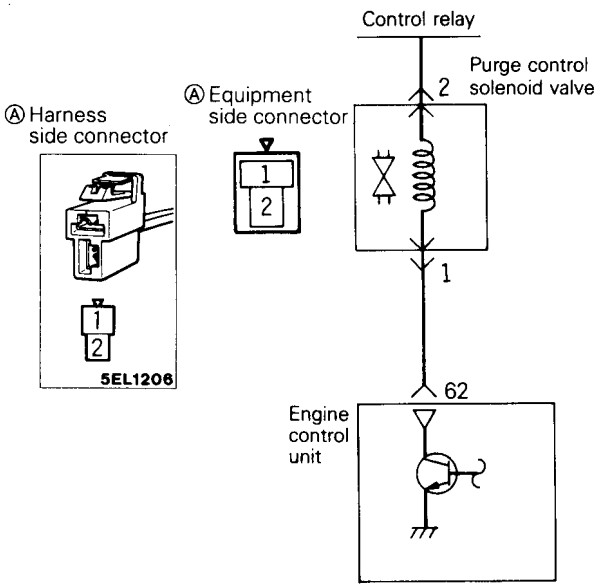
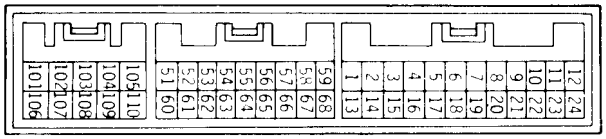
PURGE CONTROL SOLENOID VALVE





01A0324

Engine control unit connector



01L0838

OPERATION

- The purge-control solenoid valve is an ON/OFF type of solenoid valve; it functions to regulate the introduction of purge air from the canister to the intake air plenum.
- Battery power is supplied, by way of the control relay, to the purge-control solenoid valve. When the engine control unit switches ON the power transistor within the unit, current flows to the coil, and purge air is introduced.

INSPECTION

Using Multi-use tester

Function	Item No.	Activation	Check conditions	Normal condition
Actuator test	08	Solenoid valve is switched from OFF to ON.	• Ignition switch: ON	Operating sound is heard when driven.

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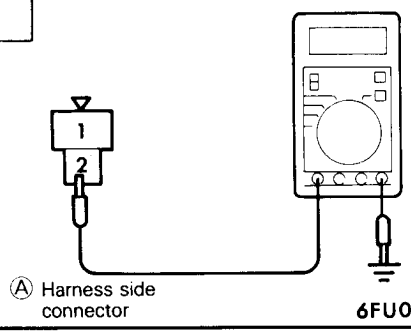
HARNESS INSPECTION

1

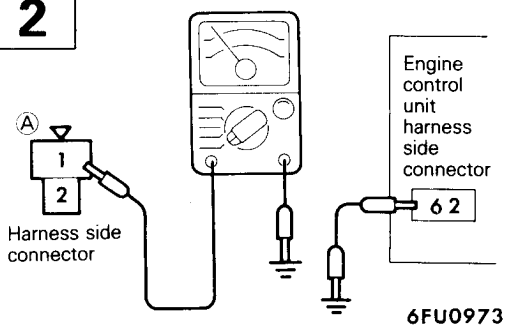


Measure the power supply voltage.
- Connector: Disconnected
- Ignition switch: ON

Voltage (V)
5V

OK → 2
Repair the harness. (Control relay – Ⓐ 2)

2



Check for an open-circuit, or a short-circuit to earth, between the purge control solenoid valve and the engine control unit.
- Purge control solenoid valve connector: Disconnected
- Engine control unit connector: Disconnected

OK → STOP
Repair the harness. (Ⓐ 1 – 62)

ACTUATOR INSPECTION

Refer to GROUP 17.

FUEL PRESSURE

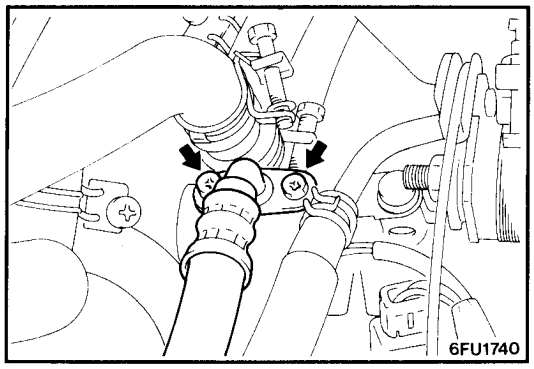
M13YXAE

HOW TO REDUCE THE FUEL LINE INTERNAL PRESSURE

Refer to P.13-89.

FUEL PUMP OPERATION CHECK

Refer to P.13-89.

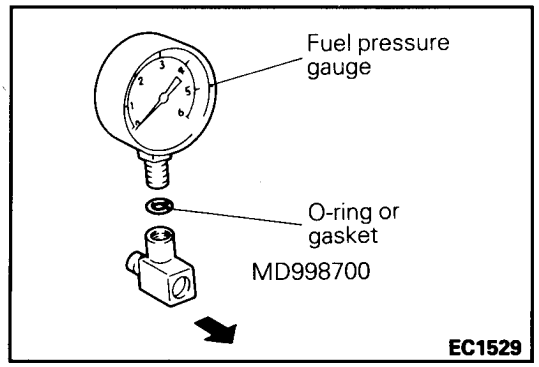


FUEL PRESSURE TEST

(1) Remove all remaining pressure from inside the fuel pipe line to prevent splash of fuel. (Refer to P.13-89.)

(2) Disconnect the fuel high pressure hose at the delivery pipe side.

Caution
Cover the hose connection with shop towel to prevent splash of fuel that could be caused by some residual pressure in the fuel pipe line.



(3) Set a fuel pressure gauge on the special tool, placing an adequate O-ring or gasket between the gauge end special tool prevent fuel leaks.

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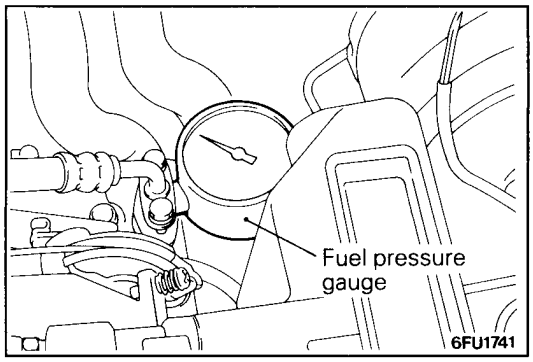
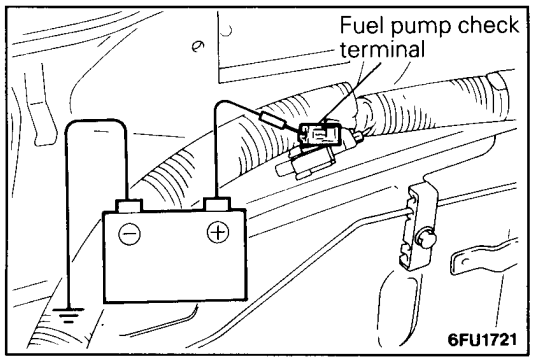
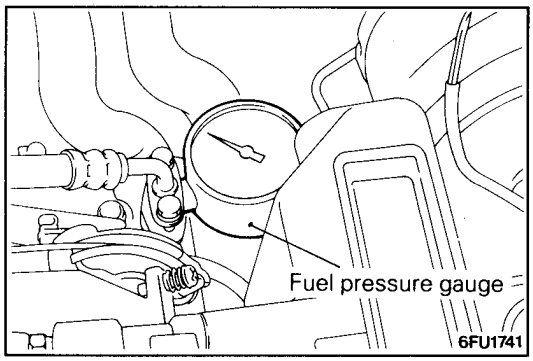


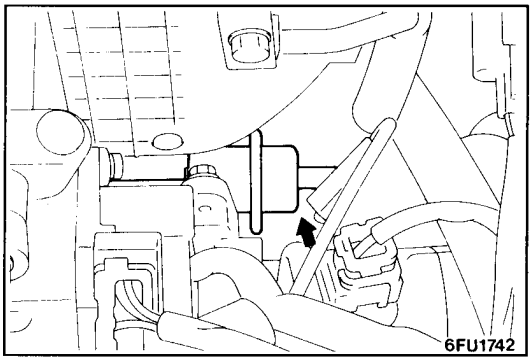
(4) Attach pressure gauge set in step (3) to the delivery pipe.
(5) Connect the (–) battery terminal.



(6) Connect a jumper wire to the terminal for activation of the fuel pump and to the positive (+) terminal of the battery to activate the fuel pump. With fuel pressure applied, check to be sure that there is no fuel leakage from the fuel pressure gauge and the special tool connection part.
(7) Disconnect the jumper wire (from the terminal for activation of the fuel pump) to stop the fuel pump.
(8) Start the engine and let it idle.



(9) Measure the fuel pressure during idling.
Standard value: Approx. 270 kPa (2.7 kg/cm^2, 38 psi) at curb idle



(10) Disconnect the vacuum hose from the fuel pressure regulator, and then measure the fuel pressure while using a finger to plug the end of the hose.
Standard value: 330–350 kPa (3.3–3.5 kg/cm^2, 47–50 psi) at curb idle speed
(11) Check to be sure that the fuel pressure during idling does not decrease even after the engine is raced a few times.

(12) Use a finger to gently press the fuel return hose while repeatedly racing the engine, and check to be sure that there is fuel pressure in the return hose also.

NOTE
There will be no fuel pressure in the return hose if there is insufficient fuel flow.

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(13)If the fuel pressure measured in steps (9) to (12) deviates from the standard value range, check for the probable cause by referring to the table below, and then make the appropriate repair.

Condition	Probable cause	Remedy
• Fuel pressure is too low. • Fuel pressure drops during racing. • No fuel pressure in fuel return hose.	Fuel filter is clogged.	Replace the fuel filter.
	Malfunction of the valve seat within the fuel pressure regulator, or fuel leakage to return side caused by spring deterioration.	Replace the fuel pressure regulator.
	Fuel pump low discharge pressure.	Replace the fuel pump.
Fuel pressure is too high.	The valve within the fuel pressure regulator is sticking.	Replace the fuel pressure regulator.
	Clogging of the fuel return hose and/or the pipe.	Clean or replace the hose and/or pipe.
No change of the fuel pressure when vacuum hose is connected and when not connected.	Damaged vacuum hose or nipple clogging.	Replace the vacuum hose, or clean the nipple.

(14)Stop the engine and check for a change of the value indicated by the fuel pressure gauge. The condition is normal if there is no decrease of the indicated value within two minutes.
If there is a decrease of the indicated value, monitor the speed of the decrease, and, referring to the table below, determine the cause of the problem and make the appropriate repair.

Condition	Probable cause	Remedy
After the engine is stopped, the fuel pressure drops gradually.	Injector leakage.	Replace the injector.
	Leakage at the fuel pressure regulator valve seat.	Replace the fuel pressure regulator.
There is a sudden sharp drop of the fuel pressure immediately after the engine is stopped.	The check valve (within the fuel pump) is not closed.	Replace the fuel pump.

(15)Remove all remaining pressure from inside the fuel pipe. (Refer to P.13-89.)
(16)Disconnect the fuel pressure gauge and the special tool from the delivery pipe.

Caution
Because there will be a slight amount of remaining pressure in the fuel pipe line, use rags to cover so that fuel doesn't splatter.

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(17)Replace the O-ring at the end of the fuel high-pressure hose with a new one.

(18)After connecting the fuel high-pressure hose to the delivery pipe, tighten the installation bolt at the specified torque.

Tightening torque: 5 Nm (0.5 kgm, 3.6 ft.lbs.)

(19)Check to be sure that there is no fuel leakage.

① Apply battery voltage to the terminal for activation of the fuel pump so as to activate the fuel pump.

② With fuel pressure applied, check for leakage of the fuel line.

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FUEL SYSTEM <4D56 Engine>

SPECIFICATIONS

GENERAL SPECIFICATIONS

E13CA-C

Items	Specifications
Fuel	
Tank capacity dm^3 (U.S. gal., Imp. gal.)	
Standard Wheelbase	75 (19.8, 16.5)
Long Wheelbase	92 (24.3, 20.2)
Fuel injection pump	
Type	Distribution type
Governor type	Half all speeds
Feed pump type	Vane type
Injection nozzle	
Nozzle type	Throttle type
Holder type	Screwed-in type

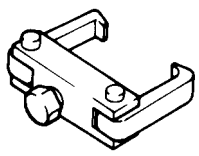
SERVICE SPECIFICATIONS

E13CB-C

Items		Specifications
Standard value		
Accelerator cable play	mm (in.)	0–1 (0–0.04)
Fuel cut solenoid valve coil resistance	Ω	8–10
Injection pressure	kPa (kg/cm^2, psi)	11,770–12,750 (120–130, 1,707–1,849) <Vehicles without EGR system built up to 1994> 14,710–15,690 (150–160, 2,133–2,276) <Vehicles with EGR system built up to 1994, Vehicles built from 1995>

SPECIAL TOOL

E13DA-C

Tool	Number	Name	Use
	MD998388	Injection pump sprocket puller	Removal of sprocket from drive shaft of injection pump

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SERVICE ADJUSTMENT PROCEDURES

FUEL INJECTION TIMING INSPECTION AND ADJUSTMENT E13FKAD

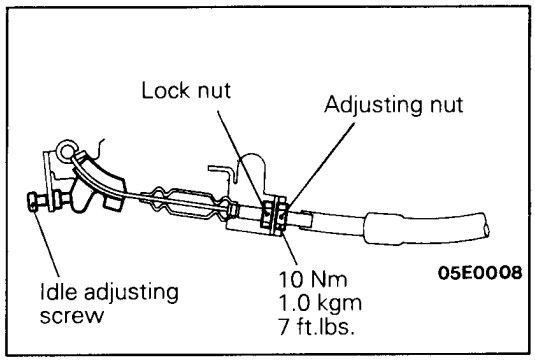
Refer to GROUP 11 – Service Adjustment Procedures.

ENGINE IDLING SPEED INSPECTION AND ADJUSTMENT E13HBAA

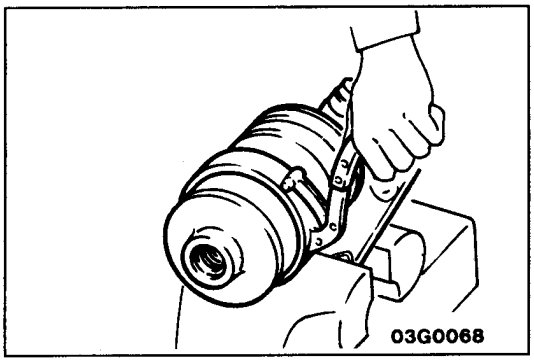
Refer to GROUP 11 – Service Adjustment Procedures.

ACCELERATOR CABLE INSPECTION AND ADJUSTMENT <VEHICLES WITHOUT AUTO-CRUISE CONTROL SYSTEM> E13FCAZ3

For models equipped with the auto-cruise control system, refer to P.13-188.



(1) Turn the air conditioner and all lights OFF so that there is no electrical load when inspecting.
(2) Warm the engine until the engine idling speed becomes stable.
(3) Check that the engine idling speed is at the specified value.
(4) Stop the engine and turn the ignition switch to OFF.
(5) Check that there are no sharp bends in the accelerator cable.
(6) Check the amount of play in the inner cable.
(7) If there is excessive play in the inner cable, or if there is no play, adjust by the following procedure.
    ① Loosen the adjusting nut and fully close the throttle lever.
    ② Tighten the adjusting nut so that the inner cable play is at the standard value, and fix it with the lock nut.
    Standard value: 0–1 mm (0–0.04 in.)
    ③ After adjusting, check that the throttle lever is touching the idle adjusting screw (stopper).



FUEL FILTER REPLACEMENT E13FZAN

(1) Remove the intercooler. (Refer to GROUP 15 – Intercooler.)
(2) Remove the fuel tank cap to release the pressure inside the tank.
(3) Disconnect the water level sensor connector.
(4) Remove the fuel hose and then remove the fuel filter.

Caution
Cover with a rag to prevent fuel from spraying out.

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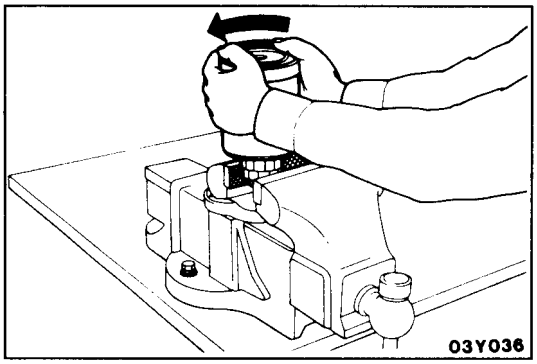
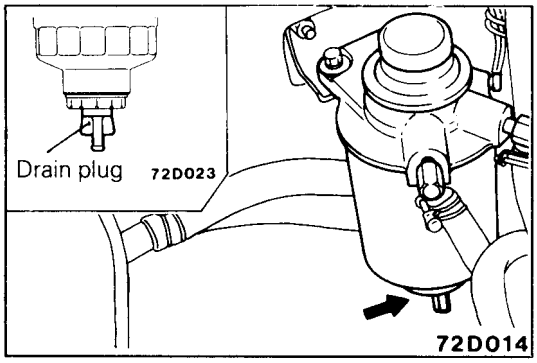


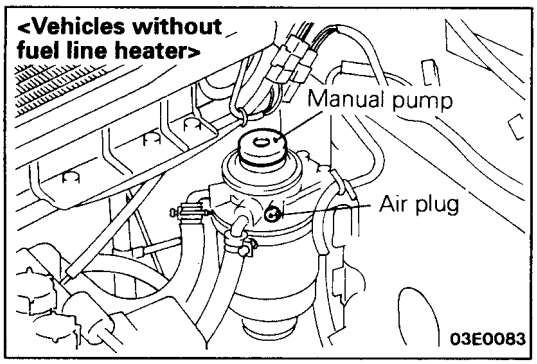
(5) Secure the fuel filter pump in a vise, and use an oil filter wrench to remove the fuel filter cartridge.
(6) Secure the water level sensor in a vise and turn the fuel filter cartridge with both hands to remove the water filter sensor.
(7) After installing a new fuel filter, bleed all air from the fuel line.
(8) Start the engine, and check that there are no fuel leakages.



EVACUATION OF WATER FROM FUEL FILTER E13FVAB

Water is in the filter when fuel filter indicator lights. Evacuate water by the following procedures.

(1) Loosen drain plug.
(2) Drain water with hand pump. Finger-tighten drain plug.

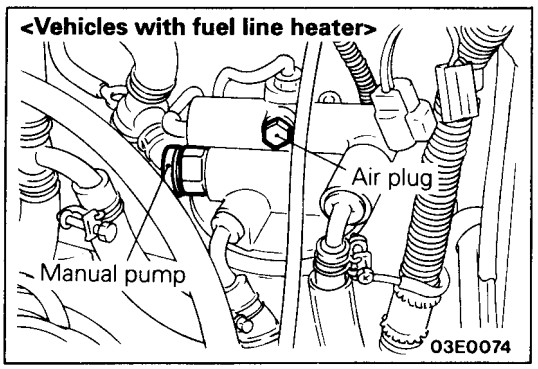


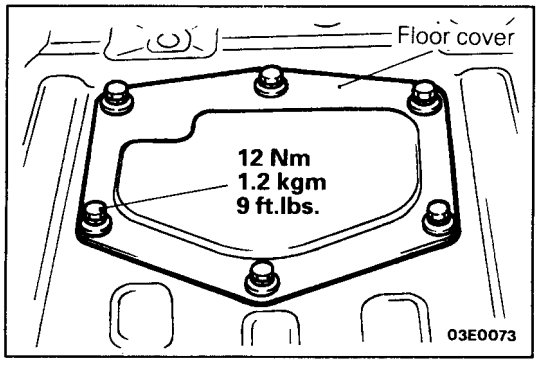
EVACUATION OF AIR FROM FUEL LINE E13FSAB

Evacuate air after following services.

- When fuel is drained and re-filled for service.
- When fuel filter is replaced.
- When main fuel line is removed.

(1) Loosen fuel filter air plug.
(2) Place rags around air plug hole. Operate hand pump repeatedly until no bubbles come from plug hole. Tighten air plug.
(3) Repeat until hand pump operation becomes stiff.





FUEL GAUGE UNIT REPLACEMENT E13FDAC2

(1) Take out the carpet in the cargo compartment and remove the floor cover.

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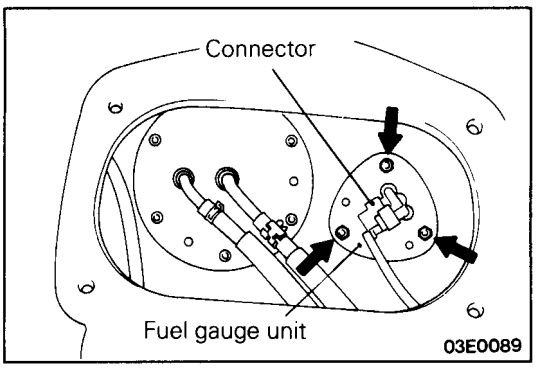
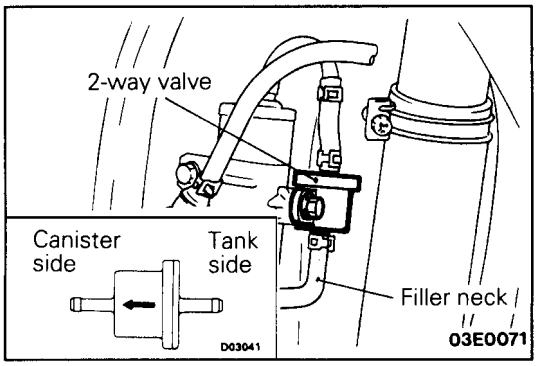


(2) Disconnect the connector from the fuel gauge unit, and remove the fuel gauge unit.
(3) Install the fuel gauge unit so that the packing stoppers (2 places) match the hole in the fuel gauge unit.
(4) Install the floor cover packing and the floor cover.

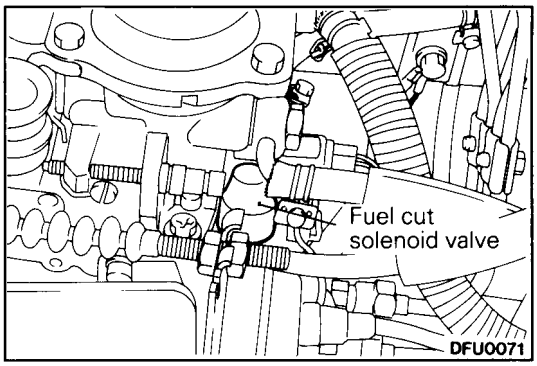


2-WAY VALVE REPLACEMENT E13FFAC2

(1) Remove the filler neck protector inside the rear left bumper.
(2) Replace the 2-way valve.

Caution
Be careful not to mistake the direction of the 2-way valve.

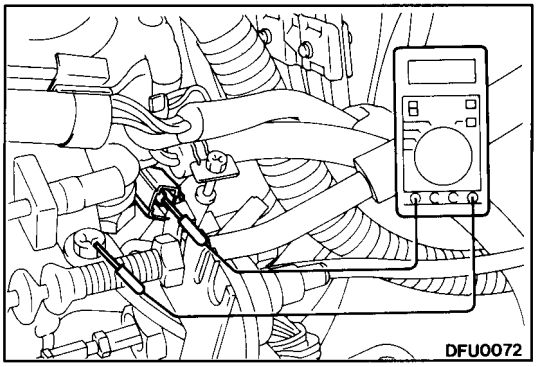
(3) Install the filler neck protector.



FUEL INJECTION PUMP INSPECTION E13FMAB

1. INSPECTION OF FUEL CUT SOLENOID VALVE OPERATION

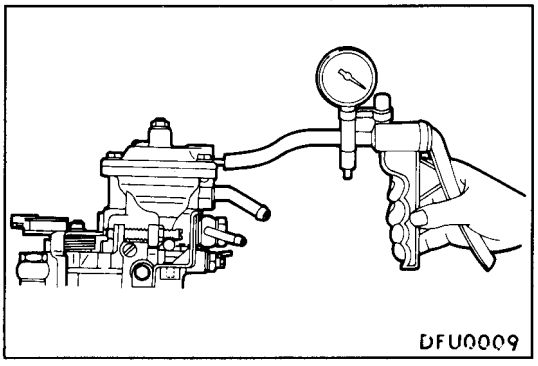
(1) When a sound scope is held against the fuel cut solenoid valve and the ignition switch is turned to "ON", check that the sound of the valve operating can be heard.



2. INSPECTION OF FUEL CUT SOLENOID VALVE COIL RESISTANCE

(1) Measure the resistance between the fuel cut solenoid valve terminal and the ignition pump and body.

Standard value: 8–10 Ω



3. BOOST COMPENSATOR INSPECTION

(1) Connect a hand pump (pressure pump type) to the boost compensator nipple.
(2) Apply positive pressure of 30 kPa (0.3 kg/cm^2, 4.3 psi.) and check that pressure is maintained.

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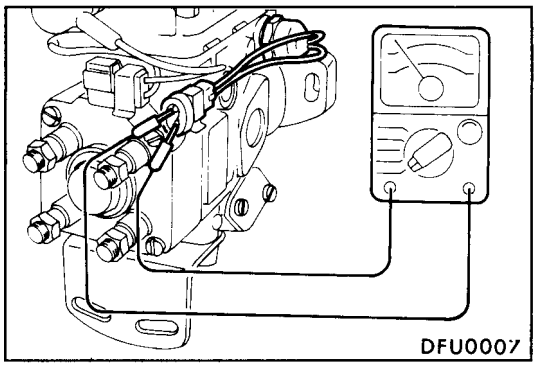


4. ENGINE SPEED SENSOR INSPECTION

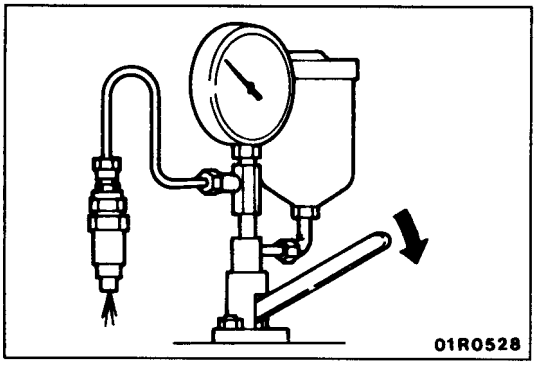
(1) Disconnect the engine speed sensor.
(2) Measure the resistance between the engine speed sensor terminals.

Standard value: 1.3–1.9 kΩ

INJECTION NOZZLE INSPECTION AND ADJUSTMENT

E13FOAG

Caution
Never touch the injection spray that is injected from the nozzle.



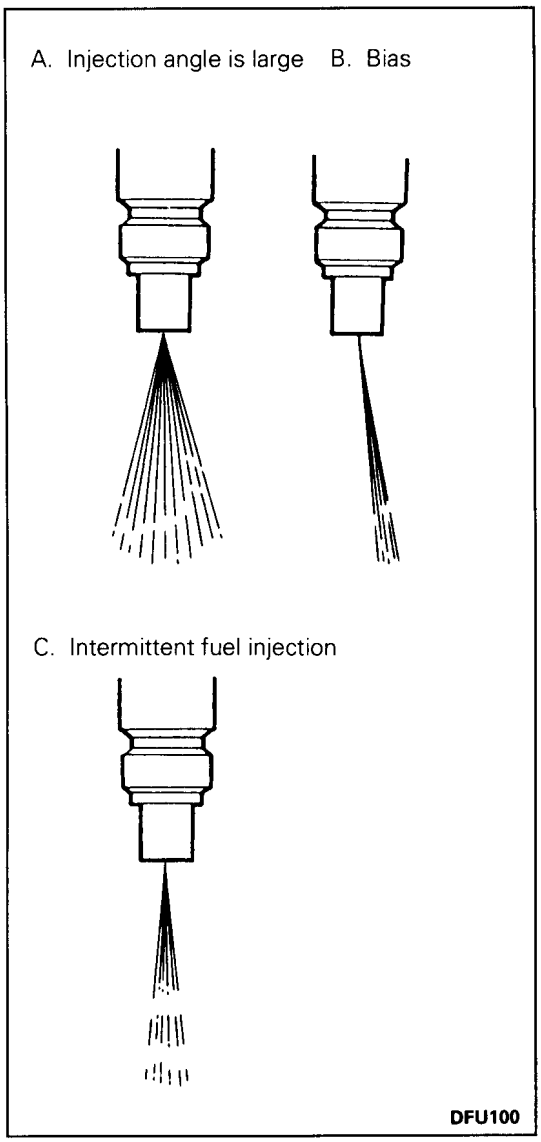
1. FUEL INJECTION INITIAL PRESSURE INSPECTION

(1) Install the injection nozzle to a nozzle tester.
(2) Move the lever of the nozzle tester 2–3 times to inject fuel and to bleed the air.
(3) Gently press down the lever of the nozzle tester, and take a reading of the indication value on the pressure gauge at the point where the needle slowly rises and then suddenly drops.

Standard value:
<Vehicles without EGR system built up to 1994>
11,770–12,750 kPa
(120–130 kg/cm^2, 1,707–1,849 psi.)
<Vehicles with EGR system built up to 1994, Vehicles built from 1995>
14,750–15,690 kPa
150–160 kg/cm^2, 2133–2276 psi.)

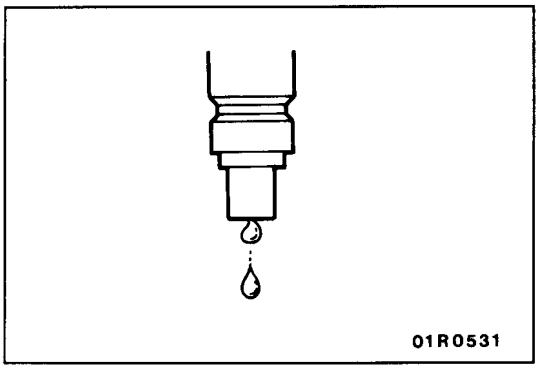
(4) If the fuel injection initial pressure is outside the standard value, disassemble the nozzle holder to clean it, and then change the thickness of the shim to adjust the fuel injection initial pressure.

NOTE
- For disassembly and reassembly of the nozzle holder, refer to the engine workshop manual.
- There are 10 shims for adjustment, with thicknesses in the range 0.10–0.80 mm (0.0039–0.0315 in.).
- When the shim thickness is increased by 0.1 mm (0.0039 in.), the fuel injection initial pressure increases by 2350 kPa (24 kg/cm^2, 341 psi.).

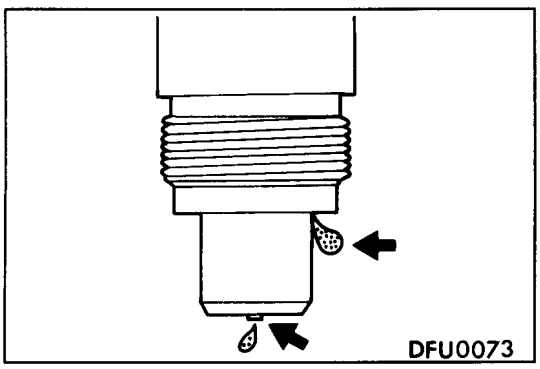


2. INJECTION SPRAY INSPECTION

(1) Move the lever of the nozzle tester rapidly (4–6 times per second) to eject the fuel continuously. Check that the injection spray comes out evenly in a straight, thin line (angle of spray is zero). The injection spray patterns shown in the illustration at left are wrong.



(2) Check that no fuel drips after injection is completed.
(3) If there are any drips, disassemble the nozzle, clean it and re-inspect, or replace the nozzle.



3. NOZZLE FUELTIGHT INSPECTION

(1) Gently raise the lever of the nozzle tester until the pressure inside the nozzle becomes 9,810–10,790 kPa (100–110 kg/cm^2, 1,422–1,565 psi.) <Vehicles without EGR system built up to 1994, vehicles built from 1995> or 12,750–13,730 kPa (130–140 kg/cm^2, 1,850–1,990 psi.) <Vehicles with EGR system built from 1995>, and after holding this pressure for approximately 10 seconds, check that there are no fuel leaks from the nozzle.
(2) If there are any leaks, disassemble the nozzle, clean it and re-inspect, or replace the nozzle.

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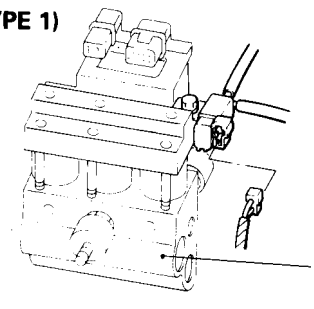
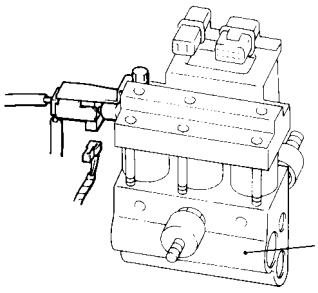
<Vehicles built up to May, 1994>

(TYPE 1)



14E0223

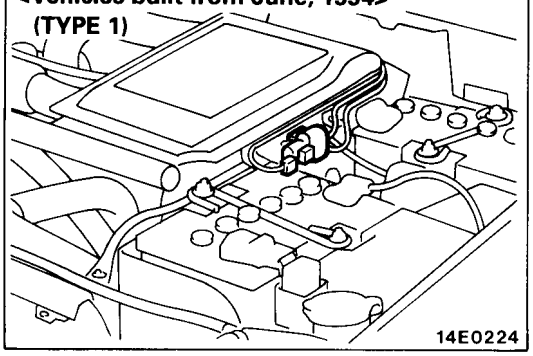
(TYPE 2)



14E0222

<Vehicles built from June, 1994>

(TYPE 1)

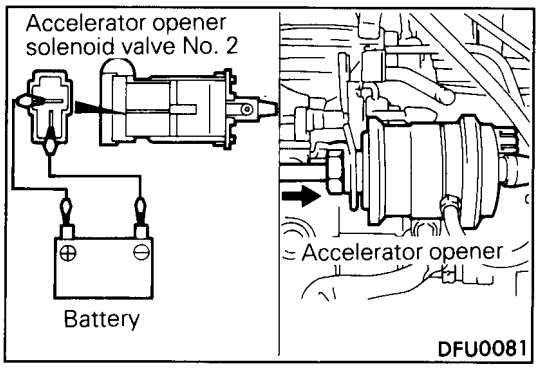


14E0224

ACCELERATOR LEVER CONTROL CHECK DURING ANTI-SKID BRAKE (ABS) OPERATION

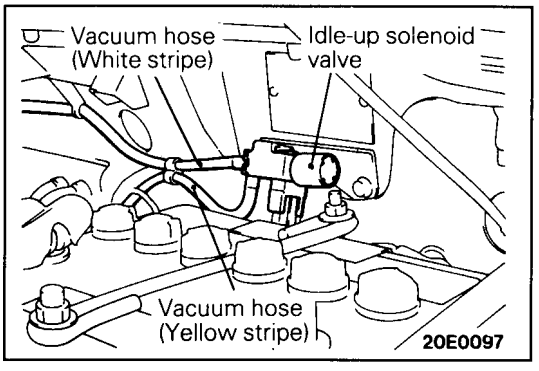
ACCELERATOR OPENER SOLENOID VALVE OPERATION CHECK

(1) Disconnect the No. 2 connector of the accelerator opener solenoid valve.
(2) Start the engine and run it at idle.



DFU0081

(3) When the solenoid valve terminals and the battery terminals are connected by jumper leads, check that the accelerator opener operates and that the engine r/min increases.



20E0097

ACCELERATOR OPENER SOLENOID VALVE NO. 1 (FOR AIR CONDITIONER) CHECK

(1) Remove the vacuum hose from the idle-up solenoid valve.

NOTE
When installing the vacuum hose, be careful not to confuse the connection ends.

(2) Remove the idle-up solenoid valve connection.

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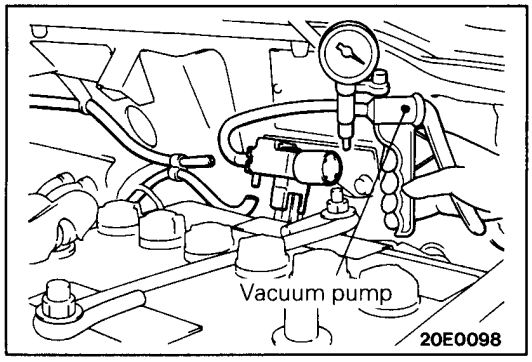
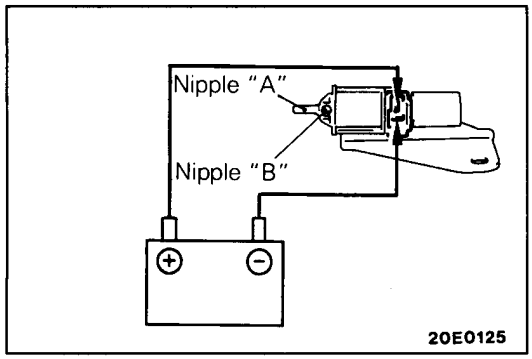
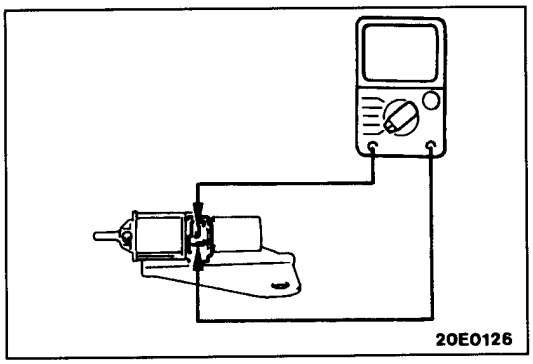


(3) Connect the vacuum pump (Mighty Vac) to nipple "A".
(4) Check the air flow with the vacuum pump (Mighty Vac) when battery voltage is applied between the idle-up solenoid valve terminals, and when battery voltage is removed.

Battery voltage	Nipple "B"	Vacuum condition
Applied	Open	Vacuum leaks from nipple "B"
	Covered with a finger*1	Vacuum is maintained
Not applied	Open	Vacuum is maintained
	Covered with a finger*2	

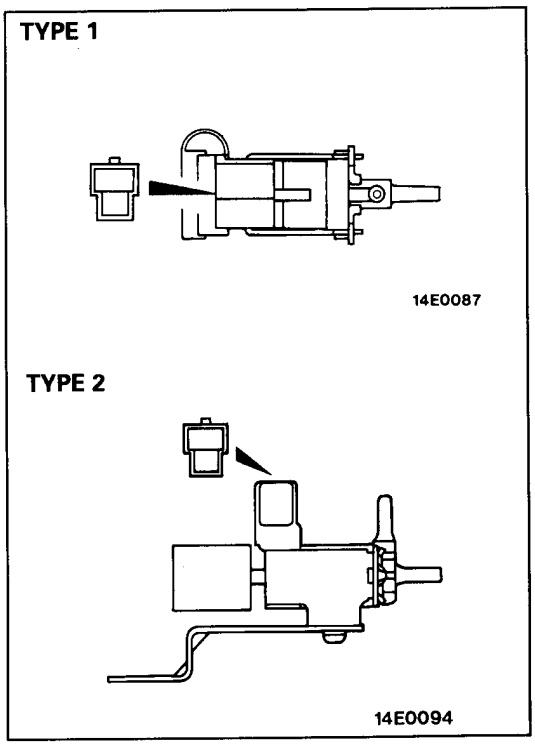
NOTE
At *1, negative pressure can be felt, but at *2, negative pressure cannot be felt.





(5) Measure the resistance between the idle-up solenoid valve terminals.

Standard value: approx. 40 Ω



ACCELERATOR OPENER SOLENOID VALVE NO. 2 (FOR ANTI-LOCK BRAKE) CHECK

NOTE
When disconnecting the vacuum hose, always make a mark so that the hose can be connected at the original position.

1. Remove the idle-up solenoid valve from the hydraulic unit.

2. Measure the resistance between the solenoid valve terminals.

Standard value: <TYPE 1> 33–39 Ω
<TYPE 2> 37–44 Ω

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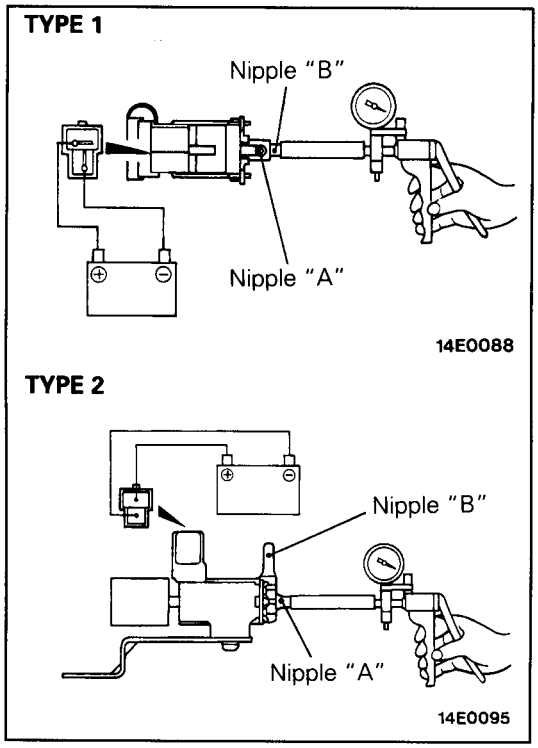
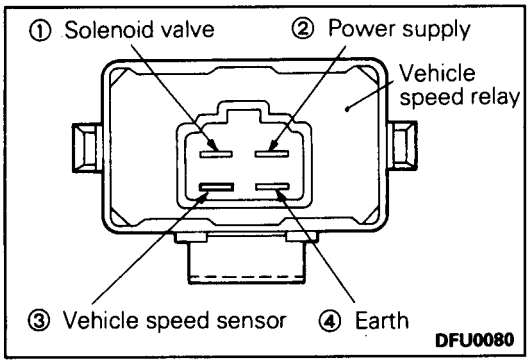




3. Connect a hand vacuum pump to the nipple "A".
4. Check airtightness by applying a vacuum with voltage applied directly from the battery to the solenoid valve terminal and without applying voltage.

Battery voltage	Solenoid valve nipple "B"	Normal condition
Applied	Open	Vacuum leaks
	Blocked with finger	Vacuum maintained
Not applied	Open	Vacuum maintained

VEHICLE SPEED SENSOR CHECK

(1) With the vehicle speed relay connector connected, connect an analog voltmeter to terminal (3).
(2) Turn the ignition switch to "ON".
(3) When the vehicle is moving slowly forward, check that the voltage repeatedly changes from 0 V to 5 V and back.

VEHICLE SPEED RELAY CHECK

With the vehicle speed relay connector connected, check the continuity between the vehicle speed relay terminals (1) and (4).

NOTE
When checking the continuity, use an analog circuit tester, and connect the (–) probe to terminal (1).

Vehicle speed	Continuity between terminals (1)–(4)
15 km/h (9 mph) or less	No continuity
35 km/h (21 mph) or more	Continuity

FUEL SYSTEM <4M40 Engine>

SPECIFICATIONS

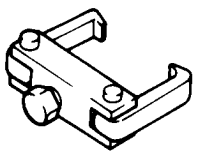
GENERAL SPECIFICATIONS

Items	Specifications
Fuel	
Tank capacity dm^3 (U.S. gal., Imp gab.)	
Standard wheelbase	75 (19.8, 16.5)
Long wheelbase	92 (24.3, 20.2)
Fuel injection pump	
Type	Distribution type
Governor type	Half all speeds
Feed pump type	Vane type
Injection nozzle	
Nozzle type	Throttle type
Holder type	Screwed-in type

SERVICE SPECIFICATIONS

Items	Specifications
Standard value	
Accelerator cable play mm (in.)	0–1 (0–0.04)
Fuel cut solenoid valve coil resistance Ω	8–10
Injection pressure kPa (kg/cm^2, psi)	14,710–15,690 (150–160, 2,133–2,276)

SPECIAL TOOL

Tool	Number	Name	Use
	MH062464	Injection pump sprocket puller	Removal of sprocket from drive shaft of injection pump

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SERVICE ADJUSTMENT PROCEDURES

FUEL INJECTION TIMING INSPECTION AND ADJUSTMENT E13FKAD

Refer to GROUP 11 – Service Adjustment Procedures.

ENGINE IDLING SPEED INSPECTION AND ADJUSTMENT E13HBAA

Refer to GROUP 11 – Service Adjustment Procedures.

ACCELERATOR CABLE INSPECTION AND ADJUSTMENT <VEHICLES WITHOUT AUTO-CRUISE CONTROL SYSTEM> E13FCAZ3

Refer to P.13-143.

For models equipped with the auto-cruise control system, refer to P.13-188.

FUEL FILTER REPLACEMENT E13FZAM

Refer to P.13-143.

EVACUATION OF WATER FROM FUEL FILTER E13FVAB

Refer to P.13-144.

EVACUATION OF AIR FROM FUEL LINE E13FSAB

Refer to P.13-144.

FUEL GAUGE UNIT REPLACEMENT E13FDAD

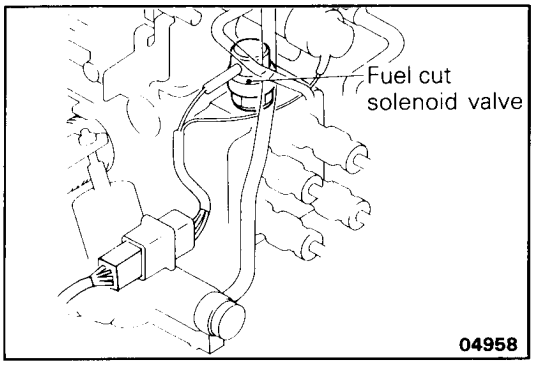
Refer to P.13-144.

2-WAY VALVE REPLACEMENT E13FFAD

Refer to P.13-145.

ACCELERATOR LEVER CONTROL CHECK DURING ANTI-SKID BRAKE (ABS) OPERATION

Refer to P.13-148



FUEL INJECTION PUMP INSPECTION

INSPECTION OF FUEL CUT SOLENOID VALVE OPERATION

When a sound scope is held against the fuel cut solenoid valve and the ignition switch is turned to "ON", check that the sound of the valve operating can be heard.

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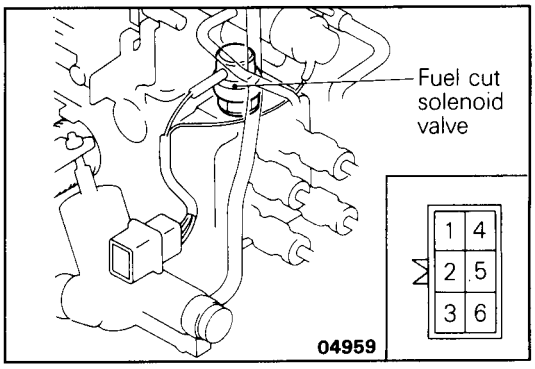
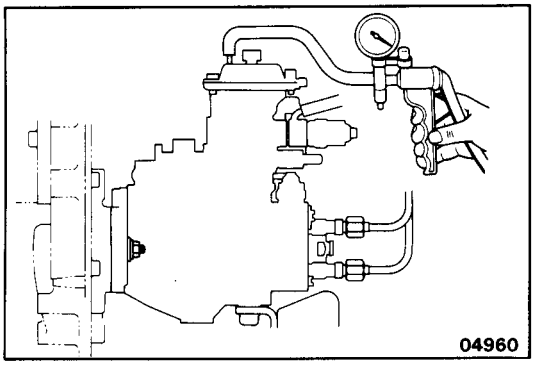


INSPECTION OF FUEL CUT SOLENOID VALVE COIL RESISTANCE

Measure the resistance between the fuel cut solenoid valve terminal ① and ⑤.

Standard value: 8–10 Ω

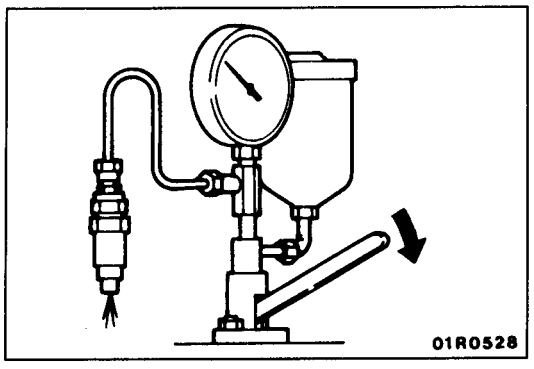


BOOST COMPENSATOR INSPECTION

(1) Connect a hand pump (pressure pump type) to the boost compensator nipple.
(2) Apply positive pressure of 29.4 kPa (0.3 kg/cm^2, 4.3 psi.), and check that pressure is maintained.

INJECTION NOZZLE INSPECTION AND ADJUSTMENT

Caution
Never touch the injection spray that is injected from the nozzle.



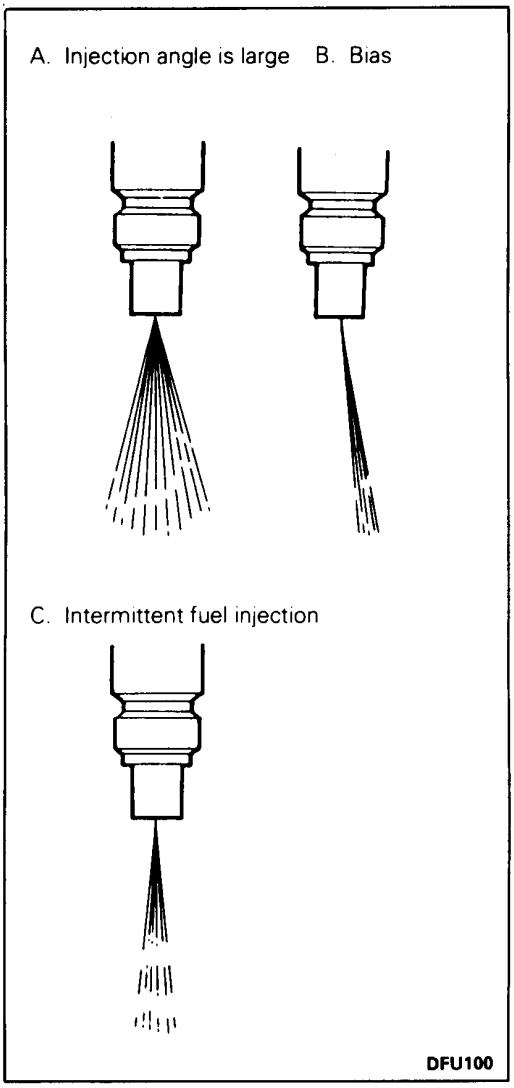
FUEL INJECTION INITIAL PRESSURE INSPECTION

(1) Install the injection nozzle to a nozzle tester.
(2) Apply positive pressure of 29.4 kPa (0.3 kg/cm^2, 4.3 psi.), and check that pressure is maintained.
(3) Gently press down the lever of the nozzle tester, and take a reading of the indication value on the pressure gauge at the point where the needle slowly rises and then suddenly drops.

Standard value: 14,710–15,690 kPa (150–160 kg/cm^2, 2,133–2,276 psi)

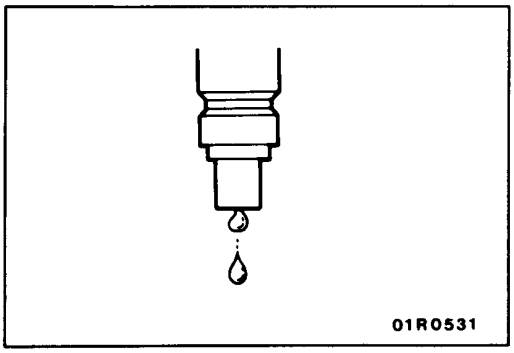
(4) If the fuel injection initial pressure is outside the standard value, disassemble the nozzle holder to clean it, and then change the thickness of the shim to adjust the fuel injection initial pressure.

NOTE
- For disassembly, reassembly and adjustment of the nozzle holder, refer to the engine workshop manual.
- When the shim thickness is increased by 0.1 mm (0.004 in.), the fuel injection initial pressure increases by approx. 1,177–2,157 kPa (12–22 kg/cm^2, 171–313 psi).

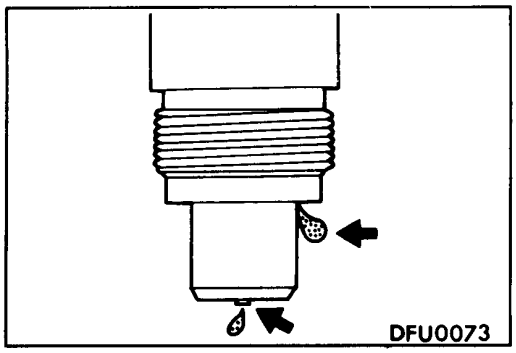


INJECTION SPRAY INSPECTION

(1) Move the lever of the nozzle tester rapidly (4–6 times per second) to eject the fuel continuously. Check that the injection spray comes out evenly in a straight, thin line angle of spray is 10°. The injection spray patterns shown in the illustration at left are wrong.



(2) Check that no fuel drips after injection is completed.
(3) If there are any drips, disassemble the nozzle, clean it and re-inspect, or replace the nozzle.



NOZZLE FUELTIGHT INSPECTION

(1) Gently raise the lever of the nozzle tester until the pressure inside the nozzle becomes 12,749–13,729 kPa (130–140 kg/cm^2, 1,849–1,991 psi.). Check that no fuel leaks from the nozzle within approx. 10 seconds.
(2) If there are any leaks, disassemble the nozzle, clean it and re-inspect, or replace the nozzle.

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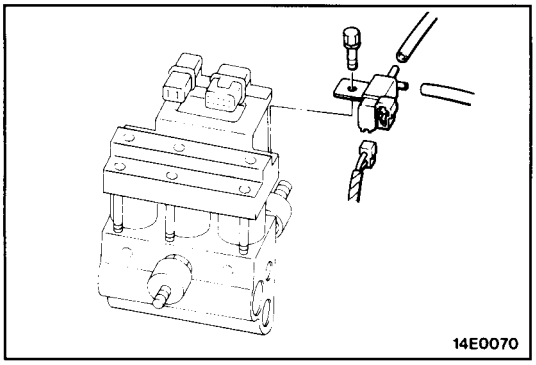
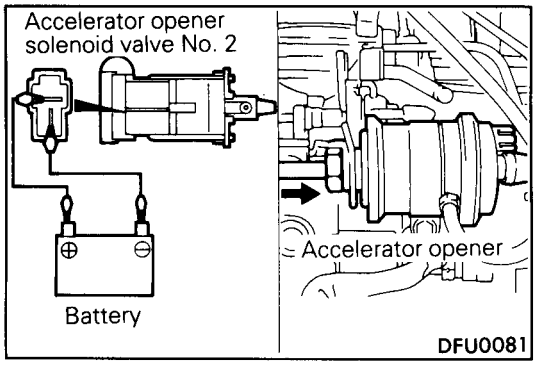


ACCELERATOR LEVER CONTROL CHECK DURING ANTI-SKID BRAKE (ABS) OPERATION

ACCELERATOR OPENER SOLENOID VALVE OPERATION CHECK

(1) Disconnect the No. 2 connector of the accelerator opener solenoid valve.
(2) Start the engine and run it at idle.



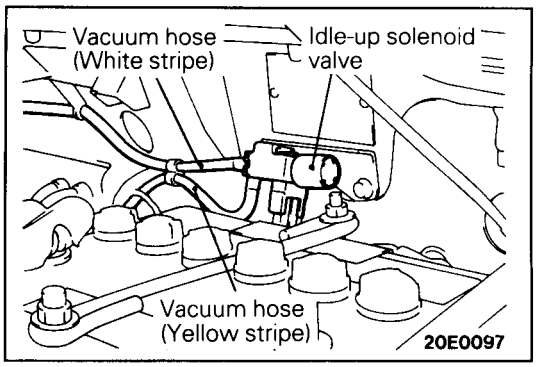
(3) When the solenoid valve terminals and the battery terminals are connected by jumper leads, check that the accelerator opener operates and that the engine r/min increases.

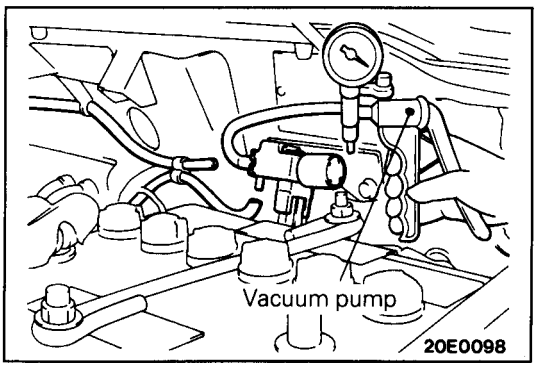
ACCELERATOR OPENER SOLENOID VALVE NO. 1 (FOR AIR CONDITIONER) CHECK

(1) Remove the vacuum hose from the idle-up solenoid valve.

NOTE
When installing the vacuum hose, be careful not to confuse the connection ends.

(2) Remove the idle-up solenoid valve connection.
(3) Connect the vacuum pump (Mighty Vac) to nipple "A".

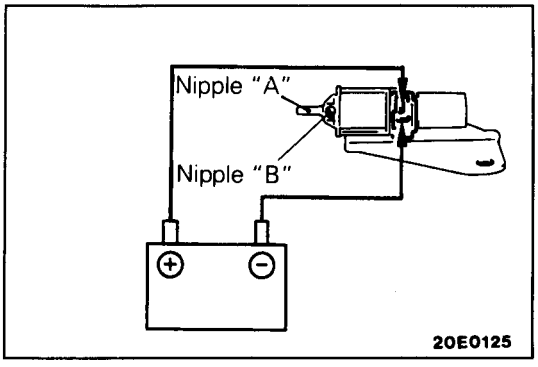




(4) Check the air flow with the vacuum pump (Mighty Vac) when battery voltage is applied between the idle-up solenoid valve terminals, and when battery voltage is removed.

Battery voltage	Nipple "B"	Vacuum condition
Applied	Open	Vacuum leaks from nipple "B"
	Covered with a finger*1	Vacuum is maintained
Not applied	Open	Vacuum is maintained
	Covered with a finger*2	

NOTE
At *1, negative pressure can be felt, but at *2, negative pressure cannot be felt.



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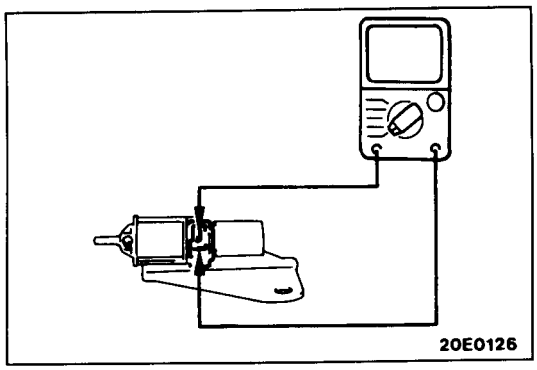
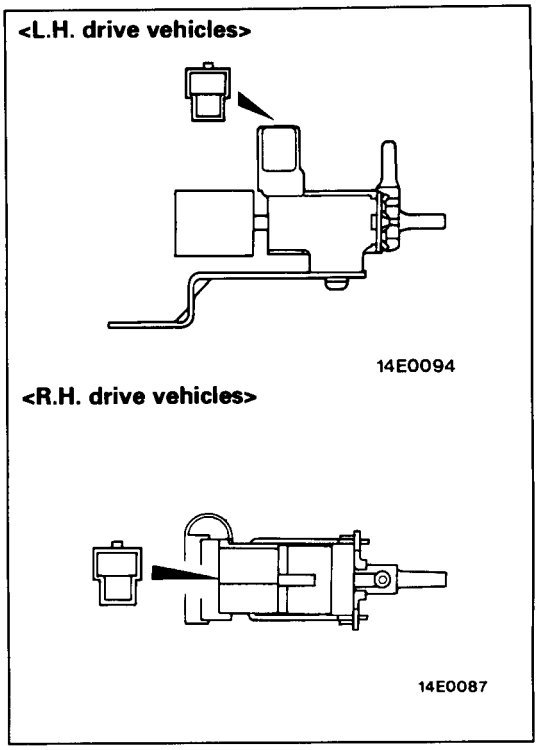

20E0126

(5) Measure the resistance between the idle-up solenoid valve terminals.

Standard value: approx. 40 Ω



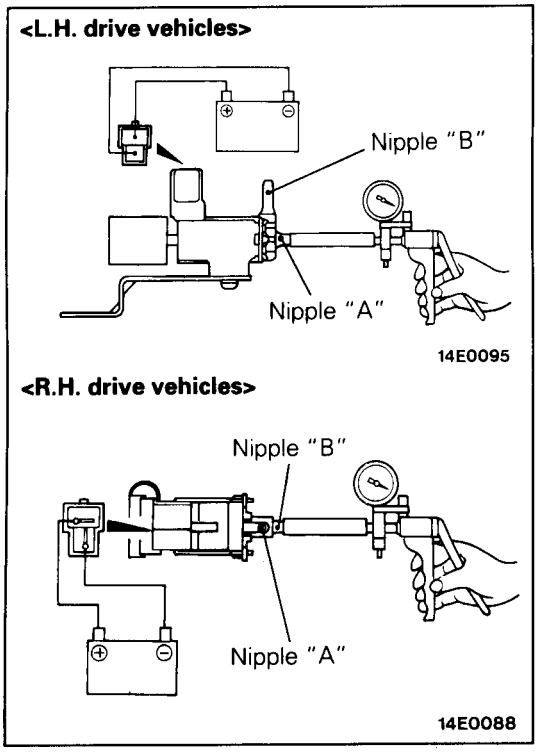
ACCELERATOR OPENER SOLENOID VALVE NO. 2 (FOR ANTI-LOCK BRAKE) CHECK

NOTE
When disconnecting the vacuum hose, always make a mark so that the hose can be connected at the original position.

1. Remove the idle-up solenoid valve from the hydraulic unit.

2. Measure the resistance between the solenoid valve terminals.

Standard value: <L.H. drive vehicles> 38–44 Ω
<R.H. drive vehicles> 33–39 Ω



3. Connect a hand vacuum pump to the nipple "A".
4. Check airtightness by applying a vacuum with voltage applied directly from the battery to the solenoid valve terminal and without applying voltage.

Battery voltage	Solenoid valve nipple "B"	Normal condition
Applied	Open	Vacuum leaks
	Blocked with finger	Vacuum maintained
Not applied	Open	Vacuum maintained

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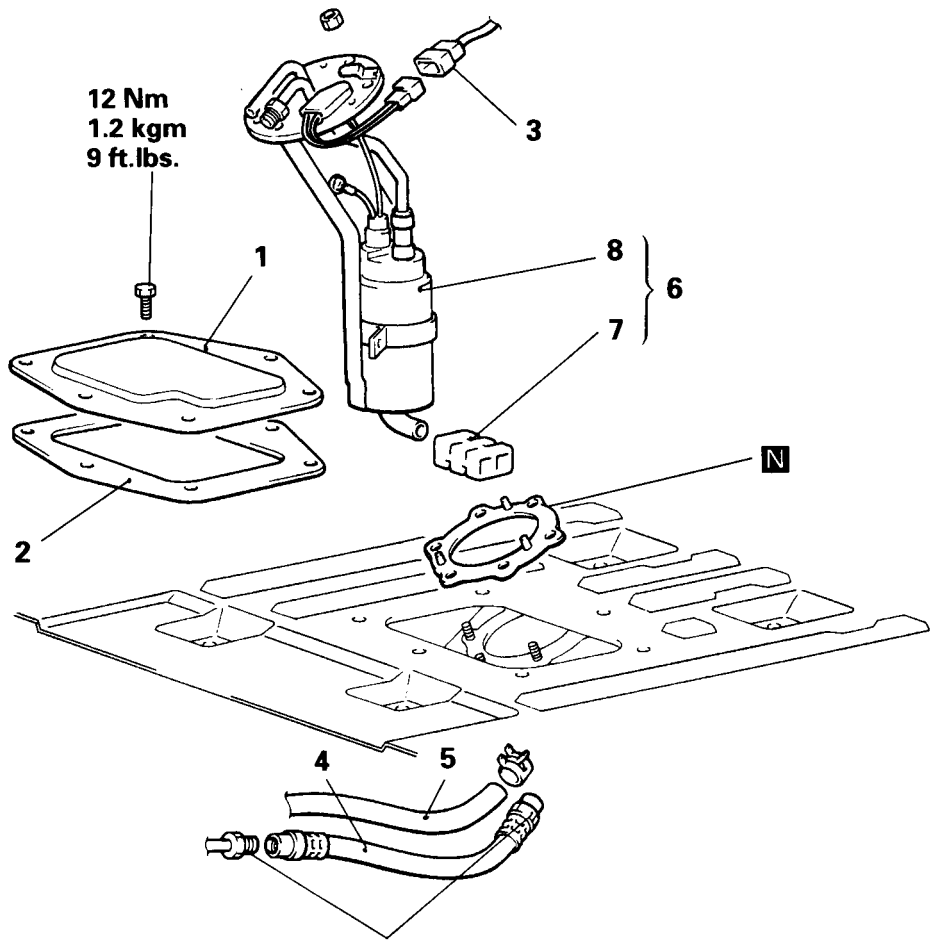
DELETED

FUEL PUMP <4G64, 6G72, 6G74>

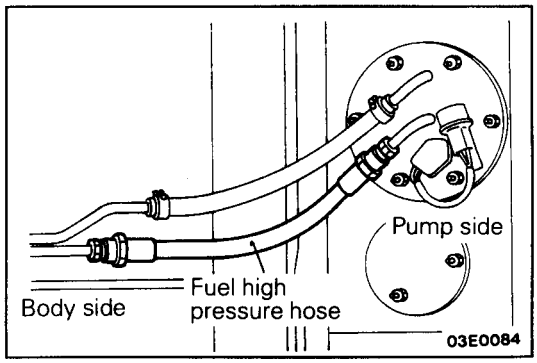
REMOVAL AND INSTALLATION

E13LA--

Pre-removal and Post-installation Operation
- Drain and Filling of Fuel
- Removal and Installation of the Floor Carpet



Removal steps
1. Floor cover
2. Packing
3. Fuel pump connector
◆◆ ◆◆ 4. Fuel high pressure hose
5. Fuel return hose connection
6. Fuel pump and filter assembly
7. Filter
8. Fuel pump assembly



SERVICE POINT OF REMOVAL AND INSTALLATION

E13LDAB

4. REMOVAL AND INSTALLATION OF FUEL HIGH PRESSURE HOSE

(1) After disconnecting the high-pressure fuel pipe at the body-side main pipe connection, disconnect the pump-side connection.
(2) To install, carry out the removal procedure in reverse.

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ADDED

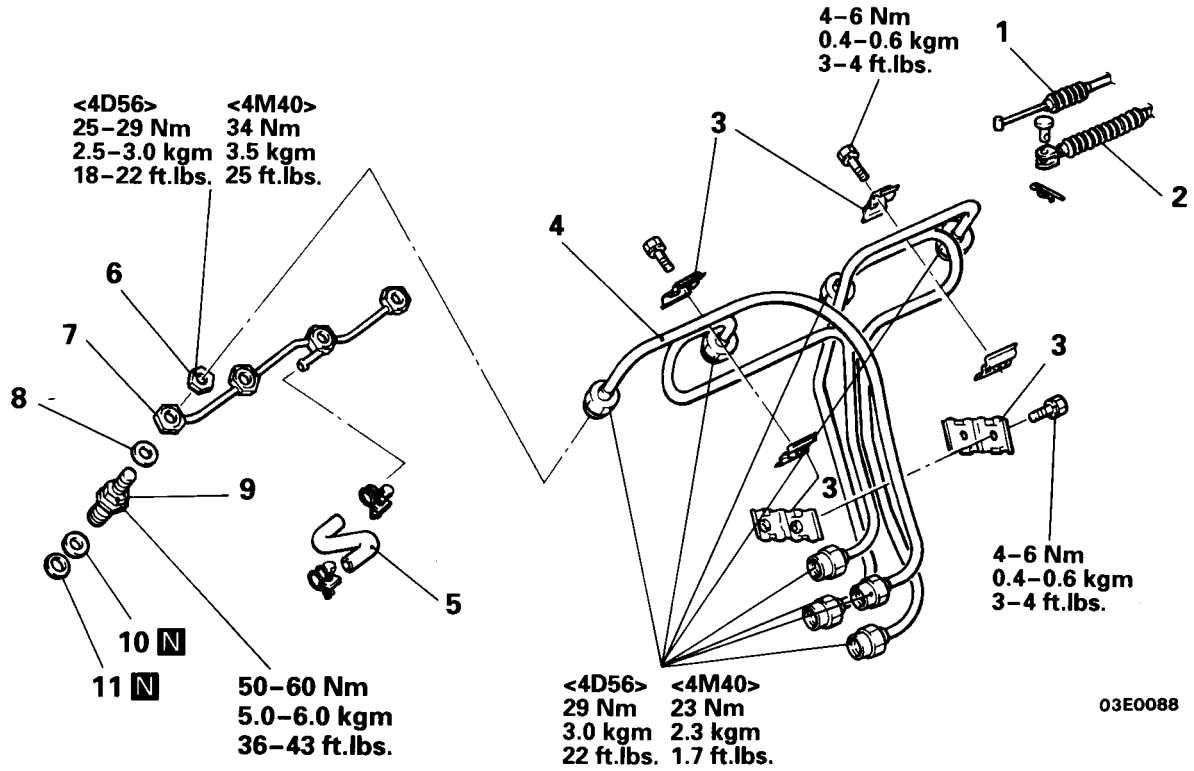
INJECTION NOZZLE <4D56, 4M40>

REMOVAL AND INSTALLATION

E13NA-

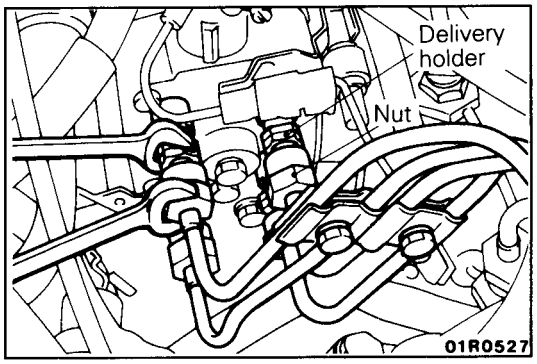
Pre-removal Operation
- Removal of Intercooler
  (Refer to GROUP15 – Intercooler)

Post-installation Operation
- Installation of Intercooler
  (Refer to GROUP 15 – Intercooler)
- Adjustment of Accelerator Cable
  (Refer to P.13-14, 89.)
- Adjustment of Throttle Control Cable
  (Refer to GROUP 23 – Service Adjustment Procedures)



Removal steps

1. Accelerator cable connection
2. Throttle control cable connection <A/T>
3. Injection pipe clamp
4. Injection pipe
5. Fuel return hose
6. Nut
7. Fuel return pipe
8. Fuel return pipe gasket
9. Nozzle holder
10. Holder gasket
11. Nozzle gasket



SERVICE POINTS OF REMOVAL

E13NBAB

4. DISCONNECTION OF INJECTION PIPE

When loosening nuts at both ends of injection pipe, hold the other side (pump side-delivery holder, nozzle side-nozzle holder) with wrench and loosen nut.

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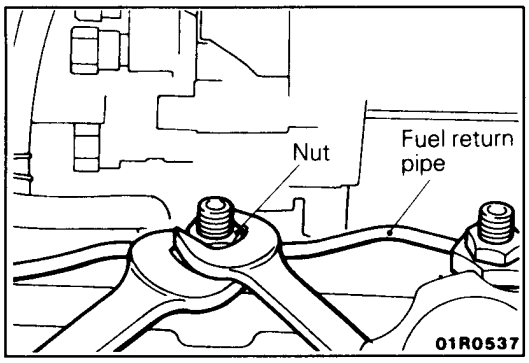
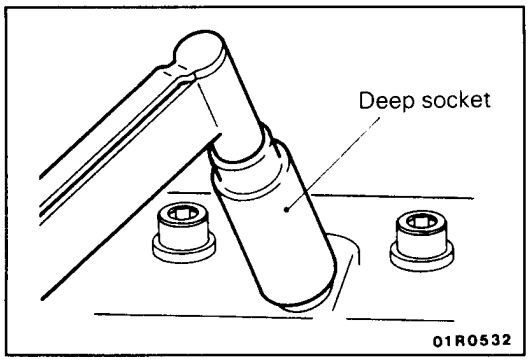


7. DISCONNECTION OF FUEL RETURN PIPE

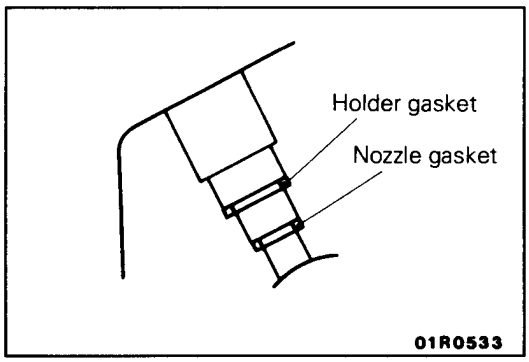
Hold fuel return line hexagon nut with wrench and remove nut.

Caution
Loosening nut without holding fuel return line may damage the line. Be sure to hold line.



9. REMOVAL OF NOZZLE HOLDER

Caution
Label cylinder No. on removed injection nozzle holder to ensure correct nozzle to cylinder reassembly.



SERVICE POINTS OF INSTALLATION E13NDAB

9. INSTALLATION OF NOZZLE HOLDER

(1) Clean cylinder head injection nozzle aperture and install new gasket.

Caution
A defective gasket can cause improper idle rpm.

(2) Tighten to specified torque with deep socket wrench.

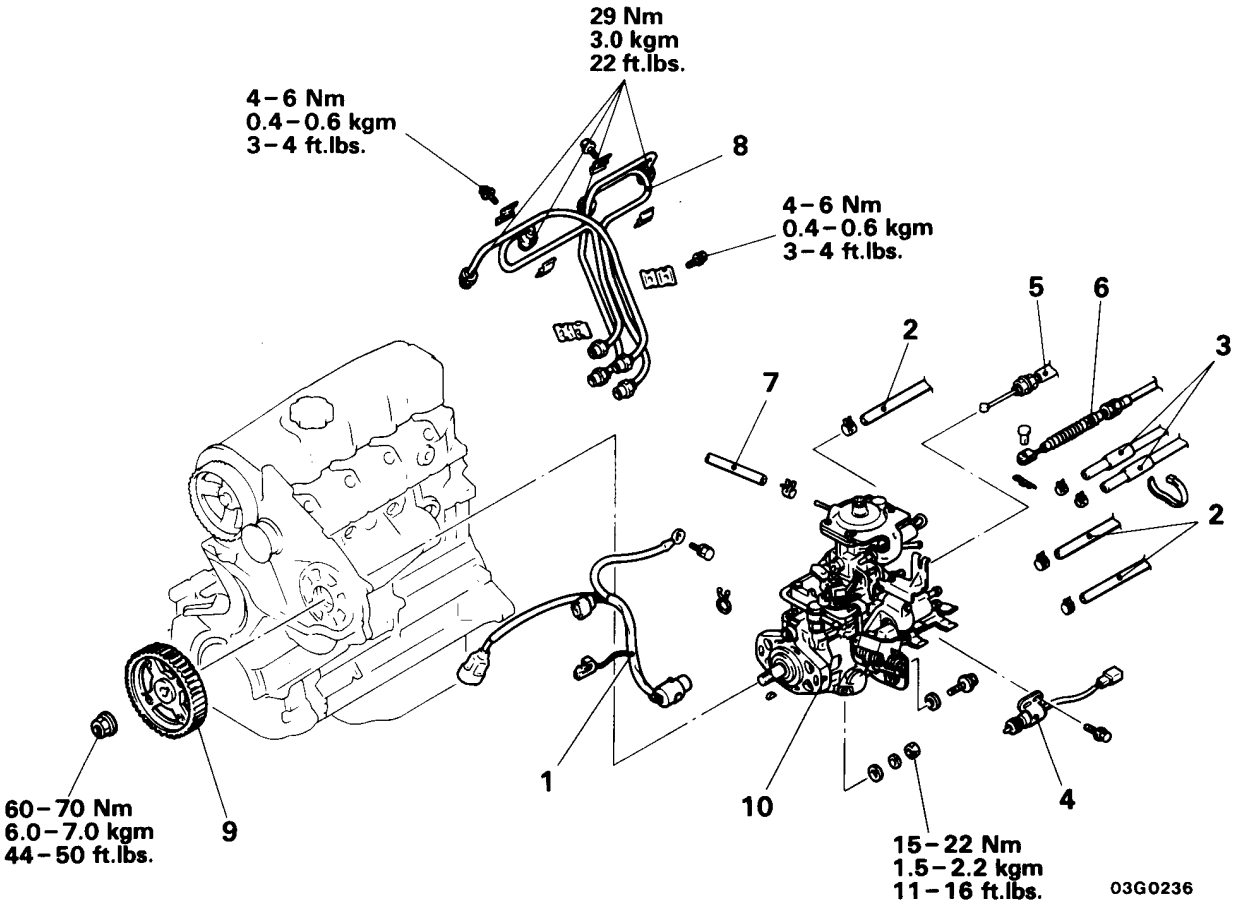
INJECTION PUMP <4D56>

REMOVAL AND INSTALLATION

E13MA-

Pre-removal Operation
- Draining of Engine Coolant <Vehicles with CSD>
- Removal of the Timing Belt (Refer to GROUP 11 – Timing Belt.)

Post-installation Operation
- Supplying of Engine Coolant <Vehicles with CSD>
- Installation of the Timing Belt (Refer to GROUP 11 – Timing Belt.)
- Adjustment of Injection Timing (Refer to GROUP 11 – Service Adjustment Procedures.)
- Adjustment of Accelerator Cable (Refer to P.13-143)
- Adjustment of Throttle Control Cable (Refer to GROUP 23 – Service Adjustment Procedures.)
- Adjustment of Lever Position Switch (Refer to GROUP 55 – Lever Position Switch.)



Removal steps

1. Fuel injection pump wiring harness
2. Water hose connection <Vehicles with CSD>
3. Fuel hoses
4. Lever position switch <A/T – A/C>
5. Accelerator cable connection
6. Throttle control cable connection <A/T>
7. Boost hose connection
8. ◀■▶ ▶◀ Fuel injection pipe
9. ◀■▶ Fuel injection pump sprocket
10. Fuel injection pump

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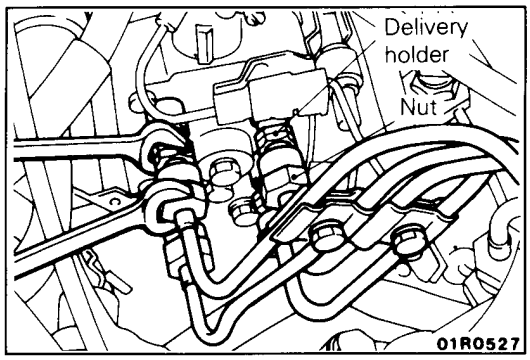
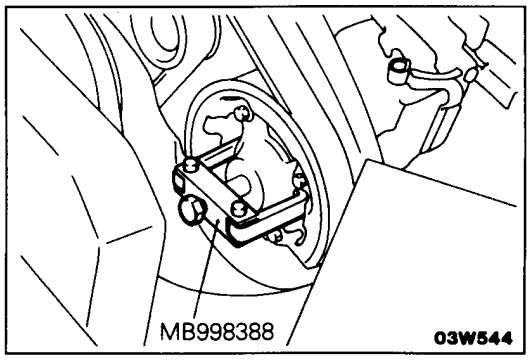


SERVICE POINT OF REMOVAL E13MBAG

8. REMOVAL OF INJECTION PIPE

Loosen the nuts at the end of the injection pipe with the correspouding holders (delivery holder for pump side and nozzle holder for nozzle side) relained by a spanner, etc..

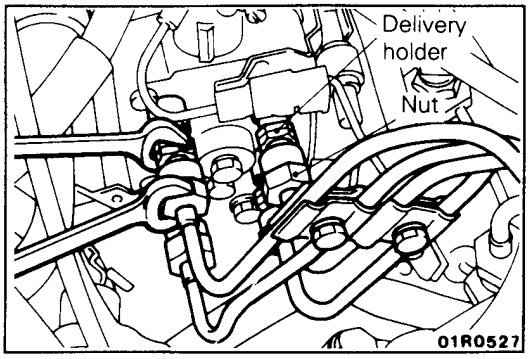


9. REMOVAL OF FUEL INJECTION PUMP SPROCKET

Remove sprocket installing nut and remove sprocket from pump drive shaft with special tool.

Caution

1. **Do not hit pump drive shaft with hammer, etc.**
2. **When holding injection pump, do not allow to dangle by holding accelerator lever or fast idle lever.**
   Do not remove these levers. Removal will cause injection pump malfunction.



SERVICE POINT OF INSTALLATION E13MDAF

8. INSTALLATION OF INJECTION PIPE

Tighten the nuts at the end of the injection pipe to the specified value with the correspouding holders (delivery holder for pump side and nozzle holder for nozzle side) relained by a spanner, etc..

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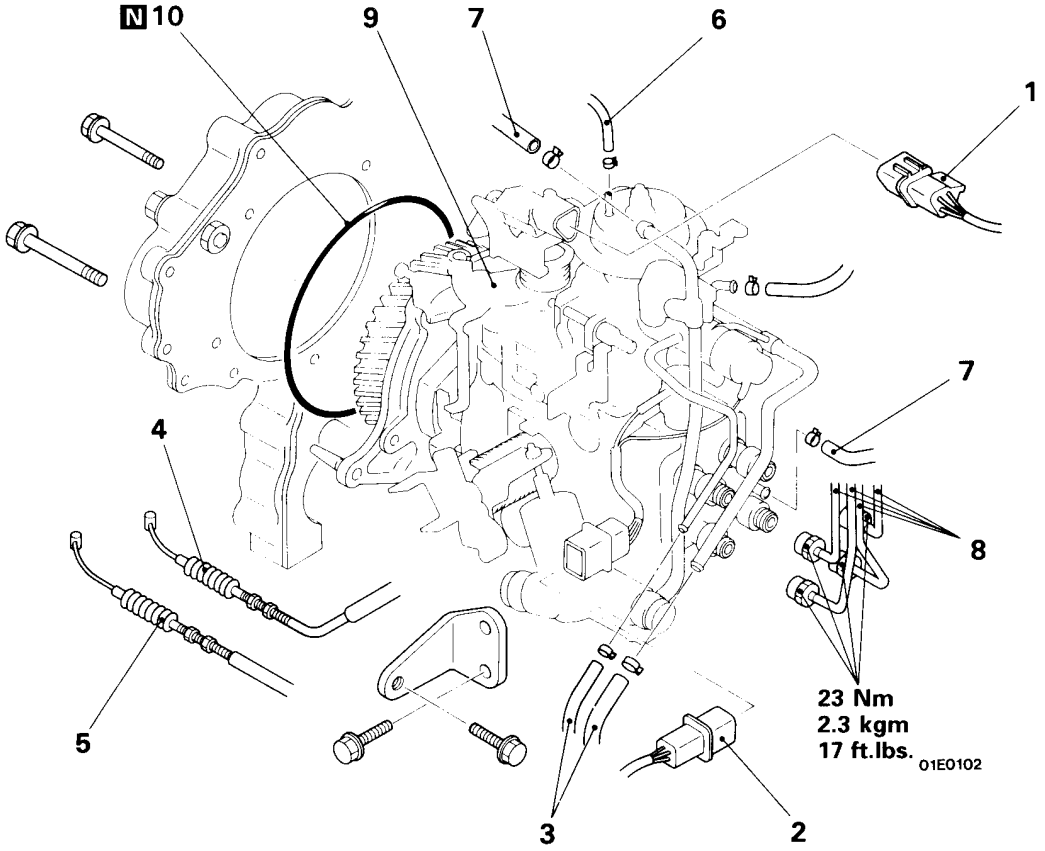
INJECTION PUMP <4M40>

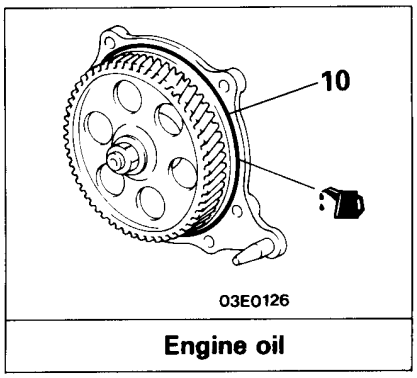
REMOVAL AND INSTALLATION

Pre-removal Operation
- Draining of Engine Coolant
- Removal of Intercooler (Refer to GROUP 15 – Intercooler.)
- Removal of Starter Motor

Post-installation Operation
- Adjustment of Injection Timing (Refer to GROUP 11 – Service Adjustment Procedures.)
- Installation of Starter Motor
- Adjustment of Accelerator Cable (Refer to P.13-150-2.)
- Adjustment of Throttle Control Cable
- Supplying of Engine Coolant (Refer to GROUP 14 – Service Adjustment Procedures.)
- Air Bleeding of Fuel Line
- Installation of Intercooler (Refer to GROUP 15 – Intercooler)



Removal steps
1. Throttle position sensor connector
2. Fuel injection pump wiring harness connector
3. Fuel hoses connection
4. Accelerator cable connection
5. Throttle control cable connection
6. Boost hose connection
7. Water hoses connection
8. Fuel injection pipe
9. Fuel injection pump
10. O-ring



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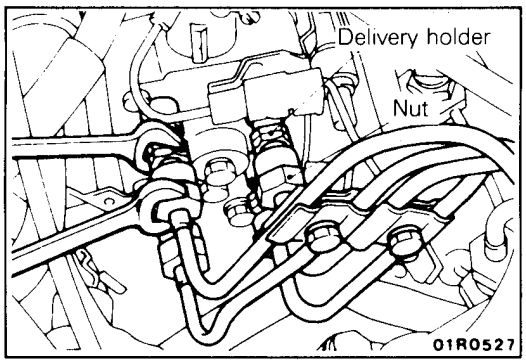
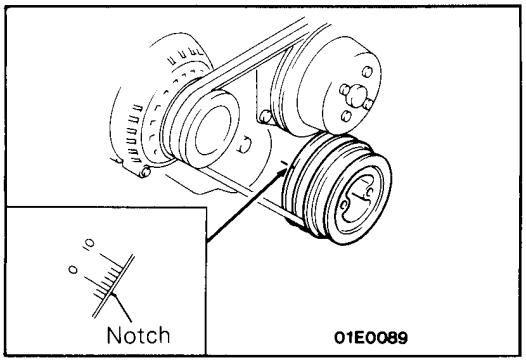


SERVICE POINTS OF REMOVAL

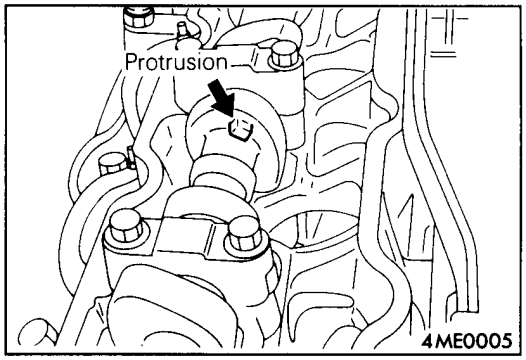
8. REMOVAL OF INJECTION PIPE

Loosen the nuts at the end of the injection pipe with the corresponding holders (delivery holder for pump side and nozzle holder for nozzle side) retained by a spanner, etc..



9. REMOVAL OF FUEL INJECTION PUMP

Align the notch of the crankshaft pulley with the "0" timing mark to set the No. 1 cylinder to the compression top dead centre position.

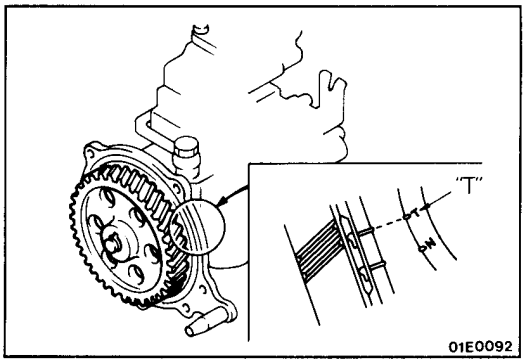


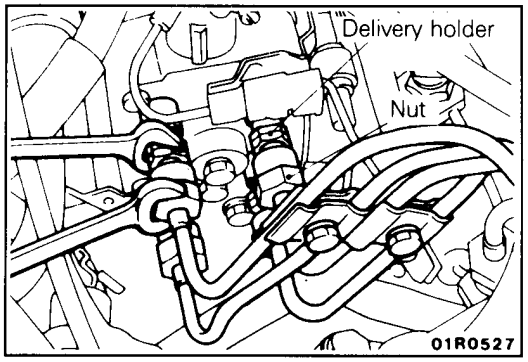
NOTE
If the protrusion on the camshaft is pointing directly upwards when the filler cap is removed, the No. 1 cylinder will be at the compression top dead centre position.

SERVICE POINTS OF INSTALLATION

9. INSTALLATION OF INJECTION PUMP

Check that the No. 1 cylinder is at the compression top dead centre position and aligning the notch of the injection pump gear with the "T" mating mark on the flange plate, and then install the injection pump to the timing gear case.

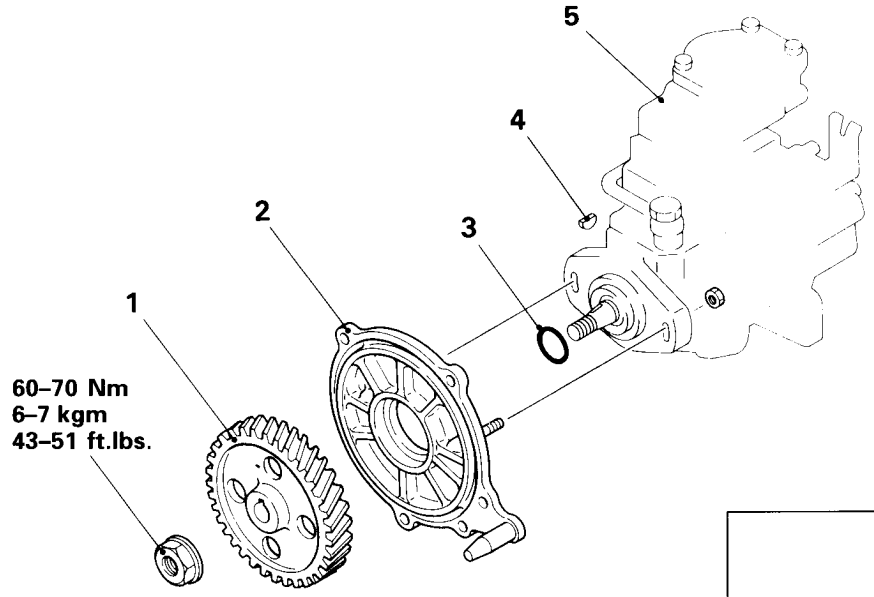




8. INSTALLATION OF INJECTION PIPE

Tighten the nuts at the end of the injection pipe to the specified value with the corresponding holders (delivery holder for pump side and nozzle holder for nozzle side) retained by a spanner, etc..

DISASSEMBLY AND ASSEMBLY



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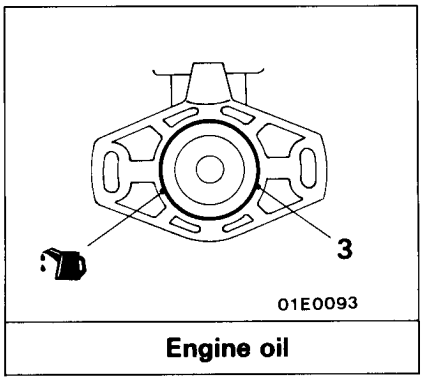
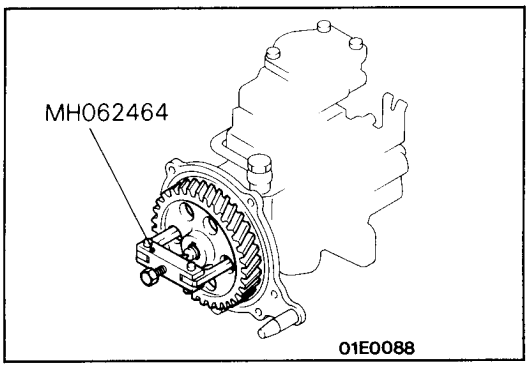


01E0093

Engine oil

Disassembly steps

◆◆ 1. Injection pump gear
2. Flange plate
3. O ring
4. Key
5. Injection pump



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SERVICE POINTS OF REMOVAL

1. REMOVAL OF INJECTION PUMP GEAR

Use the special tool to remove the injection pump gear.

NOTES

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FUEL TANK

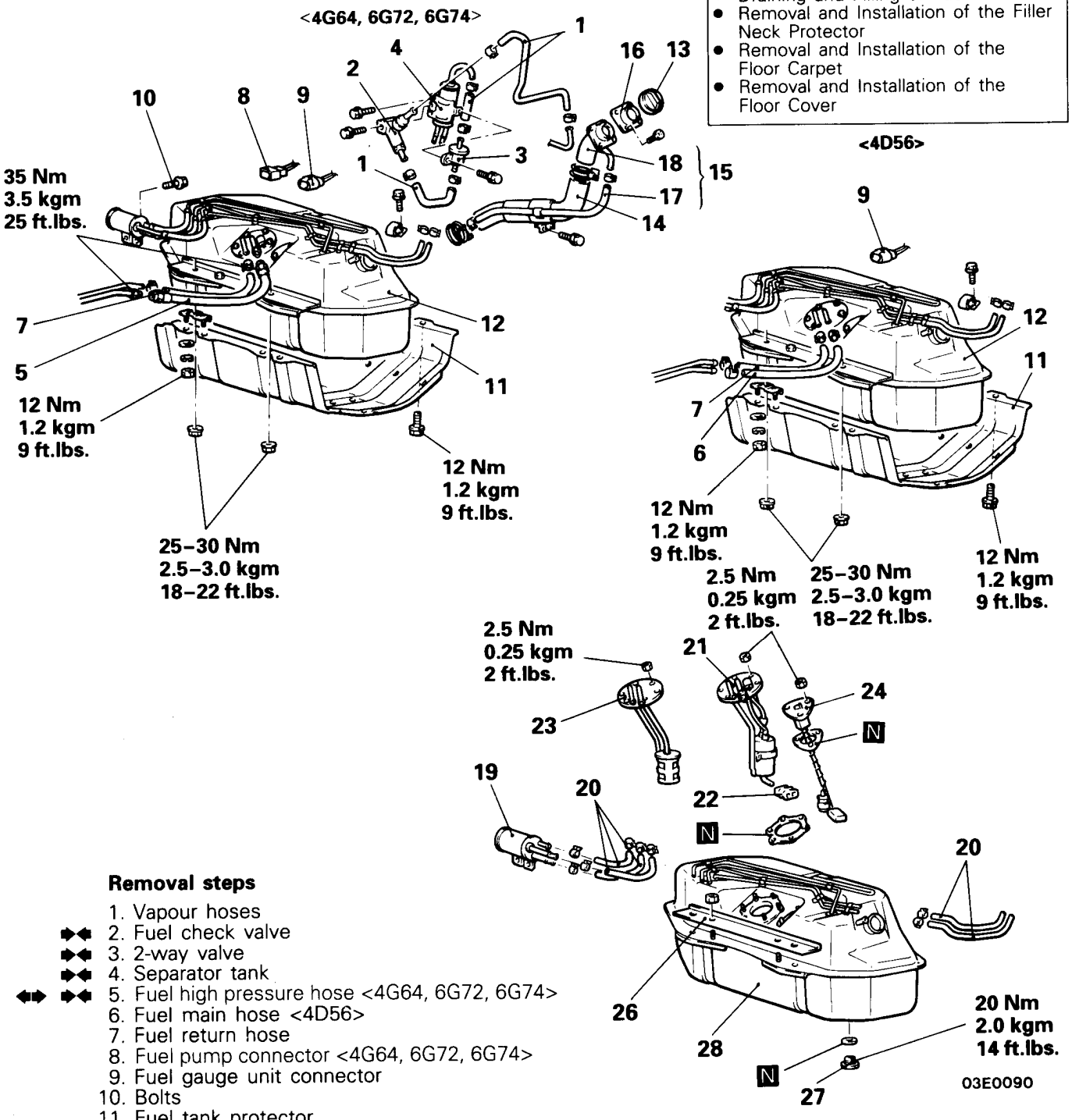
REMOVAL AND INSTALLATION

E13GA--

[Vehicles built up to May, 1994]

<Standard Wheelbase>

Pre-removal and Post-installation Operation
- Draining and Filling of Fuel
- Removal and Installation of the Filler Neck Protector
- Removal and Installation of the Floor Carpet
- Removal and Installation of the Floor Cover



Removal steps

1. Vapour hoses
2. Fuel check valve
3. 2-way valve
4. Separator tank
5. Fuel high pressure hose <4G64, 6G72, 6G74>
6. Fuel main hose <4D56>
7. Fuel return hose
8. Fuel pump connector <4G64, 6G72, 6G74>
9. Fuel gauge unit connector
10. Bolts
11. Fuel tank protector
12. Fuel tank assembly
13. Fuel tank cap
14. Fuel filler hose
15. Fuel filler neck and vapour hose assembly
16. Packing
17. Vapour hose
18. Fuel filler neck
19. Separator tank
20. Vapour hoses
21. Fuel pump assembly } <4G64, 6G72, 6G74>
22. Filter }
23. Pipe assembly <4D56>
24. Fuel gauge unit
26. Plate
27. Drain plug
28. Fuel tank

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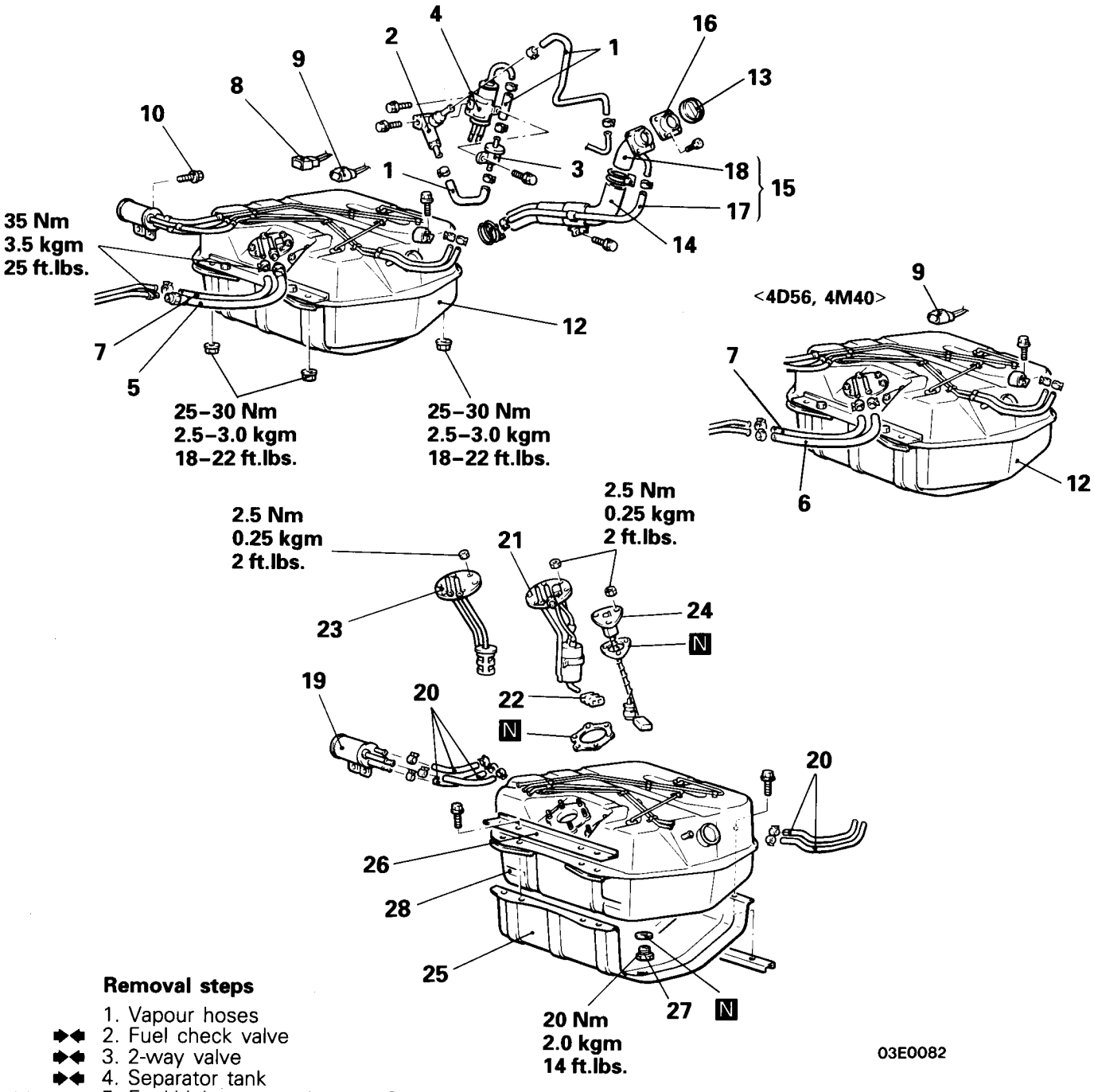
<Long Wheelbase>

<4G64, 6G72, 6G74>



Removal steps

1. Vapour hoses
◆◆ 2. Fuel check valve
◆◆ 3. 2-way valve
◆◆ 4. Separator tank
◆◆ ◆◆ 5. Fuel high pressure hose <4G64, 6G72, 6G74>
6. Fuel main hose <4D56, 4M40>
7. Fuel return hose
8. Fuel pump connector
9. Fuel gauge unit connector
10. Bolt
12. Fuel tank assembly
13. Fuel tank cap
14. Fuel filler hose
15. Fuel filler neck and vapour hose assembly
16. Packing
17. Vapour hose
18. Fuel filler neck
◆◆ 19. Separator tank
◆◆ 20. Vapour hoses
21. Fuel pump assembly } <4G64, 6G72, 6G74>
22. Filter
23. Pipe assembly <4D56, 4M40>
24. Fuel gauge unit
25. Fuel tank protector
26. Plate
27. Drain plug
28. Fuel tank

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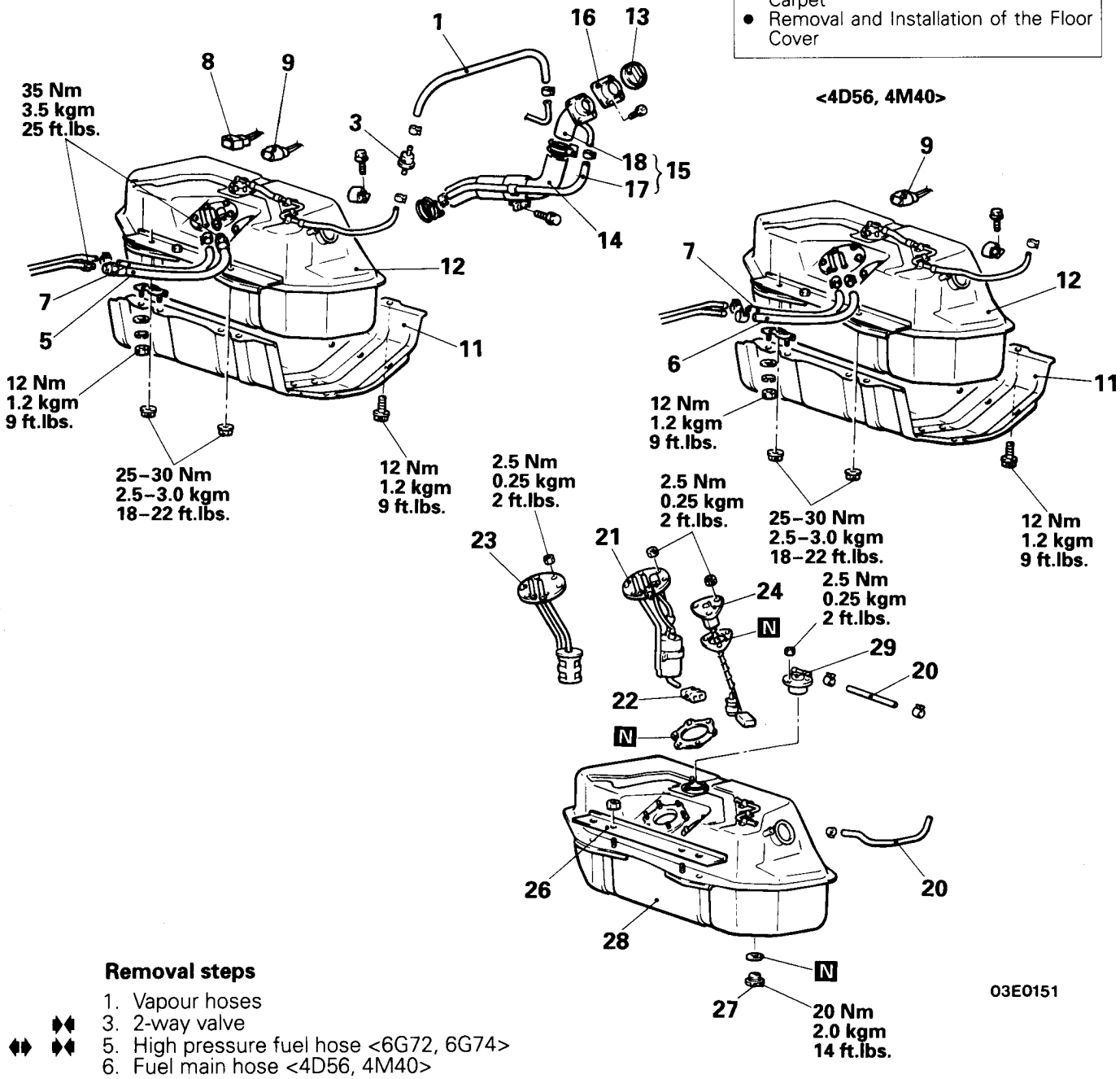
[Vehicles built from June, 1994]

<Standard Wheelbase>

Pre-removal and Post-installation Operation
- Draining and Filling of Fuel
- Removal and Installation of the Filler Neck Protector
- Removal and Installation of the Floor Carpet
- Removal and Installation of the Floor Cover



Removal steps

1. Vapour hoses
3. 2-way valve
5. High pressure fuel hose <6G72, 6G74>
6. Fuel main hose <4D56, 4M40>
7. Fuel return hose
8. Fuel pump connector <6G72, 6G74>
9. Fuel gauge unit connector
11. Fuel tank protector
12. Fuel tank assembly
13. Fuel tank cap
14. Fuel filler hose
15. Fuel filler neck and vapour hose assembly
16. Packing
17. Vapour hose
18. Fuel filler neck
20. Vapour hoses
21. Fuel pump assembly } <6G72, 6G74>
22. Filter
23. Pipe assembly <4D56, 4M40>
24. Fuel gauge unit
26. Plate
27. Drain plug
28. Fuel tank
29. Fuel cut off valve

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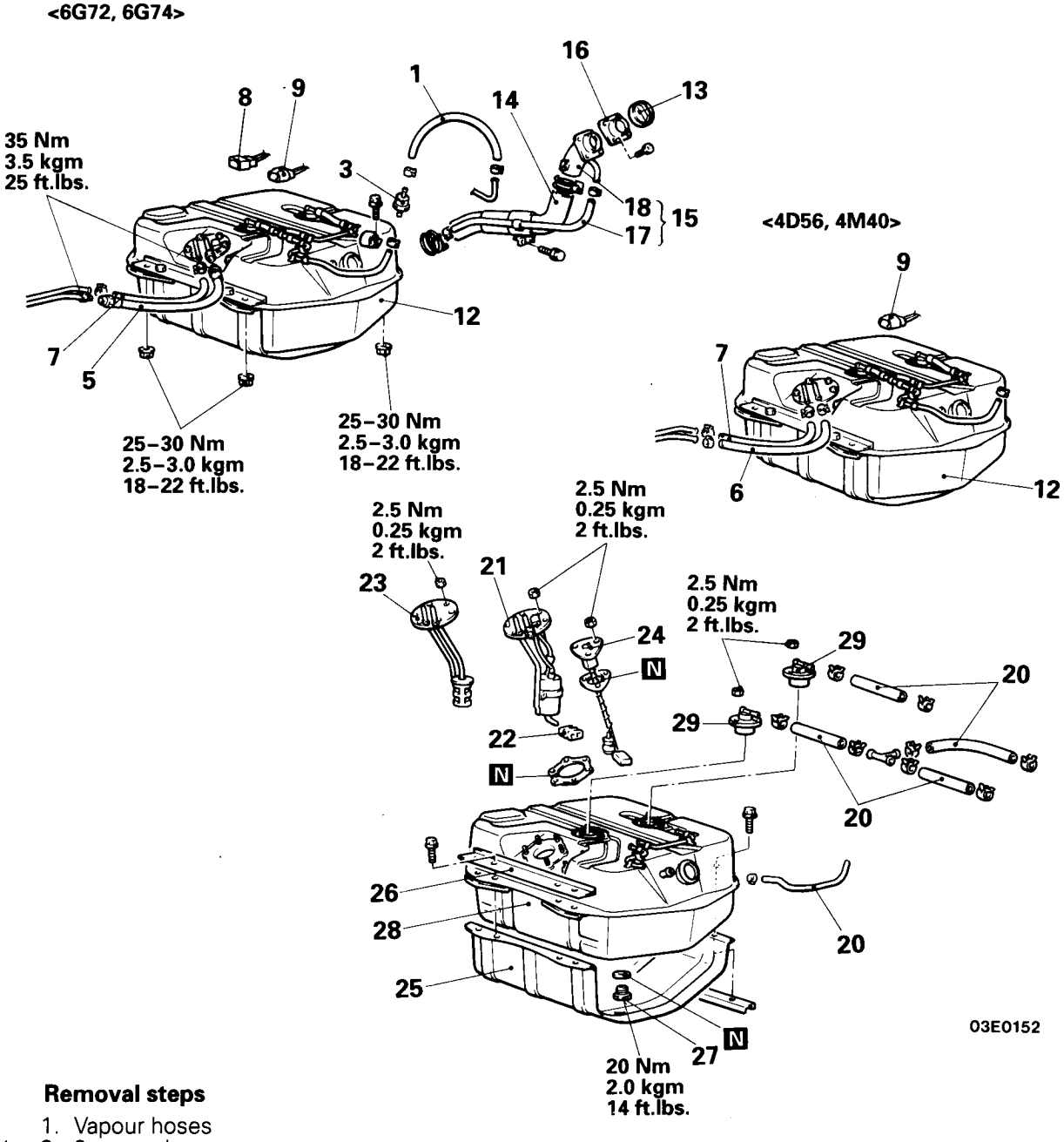
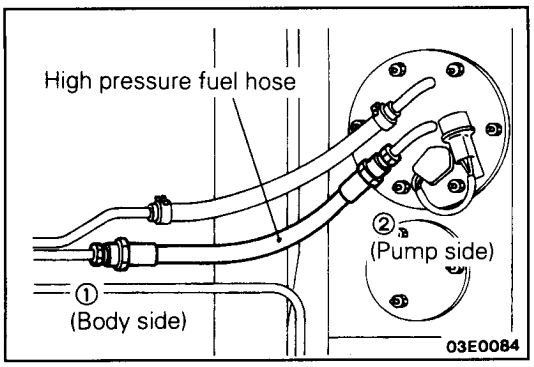
<Long Wheelbase>



Removal steps

1. Vapour hoses
◆◆ 3. 2-way valve
◆◆ ◆◆ 5. High pressure fuel hose <6G72, 6G74>
6. Fuel main hose <4D56, 4M40>
7. Fuel return hose
8. Fuel pump connector
9. Fuel gauge unit connector
12. Fuel tank assembly
13. Fuel tank cap
14. Fuel filler hose
15. Fuel filler neck and vapour hose assembly
16. Packing
17. Vapour hose
18. Fuel filler neck

◆◆ 20. Vapour hoses
21. Fuel pump assembly } <6G72, 6G74>
22. Filter
23. Pipe assembly <4D56, 4M40>
24. Fuel gauge unit
25. Fuel tank protector
26. Plate
27. Drain plug
28. Fuel tank
29. Fuel cut off valve



SERVICE POINTS OF REMOVAL E13GBAN

5. REMOVAL OF HIGH PRESSURE FUEL HOSE <4G64, 6G72, 6G74>

After disconnecting the high-pressure fuel hose at the body-side main pipe connection, disconnect the pump-side connection.

Caution
The fuel line has some residual pressure, so cover it with a rag.

12. REMOVAL OF FUEL TANK ASSEMBLY <Standard Wheelbase>

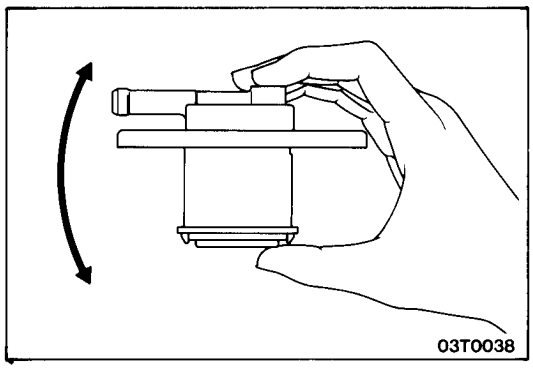
(1) Support the fuel tank with the transmission jack or similar tool.
(2) Remove the fuel tank installation nut and lower the fuel tank.
(3) Disconnect the fuel filler hose and the vapour hose connector of the fuel tank side, and then disconnect the fuel tank.

INSPECTION E13GCAM

- Check the hoses and the pipes for crack or damage.
- Check the fuel tank cap for malfunction
- Check the fuel tank for deformation, corrosion or crack.
- Check the fuel tank for dust or foreign material.

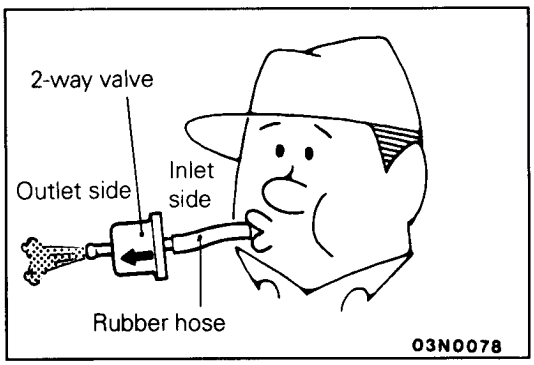
NOTE
If the inside of the fuel tank is to be cleaned, use any one of the following:
(1) Kerosene
(2) Trichloroethylene
(3) A neutral emulsion type detergent

- Check the in-tank fuel filter for damage or clogging.
- Check the check valve for malfunction.



FUEL CUT OFF VALVE INSPECTION

If the sound of the float valve moving (knocking sound) can be heard when the valve assembly is gently shaken up and down, then the valve is okay.



CHECKING 2-WAY VALVE

Attach a clean rubber hose, and check the operation of the 2-way valve.

Inspection procedure	Normal condition
Blow lightly from the inlet side (fuel tank side).	Air passes through after a slight resistance is felt.
Blow lightly from the outlet side (canister side).	Air passes through.

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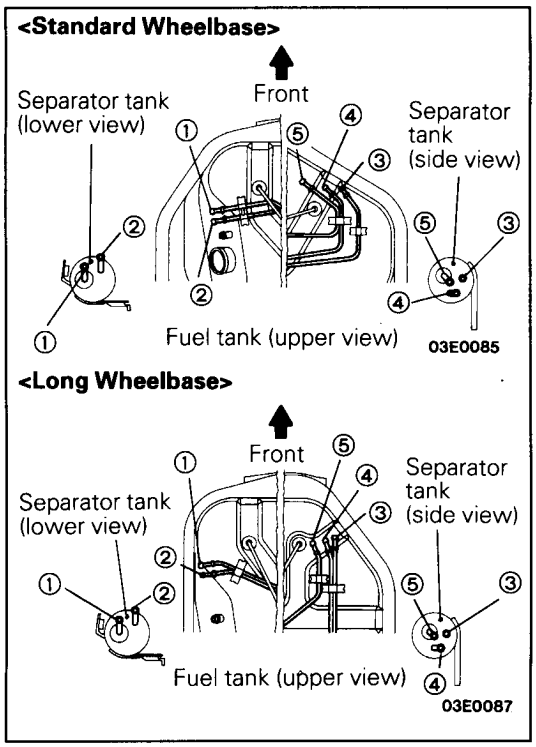
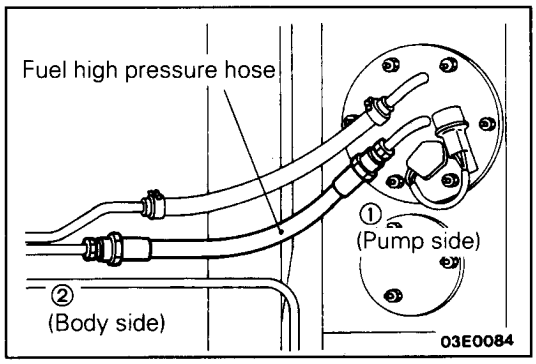


SERVICE POINTS OF INSTALLATION E13GDAZ

20. INSTALLATION OF VAPOUR HOSES/19./4. SEPARATOR TANK <Vehicle built up to May, 1994>

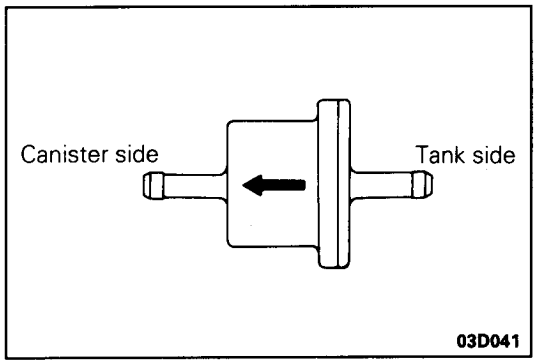
Connect the vapour hoses with the corresponding numbers as shown in the illustration.

Caution
Connect the vapour hose with the identification mark (yellow tape) between (1)–(1), with the mark towards the separator tank side.



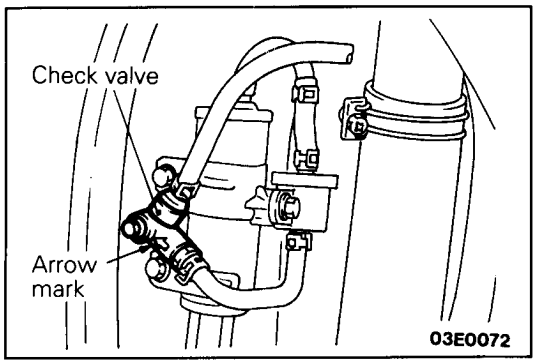
5. INSTALLATION OF FUEL HIGH PRESSURE HOSE <4G64, 6G72, 6G74>

After tightening the high pressure fuel hose at the pump side, tighten the connection at the body-side main pipe.



3. INSTALLATION OF 2-WAY VALVE

Install the 2-way valve, being careful not to mistake the direction.



2. INSTALLATION OF FUEL CHECK VALVE

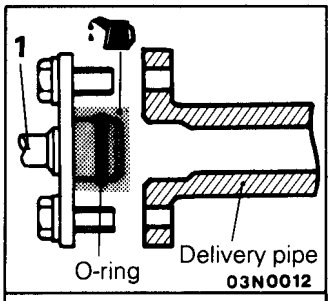
Install the fuel check valve as shown in the illustration, being careful not to mistake the direction.

FUEL LINE AND VAPOUR LINE <4G64, 6G72, 6G74>

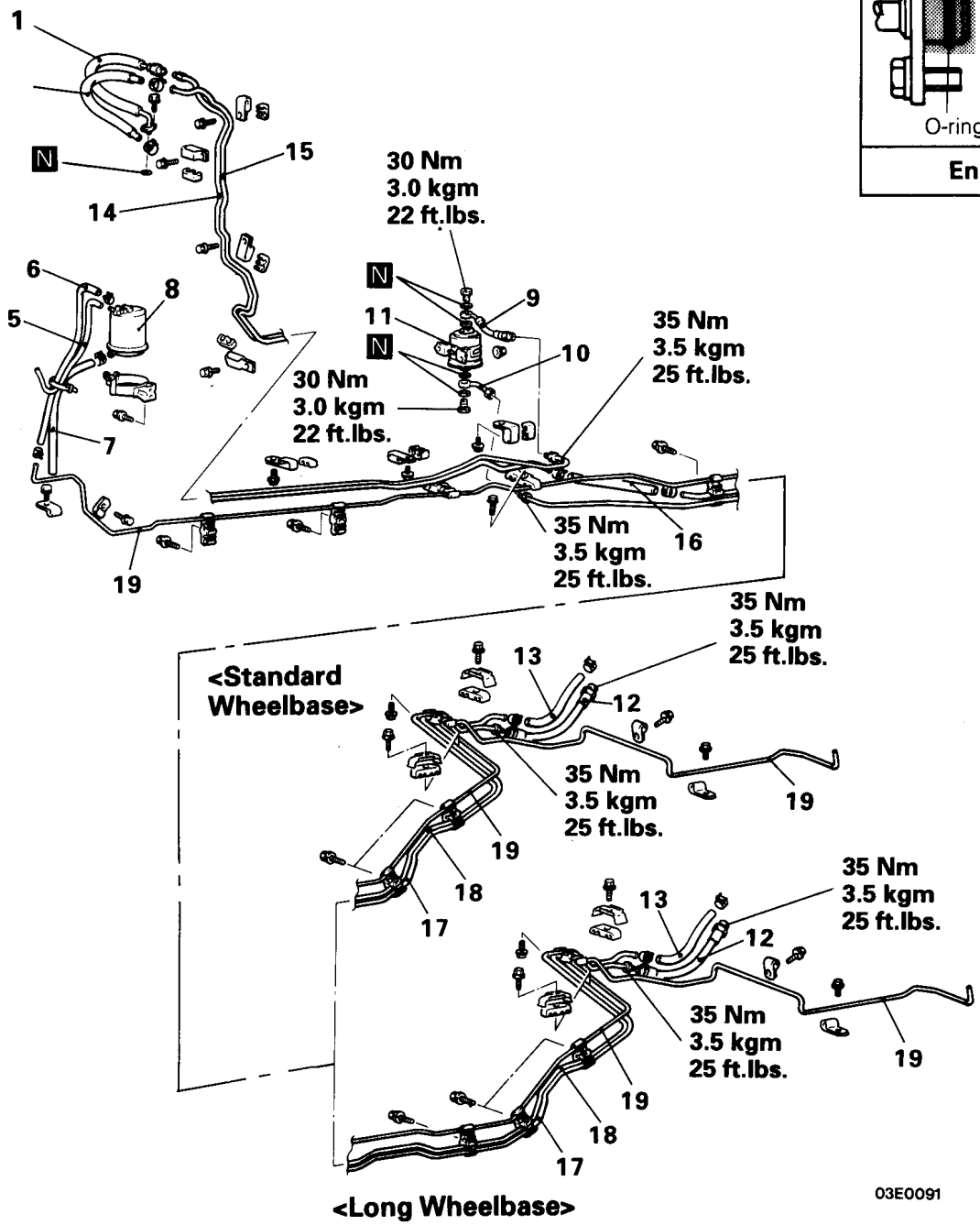
REMOVAL AND INSTALLATION

E13KA-A

Pre-removal Operation
- Release of Residual Pressure from High Pressure Fuel Hose (Refer to P.13-16, 89.)



Engine oil



Removal steps

- ◆◆ ◆◆ 1. High pressure fuel hose
- ◆◆ 2. Fuel return hose
- ◆◆ 5. Fuel vapour hose
- ◆◆ 6. Fuel vapour hose
- ◆◆ 7. Fuel vapour hose
- 8. Canister
- ◆◆ 9. High pressure fuel hose
- ◆◆ 10. Joint assembly
- 11. Fuel filter
- ◆◆ 12. High pressure fuel hose
- ◆◆ 13. Fuel return hose
- 14. Fuel main pipe (front)
- 15. Fuel return pipe (front)
- ◆◆ 16. Fuel return hose
- 17. Fuel main pipe (rear)
- 18. Fuel return pipe (rear)
- 19. Fuel vapour pipe

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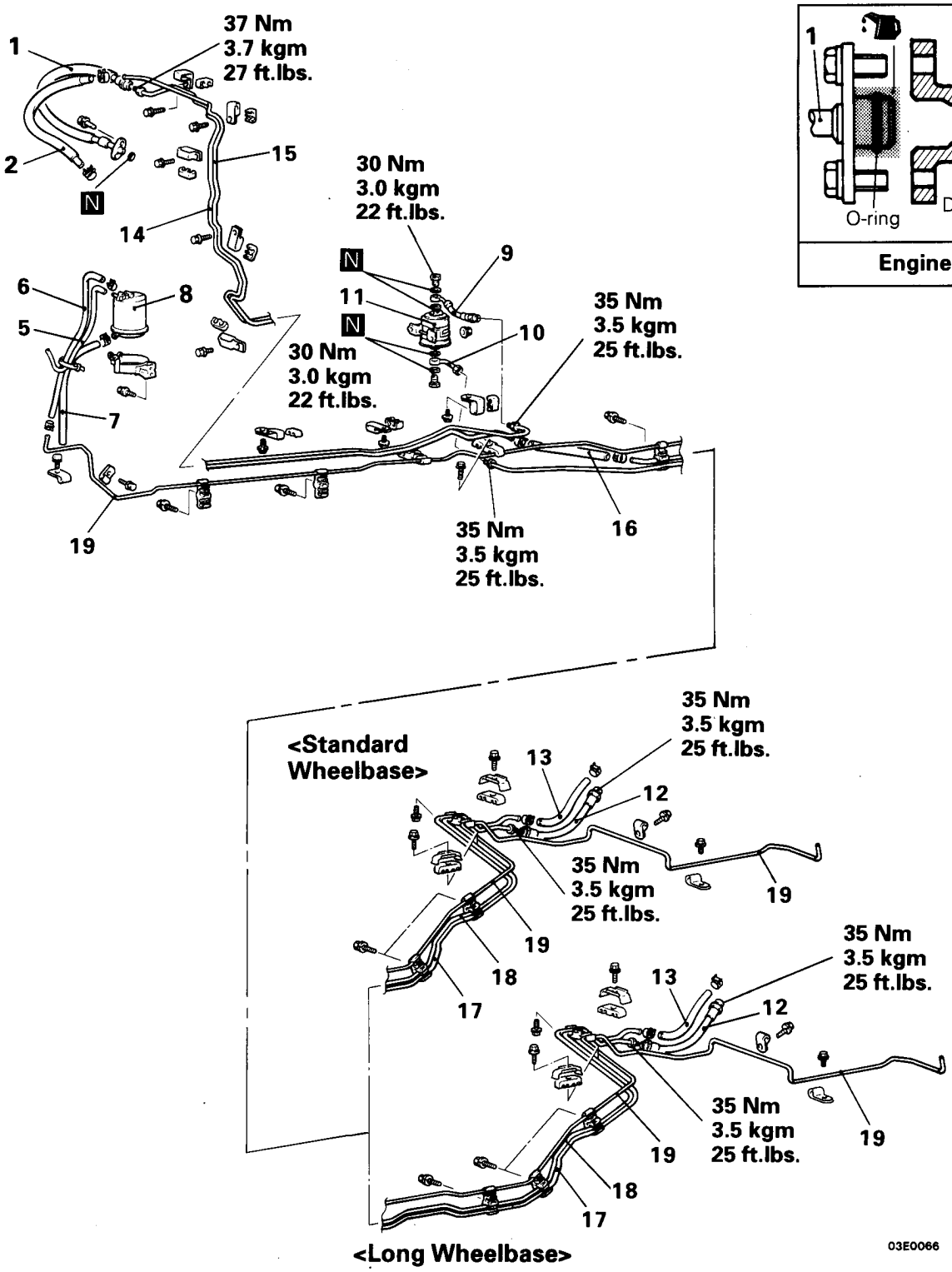
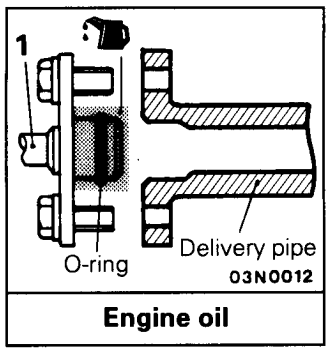
<6G72 – 12 VALVE built up to October, 1993>





Engine oil

Removal steps

- 1. High pressure fuel hose
- 2. Fuel return hose
- 5. Fuel vapour hose
- 6. Fuel vapour hose
- 7. Fuel vapour hose
- 8. Canister
- 9. High pressure fuel hose
- 10. Joint assembly
- 11. Fuel filter
- 12. High pressure fuel hose
- 13. Fuel return hose
- 14. Fuel main pipe (front)
- 15. Fuel return pipe (front)
- 16. Fuel return hose
- 17. Fuel main pipe (rear)
- 18. Fuel return pipe (rear)
- 19. Fuel vapour pipe

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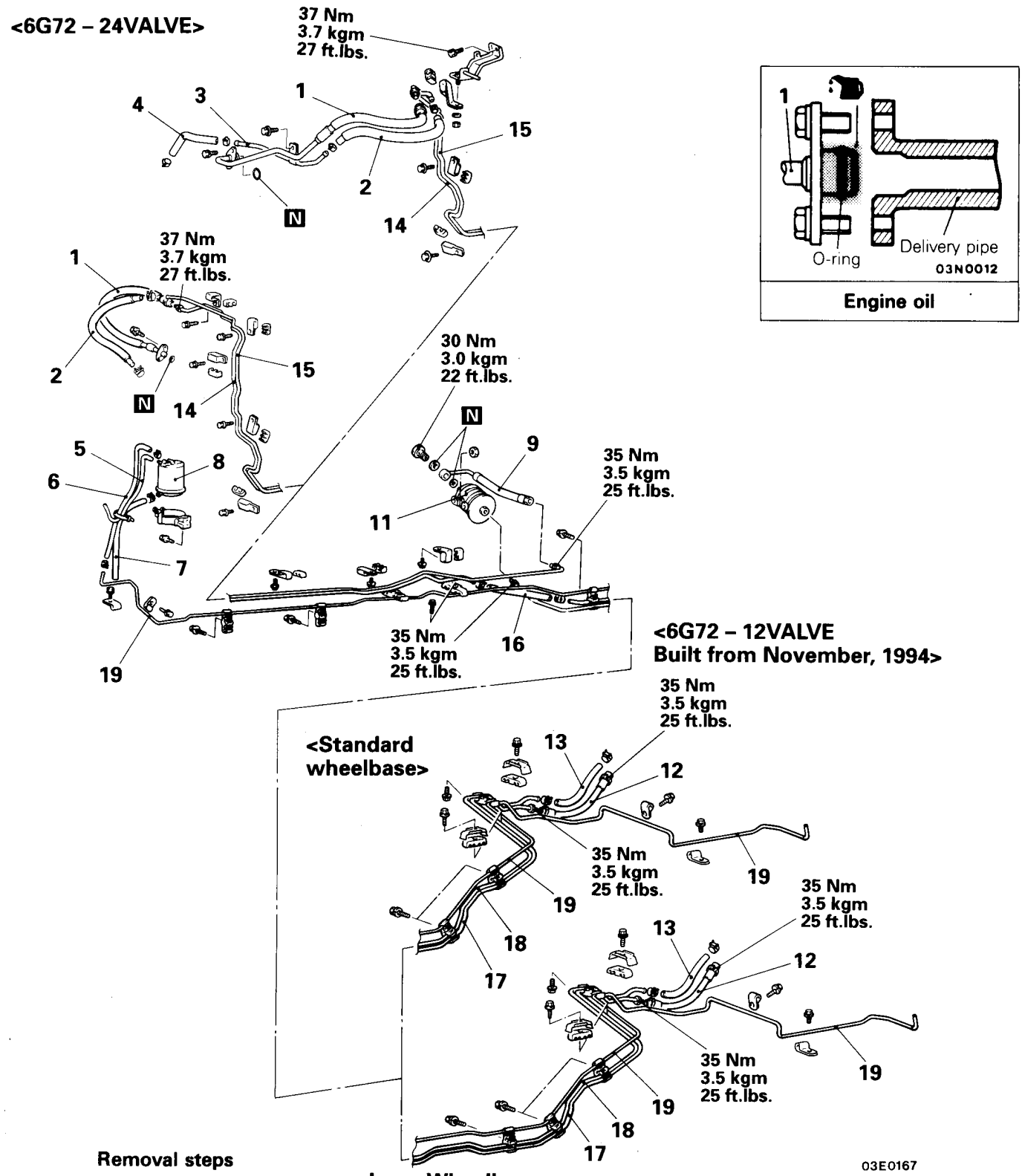

Removal steps

- 1. High pressure fuel hose
- 2. Fuel return hose
- 3. Fuel return pipe
- 4. Fuel return hose
- 5. Fuel vapour hose
- 6. Fuel vapour hose
- 7. Fuel vapour hose
- 8. Canister
- 9. High pressure fuel hose
- 10. Joint assembly
- 11. Fuel filter
- 12. High pressure fuel hose
- 13. Fuel return hose
- 14. Fuel main pipe (front)
- 15. Fuel return pipe (front)
- 16. Fuel return hose
- 17. Fuel main pipe (rear)
- 18. Fuel return pipe (rear)
- 19. Fuel vapour pipe

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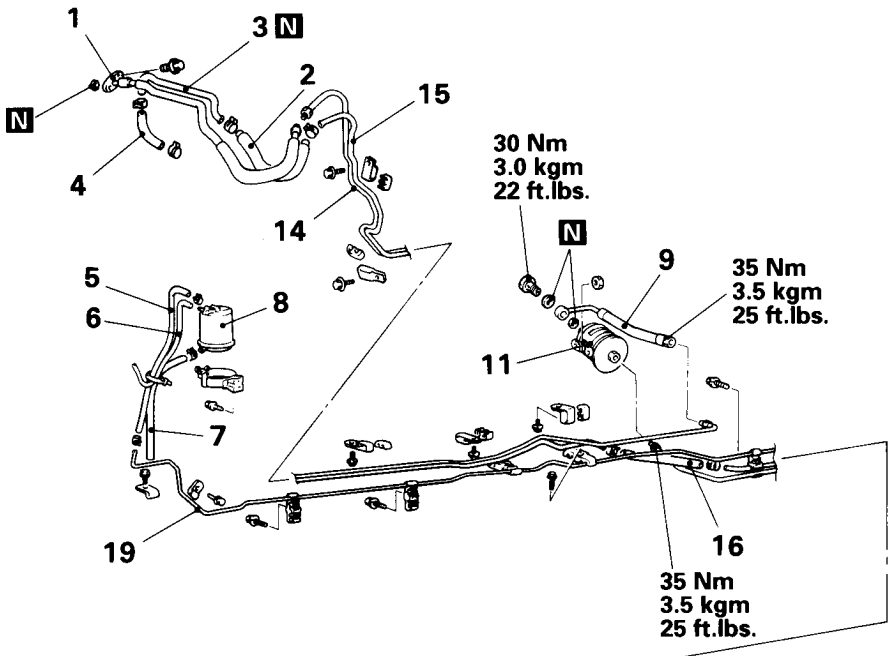
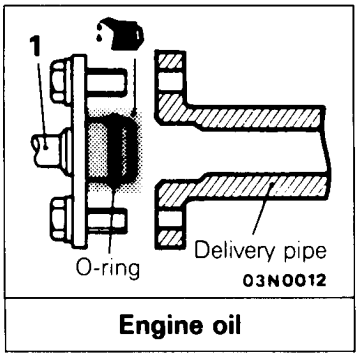
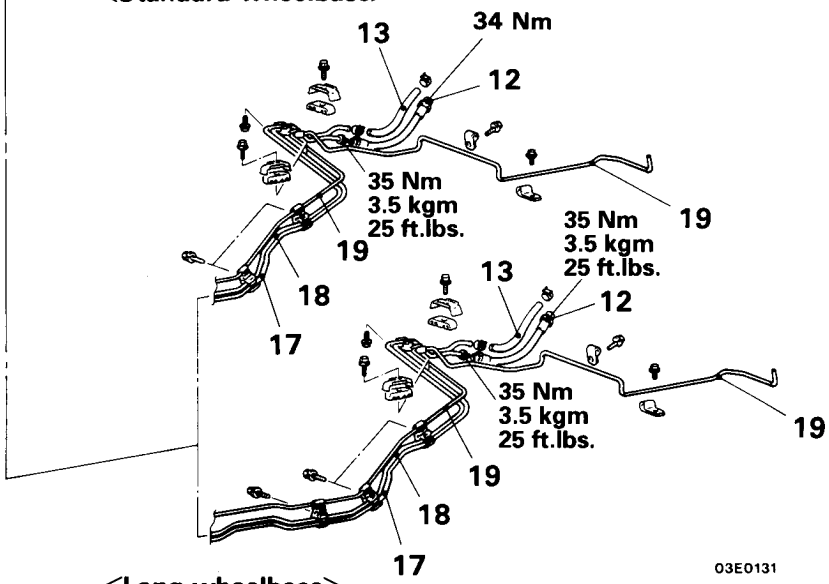
<6G74>





Engine oil

<Standard wheelbase>



<Long wheelbase>

Removal steps

- ◆◆ ◆◆ 1. High pressure fuel hose
- ◆◆ 2. Fuel return hose
- 3. Fuel return pipe
- ◆◆ 4. Fuel return hose
- ◆◆ 5. Fuel vapour hose
- ◆◆ 6. Fuel vapour hose
- ◆◆ 7. Fuel vapour hose
- 8. Canister
- ◆◆ 9. High pressure fuel hose
- ◆◆ 10. Joint assembly
- 11. Fuel filter
- ◆◆ 12. High pressure fuel hose
- ◆◆ 13. Fuel return hose
- 14. Fuel main pipe (front)
- 15. Fuel return pipe (front)
- ◆◆ 16. Fuel return hose
- 17. Fuel main pipe (rear)
- 18. Fuel return pipe (rear)
- 19. Fuel vapour pipe

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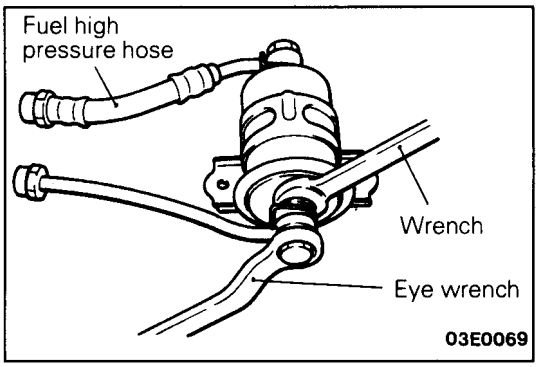
SERVICE POINTS OF REMOVAL E13KBAN

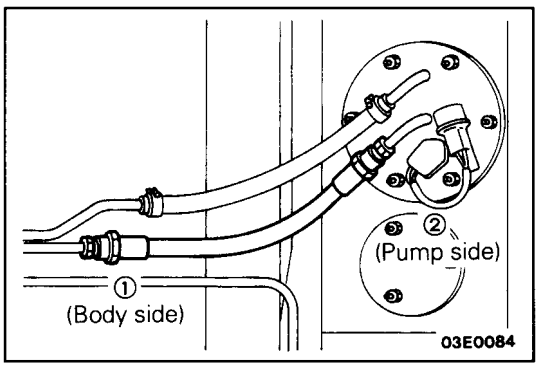
1. REMOVAL OF HIGH PRESSURE FUEL HOSE

Caution
Cover the high pressure hose connection with rags to prevent splash of fuel that could be caused by some residual pressure in the fuel pipe line.



9. REMOVAL OF HIGH PRESSURE FUEL HOSE/10. JOINT ASSEMBLY

Hold fuel filter with a wrench and remove eye bolt retaining high pressure fuel hose joint assembly with an eye wrench.

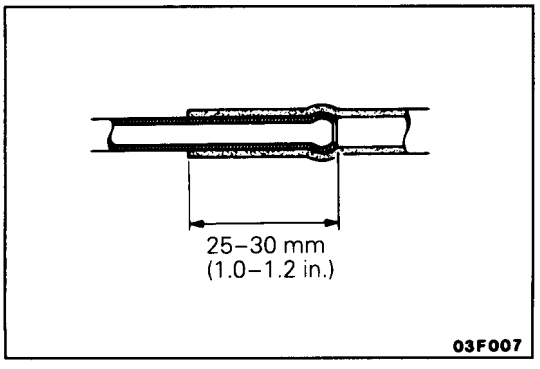


12. REMOVAL OF HIGH PRESSURE FUEL HOSE

After disconnecting the high-pressure fuel hose at the body-side main pipe connection, disconnect the pump-side connection.

INSPECTION E13KCAM

- Check the fuel hoses and pipes for cracks, bend, deformation, deterioration or clogging.
- Check the fuel filter for clogging or damage.
- Check the canister for clogging or damage.



SERVICE POINTS OF INSTALLATION E13KDBA

16./13./4./2. INSTALLATION OF FUEL RETURN HOSE/ 7./6./5. FUEL VAPOUR HOSE

Insert each hose approximately 25–30 mm (1.0–1.2 in.) into the corresponding pipe.

1. INSTALLATION OF HIGH PRESSURE FUEL HOSE (DELIVERY PIPE SIDE)

Insert the hose, being careful not to damage the O-ring, and tighten securely.

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FUEL LINE <4D56, 4M40>

REMOVAL AND INSTALLATION

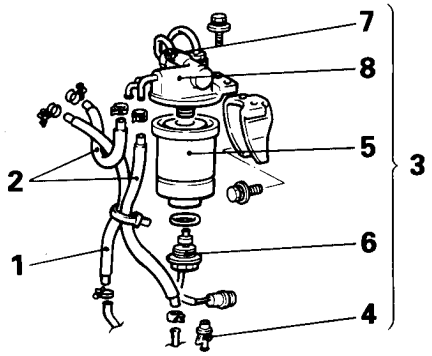
E13KA-B

Pre-removal Operation
- Removal of the Intercooler (Refer to GROUP 15 – Intercooler)

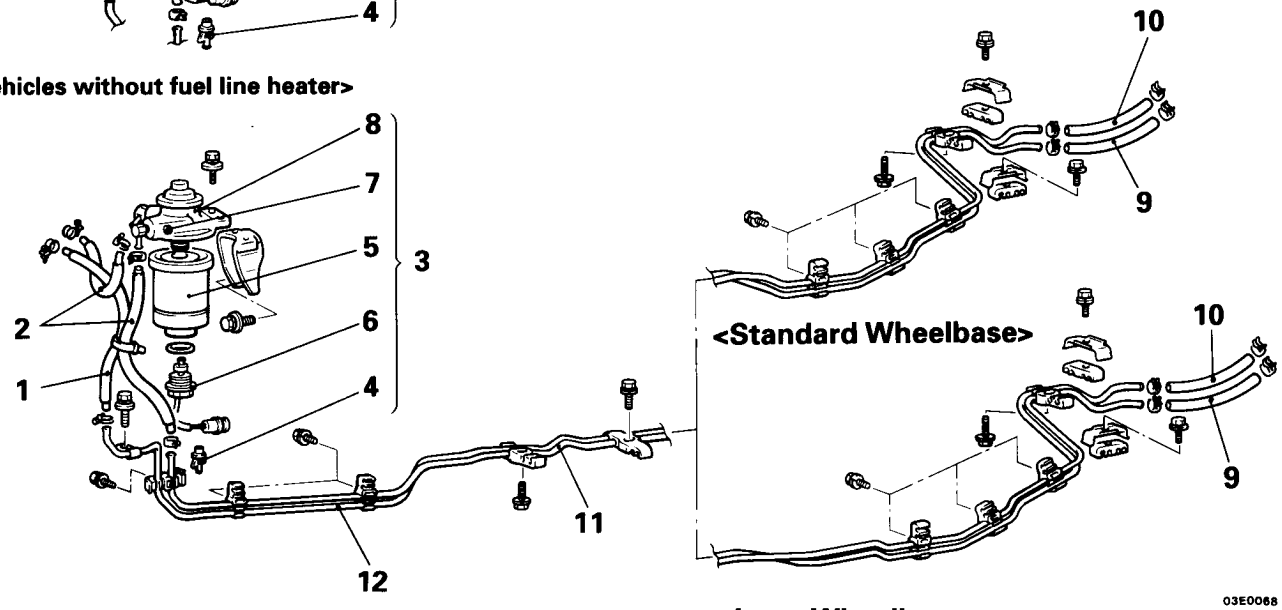
Post-installation Operation
- Installation of the Intercooler (Refer to GROUP 15 – Intercooler)
- Air Bleeding of Fuel Line (Refer to P.13-144.)

<4D56>

<Vehicles with fuel line heater>



<Vehicles without fuel line heater>

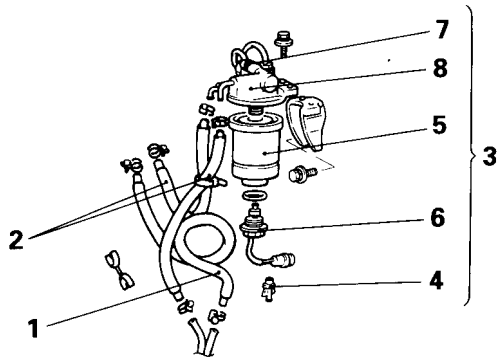


Removal steps

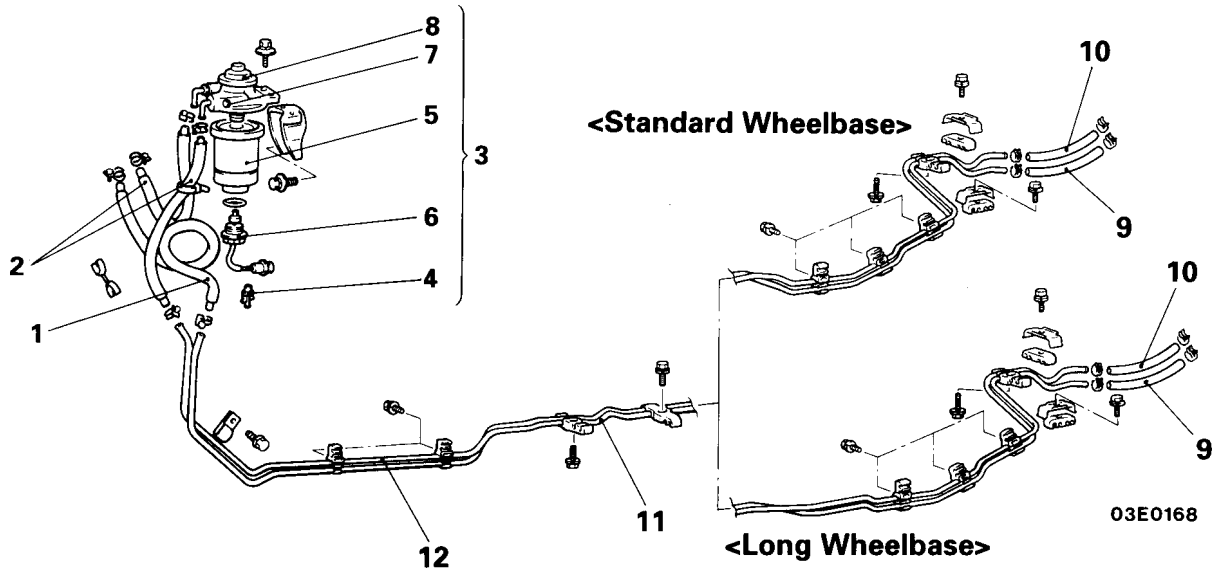
◀▶ ▶◀ 1. Fuel return hose
◀▶ ▶◀ 2. Fuel main hose
3. Fuel filter assembly
4. Drain plug
◀▶ 5. Fuel filter cartridge
◀▶ 6. Water level sensor
7. Air plug
8. Fuel filter pump body
▶◀ 9. Fuel main hose
▶◀ 10. Fuel return hose
11. Fuel main pipe
12. Fuel return pipe

<4M40>

<Vehicles with line heater>



<Vehicles without line heater>



Removal steps

- 1. Fuel return hose
- 2. Fuel main hose
- 3. Fuel filter assembly
- 4. Drain plug
- 5. Fuel filter cartridge
- 6. Water level sensor
- 7. Air plug
- 8. Fuel filter pump body
- 9. Fuel main hose
- 10. Fuel return hose
- 11. Fuel main pipe
- 12. Fuel return pipe

SERVICE POINTS OF REMOVAL E13KBAO

1. REMOVAL OF FUEL RETURN HOSE/2. FUEL MAIN HOSE

Caution
Cover with a rag to prevent fuel from spraying out.

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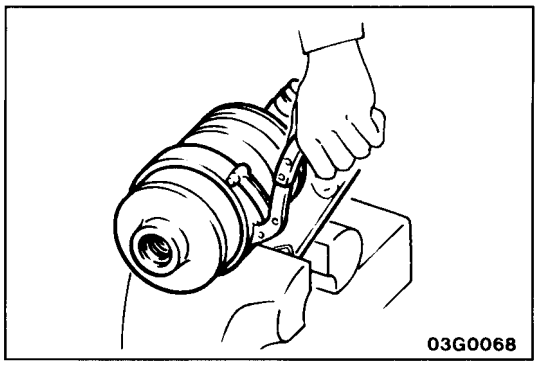
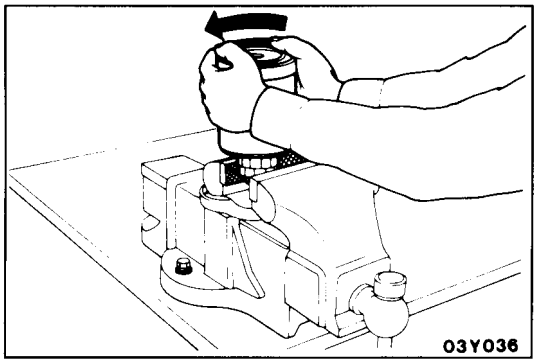


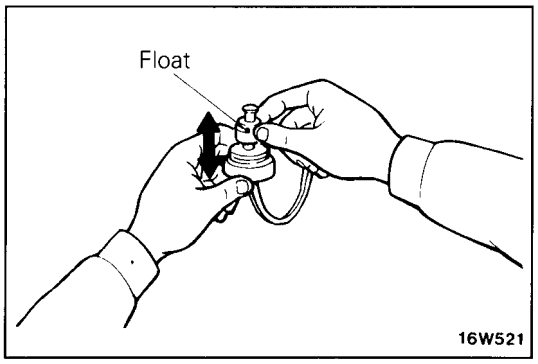
5. REMOVAL OF FUEL FILTER CARTRIDGE

Hold fuel filter pump in vice. Remove fuel filter cartridge with oil filter wrench.



6. REMOVAL OF WATER LEVEL SENSOR

Hold water level sensor in vice. Remove fuel filter cartridge by hand.

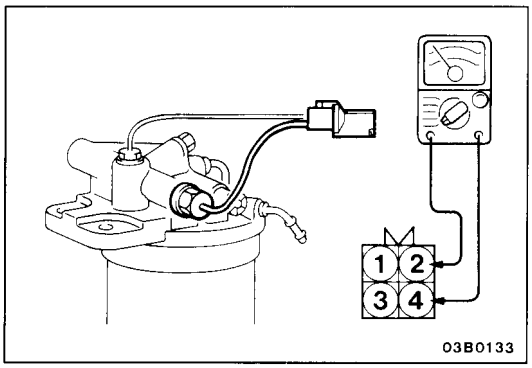


INSPECTION E13KCAN

- Check hoses and line for cracks, bends, deterioration or clogging.
- Check fuel filter for clogging or damage.

WATER LEVEL SENSOR OPERATION

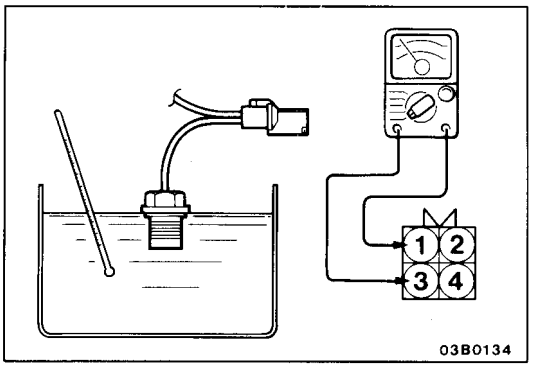
Connect circuit tester to water level sensor connector. Water level sensor is operating correctly if there is continuity when float is raised and no continuity when lowered.



HEATER <Vehicles with fuel line heater>

Measure resistance between terminals ② and ④ of the heater connector.

Standard value: 1.3±0.2 Ω



FUEL TEMPERATURE SENSOR <Vehicles with fuel line heater>

(1) Immerse the fuel temperature sensor in warm water as shown in the illustration.
(2) Check the continuity between terminals ① and ③ with a circuit tester as the temperature of the liquid changes.

Standard value:

Temperature	°C (°F)	0 (32)	10 (50)	20 (68)
Resistance	kΩ	1.85–2.5	3.3–4.6	6.0–8.0

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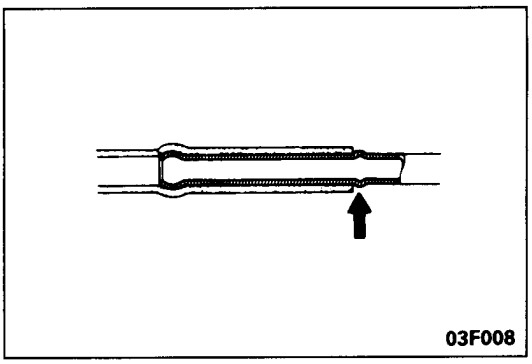
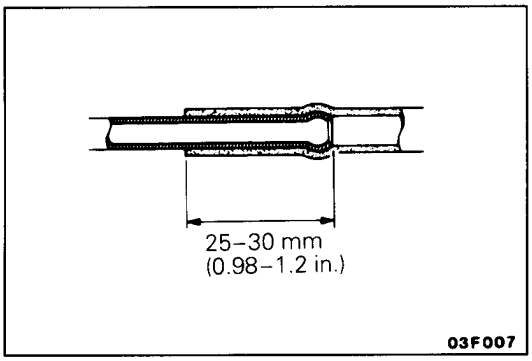

03F008

SERVICE POINTS OF INSTALLATION E13KDBB

10. INSTALLATION OF FUEL RETURN HOSE/9. FUEL MAIN HOSE

Insert each hose securely as far as the stepped section on the pipes.



03F007

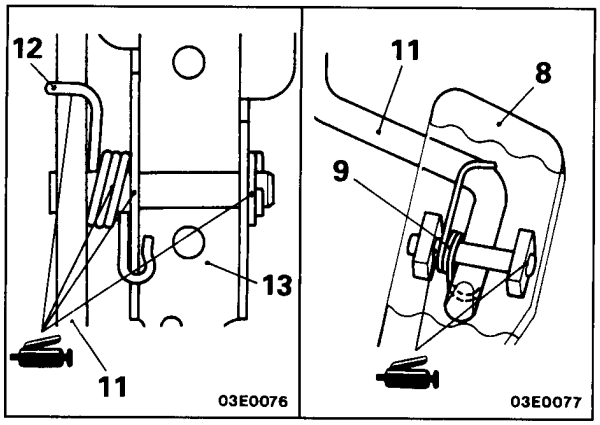
2. INSTALLATION OF FUEL MAIN HOSE/1. FUEL RETURN HOSE

Insert each hose 25–30 mm (1.0–1.2 in.). If the pipe side is too short, insert the hose as far as possible.

ACCELERATOR CABLE AND PEDAL

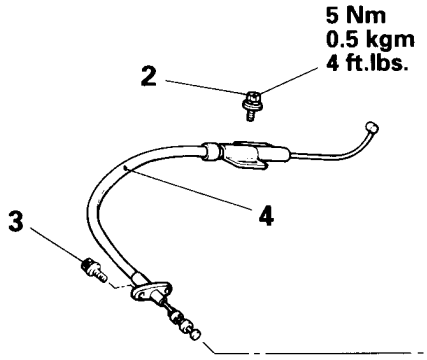
E13OA-

REMOVAL AND INSTALLATION

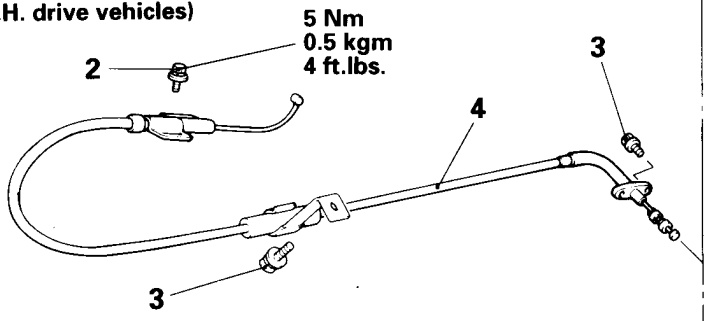


<6G72 – 12VALVE, 6G74>

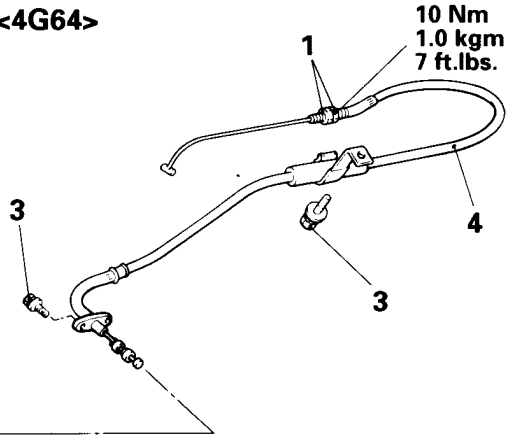
(L.H. drive vehicles)



(R.H. drive vehicles)

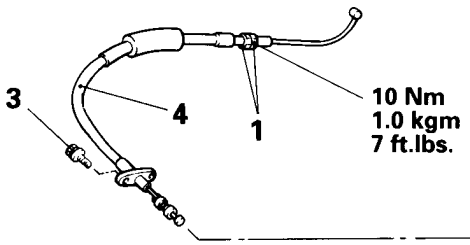


<4G64>

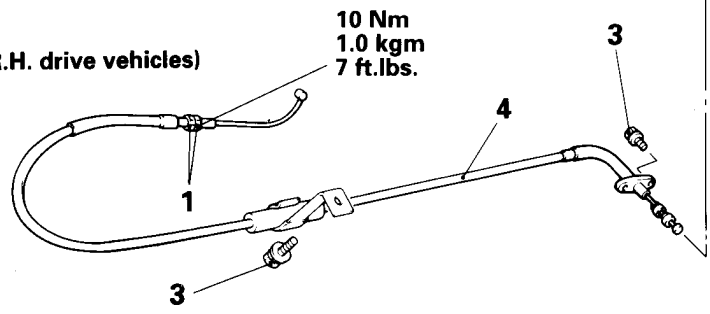


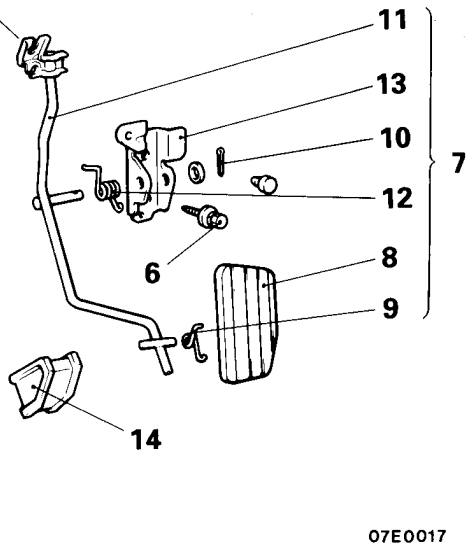
<6G72 – 24VALVE>

(L.H. drive vehicles)



(R.H. drive vehicles)





07E0017

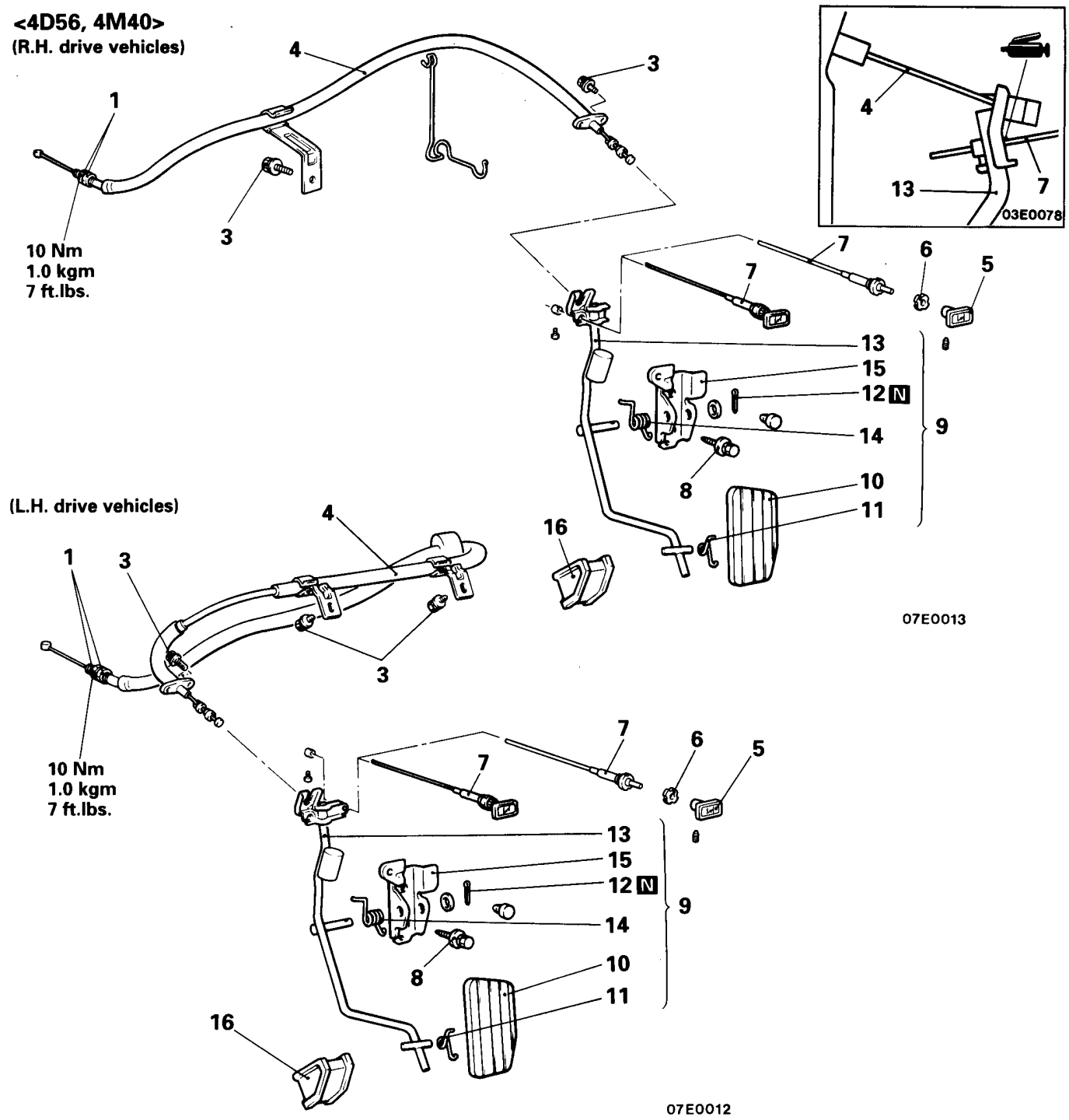
Removal steps of accelerator cable

- Adjustment of accelerator cable (Refer to P.13-14, 89.)

1. Accelerator cable adjusting nuts
2. Accelerator cable adjusting bolts
3. Accelerator cable mounting bolts
4. Accelerator cable

Removal steps of accelerator pedal

6. Accelerator arm bracket mounting bolts
7. Accelerator pedal assembly
8. Pedal
9. Spring
10. Split pin
11. Accelerator arm
12. Return spring
13. Accelerator arm bracket
14. Stopper



Removal steps of accelerator cable

- Intercooler
  (Refer to GROUP 15 – Intercooler)
- Adjustment of accelerator cable
  (Refer to P.13-143, 150-2.)

1. Accelerator cable adjusting nuts
3. Accelerator cable mounting bolts
4. Accelerator cable

Removal steps of accelerator pedal

5. Nob
6. Nut
   } (Vehicles built from June 1991)
◆◆ 7. Idle control cable
8. Accelerator arm bracket mounting bolts
9. Accelerator pedal assembly
10. Pedal
11. Spring
12. Split pin
13. Accelerator arm
14. Return spring
15. Accelerator arm bracket
16. Stopper

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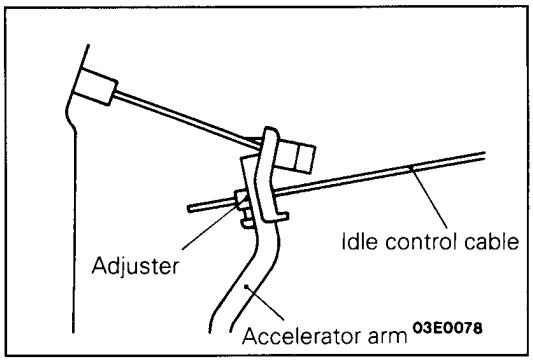
INSPECTION E13OCAM

- Check inner cable for damage.
- Check outer cable for damage.
- Check sliding condition of cable.
- Check accelerator arm bend.
- Check return spring for wear.
- Check connection of inner cable and end metal fittings.

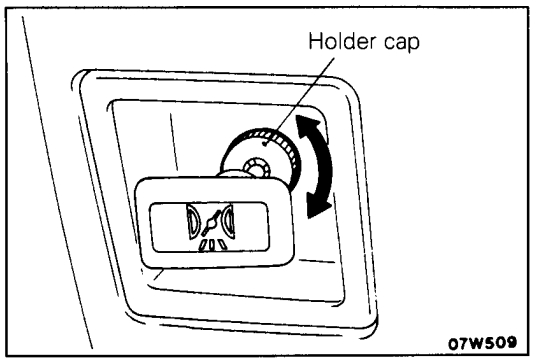


SERVICE POINTS OF INSTALLATION E13ODAP

7. INSTALLATION OF IDLE CONTROL CABLE

(1) With the idle control knob pushed in fully, move the adjuster until there is no play in the idle control cable, and then tighten the cable.

Caution
Check that there is no tension on the accelerator arm from the idle control cable.



(2) Adjust the holder cap so that when the idle control knob is pulled out by hand fully and then released, the knob moves back no more than 10 mm (0.4 in.). (Vehicles built up to May 1991)

AUTO-CRUISE CONTROL SYSTEM

SPECIFICATIONS

GENERAL SPECIFICATIONS

E13CA--

Items		Specifications
Main switch		
Rated load	A	1
Voltage drop	V	0.15 or less
Control switch		
Rated load	A	
SET		0.1
RESUME		0.1
CANCEL		1.2
Voltage drop	V	0.2 or less
Auto-cruise control unit		
Set error	km/h (mph)	$0^{0}_{-1.0}$ ($0^{0}_{-0.6}$)
Range of speed control	km/h (mph)	40–200 (25–125)
Actuator		
Drive system		Vacuum type
Stroke	mm (in.)	38–42 (1.5–1.7)
Motor-driven vacuum pump		
Rated load	A	0.4 or less

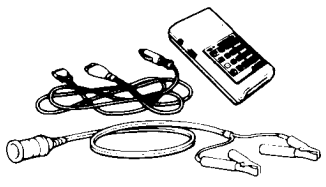
SERVICE SPECIFICATIONS

E13CB--

Items		Specifications
Accelerator cable play	mm (in.)	0–1 (0–0.04)
Throttle cable play	mm (in.)	1–2 (0.04–0.08)
Auto-cruise control cable play	mm (in.)	1–2 (0.04–0.08)
Control valve, release valve resistance	Ω	50–60

SPECIAL TOOLS

E13DA--

Tool	Number	Name	Use
	MB991341	Multi-use tester assembly	Vehicles built up to October, 1993 • Checking of the self-diagnosis output
	MB991419	ROM pack	

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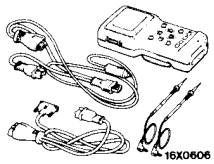
Tool	Number	Name	Use
 16X0606	MB991502	MUT-II	All models • Checking of the diagnostic output
16X0607		ROM pack	

NOTES

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TROUBLESHOOTING <AUTO-CRUISE CONTROL SYSTEM> E13EDACa

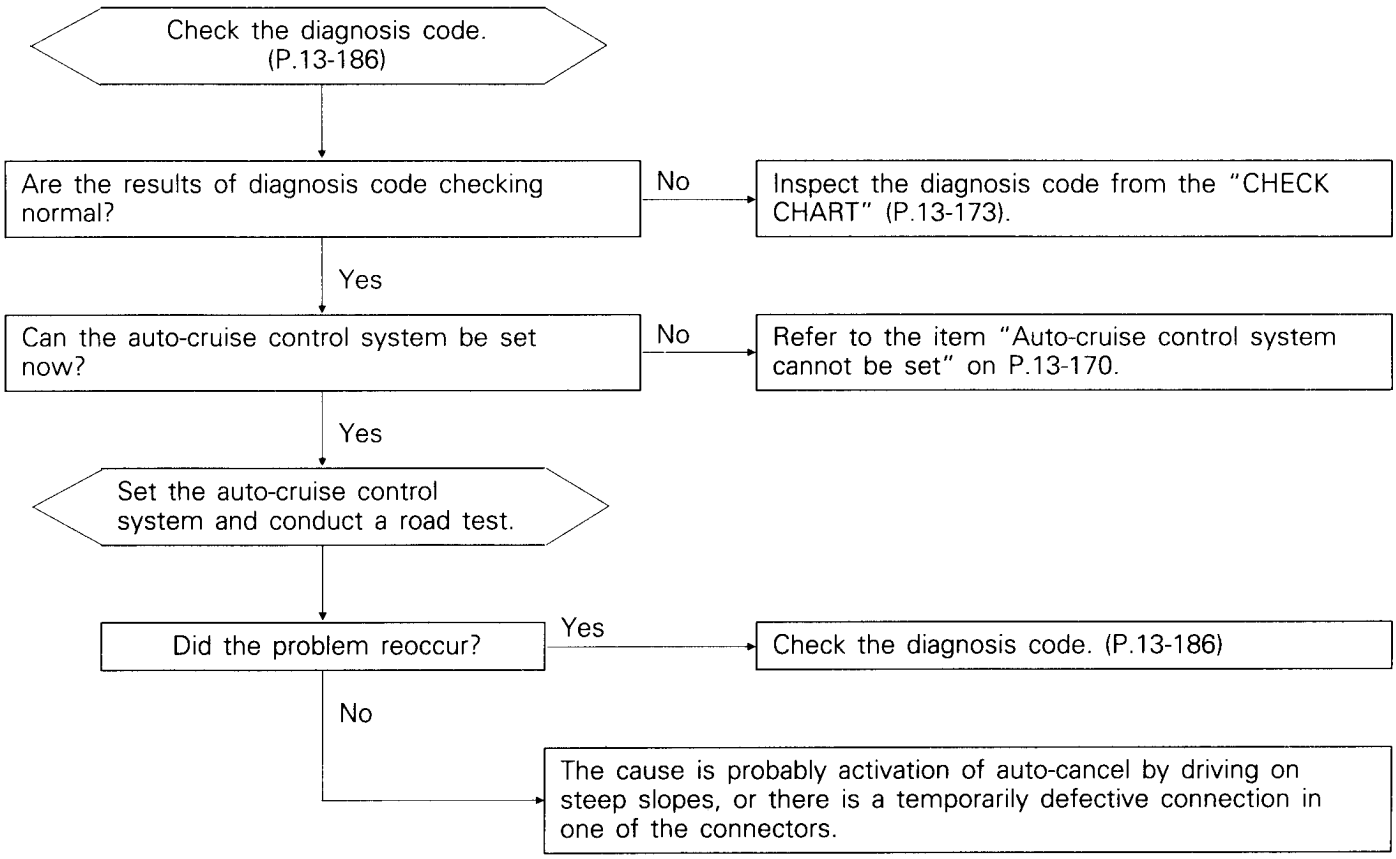
Before commencing troubleshooting, carry out each of the following inspections, and make repairs if necessary.

1. Check that the motor-driven vacuum pump assembly, actuator, intermediate link, each cable and the vacuum hose are all installed correctly, and that each cable and vacuum hose circuit is correct.
2. Check that the movement of the intermediate link and each cable is smooth.
3. Check that there is not too much play or tension in each cable.

TROUBLESHOOTING QUICK-REFERENCE CHART

Auto-cruise control system is canceled when cancellation not wanted.
Or, the auto-cruise control system cannot be set after an automatic cancellation.

ECU: Electronic control unit



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Auto-cruise control system cannot be set.

NOTE
This chart is to be used, then, for troubleshooting if it is not possible to use the self-diagnosis for checking.

Prepare to conduct input checking. (P.13-187)

↓

Are the results of all input checks normals?

Yes

No

Check results	Probable cause	Remedy	Check chart No.
Code 21 remains even though SET switch is set to OFF.	SET switch ON malfunction	Replace the control switch.	No. 2
	SET switch input line short-circuit	Repair the harness.	
Code 22 remains even though RESUME switch is set to OFF.	RESUME switch ON malfunction	Replace the control switch.	No. 3
	RESUME switch input line short-circuit	Repair the harness.	
Code 23 remains even if the stop lamp switch is turned OFF by releasing the brake pedal.	Malfunction of stop lamp switch circuit.	Replace stop lamp switch or repair harness.	No. 7
Code 25 remains, and code 24 does not appear, even though vehicle speed reaches approximately 40 km/h (25 mph) or higher.	Malfunction of the vehicle-speed sensor circuit (damaged or disconnected wiring, or short-circuit)	Check or repair the vehicle speed sensor circuit.	No. 5
Code 26 remains even if the clutch switch is turned OFF by releasing the clutch pedal. <M/T>	Malfunction of clutch switch circuit.	Replace clutch switch or repair harness.	No. 8
Code 26 remains even if the selector lever is moved to anything but N, P. <A/T>	Malfunction of inhibitor switch circuit.	Replace inhibitor switch or repair harness.	No. 9
Code 27 remains even though CANCEL switch is set to OFF.	Malfunction of CANCEL switch circuit.	Replace the control switch or repair harness.	No. 4
Code 28 remains even if the accelerator is released. <3000>	Malfunction of throttle position sensor circuit.	Replace the sensor or repair harness.	No. 11
Code 29 remains even though the idle switch is set to ON. <3000>	Malfunction of idle switch circuit	Replace the switch or repair harness.	No. 11

↓

Check the motor-driven vacuum pump circuit. (Go to check chart No. 6)

NOTE
If the results of the check of the motor-driven vacuum pump circuit (check chart No. 6) and actuator reveal no abnormal condition, replace the electronic control unit (ECU).

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Trouble symptom	Probable cause	Check chart No.	Remedy
• The set vehicle speed varies greatly upward or downward. • "Hunching" (repeated alternating acceleration and deceleration) occurs after setting is made.	Malfunction of the vehicle speed sensor circuit	No. 5	Repair the vehicle speed sensor system, or replace the part.
	Malfunction of the speedometer cable or speedometer drive gear		
	Motor-driven vacuum pump circuit poor contact	No. 6	Repair the motor-driven vacuum pump or replace the part.
	Malfunction of the motor-driven vacuum pump		
	Malfunction of the ECU	—	Replace the ECU.
The auto-cruise control system is not canceled when the brake pedal is depressed.	Damaged or disconnected wiring of the stop lamp switch input circuit or stop lamp switch (for auto-cruise control) poor contact (short-circuit)	If the input check code No. 23 indicates a malfunction, see the check chart No. 7	Repair the harness or replace the stop lamp switch.
	Motor-driven vacuum pump drive circuit short-circuit	No. 6	Repair the harness or replace the motor-driven vacuum pump.
	Malfunction of the ECU	—	Replace the ECU.
The auto-cruise control system is not canceled when the clutch pedal is depressed. <M/T> (It is canceled, however, when the brake pedal is depressed.)	Damaged or disconnected wiring of clutch switch input circuit	If the input check code No. 23 indicates a malfunction, see the check chart No. 8	Repair the harness, or repair or replace the clutch switch.
	Clutch switch improper installation (won't switch ON)		
	Malfunction of the ECU	—	Replace the ECU.
The auto-cruise control system is not canceled when the selector lever is moved to the "N" position. <A/T> (It is canceled, however, when the brake pedal is depressed.)	Damaged or disconnected wiring of inhibitor switch input circuit	If the input check code No. 23 indicates a malfunction, see the check chart No. 9	Repair the harness, or repair or replace the inhibitor switch.
	Improper adjustment of inhibitor switch		
	Malfunction of the ECU	—	Replace the ECU.

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Trouble symptom	Probable cause	Check chart No.	Remedy
Cannot decelerate by using the SET switch	Temporary damaged or disconnected wiring of SET switch input circuit	No. 2	Repair the harness or replace the control switch.
	Motor-driven vacuum pump circuit poor contact	No. 6	Repair the harness or replace the motor-driven vacuum pump.
	Malfunction of the auto-cruise actuator		
	Malfunction of the ECU	—	Replace the ECU.
Cannot accelerate or resume speed by using the RESUME switch.	Damaged or disconnected wiring, or short-circuit, of RESUME switch input circuit	No. 3	Repair the harness or replace the control switch.
	Motor-driven vacuum pump circuit poor contact	No. 6	Repair the harness or replace the motor-driven vacuum pump.
	Malfunction of the motor-driven vacuum pump		
	Malfunction of the ECU	—	Replace the ECU.
Auto-cruise control system can be set while traveling at a vehicle speed of less than 40 km/h (25 mph), or there is no automatic cancellation at that speed.	Malfunction of the vehicle-speed sensor circuit	No. 5	Repair the vehicle-speed sensor system, or replace the part.
	Malfunction of the speedometer cable or the speedometer drive gear		
	Malfunction of the ECU	—	Replace the ECU.
The indicator lamp of the main switch does not illuminate. (But auto-cruise control system is normal.)	Damaged or disconnected bulb of indicator lamp or malfunction of the main switch	—	Repair the harness or replace the main switch.
	Harness damaged or disconnected		
Overdrive is not canceled during fixed speed driving. <3000-A/T>	Malfunction of circuit related to overdrive cancelation, or malfunction of ECU	No. 10	Repair the harness or replace the part.
No shift to overdrive during manual driving. <3000-A/T>			

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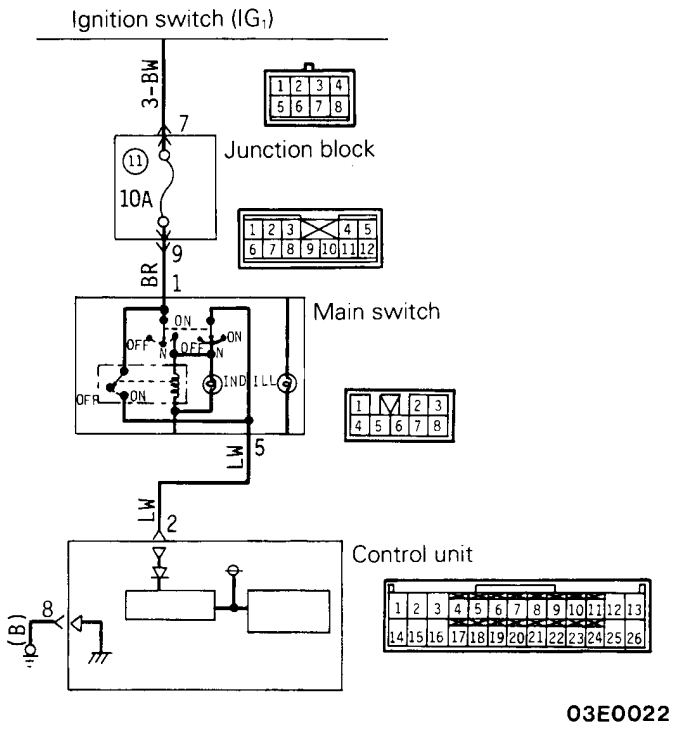
CHECK CHART

1. CHECKING THE CONTROL UNIT POWER SUPPLY CIRCUIT



Description of operation

When the main switch is switched ON while the ignition switch is ON, current flows to the ignition switch (IG_1), to fuse No. 11 of the junction block, and to the main switch, the control unit, and to earth. When the ignition switch is turned off, the main switch is also turned off.

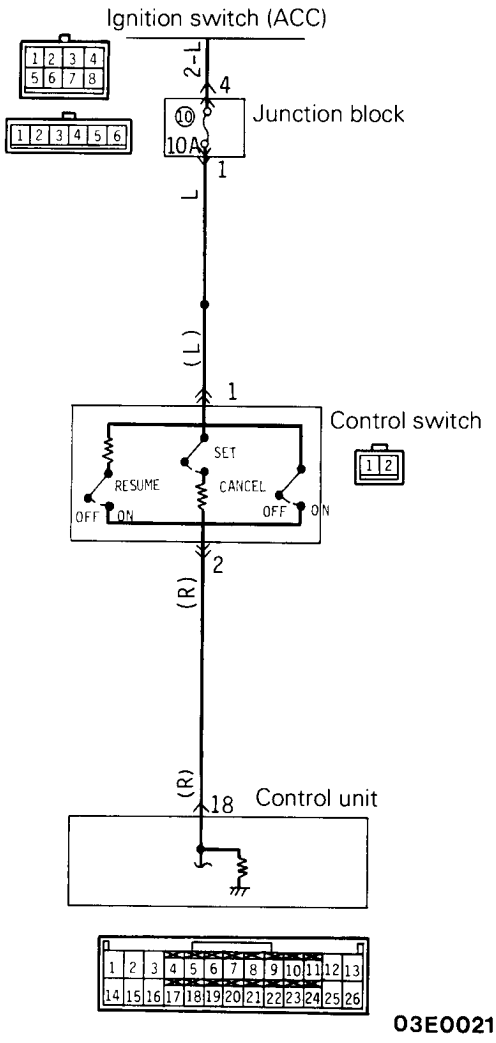
Troubleshooting hint

ECU terminal voltage

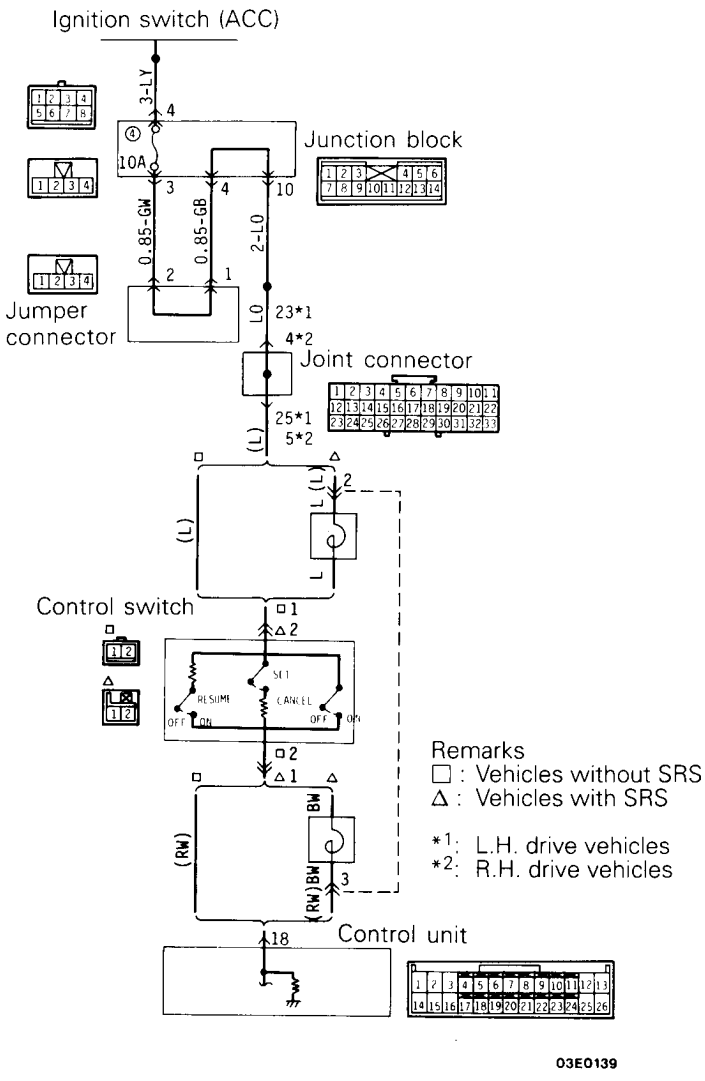
Terminal No.	Signal	Conditions	Terminal voltage
2	Control unit power supply	When the main switch is switched ON	System voltage
8	Control unit earth	At all times	0 V

2. CHECKING THE SET SWITCH CIRCUIT

<Vehicles built up to October, 1993>



<Vehicles built from November, 1993>



Description of operation

When driving at the desired speed [40–200 km/h (25–125 mph) and the main switch of the auto-cruise control system is pressed to ON, by turning the control switch to SET, the vehicle speed at this time will become the constant driving speed. Also, during constant speed driving, if the control switch is held continuously in the SET position, the vehicle speed will gradually decrease (COAST), and when the control switch is released, the speed at that time will be the constant driving speed. Current flows to fuse No. 4 of the junction block, to the control switch (SET) and to the control unit.

Troubleshooting hint

Diagnosis–No. 15 (automatically cancelled)

ECU terminal voltage

Terminal No.	Signal	Conditions	Terminal voltage
18	SET switch	When the control switch is turned to the SET position	3 V
		When the control switch is turned to the off position	0 V

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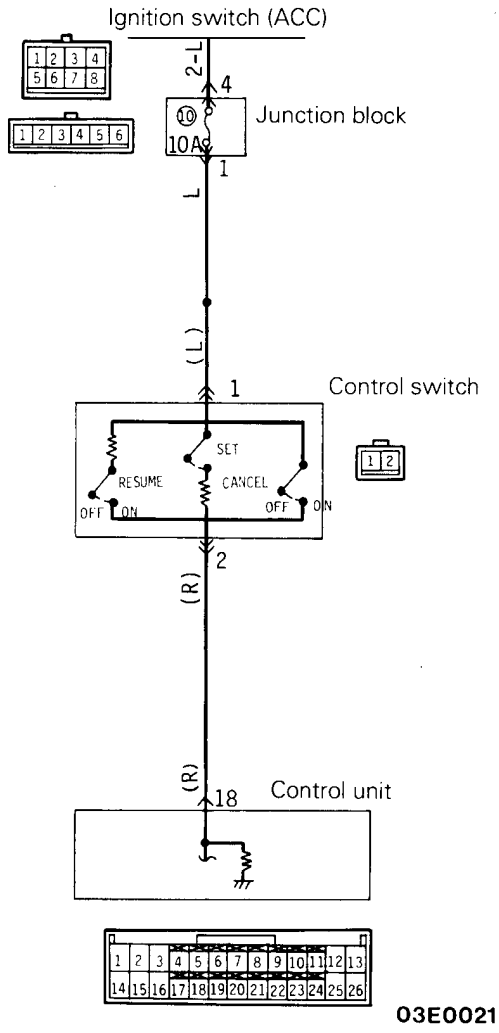
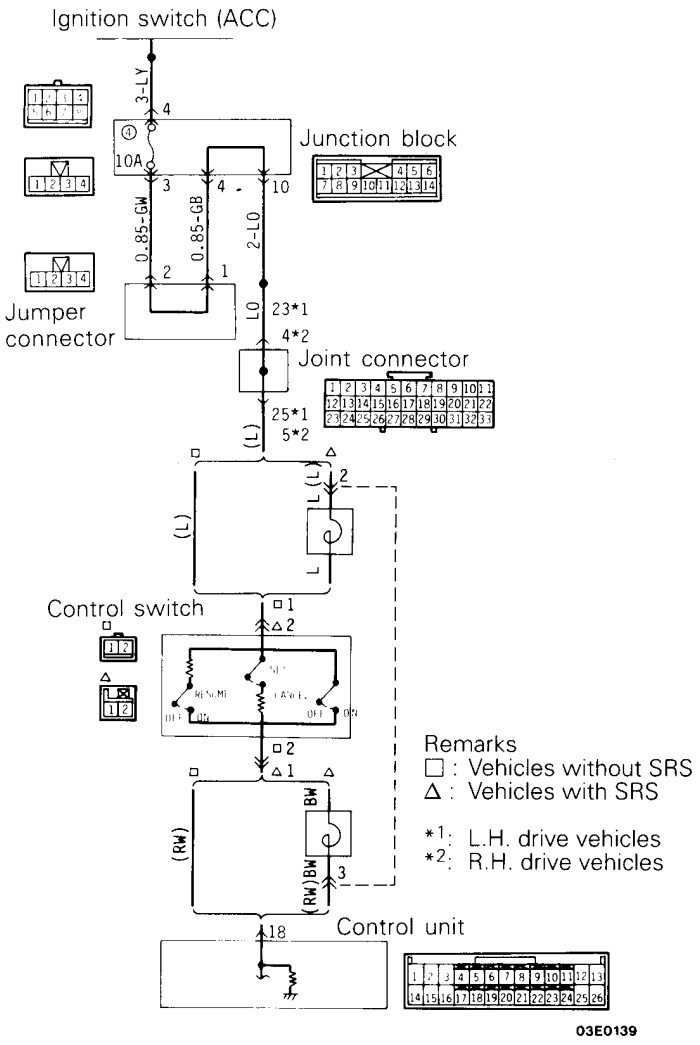
3. CHECKING THE RESUME SWITCH CIRCUIT

<Vehicles built up to October, 1993>



<Vehicles built from November, 1993>



Description of operation

The set speed (before cancellation) resumes when the control switch is turned to RESUME position, even if the constant-speed control has been cancelled.
That speed will not resume, however, even if the control switch is turned to RESUME position, if the main switch is switched OFF and if the vehicle speed decreases to 40 km/h (25 mph) or lower.

In addition when the control switch is turned to RESUME position and held while the vehicle is traveling at a constant speed the vehicle speed will increase the speed at which the switch is subsequently released will become the newly set constant speed.
Current flows to the fuse No. 4 of the junction block, to the control switch (RESUME), and to the control unit.

Troubleshooting hint

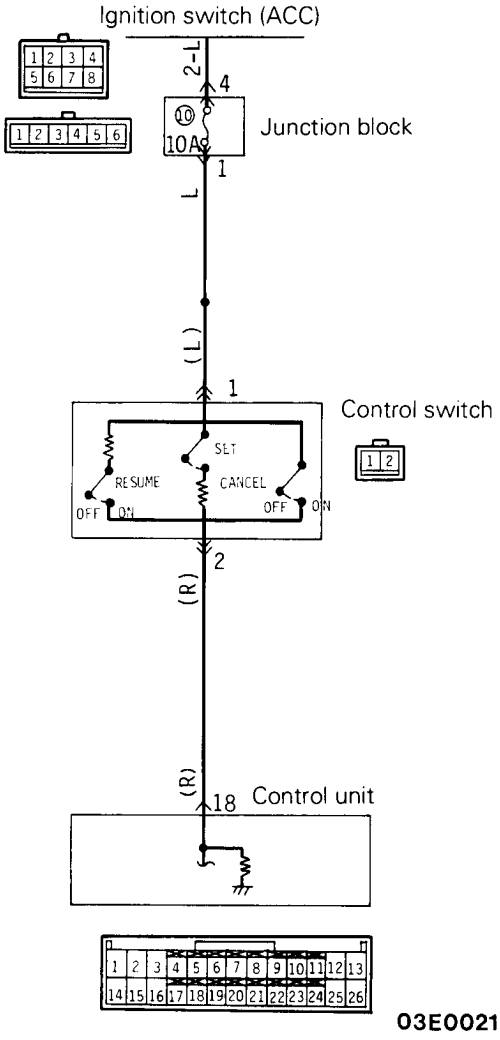
Diagnosis–No. 5 (automatically cancelled)

ECU terminal voltage

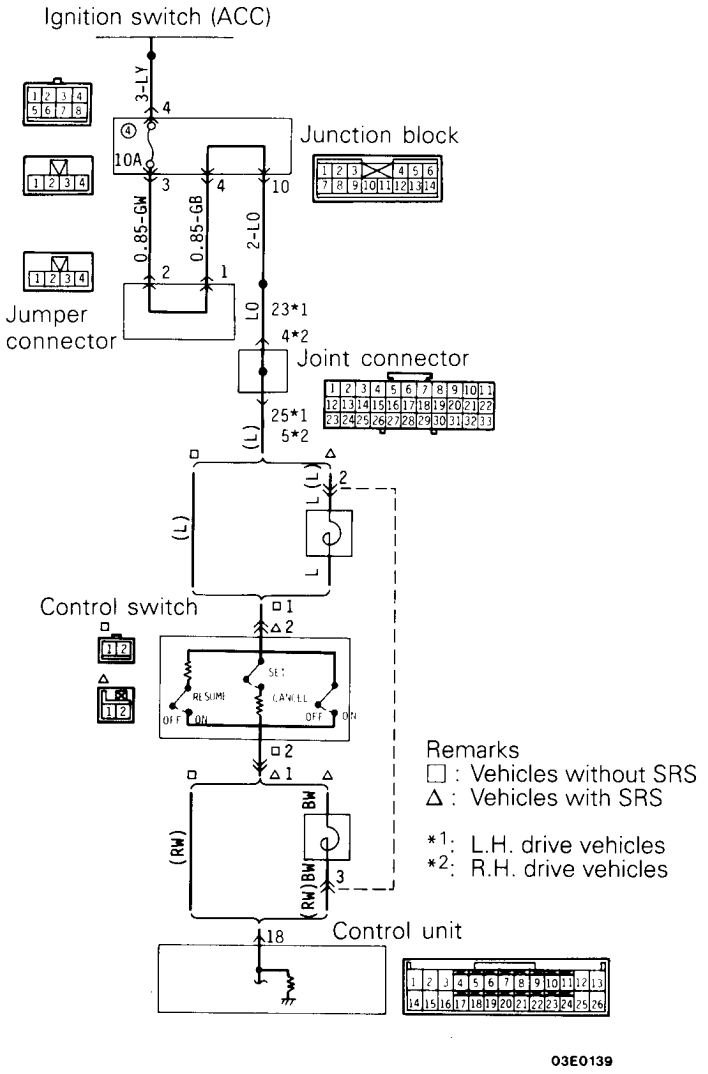
Terminal No.	Signal	Conditions	Terminal voltage
18	RESUME switch	When the control switch is turned to the RESUME position	6 V
		When the control switch is turned to the off position	0 V

4. CHECKING THE CANCEL SWITCH CIRCUIT

<Vehicles built up to October, 1993>



<Vehicles built from November, 1993>



Description of operation

During constant speed driving, when the control switch is turned to the CANCEL position, a cancel signal is sent to the control unit, the current to the motor-driven vacuum pump is stopped, and constant speed driving is cancelled.
Current flows to the fuse No. 4 of the junction block, to the control switch (CANCEL) and to the control unit.

Troubleshooting hint

Diagnosis–No. 15 (automatically cancelled)

ECU terminal voltage

Terminal No.	Signal	Conditions	Terminal voltage
18	CANCEL switch	When the control switch is turned to the CANCEL position	System voltage
		When the control switch is turned to the off position	0 V

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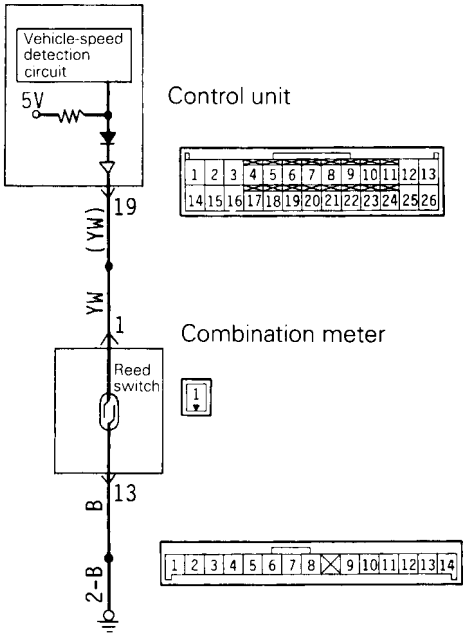
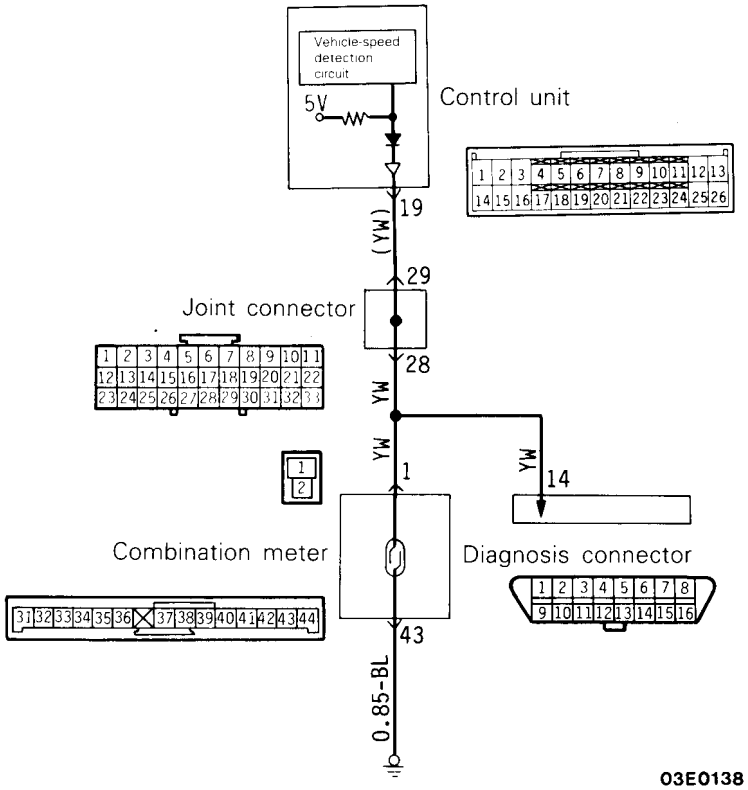
5. CHECKING THE VEHICLE-SPEED SENSOR CIRCUIT

<Vehicles built up to October, 1993>



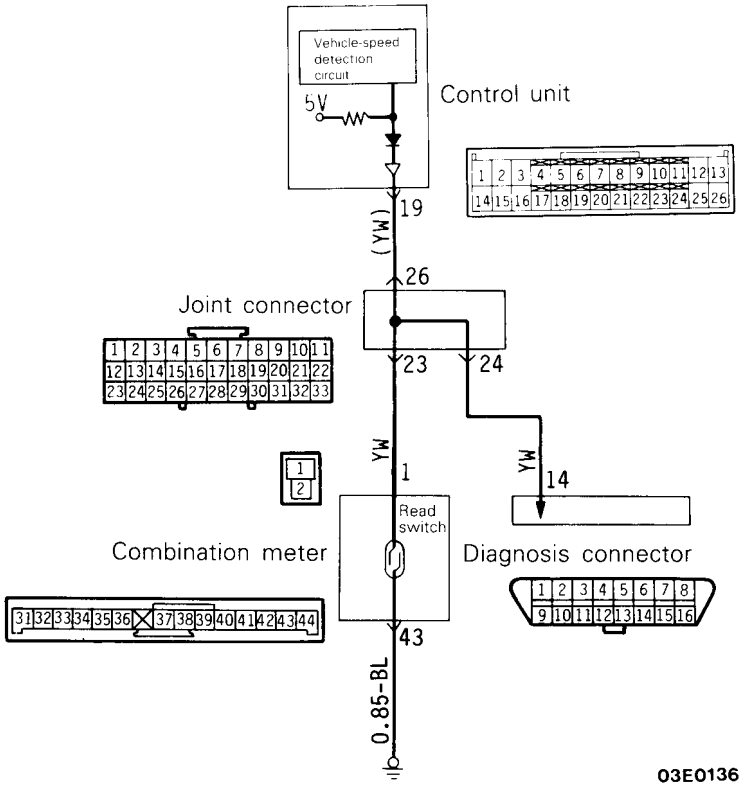
03E0019

<Vehicles built from November, 1993 (L.H. drive vehicles)>



03E0138

<Vehicles built from November, 1993 (R.H. drive vehicles)>



03E0136

Description of operation

The vehicle-speed sensor is installed within the speedometer; it sends to the control unit pulse signals that are proportional to the rotation speed (i.e., the vehicle speed) of the transmission's output gear.
This vehicle-speed sensor is the reed switch type of sensor; it generates four pulse signals for each rotation of the speedometer's driven gear.

Troubleshooting hint

Diagnosis–No. 12 (automatically cancelled)

ECU terminal voltage

Terminal No.	Signal	Conditions	Terminal voltage
19	Vehicle-speed sensor	Set the shift lever to the 1st range <M/T> or the selector lever to D-range <A/T>, move the vehicle forward slowly.	0 V– 0.6 V ← Flashing → 2 V or higher

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NOTES

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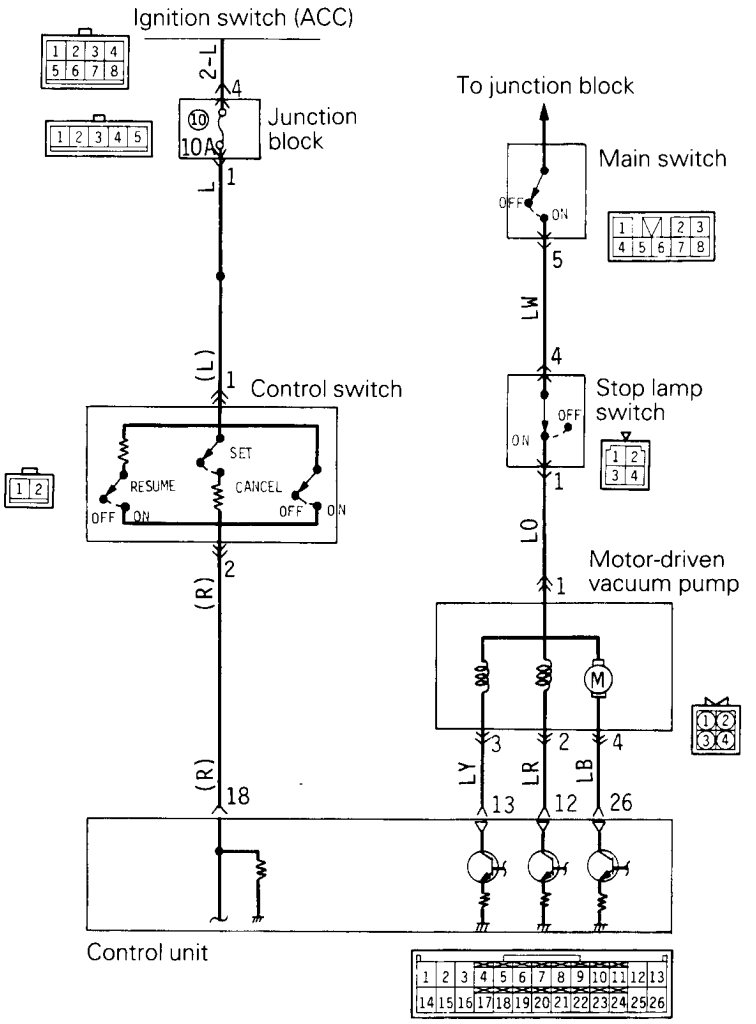
6. CHECKING THE MOTOR-DRIVEN VACUUM PUMP CIRCUIT

<Vehicles built up to October, 1993>



03E0020

Description of operation

HOLD MODE

When driving at 40 km/h (25 mph) and the main switch is pressed to ON and the control switch is turned to the SET position, the control unit receives a "set" signal. The control unit stops current from flowing to the motor-driven vacuum pump, and makes current flow to the solenoid coils in the control valve and the release valve to close both valves together.

Also, after reaching the desired speed, the motor-driven vacuum pump and the control valve turn ON and OFF repeatedly according to the driving conditions.

ACCELERATION MODE

When the control switch is moved to the RESUME position, the control unit receives a "resume" signal. The control unit controls current flow to the motor-driven vacuum pump, and controls current flow to the solenoid coils in the control valve and the release valve to close both valves together.

DECELERATION MODE

When the control switch is moved to the SET position, the control unit receives a "set" signal. The control unit stops current from flowing to the motor-driven vacuum pump, and stops current from flowing to the solenoid coil in the control valve to open the valve. At the same time, the current flowing to the solenoid coil in the release valve is stopped, closing the valve.

RELEASE MODE

When the control switch is moved to the CANCEL position, the control unit receives a "cancel" signal. The control unit stops current from flowing to the motor-driven vacuum pump, and stops current from flowing to the solenoid coils in the control valve and the release valve to open both valves together.

Troubleshooting hint

Diagnosis–No. 11 (automatically cancelled)

ECU terminal voltage

Terminal No.	Signal	Mode/Terminal voltage (V)			
		Hold	Acceleration	Deceleration	Release
26	Motor-driven vacuum pump drive	System voltage	0	System voltage	System voltage
13	Control valve open/close		0	System voltage	System voltage
12	Release valve open/close		0	0	System voltage

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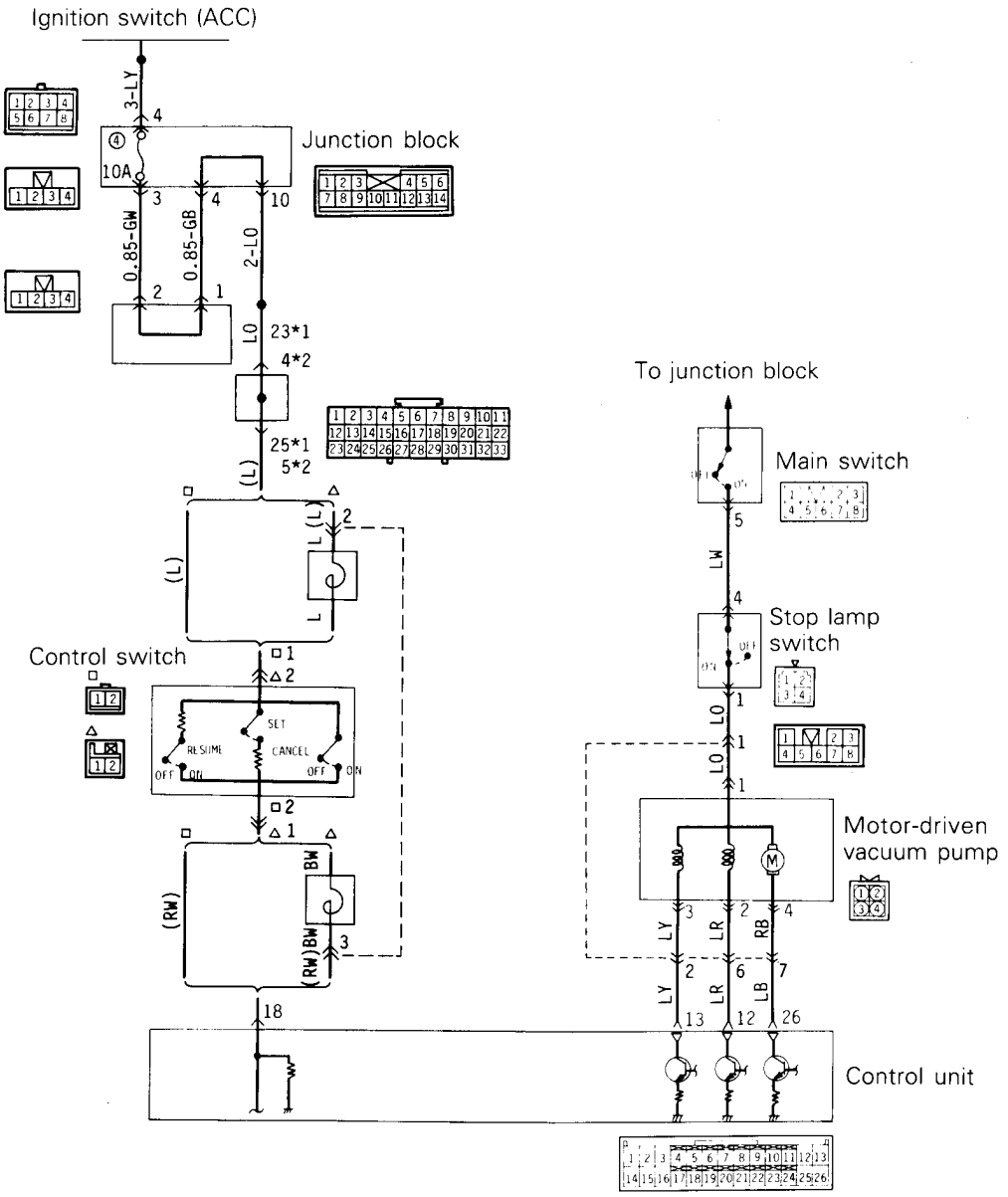
6. CHECKING THE MOTOR-DRIVEN VACUUM PUMP CIRCUIT

<Vehicles built from November, 1993>



Remarks
□ : Vehicles without SRS
△ : Vehicles with SRS
*1: L.H. drive vehicles
*2: R.H. drive vehicles

Description of operation

HOLD MODE

When driving at 40 km/h (25 mph) and the main switch is pressed to ON and the control switch is turned to the SET position, the control unit receives a "set" signal. The control unit stops current from flowing to the motor-driven vacuum pump, and makes current flow to the solenoid coils in the control valve and the release valve to close both valves together.
Also, after reaching the desired speed, the motor-driven vacuum pump and the control valve turn ON and OFF repeatedly according to the driving conditions.

ACCELERATION MODE

When the control switch is moved to the RESUME position, the control unit receives a "resume" signal. The control unit controls current flow to the motor-driven vacuum pump, and controls current flow to the solenoid coils in the control valve and the release valve to close both valves together.

DECELERATION MODE

When the control switch is moved to the SET position, the control unit receives a "set" signal. The control unit stops current from flowing to the motor-driven vacuum pump, and stops current from flowing to the solenoid coil in the control valve to open the valve. At the same time, the current flowing to the solenoid coil in the release valve is stopped, closing the valve.

RELEASE MODE

When the control switch is moved to the CANCEL position, the control unit receives a "cancel" signal. The control unit stops current from flowing to the motor-driven vacuum pump, and stops current from flowing to the solenoid coils in the control valve and the release valve to open both valves together.

Troubleshooting hint

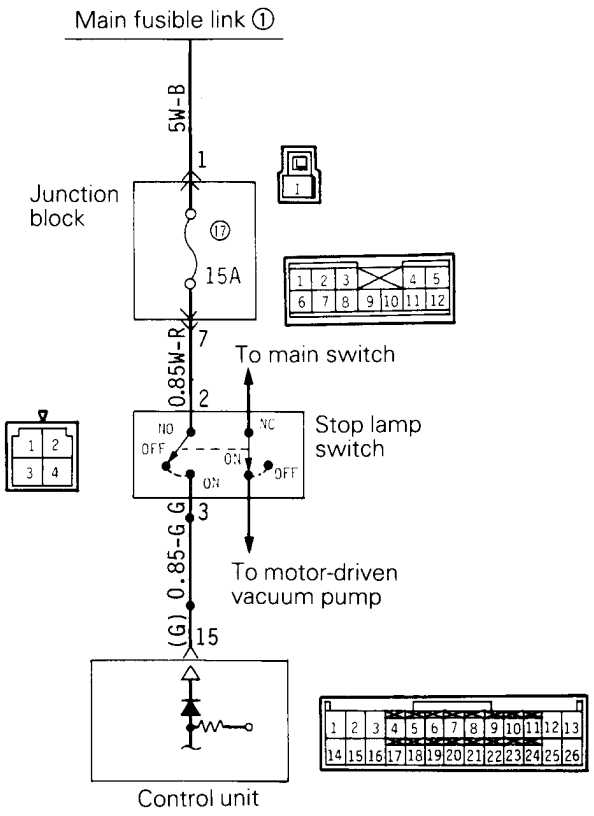
Diagnosis–N0. 11 (automatically cancelled)

ECU terminal voltage

Terminal No.	Signal	Mode/Terminal voltage (V)			
		Hold	Acceleration	Deceleration	Release
26	Motor-driven vacuum pump drive	System voltage	0	System voltage	System voltage
13	Control valve open/close		0	System voltage	System voltage
12	Release valve open/close		0	0	System voltage

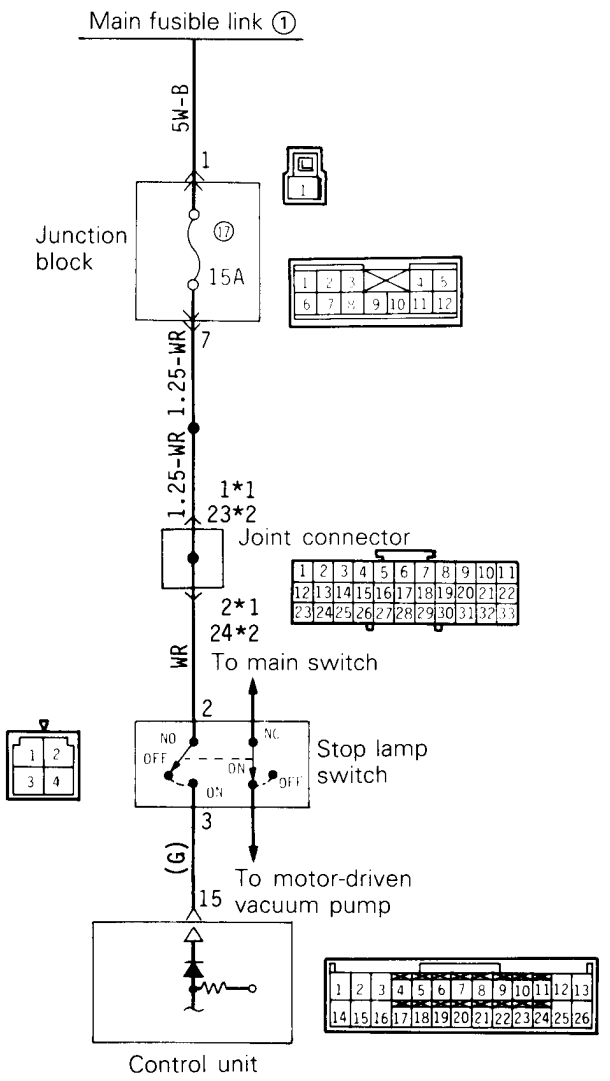
7. CHECKING THE STOP LAMP SWITCH CIRCUIT

<Vehicles built up to October, 1993>



03E0017

<Vehicles built from November, 1993>



03E0140

NOTE
(1) NC: ON at all times
(2) NO: OFF at all times

Remarks
*1: L.H. drive vehicles
*2: R.H. drive vehicles

Description of operation

When the brake pedal is depressed during constant-speed travel, the stop lamp switch's (NC) contacts for the auto-cruise control system open, with the result that the current to the motor-driven vacuum pump is interrupted, thus cancelling the constant-speed travel.

At the same time, moreover, the closing of the (NO) contacts for the stop lamp results in the sending of the cancel signal to the control unit, so that the motor-driven vacuum pump current is discontinued within the control unit, thereby cancelling the constant-speed travel.

Troubleshooting hint

ECU terminal voltage

Terminal No.	Signal	Conditions	Terminal voltage
15	Stop lamp switch (load side)	When the brake pedal is depressed	System voltage
		When the brake pedal is not depressed	0 V

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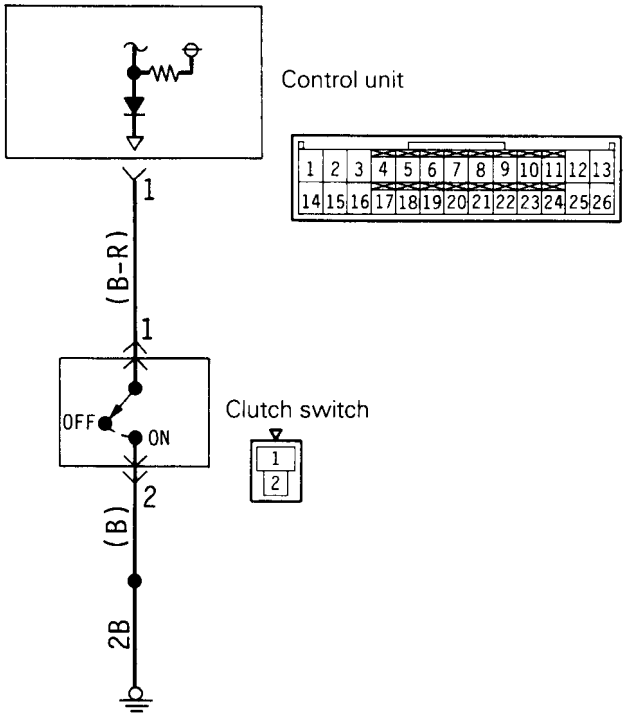
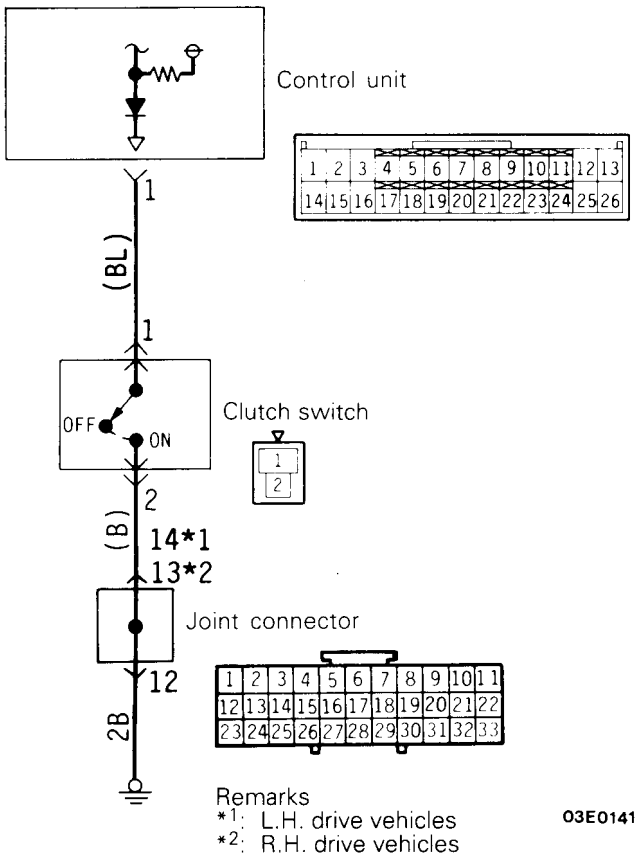
8. CHECKING THE CLUTCH SWITCH CIRCUIT <M/T>

<Vehicles built up to October, 1993>



03E0018

<Vehicles built from November, 1993>



Remarks
*1: L.H. drive vehicles
*2: R.H. drive vehicles

03E0141

Description of operation

If the clutch pedal is pressed when driving at a constant speed, the clutch switch is turned ON and a cancel signal is input to the control unit and the determined driving speed is canceled, because the current flows to the control unit, to the clutch switch and to the earth.

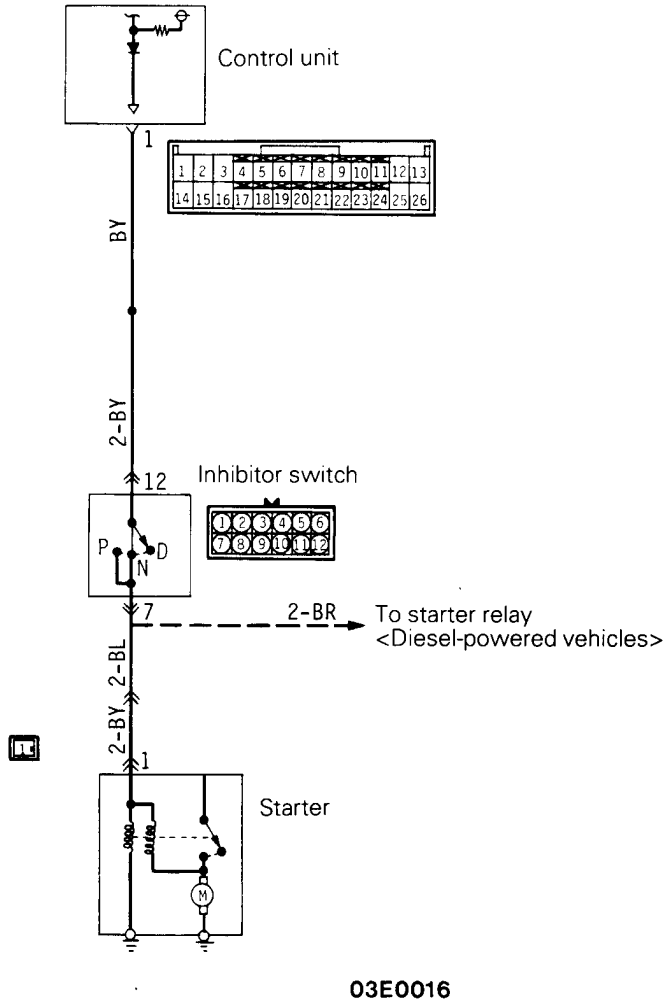
Troubleshooting hint

ECU terminal voltage

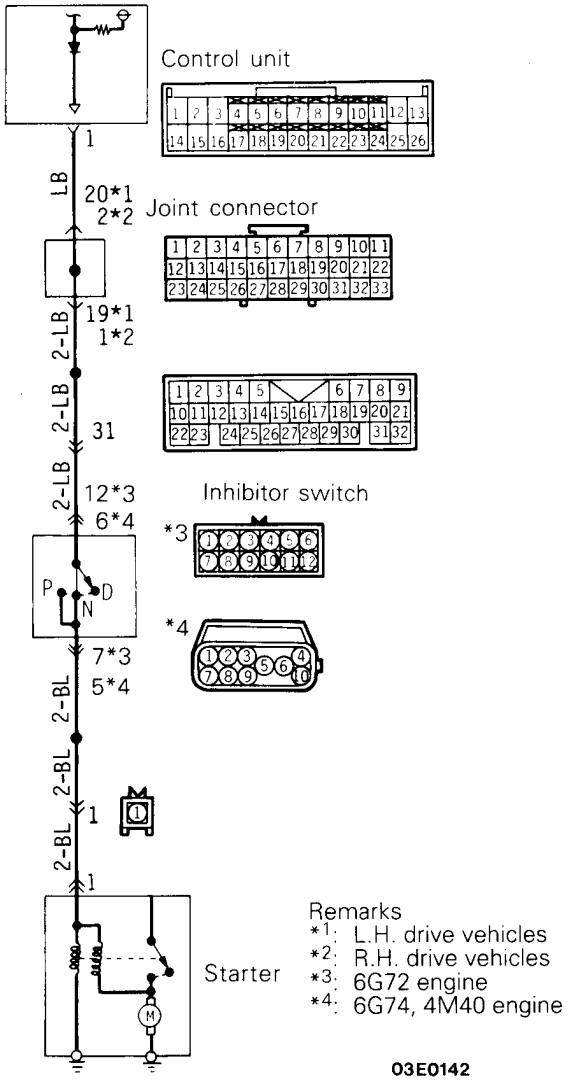
Terminal No.	Signal	Conditions	Terminal voltage
1	Clutch switch	When the clutch pedal is depressed	System voltage
		When the clutch pedal is not depressed	0 V

9. CHECKING THE INHIBITOR SWITCH CIRCUIT <A/T>

<Vehicles built up to October, 1993>



<Vehicles built from November, 1993>



Description of operation

The inhibitor switch also functions as the switch for the starter.
If the selector lever is moved to the "N" position during constant-speed travel, current flows to the control unit, inhibitor switch, starter motor, and to earth; the cancel signal is therefore input to the control unit, thus canceling the constant-speed travel.

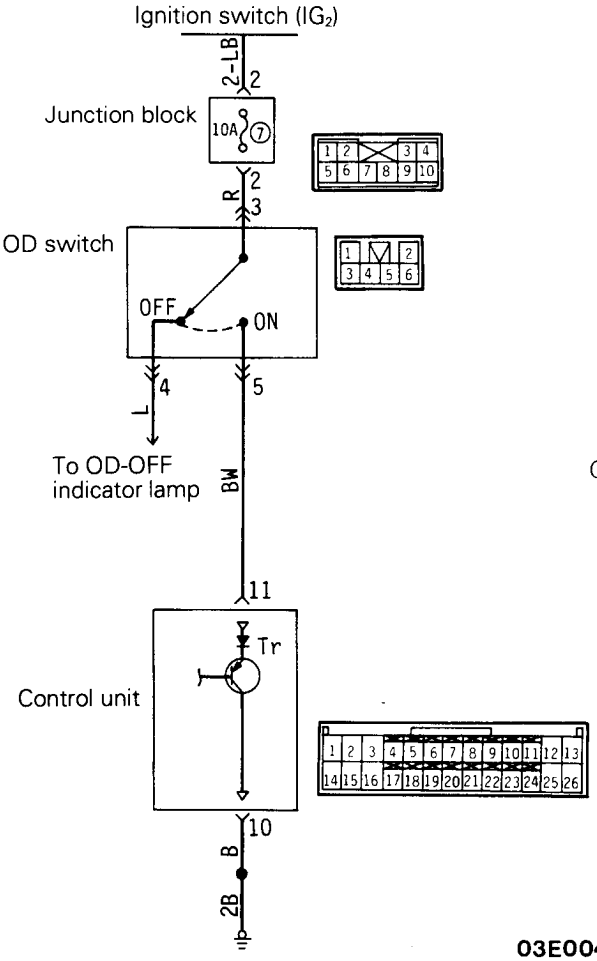
Troubleshooting hint

ECU terminal voltage

Terminal No.	Signal	Conditions	Terminal voltage
1	Inhibitor switch	Neutral	System voltage

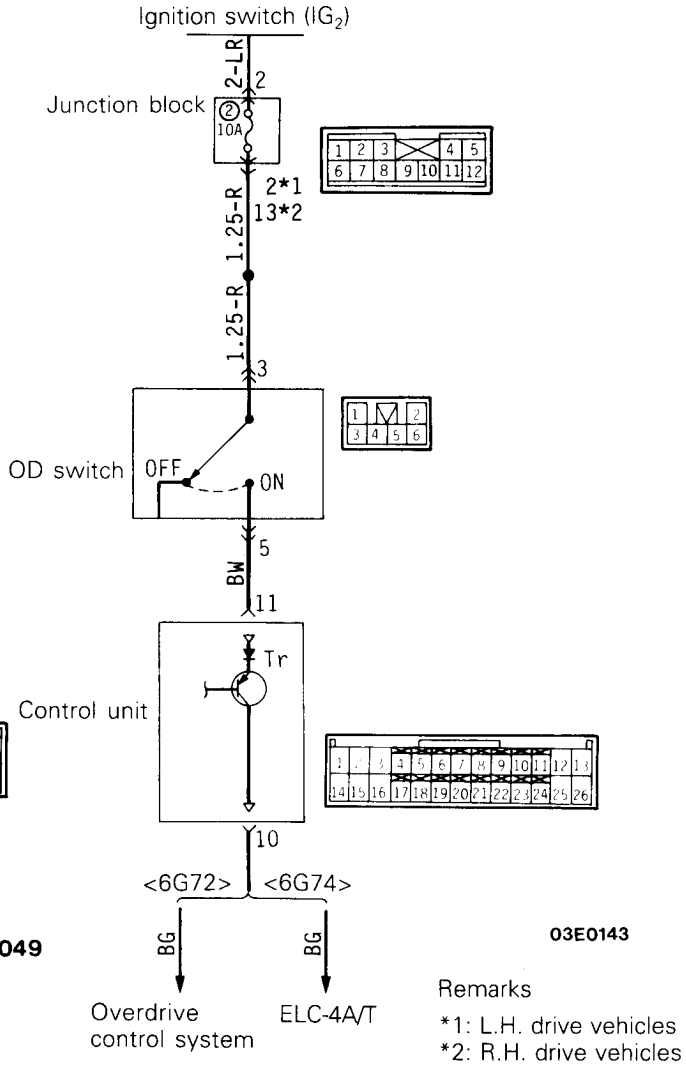
10. CHECKING THE CIRCUIT RELATED TO THE OVERDRIVE-CANCELLATION FUNCTION <3000-A/T, 3500-A/T>

<Vehicles built up to October, 1993>



03E0049

<Vehicles built from November, 1993>



03E0143

Remarks
*1: L.H. drive vehicles
*2: R.H. drive vehicles

Description of operation

This is a function that cancels the overdrive function for a certain fixed period of time, if during constant-speed travel in overdrive, the actual vehicle speed decreases to less than the vehicle speed retained in the memory, and then after a short time causes the vehicle speed to return to the vehicle speed retained in the memory.

Overdrive will be cancelled in the following cases:
- If the control switch is turned to the RESUME position.
- If the actual vehicle speed decreases to 7 km/h (4.4 mph) or more below the constant driving speed.

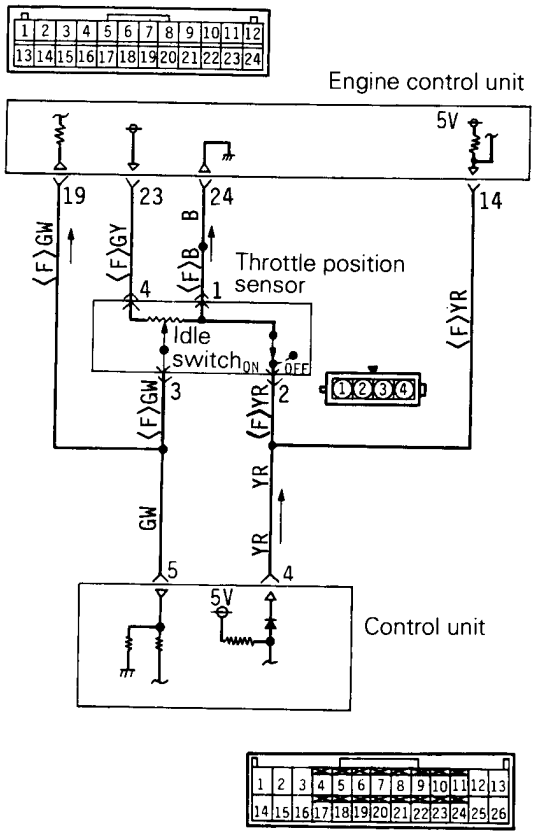
In these case, the OD-ON signal output from the control unit turns the transistor Tr off, and so the current flowing through the overdrive switch is stopped at the transistor Tr, and is then controlled by the 3-speed automatic transmission.

Troubleshooting hint

ECU terminal voltage

Terminal No.	Signal	Conditions	Terminal voltage
11	OD switch	When the OD switch is switched ON	System voltage

11.CHECKING THE THROTTLE POSITION SENSOR AND IDLE SWITCH CIRCUIT <3000, 3500> <Vehicles built up to October, 1993>



Description of operation

The throttle position sensor and idle switch are mounted in the throttle body and are sensors in the MPI system
The throttle position sensor converts the opening position of the throttle valve to a voltage value, and inputs it to the control unit. The control unit compares this signal with the vehicle speed signal and changes the amount of actuator control accordingly. The idle switch turns ON and OFF depending on the voltage value from the throttle position sensor to compensate for fluctuations or deviations in the voltage.

Diagnosis–No. 17 (automatically cancelled)

ECU terminal voltage

Terminal No.	Signal	Conditions	Terminal voltage
4	Idle switch	When accelerator pedal is pressed	4.5–5.5 V
		When accelerator pedal is released	0 V
5	Throttle position sensor	When accelerator pedal is pressed all the way down	4.0–5.5 V
		When accelerator pedal is released	0.5–0.7 V

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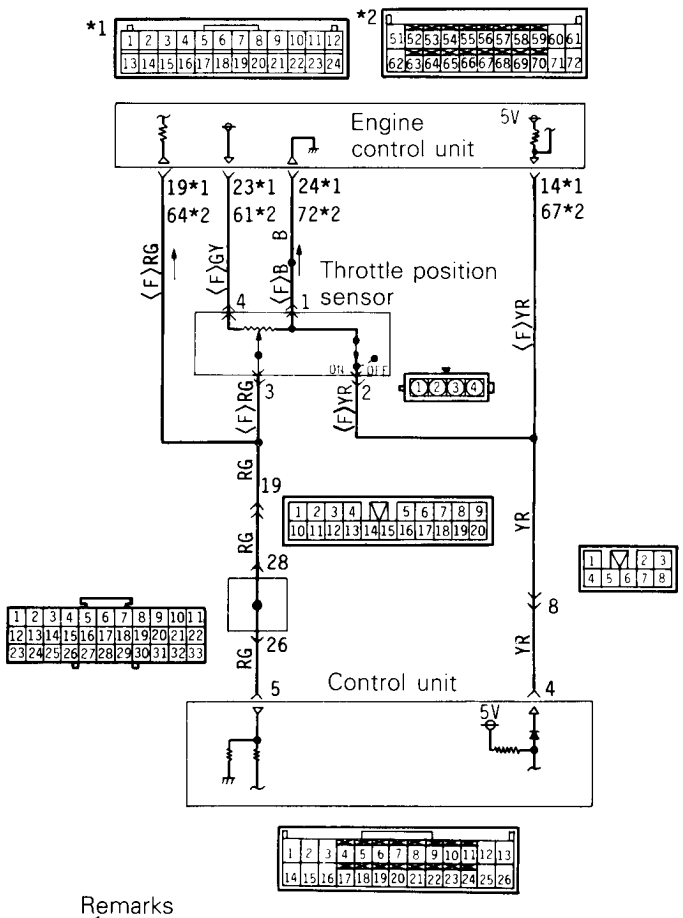
11.CHECKING THE THROTTLE POSITION SENSOR AND IDLE SWITCH CIRCUIT <3000, 3500> <Vehicles built from November, 1993>



Description of operation

The throttle position sensor and idle switch are mounted in the throttle body and are sensors in the MPI system.
The throttle position sensor converts the opening position of the throttle valve to a voltage value, and inputs it to the control unit. The control unit compares this signal with the vehicle speed signal and changes the amount of actuator control accordingly. The idle switch turns ON and OFF depending on the voltage value from the throttle position sensor to compensate for fluctuations or deviations in the voltage.

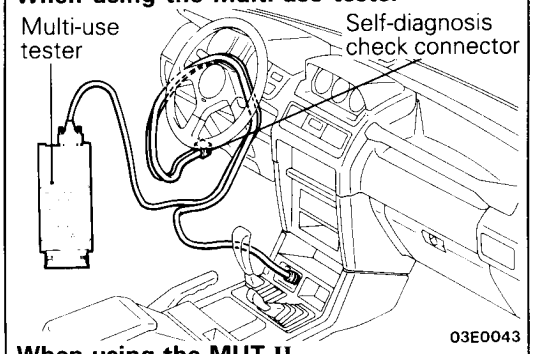
Diagnosis–No. 17 (automatically cancelled)

ECU terminal voltage

Terminal No.	Signal	Conditions	Terminal voltage
4	Idle switch	When accelerator pedal is pressed	4.5–5.5 V
		When accelerator pedal is released	0 V
5	Throttle position sensor	When accelerator pedal is pressed all the way down	4.0–5.5 V
		When accelerator pedal is released	0.5–0.7 V

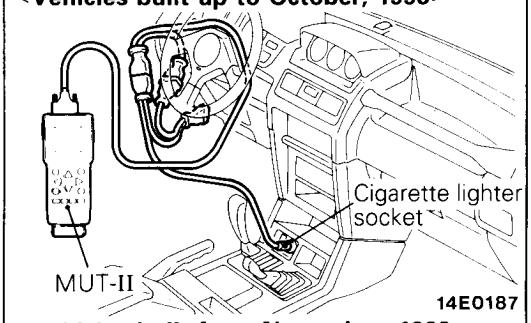
NOTES

When using the Multi-use tester

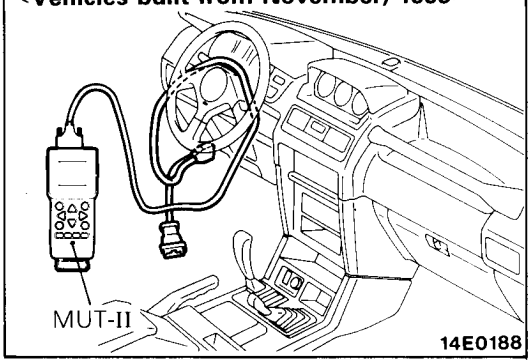


When using the MUT-II

<Vehicles built up to October, 1993>



<Vehicles built from November, 1993>



SELF-DIAGNOSIS CHECKING

Self-diagnosis checking is performed when there has been an automatic cancellation, without cancel switch operation.

(1) Note that the diagnosis check connector is located under the driver's side instrument panel.
Connect the multi-use tester's or MUT-II's socket and connector to the accessories socket and the self-diagnosis check connector, and set the tester.

Caution
The ignition switch should always be turned off when connecting or disconnecting the tester.

Use the multi-use tester or MUT-II according to its operation instructions; display the diagnosis code number and then check.

(2) When diagnosis code No. is displayed, check by referring to the check chart applicable to that number.

ERASURE OF DIAGNOSIS CODE

Diagnosis codes are memorized until battery power source is disconnected. It, however, can be erased without removing battery terminal by the following procedure.

1. Turn the ignition switch to ON.
2. With the control switch in the SET position, press the main switch to ON, and within 1 second, turn the control switch to RESUME.
3. Turn the control switch back to the SET position, and turn the stop lamp switch to ON for a continuous period of 5 seconds or more.
4. Check the self-diagnosis code, and check that the abnormal code is erased and a normal code is output.

DIAGNOSIS DISPLAY PATTERNS AND CODES

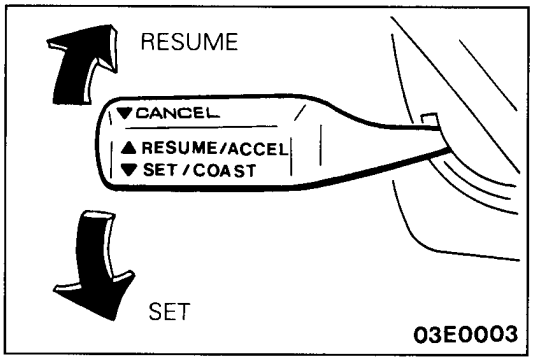
Code No.	Probable cause	Check chart No.
11	Abnormal condition of motor-driven vacuum pump system	No. 6
12	Abnormal condition of vehicle-speed signal system	No. 5
15	Control switch malfunction (when SET and RESUME switches switched ON simultaneously.)	No. 2, 3
16	Abnormal condition of ECU	No. 7, 8, 9
17	Abnormal condition of throttle position sensor <3000, 3500> Abnormal condition of idle switch <3000, 3500>	No. 11

NOTE
1. These diagnosis codes are displayed when not driving at continuous speed with the main switch at ON.
2. After the diagnosis codes in the memory are erased, if (when the power supply of the control unit is switched ON once again) the power supply of the control unit is normal, the diagnosis output code display will be normal, regardless of whether the system condition is normal or not.

INPUT CHECKING

Input checks should be made when the auto-cruise control system cannot be set and when it is necessary to check (when a malfunction related to the auto-cruise control system occurs) whether or not the input signals are normal.

NOTE
1. Self-diagnosis terminal outputs display patterns.
2. Display codes are displayed only if the circuit is normal according to the conditions shown in the "Input Check Table".



Carry out input checking by the following procedure:
(1) The setting of the multi-use tester or the MUT-II is the same as for self-diagnosis check.
(2) Turn the ignition switch to ON.
(3) When the control switch is moved to the SET position, press the main switch to ON, and within 1 second, turn the control switch to RESUME to display the results of input checking.

(4) Perform each input operation according to the Input Check Table and read the codes.

NOTE
1. If two or more input operations are performed at the same time, the codes will be output in order starting from the lowest number.
2. Each code will be displayed in order of priority beginning from No. 1.
   If there is no display, it is possible that there is a malfunction of the ECU power-supply circuit or the SET and/or RESUME switch (control switch), so check according to check chart 1, 2 and 3.

INPUT CHECK TABLE

Check No.	Input operation	Code No.	Check results
1	SET switch ON	21	SET switch circuit normal
2	RESUME switch ON	22	RESUME switch circuit normal
3	Stop lamp switch (brake pedal depressed)	23	Stop lamp switch normal
4	Driving at approximately to 40 km/h (25 mph) or higher	24	When both No. 4 and No. 5 can be confirmed, vehicle-speed sensor circuit normal.
5	Driving at less than approximately 40 km/h (25 mph)	25	
6	1. Clutch switch ON (clutch pedal depressed) <M/T> 2. Inhibitor switch ON (selector lever to "N" range) <A/T>	26	Clutch switch or inhibitor switch normal
7	CANCEL switch ON	28	CANCEL switch circuit normal
8	Throttle position sensor output (when the accelerator pedal is pressed more than half way) <3000, 3500>	28	Throttle position sensor normal
9	Idle switch OFF (accelerator pedal depressed) <3000, 3500>	29	Idle switch normal

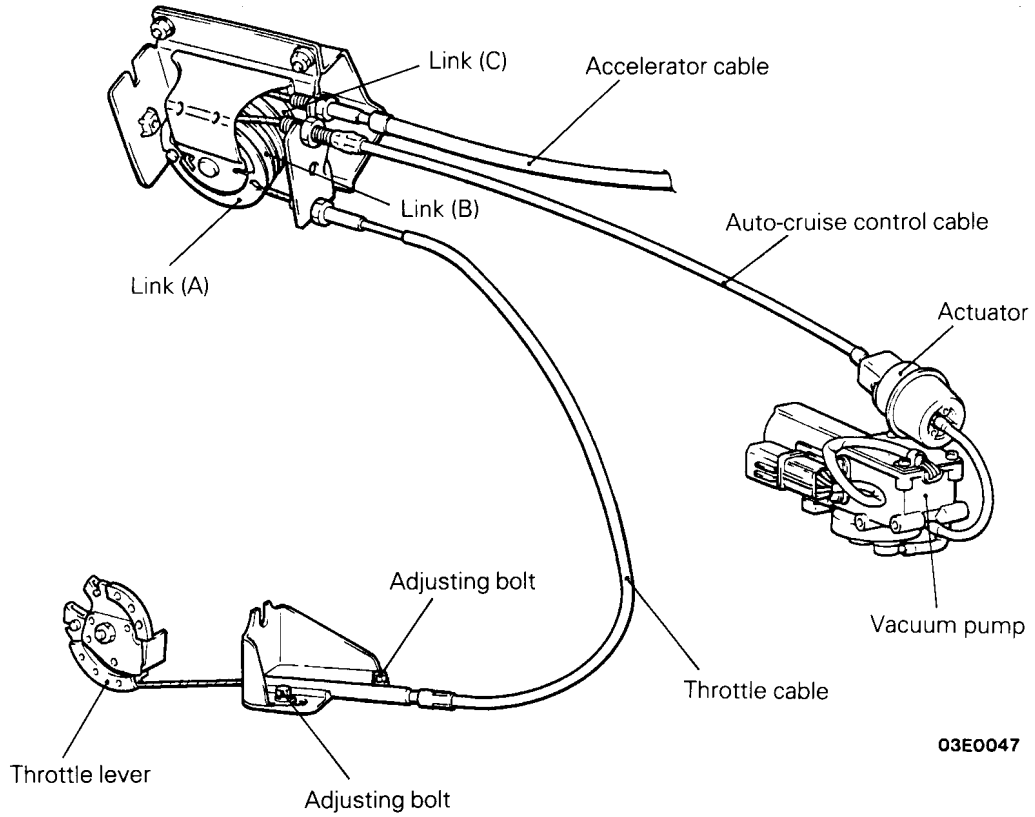
SERVICE ADJUSTMENT PROCEDURES

CONTROL CABLES INSPECTION AND ADJUSTMENT

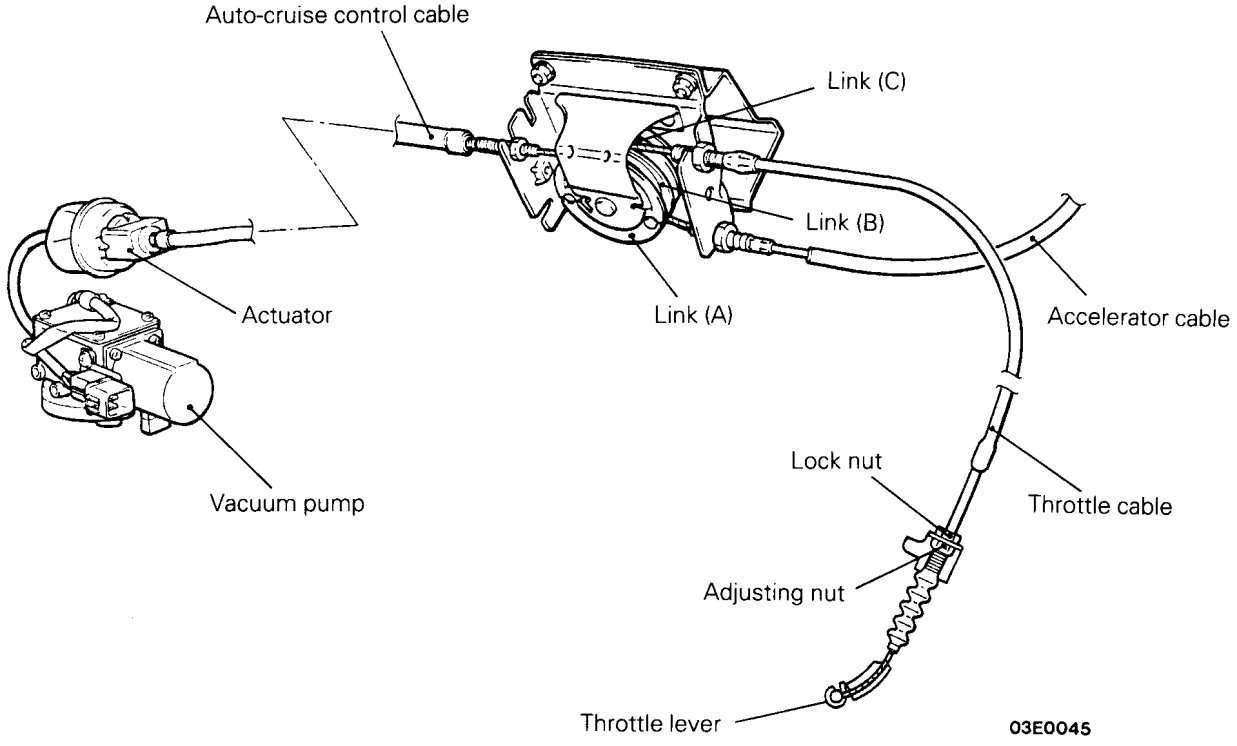
E13FYAEc

<L.H. drive vehicles>

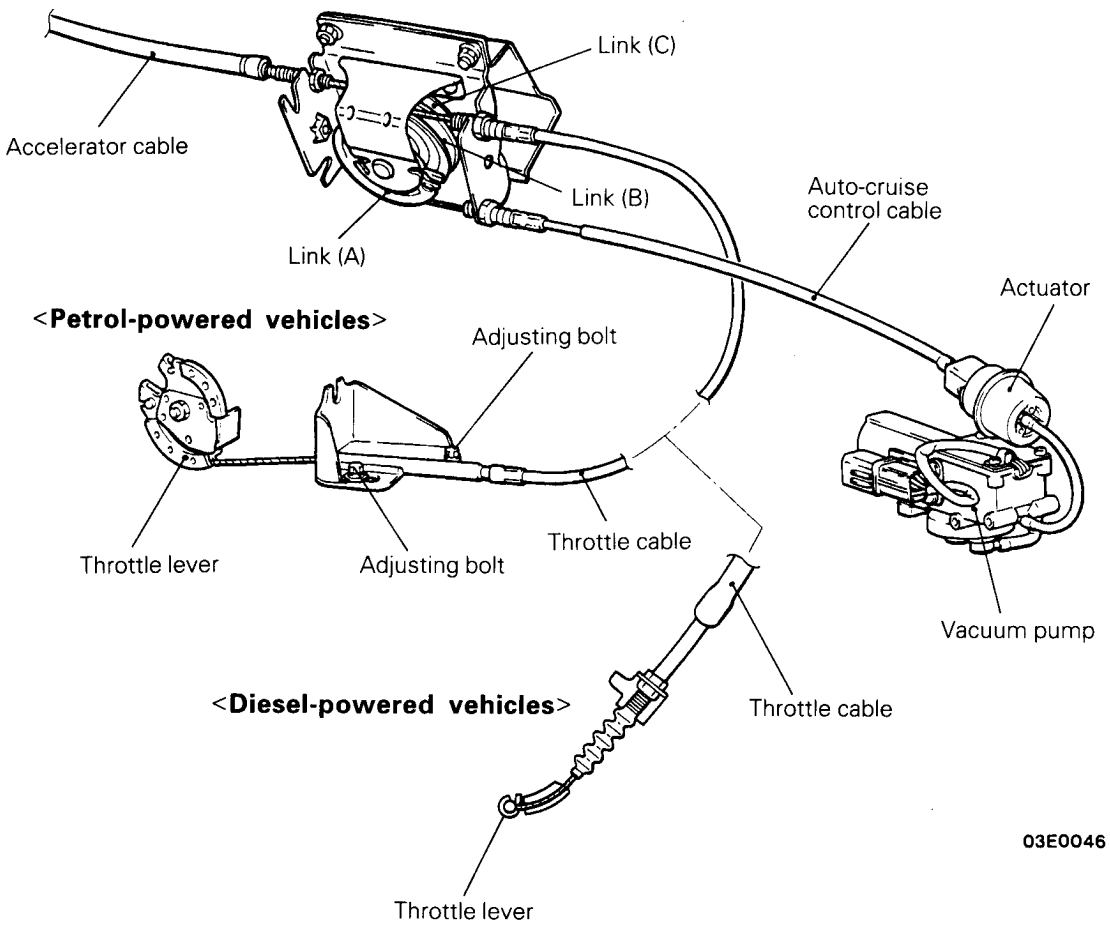
<Petrol-powered vehicles>



<Diesel-powered vehicles>

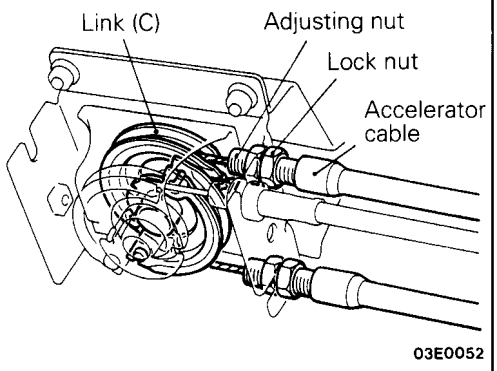


<R.H. drive vehicles>

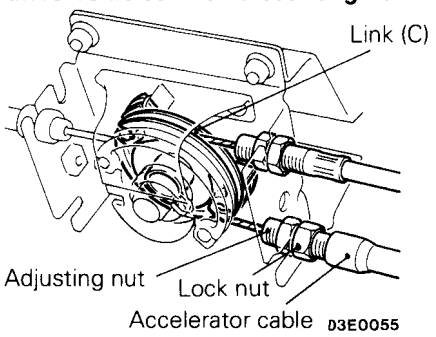


(1) Remove the link protector. (Refer to P.13-195.)
(2) Check if there is any flexion in the inner cables of the accelerator cable, auto-cruise control cable and throttle cable.
If there is excessive flexion or no play in one of the inner cables, loosen the adjusting bolts and nuts of the throttle lever and each link to release each link from the throttle lever.
(Do not remove the adjusting bolts or nuts.)

<L.H. drive vehicles with petrol engine>



<L.H. drive vehicles with diesel engine>



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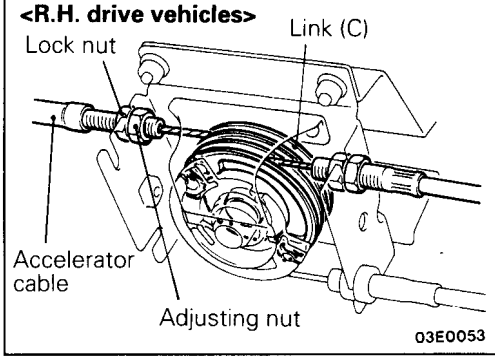


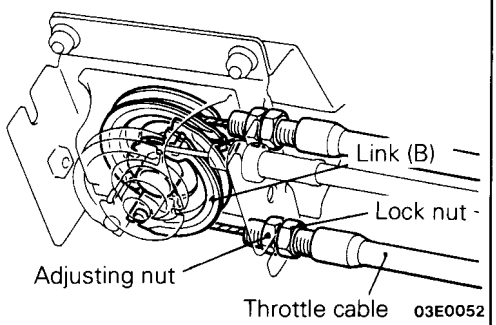
Accelerator Cable

(1) While holding link (C) so that it is touching the stopper, adjust the play of the accelerator cable with the adjusting nut so that the cable play is at the standard value.

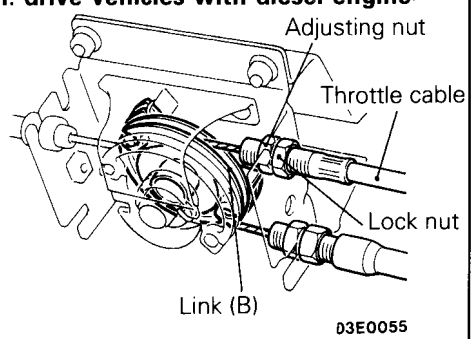
Standard value: 0–1 mm (0–0.04 in.)

(2) After adjusting, fix the cable with the lock nut.

<L.H. drive vehicles with petrol engine>



<L.H. drive vehicles with diesel engine>



Throttle Cable

(1) While holding link (B) so that it is touching link (C), adjust the play of the throttle cable with the adjusting nut and adjusting bolts so that the cable play is at the standard value.

Standard value: 1–2 mm (0.04–0.08 in.)

(2) After adjusting, fix the cable with the lock nut.

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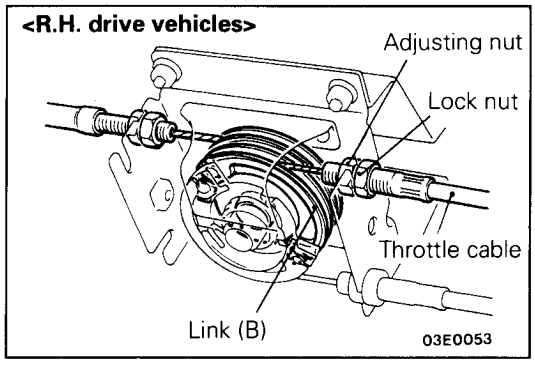
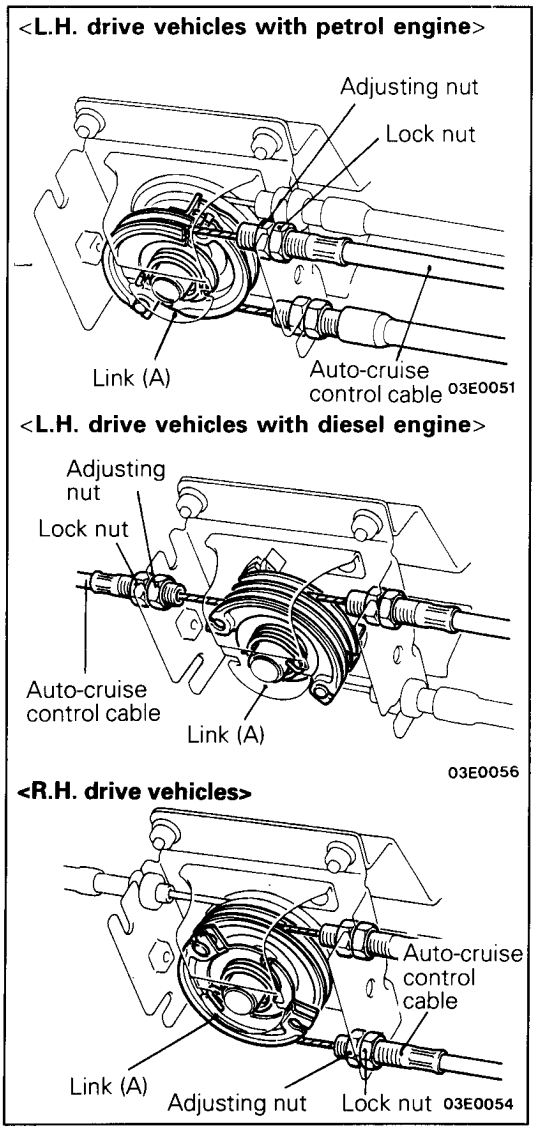


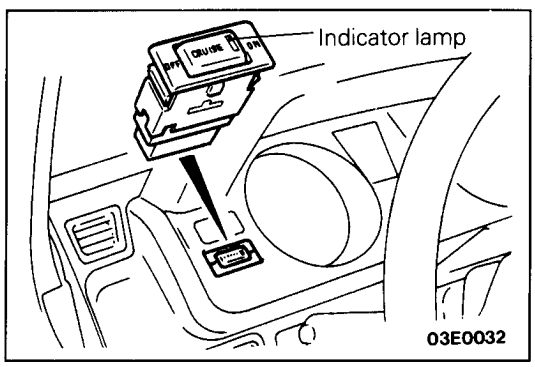


Auto-cruise Control Cable

(1) While holding link (A) so that it is touching link (B), adjust the play of the auto-cruise control cable with the adjusting nut so that the cable play is at the standard value.

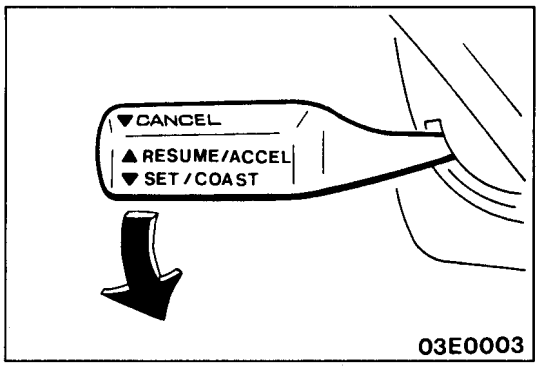
Standard value: 1–2 mm (0.04–0.08 in.)

(2) After adjusting, fix the cable with the lock nut.



AUTO-CRUISE CONTROL MAIN SWITCH INSPECTION

(1) Turn the ignition key to ON.
(2) Check to be sure that the indicator lamp within the switch illuminates when the main switch is switched ON.



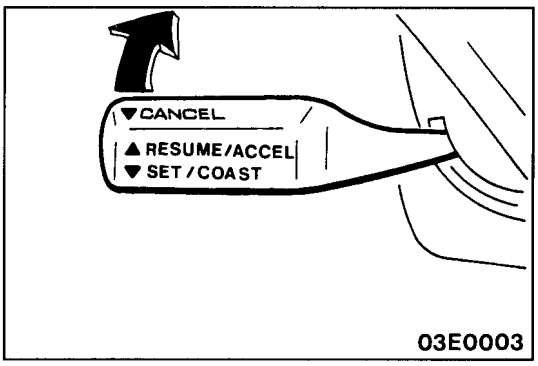
AUTO-CRUISE CONTROL SWITCH INSPECTION

Auto-cruise Control Setting Check

(1) Switch ON the main switch.
(2) Drive at the desired speed within the range of approximately 40–200 km/h (25–125 mph).
(3) Turn the control switch to the SET position.
(4) Check to be sure that when the switch is released the speed is the desired constant speed.

NOTE
If the vehicle speed decreases to approximately 15 km/h (9 mph) below the set speed, because of climbing a hill for example, the auto-cruise control will be cancelled.

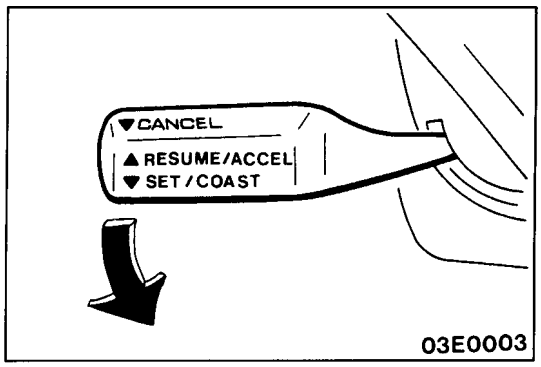
Speed-increase Setting Check



(1) Set to the desired speed.
(2) Turn the control switch to RESUME position.
(3) Check to be sure that acceleration continues while the switch is hold, and that when it is released the constant speed at the time when it was released becomes the driving speed.

NOTE
Even if, during acceleration, the vehicle speed reaches or exceeds the high limit [approximately 200 km/h (125 mph)], acceleration will continue, however, when the switch is released, the set speed ("memorized speed") will become the high limit of the vehicle speed.

Speed Reduction Setting Check



(1) Set to the desired speed.
(2) Turn the control switch to the SET position.
(3) Check to be sure that deceleration continues while the switch is pressed, and that when it is released the constant speed at the time when it was released becomes the driving speed.

NOTE
When the vehicle speed reaches the low limit [approximately 40 km/h (25 mph)] during deceleration, the automatic speed control will be cancelled.

Auto-cruise Control Cancellation Check and Check of Return to the Set Speed before Cancellation

(1) Set the auto-cruise speed control.
(2) Check to be sure that there is a return to ordinary driving when either of the operations below is performed.

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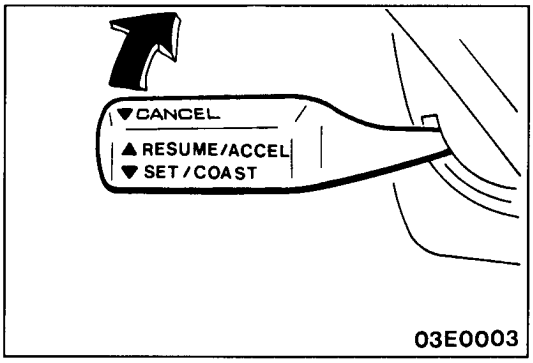
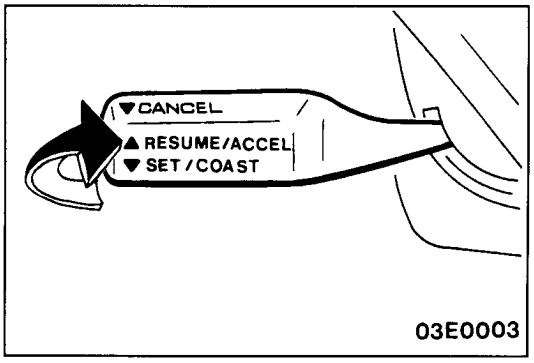
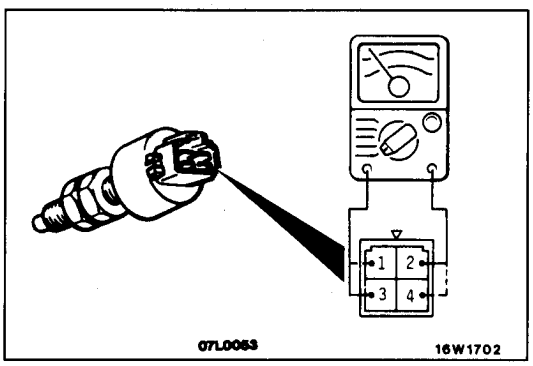


① The auto-cruise control switch is turned to the CANCEL position.
② The brake pedal is depressed.
③ The clutch pedal is depressed. <M/T>
④ The selector lever is moved to the "N" range. <A/T>



(3) Turn the control switch to RESUME position while driving at a vehicle speed of approximately 40 km/h (25 mph) or higher, and check to be sure that there is a return to the auto-cruise control speed before it will be cancelled and the vehicle will travel at the constant speed.
(4) When driving at constant speed and the main switch is turned to OFF, check that the vehicle returns to normal driving conditions.



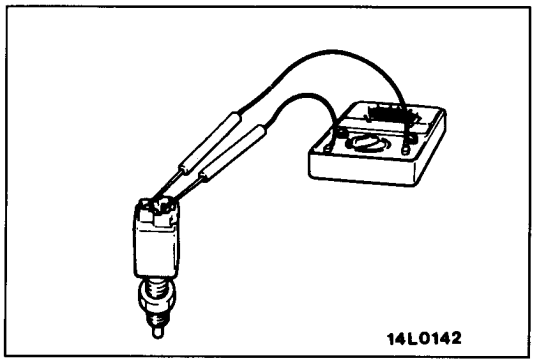
INDIVIDUAL PARTS INSPECTION E13HAEEc

Stop Lamp Switch/Brake Switch Inspection

(1) Disconnect the connector.
(2) Check for continuity between the terminals of the switch.

○—○: continuity

Switch / Measurement conditions \ Terminal	Brake switch		Stop lamp switch	
	1	4	2	3
When brake pedal depressed.			○—○	
When brake pedal not depressed.	○—○			



Clutch Switch Inspection <M/T>

(1) Disconnect the connector.
(2) Check to be sure that there is continuity between connector terminals when the clutch pedal is depressed.

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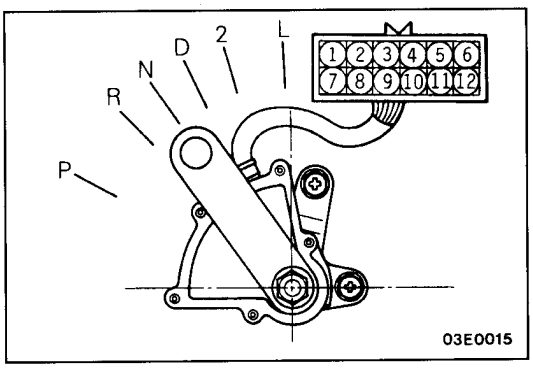

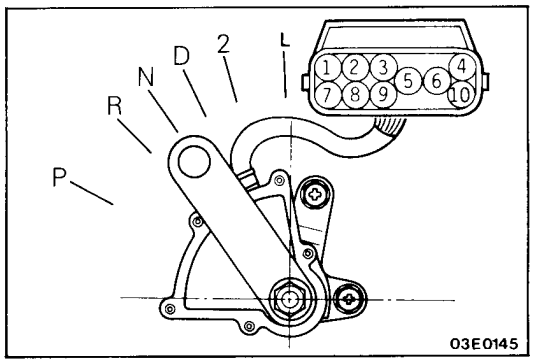

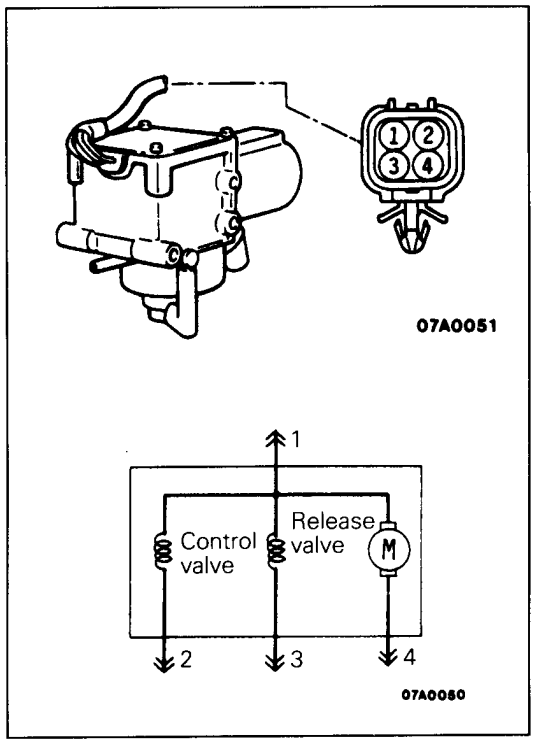

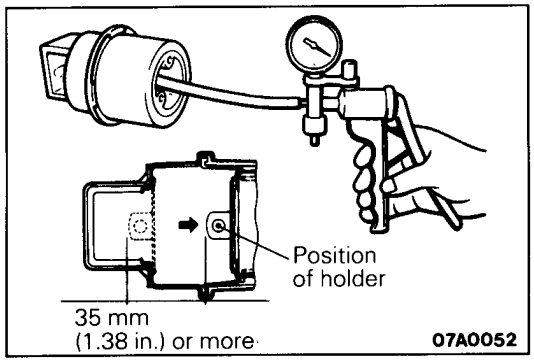

Inhibitor Switch ("N" position) Inspection <A/T>

<Vehicles built up to October, 1993>

(1) Disconnect the connector.
(2) Check to be sure that there is continuity between connector terminals (7) and (12) when the selector lever is moved to the "N" range.

<Vehicles built from November, 1993>

(1) Disconnect the connector
(2) Check to be sure that there is continuity between connector terminals (5) and (6) when the selector lever is moved to the "N" range.

Throttle Position Sensor Inspection <3000, 3500>

Refer to P.13-17.

Idle Switch Inspection <3000, 3500>

Refer to P.13-17.

Vehicle-speed Sensor Inspection

Refer to GROUP 54 – Meters and Gauges.

Auto-cruise Vacuum Pump Inspection

<Solenoid valve (Control valve, Release valve)>

(1) Remove the auto-cruise vacuum pump connector.
(2) Measure the resistance value between terminals (1)–(2) and between (1)–(3).

Standard value: 50–60 Ω

(3) Check that the solenoid valve makes an operating noise when battery voltage is impressed between terminals (1)–(2) and between (1)–(3).
(4) If there is a malfunction of the solenoid valve, replace the auto-cruise vacuum pump assembly.

<Motor>

(1) Remove the auto-cruise vacuum pump connector.
(2) Check that the motor revolves when battery voltage is impressed between terminals (1)–(4).

Actuator Inspection

(1) Remove the actuator.
(2) Apply negative pressure to the actuator with the vacuum pump and check that the holder moves more than 35 mm (1.38 in.). In addition, check that there is no change in the position of the holder when negative pressure is maintained in that condition.
(3) First install the actuator and then inspect and adjust the auto-cruise control cable. (Refer to P.13-188.)

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AUTO-CRUISE CONTROL

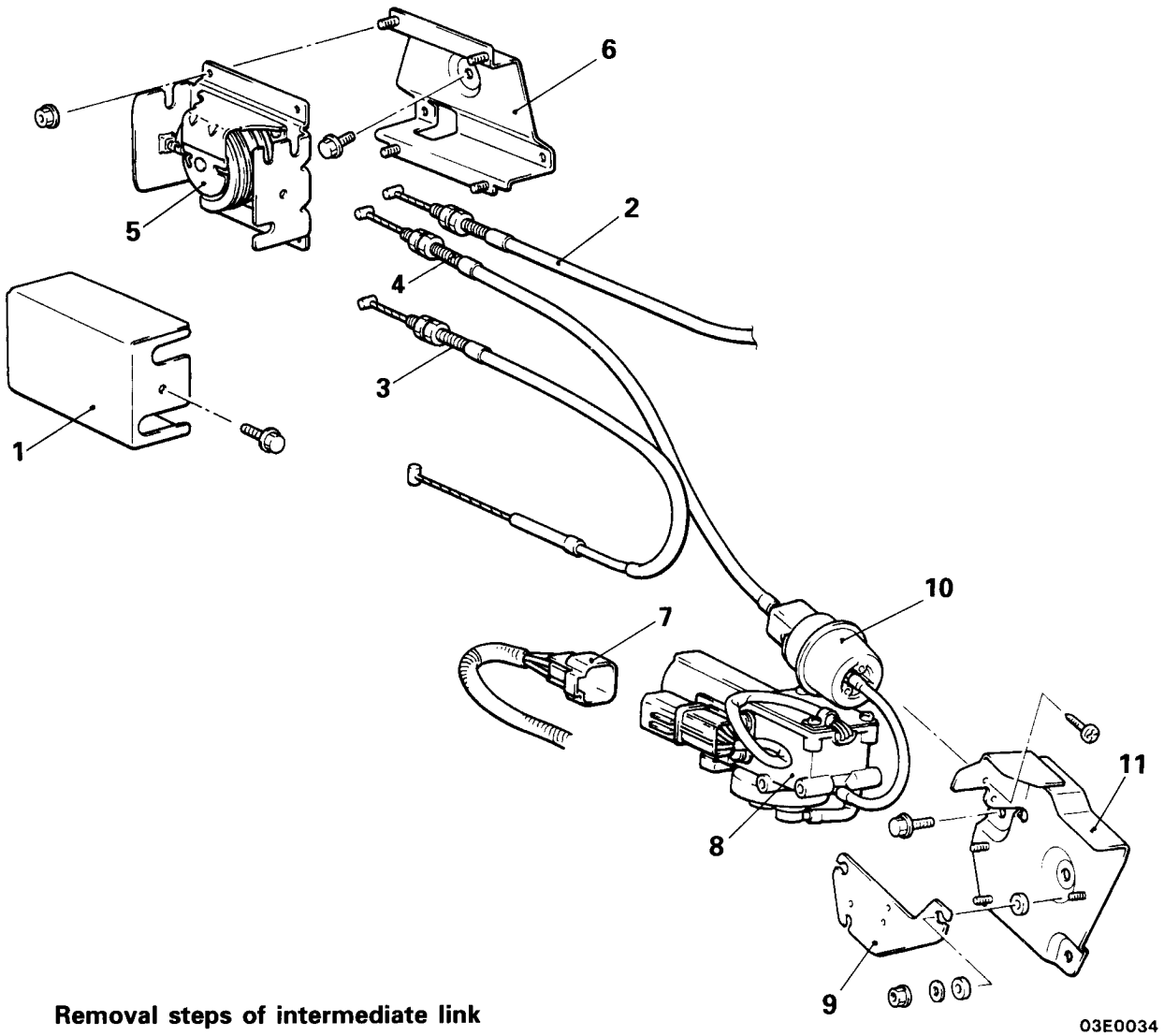
REMOVAL AND INSTALLATION <LINK AND ACTUATOR>

E13SA--

<L.H. drive vehicles>

Post-installation Operation
- Control Cables Adjustment (Refer to P.13-188.)

<Petrol-powered vehicles>



03E0034

Removal steps of intermediate link

1. Link protector
2. Connection for accelerator cable and link
3. Connection for throttle cable and link
4. Connection for auto-cruise control cable and link
5. Intermediate link
6. Link bracket

Removal steps of actuator

4. Connection for auto-cruise control cable and link
7. Wiring connector
8. Vacuum pump
9. Pump bracket
10. Actuator
11. Actuator bracket

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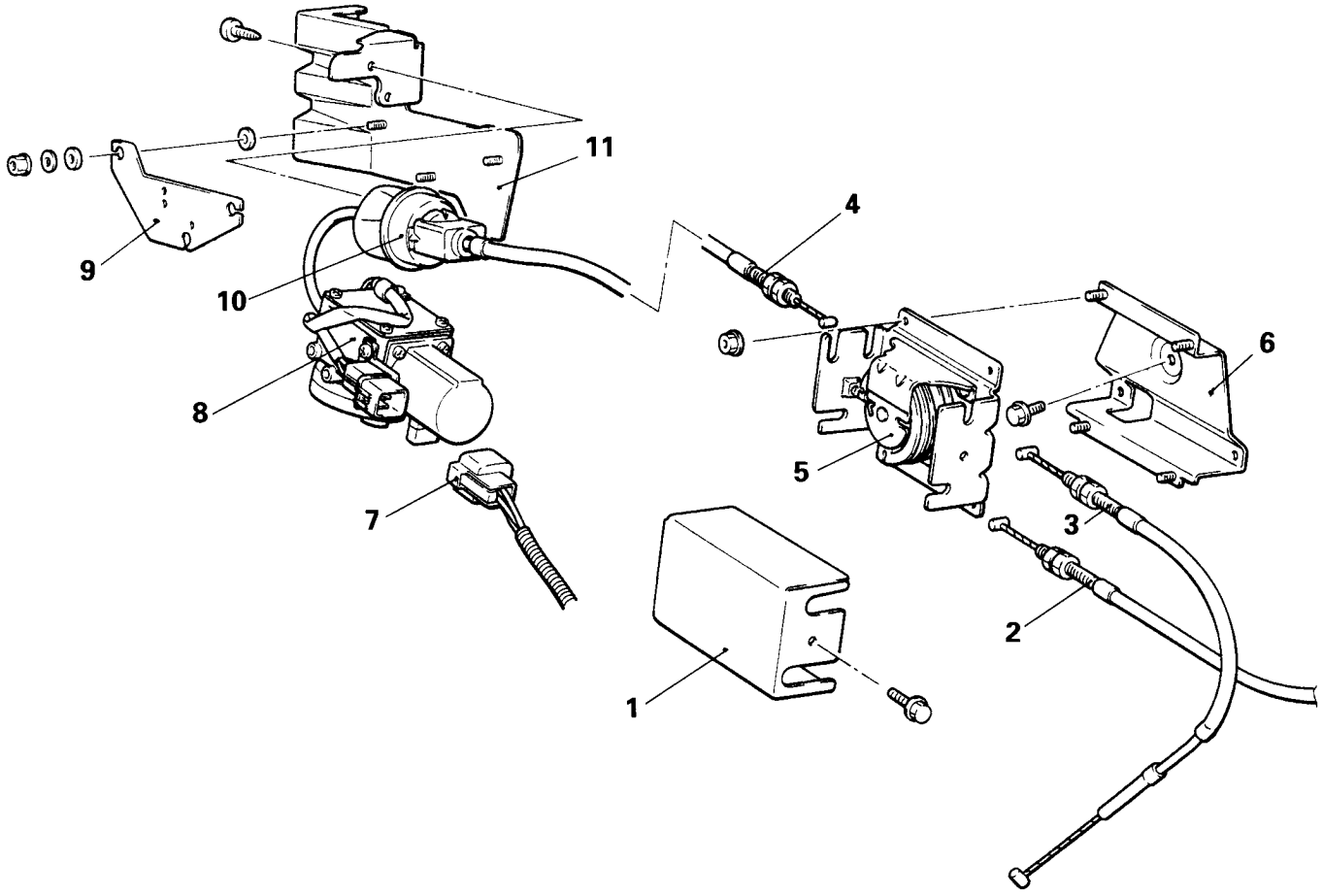
<Diesel-powered vehicles>

Post-installation Operation
- Control Cables Adjustment (Refer to P.13-188.)



03E0035

Removal steps of intermediate link

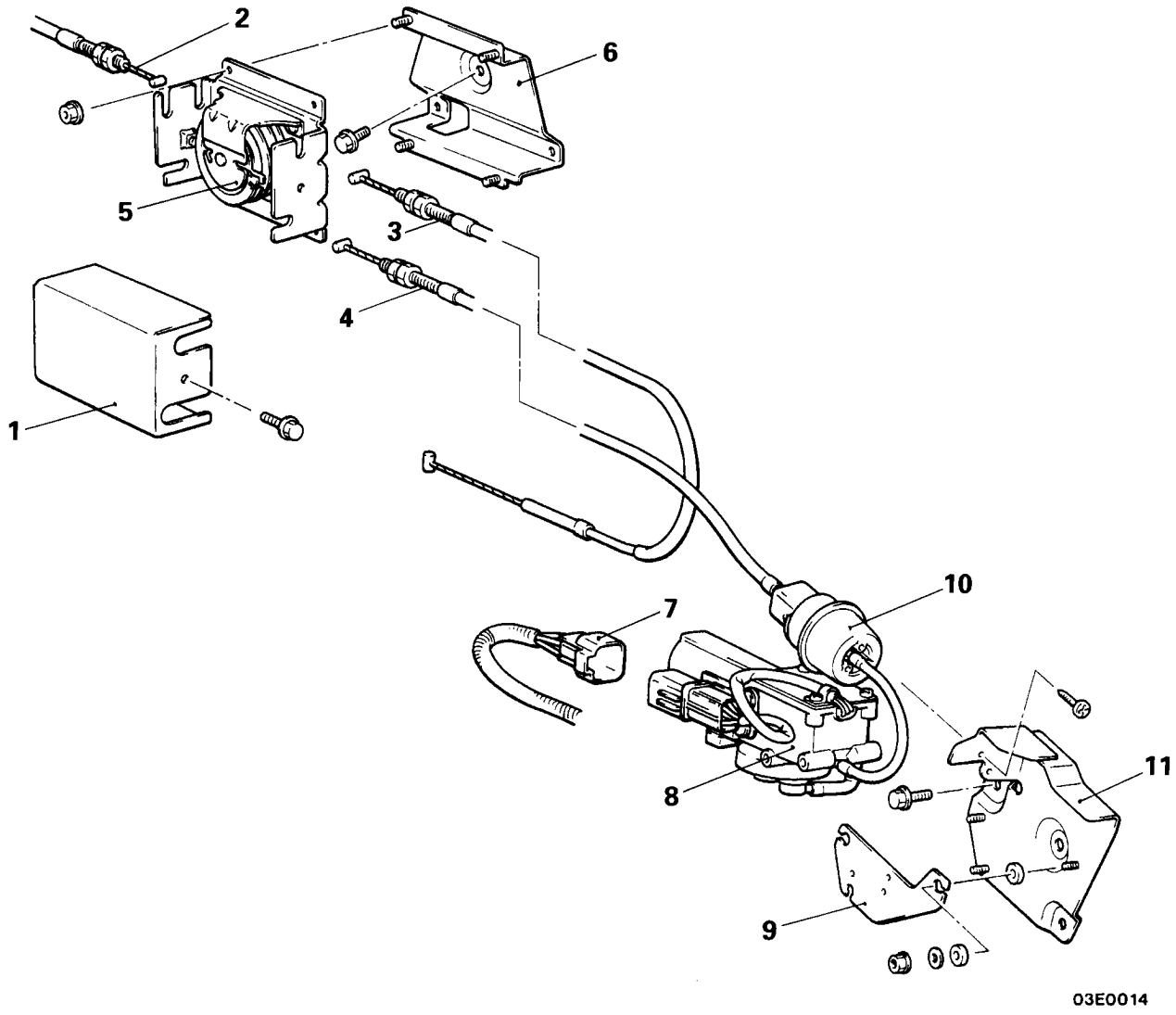
1. Link protector
2. Connection for accelerator cable and link
3. Connection for throttle cable and link
4. Connection for auto-cruise control cable and link
5. Intermediate link
6. Link bracket

Removal steps of actuator

4. Connection for auto-cruise control cable and link
7. Wiring connector
8. Vacuum pump
9. Pump bracket
10. Actuator
11. Actuator bracket

<R.H. drive vehicles>

Post-installation Operation
- Control Cables Adjustment (Refer to P.13-189.)



Removal steps of intermediate link

1. Link protector
2. Connection for accelerator cable and link
3. Connection for throttle cable and link
4. Connection for auto-cruise control cable and link
5. Intermediate link
6. Link bracket

Removal steps of actuator

4. Connection for auto-cruise control cable and link
7. Wiring connector
8. Vacuum pump
9. Pump bracket
10. Actuator
11. Actuator bracket

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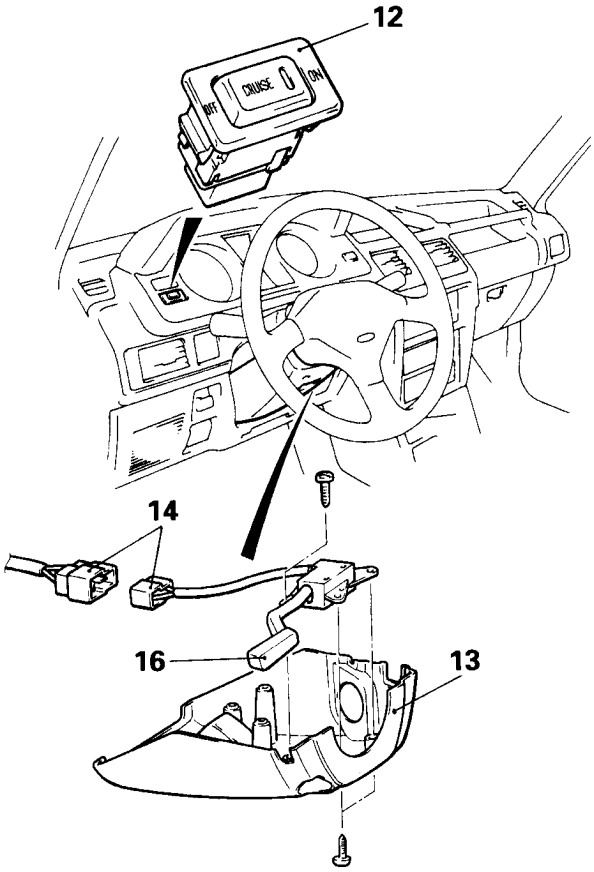
REMOVAL AND INSTALLATION <SWITCHES, CONTROL UNIT AND SENSORS>

E13SA-A



Removal steps of switches

CAUTION: SRS
Before removal of air bag module, refer to GROUP 52B – SRS Service Precautions and Air Bag Module and Clock Spring.

12. Main switch
13. Steering column lower trim
14. Wiring connectors
16. Control switch

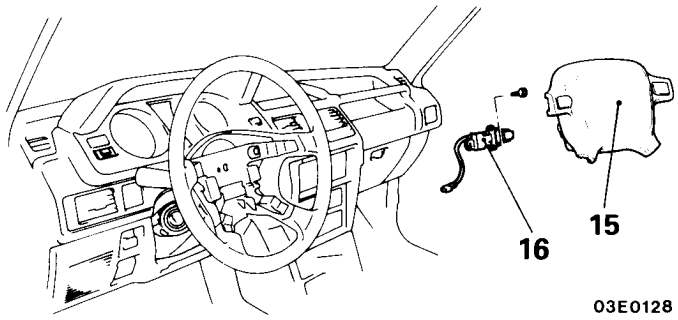
<Vehicles built up to October, 1993>

15. Air bag module (Refer to GROUP 52B – Air Bag Module and Clock Spring.)
16. Control switch

<Vehicles built from November, 1993>

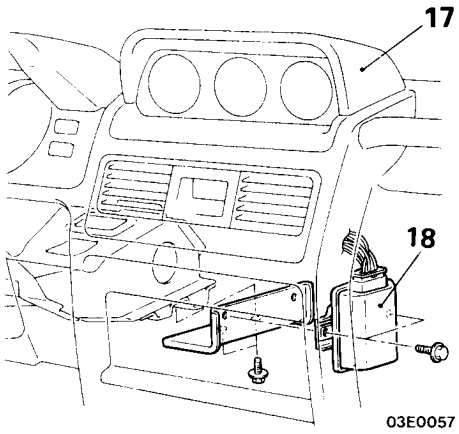
Removal steps of control unit

17. Instrument panel (Refer to GROUP 52A – Instrument Panel.)
18. Control unit



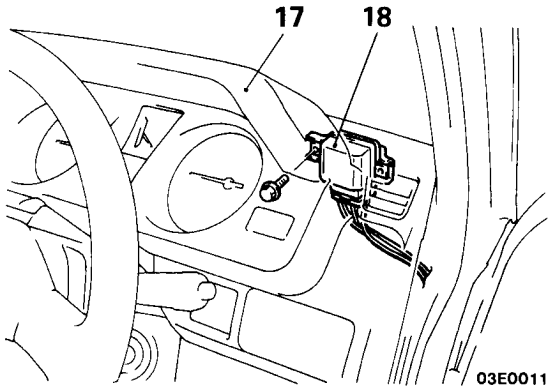
03E0128

<L.H. drive vehicles>



03E0057

<R.H. drive vehicles>



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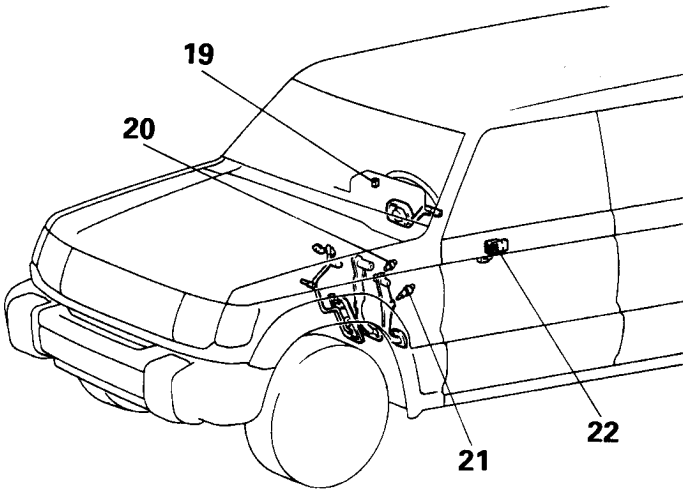

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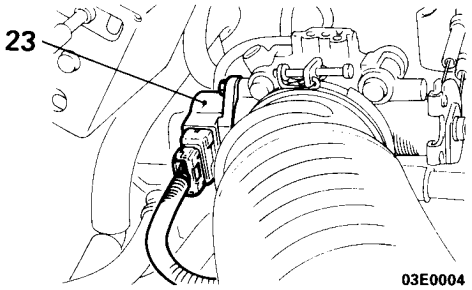

03E0004

Removal steps of sensors

19. Vehicle speed sensor (reed switch)
    (Refer to GROUP 54 – Meters and Gauges.)
20. Stop lamp switch
21. Clutch switch <M/T>
22. Inhibitor switch <A/T>
23. TPS (Throttle position sensor) <3000, 3500>

COOLING

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- General Specifications 2
- Service Specifications 2
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- Coolant Replacement 4
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COOLING FAN 6

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THERMOSTAT AND WATER PUMP <4D56> 10

WATER PUMP <4G64> 12

WATER PUMP <6G72-12 VALVE> 13

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WATER PUMP <4M40> 13-2

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RADIATOR * 14

THERMO SWITCH, ENGINE COOLANT TEMPERATURE GAUGE UNIT, ENGINE COOLANT TEMPERATURE SENSOR AND ENGINE COOLANT TEMPERATURE SWITCH 16

SUPPLEMENTAL RESTRAINT SYSTEM (SRS) – AIR BAG

(1) An SRS air bag for the driver's side seat is optional equipment in this vehicle.
(2) The SRS includes the following components: impact sensors, SRS diagnosis unit: SRS warning lamp, air bag module, clock spring, interconnecting wiring. Other SRS-related components (that may have to be removed/installed in connection with SRS service or maintenance) are indicated in the table of contents by an asterisk (*).

WARNING!

(1) Improper service or maintenance of any component of the SRS, or any SRS-related component, can lead to personal injury or death to service personnel (from inadvertent firing of the air bag) or to the driver (from rendering the SRS inoperative).
(2) Service or maintenance of any SRS component or SRS-related component must be performed only at an authorized MITSUBISHI dealer.
(3) MITSUBISHI dealer personnel must thoroughly review this manual, and especially its GROUP 52B – Supplemental Restraint System (SRS), before beginning any service or maintenance of any component of the SRS or any SRS-related component.

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SPECIFICATIONS

E14CA--

GENERAL SPECIFICATIONS

Items	Specifications
Cooling method	Water-cooled pressurized, forced circulation
Radiator	
Type	Pressurized corrugated fin type
Performance J/h (kcal/h, BTU/h)	
<6G72 A/T, 4G64>	193,396 × 10^3 (46,200, 183,333)
<6G72 M/T>	182,093 × 10^3 (43,500, 172,619)
<6G74>	200,930 × 10^3 (48,000, 190,476)
<4D56>	221,861 × 10^3 (53,000, 210,317)
<4M40>	274,186 × 10^3 (65,500, 259,920)
Automatic transmission oil cooler <Vehicles with A/T>	
Performance J/h (kcal/h, BTU/h)	
<6G72, 6G74>	6,195 × 10^3 (1,480, 5,873)
<4D56>	4,814 × 10^3 (1,150, 4,563)
<4M40>	6,279 × 10^3 (1,500, 5,952)
Thermostat	
Type	Wax type with jiggle valve
Fan clutch	
Type	Thermo type with spiral type bimetal
Water pump	
Type	Impeller of centrifugal type

SERVICE SPECIFICATIONS

E14CB--

Items		Specifications
Standard value		
Radiator cap		
High pressure valve opening pressure	kPa(kg/cm^2, psi)	75–105 (0.75–1.05, 11–15)
Vacuum valve opening pressure	kPa(kg/cm^2, psi)	–5 or less (–0.05, –0.7 or less)
Range of coolant antifreeze concentration	%	30–60
Thermostat		
<4G64, 6G72-12 VALVE>		
Valve opening temperature of thermostat	°C (°F)	88 (190)
Full-opening temperature of thermostat	°C (°F)	100 (212) or more
<6G74, 6G72-24 VALVE>		
Valve opening temperature of thermostat	°C (°F)	82 (180)
Full-opening temperature of thermostat	°C (°F)	95 (203) or more
<4D56, 4M40>		
Valve opening temperature of thermostat	°C (°F)	76.5 (170)
Full-opening temperature of thermostat	°C (°F)	90 (194) or more
Engine coolant temperature gauge unit <4G64, 6G72, 6G74>		
Resistance		
At 70°C (158°F)	Ω	104 ± 13.5

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Items		Specifications
Engine coolant temperature sensor <4G64, 6G72, 6G74>		
Resistance		
At 20°C (68°F)	kΩ	2.37 ± 0.24
At 80°C (176°F)	Ω	290 ± 32
Thermo switch <6G72-A/T, 6G74-A/T> (always opened type)		
OFF → ON operating temperature	°C (°F)	More than 50 (122)
Engine coolant temperature gauge unit and sensor <4D56, 4M40>		
Resistance of terminal A		
At 70°C (158°F)	Ω	104 ± 13.5
Resistance of terminal B		
At 20°C (68°F)	Ω	3.25 ± 0.33
At 80°C (176°F)	Ω	300
Limit		
Opening pressure of radiator cap high pressure valve	kPa (kg/cm^2, psi)	65 (0.65, 9.2)

NOTES

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LUBRICANTS

E14CD--

Items	Recommended antifreeze	Engine	Quantity		
			dm^3	U.S.qts.	Imp.qts.
Engine coolant	HIGH QUALITY ETHYLENE GLYCOL ANTIFREEZE COOLANT	4G64 6G72, 6G74, 4D56, 4M40	8.0 (9.0) 9.5 (10.5)	8.5 (9.5) 10.0 (11.1)	7.0 (7.9) 8.4 (9.3)

NOTE
( ) indicates figures with rear heater.

SEALANT

E14CE--

Items	Specified sealant adhesive	Remarks
Cylinder block drain plug Engine coolant temperature sensor <4G64, 6G72, 6G74> Engine coolant temperature gauge unit and sensor <4D56, 4M40>	3M Nut Locking Part No. 4171 or equivalent	Drying sealant
Engine coolant temperature gauge unit <4G64, 6G72, 6G74> Thermo switch <6G72-A/T, 6G74-A/T>	3M ATD Part No. 8660 or equivalent	Semi-drying sealant

SERVICE ADJUSTMENT PROCEDURES

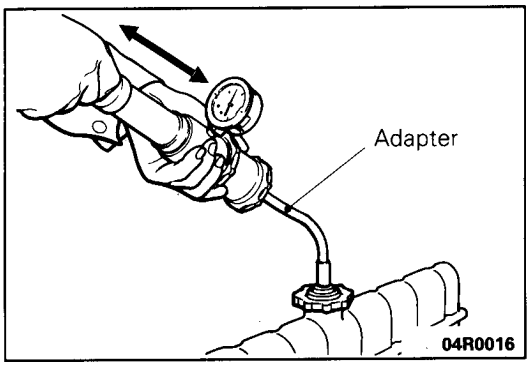
E14FAAA

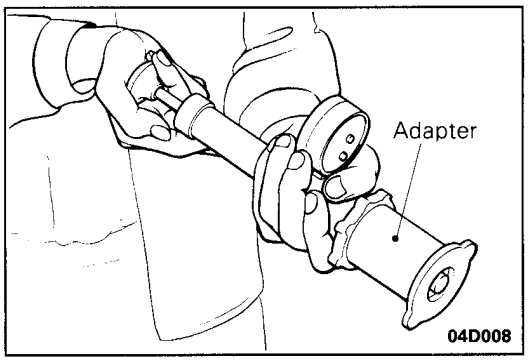
COOLANT LEAKS CHECKING

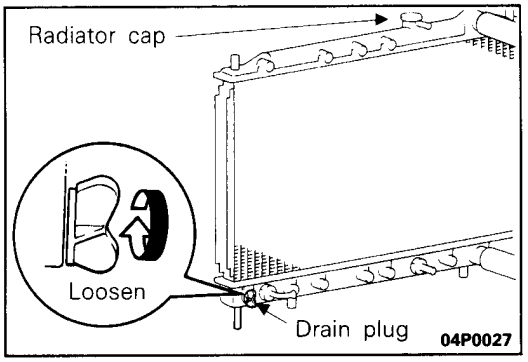
1. Confirm that the coolant level is up to the filler neck. Install a radiator cap tester and apply 160 kPa (1.6 kg/cm^2, 23 psi) pressure, and then check for leakage from the radiator hose or connections.

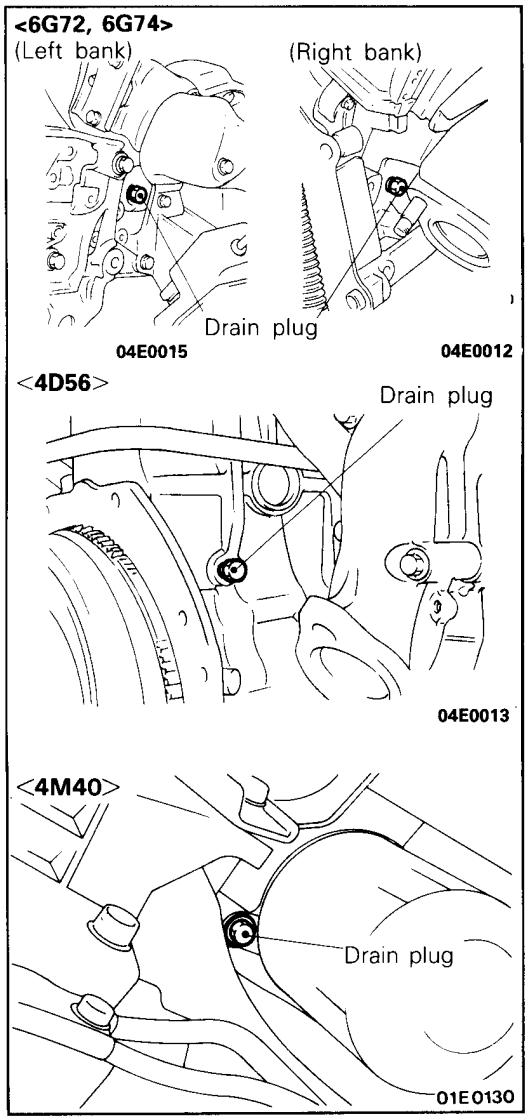
   Caution
   1. **Be sure to completely clean away any moisture from the places checked.**
   2. **When the tester is taken out, be careful not to spill any coolant from it.**
   3. **Be careful, when installing and removing the tester and when testing, not to deform the filler neck of the radiator.**

2. If there is leakage, repair or replace the appropriate part.









RADIATOR CAP VALVE OPENING PRESSURE CHECKING E14FBAE

1. Use an Adapter to attach the cap to the tester.
2. Increase the pressure until the indicator of the gage stops moving.

   Limit: 65 kPa (0.65 kg/cm², 9.2 psi)
   Standard value: 75–105 kPa (0.75–1.05 kg/cm², 11–15 psi)
3. Replace the radiator cap if the reading does not remain at or above the limit.

   NOTE
   Be sure that the cap is clean before testing, since rust or other foreign material on the cap seal will cause an improper indication.

COOLANT REPLACEMENT E14FCAS

(1) Drain the engine coolant by removing the drain plug and then the radiator cap.
(2) Remove the cylinder block drain plugs to drain the engine coolant. <6G72, 6G74, 4D56, 4M40>

   NOTE
   For the 6G72 and 6G74, the drain plugs are on the left and right bank and for the 4D56 and 4M40, the drain plugs are on the right side.
(3) Remove the reserve tank to drain the engine coolant.
(4) When the engine coolant has drained out, pour in water from the radiator cap to clean the engine coolant line.
(5) Coat the thread of the cylinder block drain plug with specified sealant, and tighten to the specified torque.
(6) Securely tighten the radiator drain plug.
(7) Install the reserve tank.
(8) Slowly pour the engine coolant into the mouth of the radiator until the radiator is full, and pour also into the reserve tank up to the FULL line.

Recommended antifreeze:
HIGH QUALITY ETHYLENE GLYCOL ANTIFREEZE COOLANT

Quantity	**dm³(U.S.qts., Imp.qts.)**
<4G64>	**8.0 (8.5, 7.0)**
	***9.0 (9.5, 7.9)**
<6G72, 6G74, 4D56, 4M40>	**9.5 (10.0, 8.4)**
	***10.5 (11.1, 9.2)**

NOTE
1. (*) indicates vehicles with rear heater.
2. For Norway, the non-amine type of antifreeze should be used.

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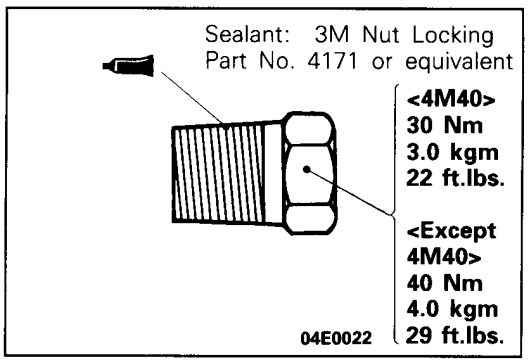
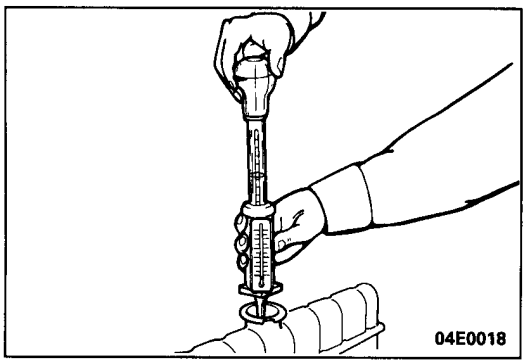


(9) Install the radiator cap securely.
(10) Start the engine and warm the engine until the thermostat opens.
(11) After racing the engine several times, stop the engine.
(12) When the engine has cooled down, remove the radiator cap and once again add engine coolant until the radiator is full, and also refill the reserve tank up to the FULL line.



CONCENTRATION MEASUREMENT E14FDAC

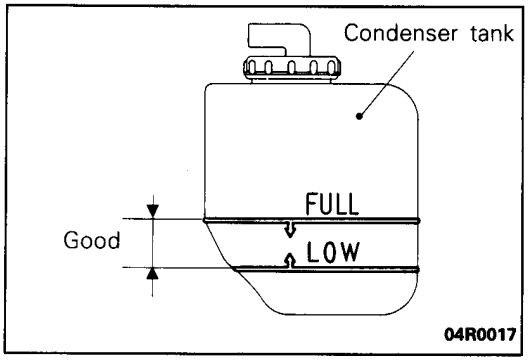
Measure the temperature and specific gravity of the engine coolant to check the antifreeze concentration.

Standard value: 30%–60% (allowable concentration range)

RECOMMENDED ANTIFREEZE

Antifreeze	Allowable concentration
HIGH QUALITY ETHYLENE GLYCOL ANTIFREEZE COOLANT	30–60 %

Caution
If the concentration of the antifreeze is below 30 %, the anti-corrosion property will be adversely affected.
In addition, if the concentration is above 60 %, both the anti-freezing and engine cooling properties will decrease, affecting the engine adversely.
For these reasons, be sure to maintain the concentration level within the specified range.



COOLANT INSPECTION E14FHAB

1. Check that the coolant level in the reserve tank is within FULL and LOW limits.
2. Check for presence of oil in the coolant.

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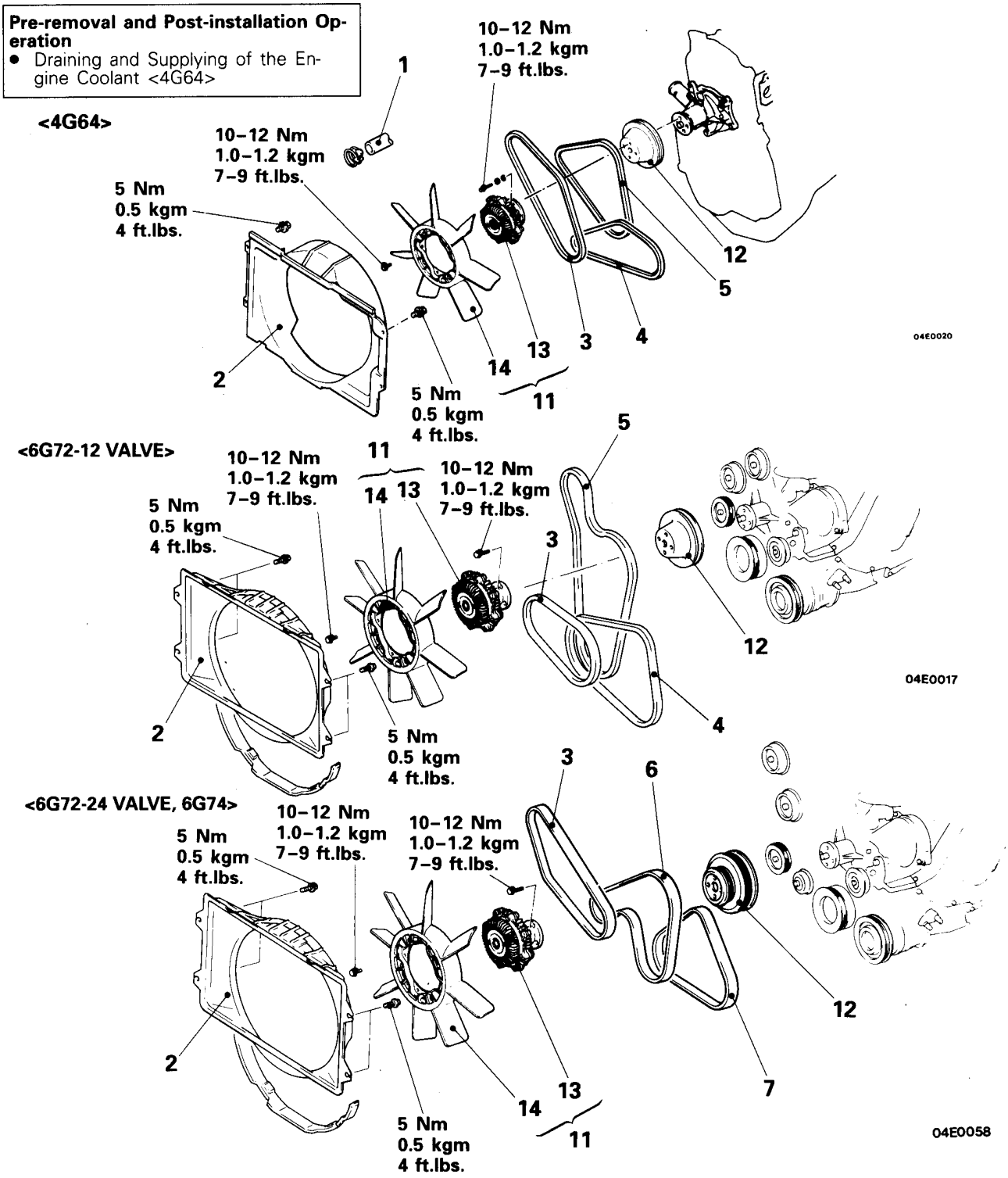
COOLING FAN

E14JA--

REMOVAL AND INSTALLATION

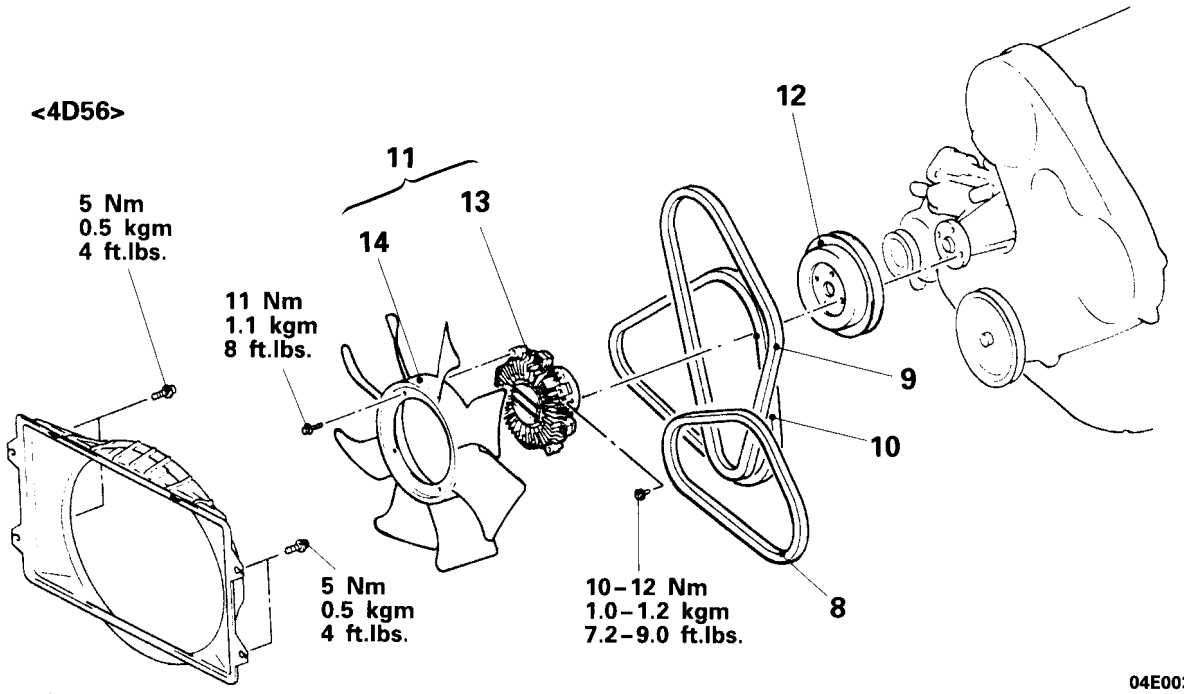
Pre-removal and Post-installation Operation
- Draining and Supplying of the Engine Coolant <4G64>



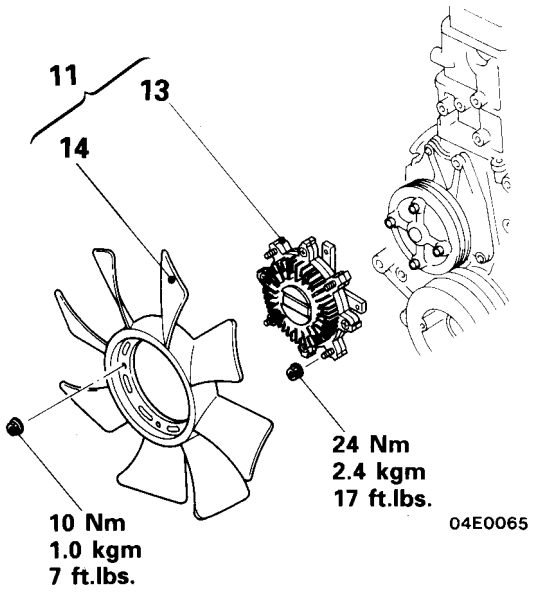
Removal steps

1. Radiator upper hose connection
2. Shroud
3. Drive belt (Power steering)
4. Drive belt (Air conditioner) } <6G64, 6G72-12 VALVE>
5. Drive belt (Alternator) }
6. Drive belt (Alternator) } <4G72-24 VALVE, 6G74>
7. Drive belt (Air conditioner) }
11. Cooling fan and fan clutch assembly
12. Pully
13. Fan clutch
14. Cooling fan

<4D56>



<4M40 (L.H. drive vehicles)>



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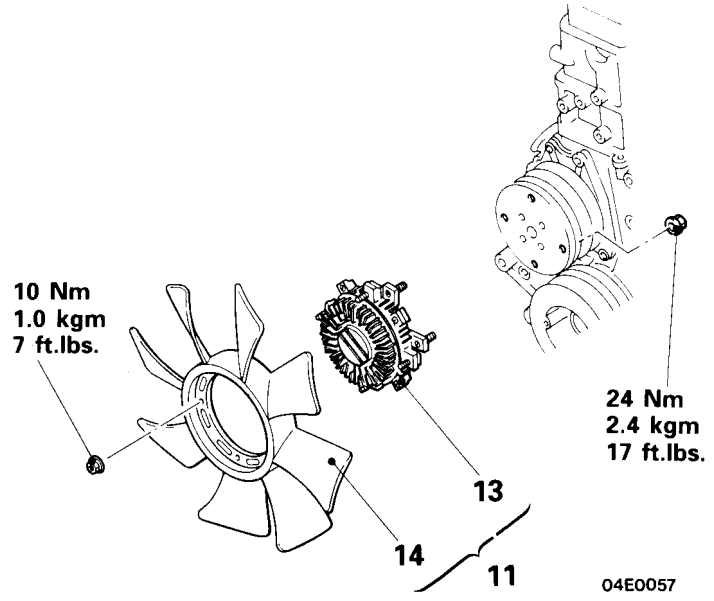
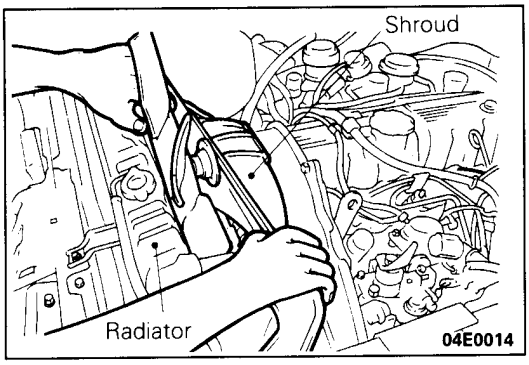


Removal steps

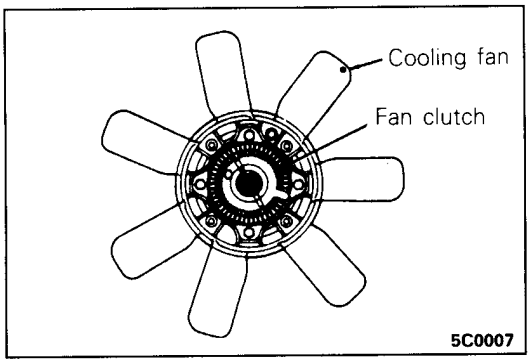
- Intercooler
  (Refer to GROUP 15 – Intercooler)
8. Drive belt (Air conditioner)
9. Drive belt (Power steering)
10. Drive belt (Alternator)
11. Cooling fan and fan clutch assembly
12. Pully
13. Fan clutch
14. Cooling fan



SERVICE POINT OF REMOVAL E14JBAB

11. REMOVAL OF COOLING FAN AND FAN CLUTCH ASSEMBLY <4D56, 4M40>

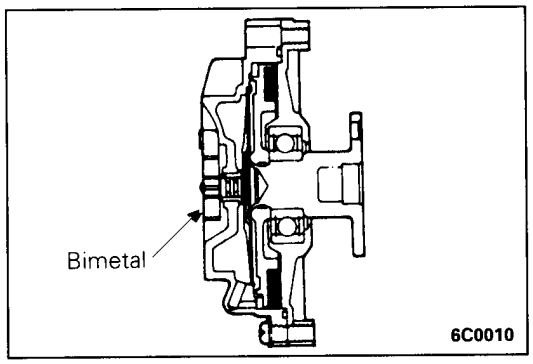
Remove the shroud mounting bolt, and remove the cooling fan and fan clutch assembly through the gap between the shroud and the radiator.



INSPECTION E14JCAD

COOLING FAN

- Check blades for damage and cracks.
- Check for cracks and damage around bolt holes in fan hub.
- If any portion of fan is damaged or cracked, replace cooling fan.



FAN CLUTCH

- Check to ensure that fluid in fan clutch is not leaking at case joint and seals. If fluid quantity decreases due to leakage, fan speed will decrease and engine overheating might result.
- When a fan attached to an engine is turned by hand, it should give a sense of some resistance. If fan turns lightly, it is faulty.
- Check bimetal strip for damage.

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NOTES

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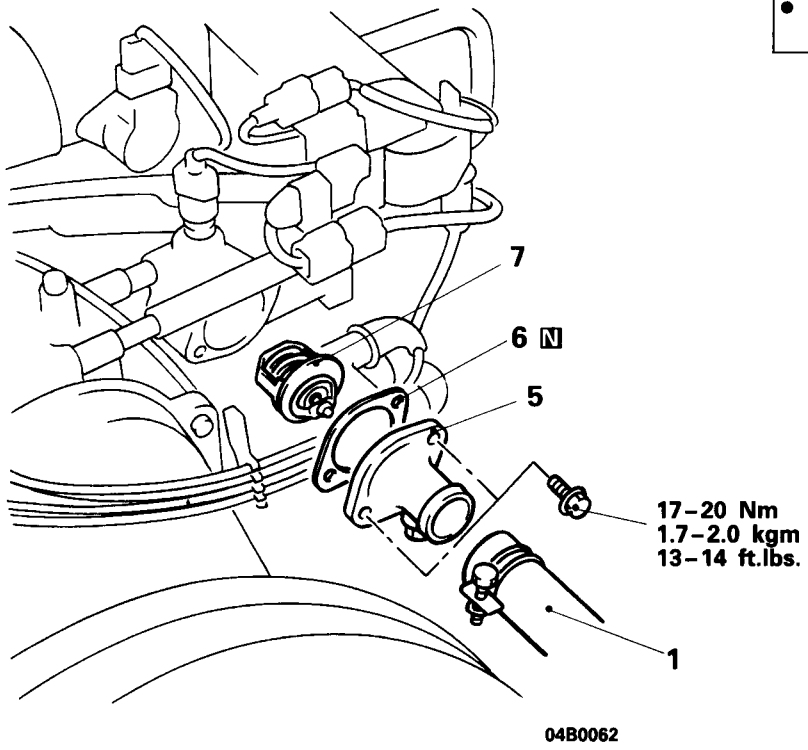
THERMOSTAT <4G64, 6G72, 6G74, 4M40>

REMOVAL AND INSTALLATION

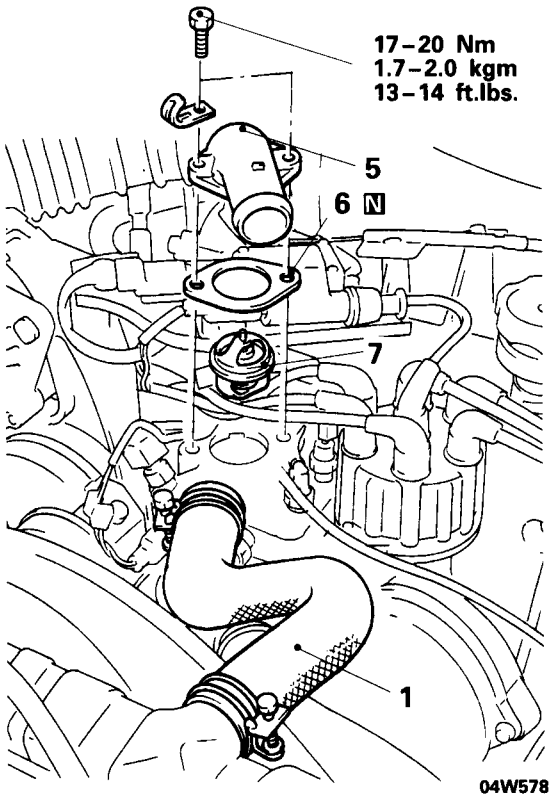
E14GA--

Pre-removal and Post-installation Operation
- Draining and Supplying of Engine Coolant

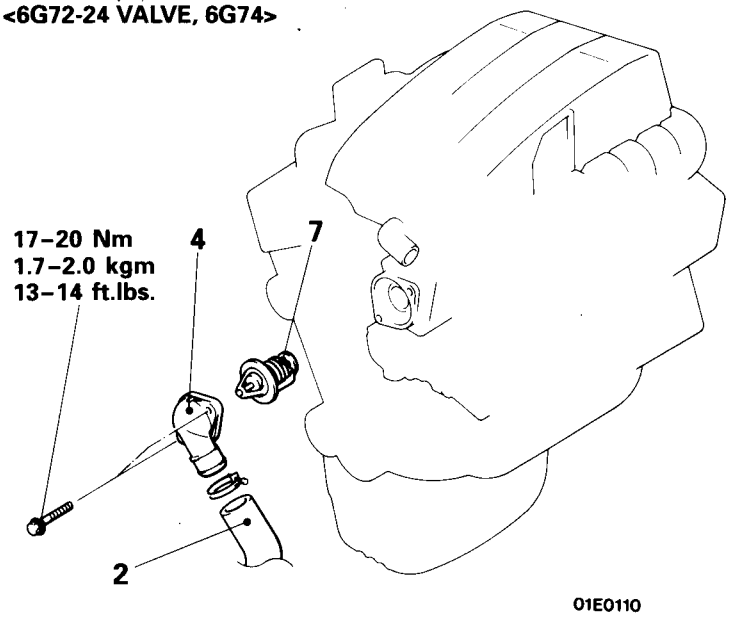
<4G64>



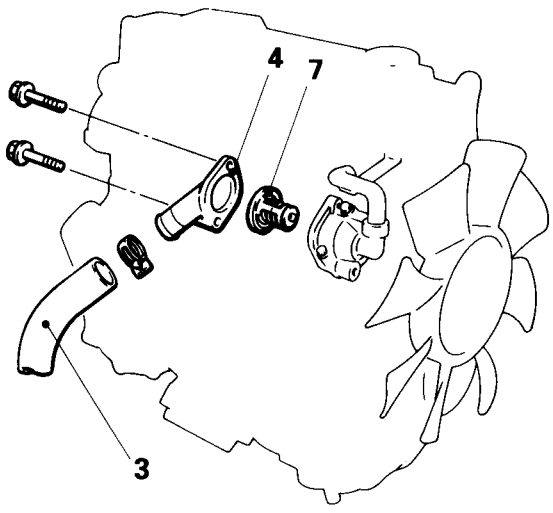
<6G72-12 VALVE>



<6G72-24 VALVE, 6G74>



<4M40>



Removal steps

1. Radiator upper hose connection
2. Radiator lower hose connection
3. Water inlet hose connection
4. Water inlet fitting
5. Water outlet fitting
6. Water outlet fitting gasket
- ◆◆ 7. Thermostat

04E0056

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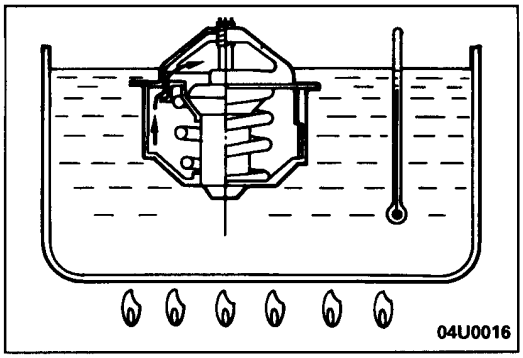

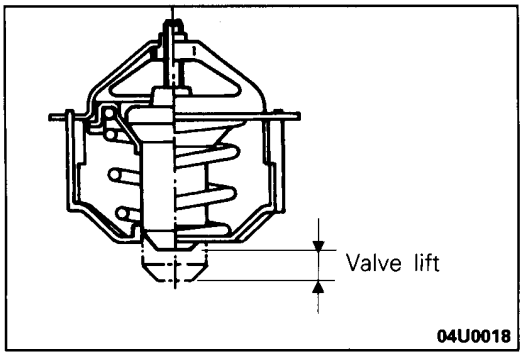

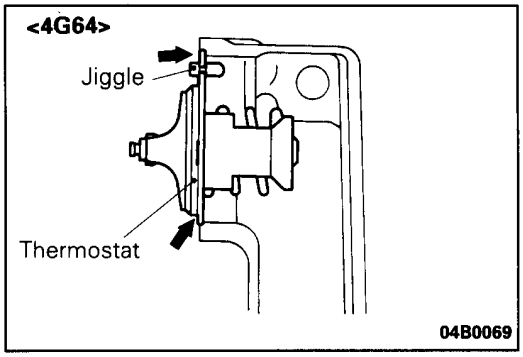

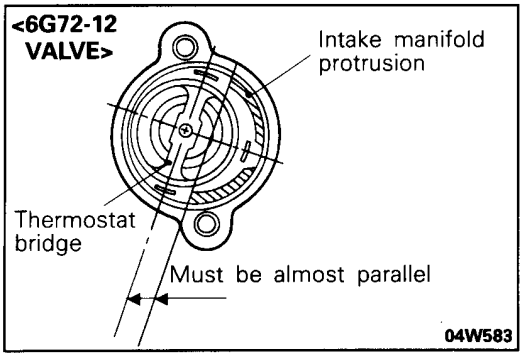

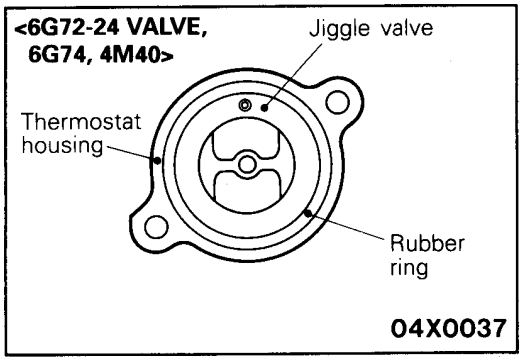

INSPECTION E14GCAT

- Check that valve closes tightly at room temperature.
- Check for defects or damage.
- Check for rust or encrustation on valve. Remove if any.
- Immerse the thermostat in water. Stir to raise water temperature and check that thermostat valve opening temperature and the temperature at which valve fully opens valve lift amount [8 mm (0.31 in.) <4G64, 6G72-12 VALVE>], [8.5 mm (0.33 in.) <4M40>], [10 mm (0.39 in.) <6G72-24 VALVE, 6G74>] are at the standard value.

Standard value:

<4G64, 6G72-12 VALVE>

Valve opening temperature 88°C (190°F)

Temperature at which the valve fully opens 100°C (212°F) or more

<4M40>

Valve opening temperature 76.5°C (170°F)

Temperature at which the valve fully opens 90°C (194°F) or more

<6G72-24 VALVE, 6G74>

Valve opening temperature 82°C (180°F)

Temperature at which the valve fully opens 95°C (203°F) or more

NOTE
Measure valve height when fully closed. Calculate lift by measuring the height when fully open.

SERVICE POINTS OF INSTALLATION E14GDAJ

7. INSTALLATION OF THERMOSTAT

<4G64>

Caution
Check to ensure that the thermostat flange is correctly seated in the thermostat housing socket. If thermostat is installed in the wrong direction, the bottom of the thermostat will touch the rib inside the intake manifold, making it impossible to seat the flange in position.

<6G72-12 VALVE>

Install the thermostat to the intake manifold as illustrated.

Caution
The thermostat flange fits over the manifold seat; ensure that the thermostat is not installed at an angle.

<6G72-24 VALVE, 6G74, 4M40>

Install the thermostat so that the jiggle valve is facing straight up and is aligned with the mark on the thermostat case as shown in the illustration.

Caution
Make absolutely sure that no oil is adhering to the rubber ring of the thermostat. In addition, be careful not to fold over or scratch the rubber ring when inserting.

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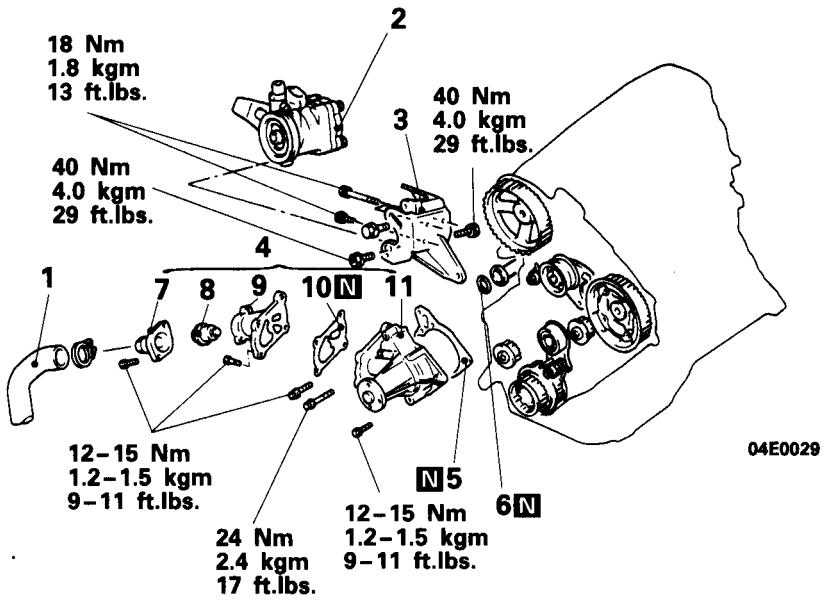
THERMOSTAT AND WATER PUMP <4D56>

REMOVAL AND INSTALLATION

E14HA–

Pre-removal and Post-installation Operation
- Draining and Supplying of the Engine Coolant
- Removal and Installation of the Air Intake Hose

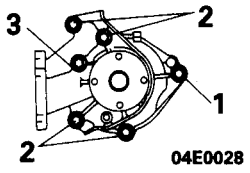
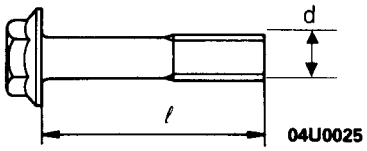


Removal steps of water pump
- Timing belt – Timing belt "B" (Refer to GROUP 11 – Timing Belt · Timing Belt "B")

1. Radiator lower hose
2. Power steering oil pump
3. Power steering oil pump bracket
4. Water pump with thermostat
5. Water pump gasket
6. O-ring
7. Water inlet fitting
8. Thermostat
9. Thermostat housing
10. Thermostat housing gasket
11. Water pump

Removal steps of thermostat

1. Radiator lower hose
7. Water inlet fitting
8. Thermostat

No.	Hardness category (Head mark)	d × ℓ mm (in.)	Remark
1	4T	8×25 (0.31×0.98)	 04E0028  04U0025
2	4T	8×40 (0.31×1.57)	
3	7T	8×70 (0.31×2.76)	

SERVICE POINTS OF REMOVAL

E14HBAA

2. REMOVAL OF POWER STEERING OIL PUMP

(1) Remove the power steering oil pump from the bracket with the hose still attached.
(2) Place the power steering oil pump somewhere where it will not be a hindrance to working, being careful not to put too much strain on the hose.

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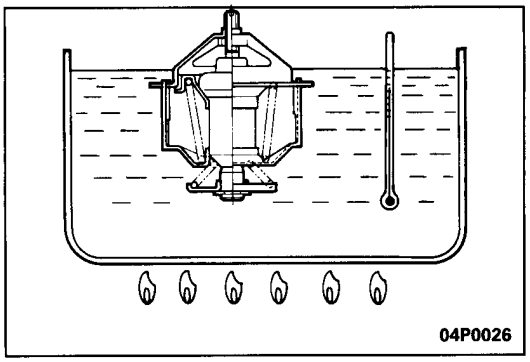

04P0026

INSPECTION E14HCAA

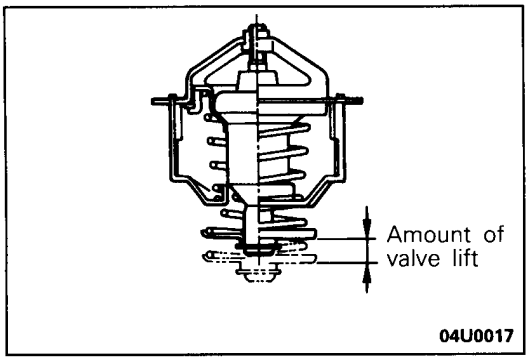
THERMOSTAT

- Check that valve closes tightly at room temperature.
- Check for defects or damage.
- Check for rust or encrustation on valve. Remove if any.
- Immerse thermostat in container of water. Stir to raise water temperature and check that thermostat opening valve temperature and the temperature with valve fully open [valve lift-over 8 mm (0.32 in.)] are at the standard value.

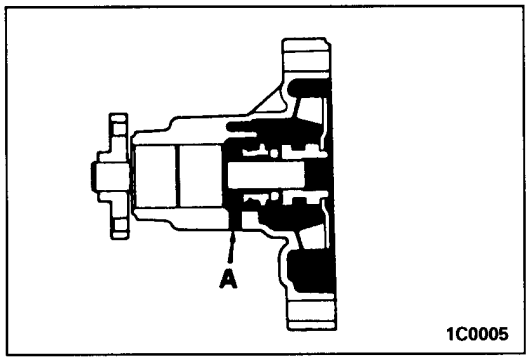
Standard value:

Opening valve temperature	**76.5°C (170°F)**
Full-open	**90°C (194°F) or more**

NOTE
Measure valve height when fully closed. Calculate lift by measuring the height when fully open.



04U0017



1C0005

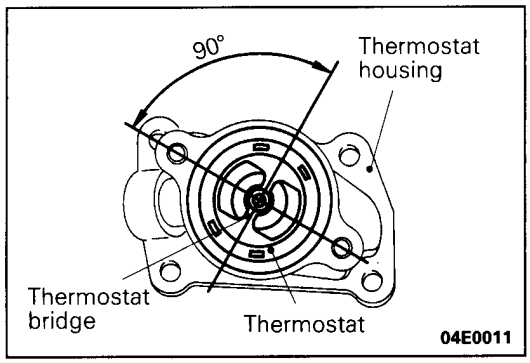
WATER PUMP

- Check each part for cracks, damage or wear, and replace the water pump assembly if necessary.
- Check the bearing for damage, abnormal noise and sluggish rotation, and replace the water pump assembly if necessary.
- Check the seal unit for leaks, and replace the water pump assembly if necessary.
- Check for water leakage. If water leaks from hole "A" seal unit is defective. Replace as an assembly.

SERVICE POINTS OF INSTALLATION E14HDAA

8. INSTALLATION OF THERMOSTAT

Install the thermostat as shown in the illustration.



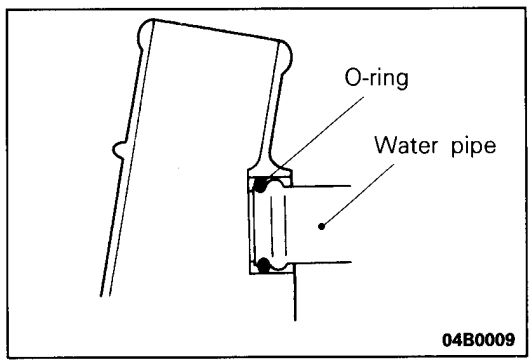
04E0011

4. INSTALLATION OF WATER PUMP WITH THERMOSTAT

Rinse the mounting location of the O-ring and water pipe with water, and install the O-ring and water pipe.

Caution

1. **Do not apply oil and grease to water pipe O-ring.**
2. **Keep the water pipe connections free of sand, dust, etc.**
3. **Insert water pipe until its end bottoms.**



04B0009

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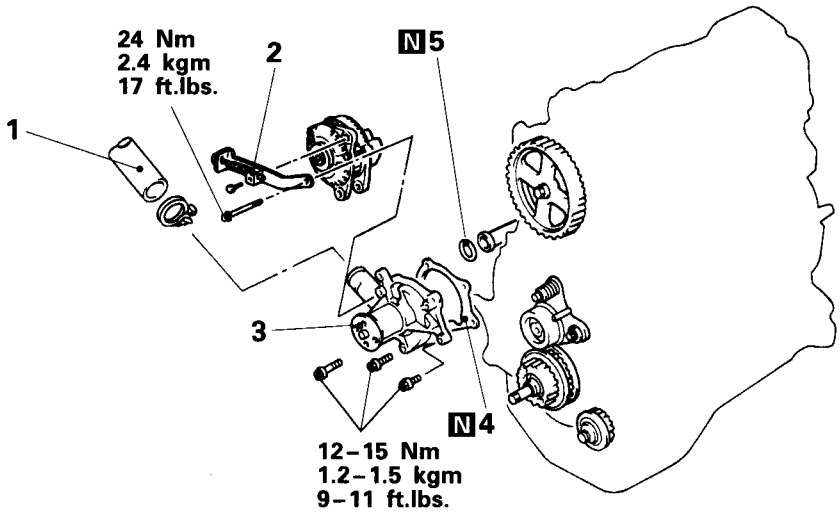
WATER PUMP <4G64>

REMOVAL AND INSTALLATION

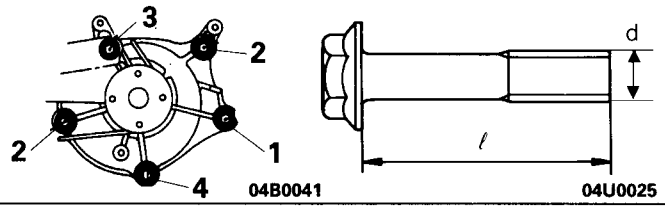
E14MA–

Pre-removal and Post-installation Operation
- Draining and Supplying of the Engine Coolant
- Removal and Installation of Timing Belt, Timing Belt (B)
(Refer to GROUP 11 – Timing Belt)

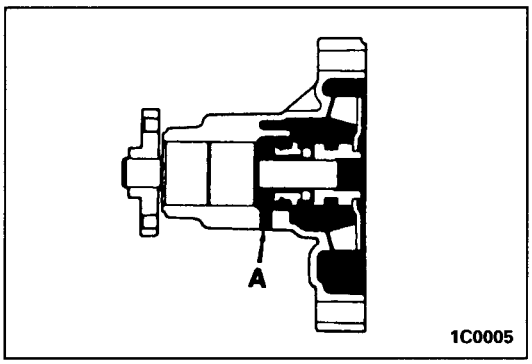


04E0024

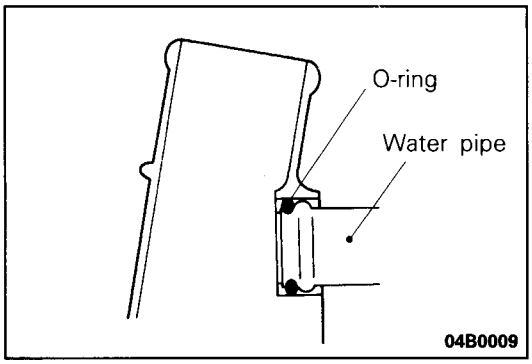
Removal steps
1. Radiator lower hose
2. Alternator brace
◆◆ 3. Water pump
4. Water pump gasket
5. O-ring

No.	Hardness category (Head mark)	d × ℓ mm (in.)	Remark
1	4T	8×20 (0.31×0.79)	
2	4T	8×30 (0.31×1.18)	
3	7T	8×65 (0.31×2.26)	
4	4T	8×40 (0.31×1.57)	

04B0041 04U0025



1C0005



04B0009

INSPECTION

E14MCAP

WATER PUMP

- Check each part for cracks, damage or wear, and replace the water pump assembly if necessary.
- Check the bearing for damage, abnormal noise and sluggish rotation, and replace the water pump assembly if necessary.
- Check the seal unit for leaks, and replace the water pump assembly if necessary.
- Check for water leakage. If water leaks from hole "A" seal unit is faulty. Replace as an assembly.

SERVICE POINTS OF INSTALLATION

E14MDBC

3. INSTALLATION OF WATER PUMP

Rinse the mounting location of the O-ring and water pipe with water, and install the O-ring and water pipe.

Caution
1. **Do not apply oil and grease to water pipe O-ring.**
2. **Keep the water pipe connections free of sand, dust, etc.**
3. **Insert water pipe until its end bottoms.**

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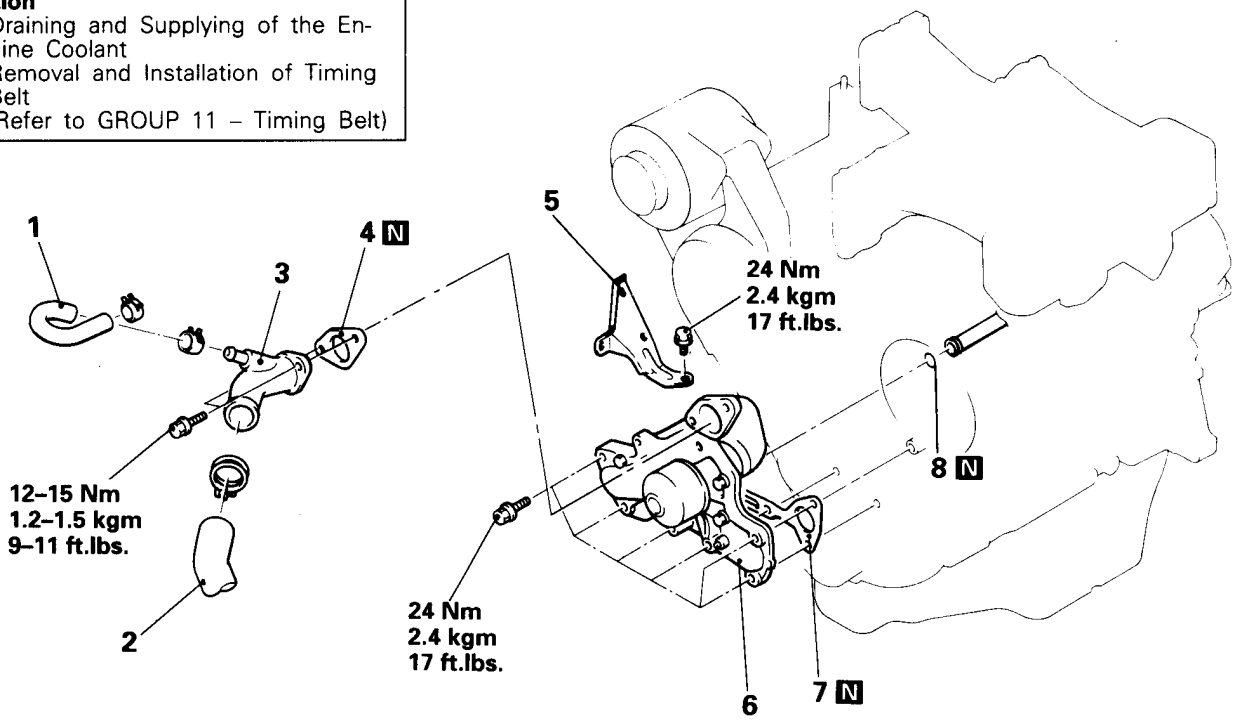
PWJE9086

WATER PUMP <6G72-12 VALVE>

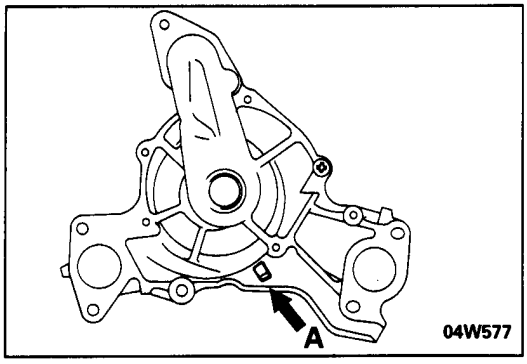
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Draining and Supplying of the Engine Coolant
- Removal and Installation of Timing Belt
  (Refer to GROUP 11 – Timing Belt)

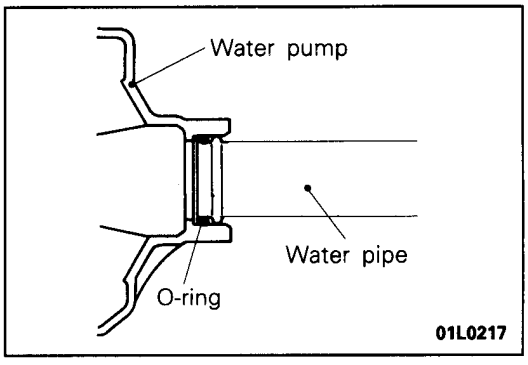


04E0039

Removal steps
1. Water bypass hose
2. Radiator lower hose
3. Water inlet fitting
4. Water inlet fitting gasket
5. Cooling fan stay
6. Water pump
7. Water pump gasket
8. O-ring



04W577



01L0217

INSPECTION E14MCAP

WATER PUMP

- Check each part for cracks, damage or wear, and replace the water pump assembly if necessary.
- Check the bearing for damage, abnormal noise and slugish rotation, and replace the water pump assembly if necessary.
- Check the seal unit for leaks, and replace the water pump assembly if necessary.
- Check for water leakage if water leaks from hole "A" seal unit is faulty. Replace as an assembly.

SERVICE POINTS OF INSTALLATION E14MDBC

6. INSTALLATION OF WATER PUMP

Rinse the mounting location of the O-ring and water pipe with water, and install the O-ring and water pipe.

Caution
1. **Do not apply oil and grease to water pipe O-ring.**
2. **Keep the water pipe connections free of sand, dust, etc.**
3. **Insert water pipe until its end bottoms.**

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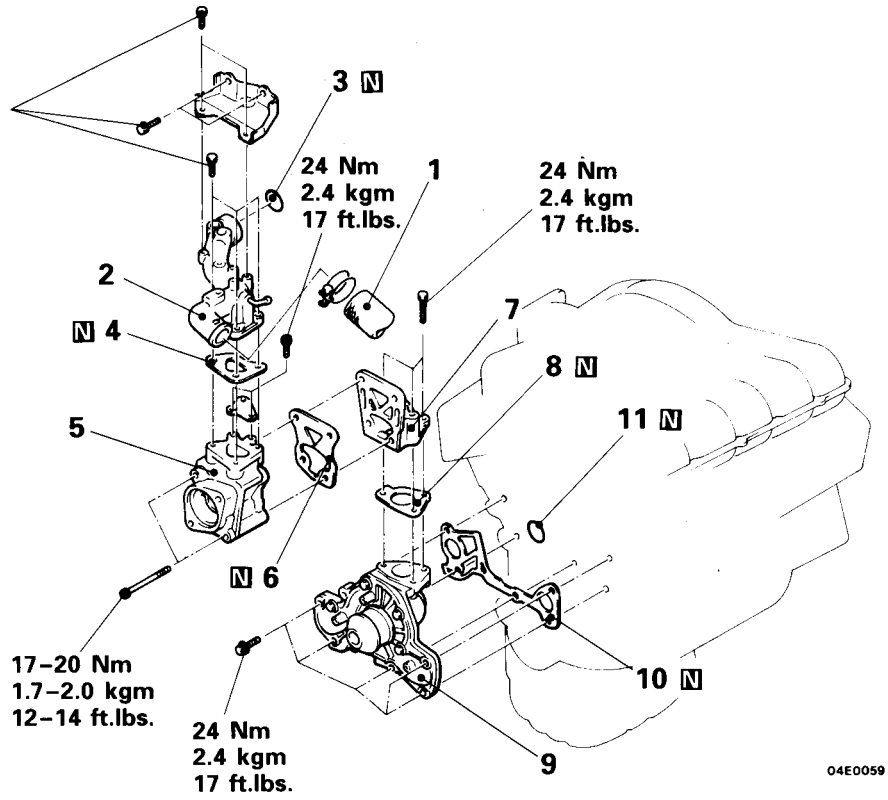
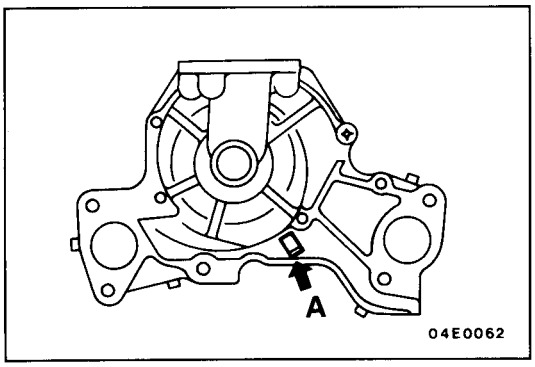
WATER PUMP <6G74>

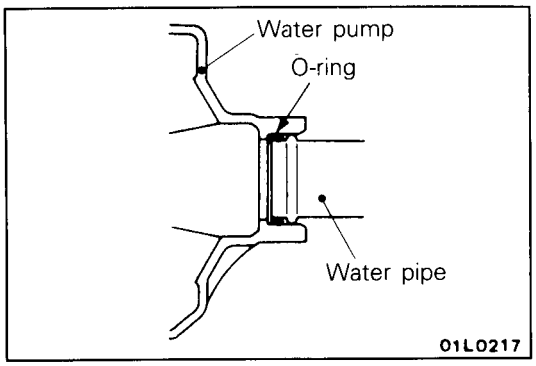
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Draining and Supplying of the Engine Coolant
- Removal and Installation of Timing Belt
  (Refer to GROUP 11 – Timing Belt)
- Removal and Installation of Thermostat (Refer to P. 14-8)



Removal steps
1. Radiator hose
2. Water outlet fitting
3. O-ring ◆◆
4. Gasket
5. Thermostat case
6. Gasket
7. Water pump fitting
8. Gasket
9. Water pump
10. Gasket
11. O-ring ◆◆





INSPECTION

M14MDAP

WATER PUMP

- Check each part for cracks, damage or wear, and replace the water pump assembly if necessary.
- Check the bearing for damage, abnormal noise and slugish rotation, and replace the water pump assembly if necessary.
- Check the seal unit for leaks, and replace the water pump assembly if necessary.
- Check for water leakage if water leaks from hole "A" seal unit is faulty. Replace as an assembly.

SERVICE POINTS OF INSTALLATION

11./3/ INSTALLATION OF O-RINGS

Rinse the mounting location of the O-ring and water pipe with water, and install the O-ring and water pipe.

Caution
1. **Do not apply oil and grease to water pipe O-ring.**
2. **Keep the water pipe connections free of sand, dust, etc.**
3. **Insert water pipe until its end bottoms.**

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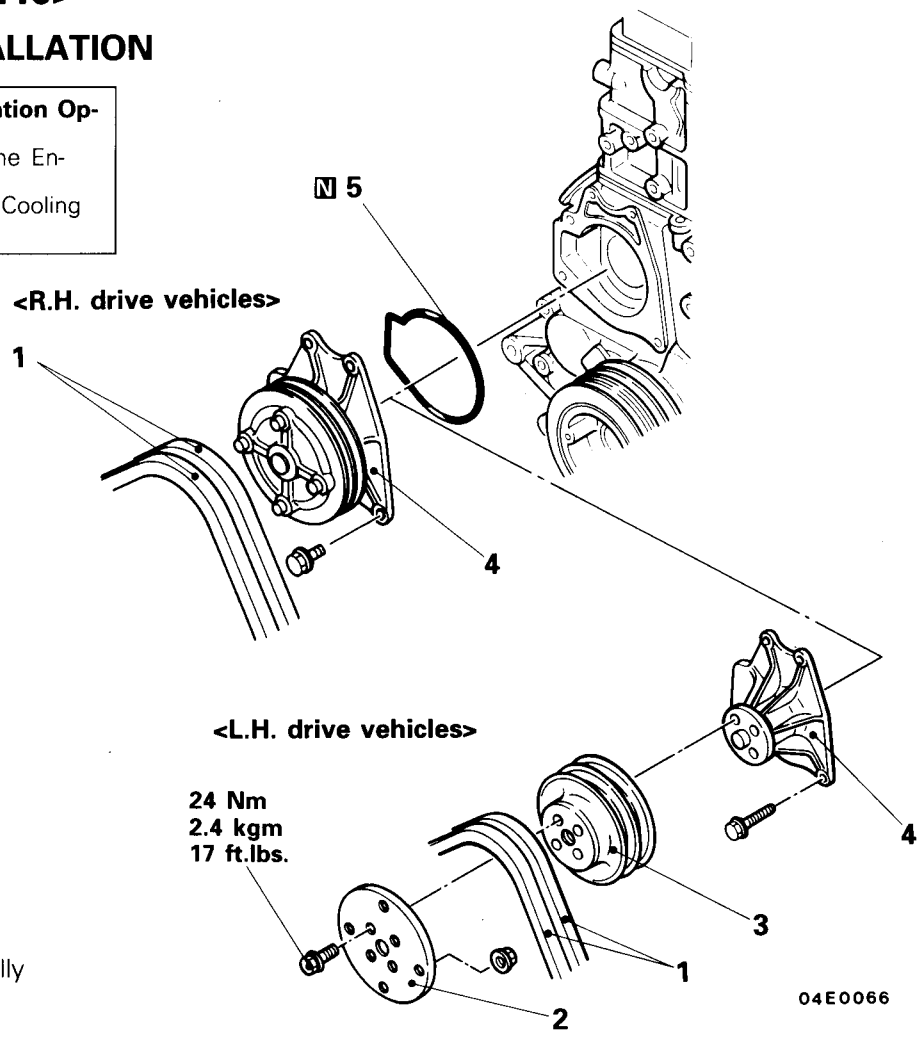
WATER PUMP <4M40>

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Draining and Supplying of the Engine Coolant
- Removal and Installation of Cooling Fan (Refer to P. 14-7.)



Removal steps
1. Drive belt
2. Cupling plate
3. Water pump pully
4. Water pump
5. O-ring

INSPECTION

WATER PUMP

- Check each part for cracks, damage or wear, and replace the water pump assembly if necessary.
- Check the bearing for damage, abnormal noise and sluggish rotation, and replace the water pump assembly if necessary.
- Check the seal unit for leaks, and replace the water pump assembly if necessary.

SERVICE POINTS OF INSTALLATION

4. INSTALLATION OF WATER PUMP

Rinse the mounting location of the O-ring and water pipe with water, and install the O-ring and water pipe.

Caution
1. **Do not apply oil and grease to water pipe O-ring.**
2. **Keep the water pipe connections free of sand, dust, etc.**
3. **Insert water pipe until its end bottoms.**

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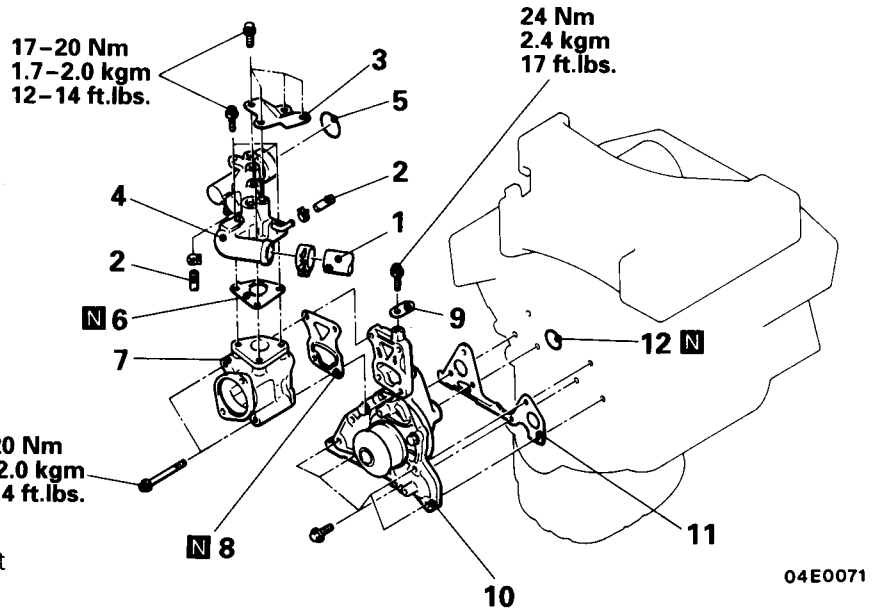
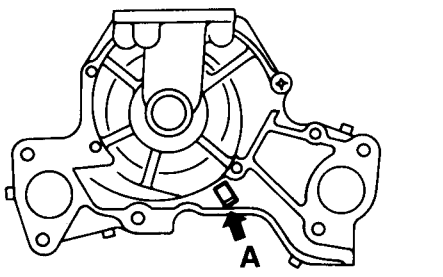
WATER PUMP <6G72-24 VALVE>

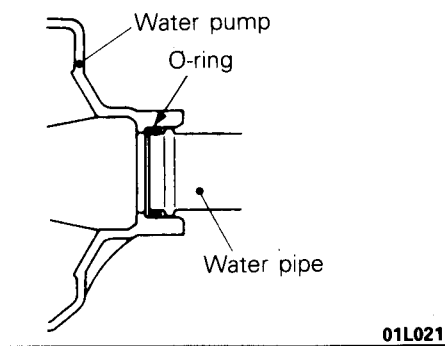
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Draining and Supplying of the Engine Coolant
- Removal and Installation of Timing Belt (Refer to GROUP 11 – Timing Belt)
- Removal and Installation of Thermostat (Refer to P.14-8)



Removal steps
1. Radiator hose
2. Water hose
3. Water outlet fitting bracket
4. Water outlet fitting
◆◆ 5. O-ring
6. Gasket
7. Thermostat case
8. Gasket
9. Water pump bracket
10. Water pump
11. Water pump gasket
◆◆ 12. O-ring





INSPECTION

WATER PUMP

- Check each part for cracks, damage or wear, and replace the water pump assembly if necessary.
- Check the bearing for damage, abnormal noise and slugish rotation, and replace the water pump assembly if necessary.
- Check the seal unit for leaks, and replace the water pump assembly if necessary.
- Check for the water leakage if water leaks from hole "A" seal unit is faulty. Replace as an assembly.

SERVICE POINTS OF INSTALLATION

12./5. INSTALLATION OF O-RINGS

Rinse the mounting location of the O-ring and water pipe with water, and install the O-ring and water pipe.

Caution
1. **Do not apply oil and grease to water pipe O-ring.**
2. **Keep the water pipe connections free of sand, dust, etc.**
3. **Insert water pipe until its end bottoms.**

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NOTES

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RADIATOR

E14QA--

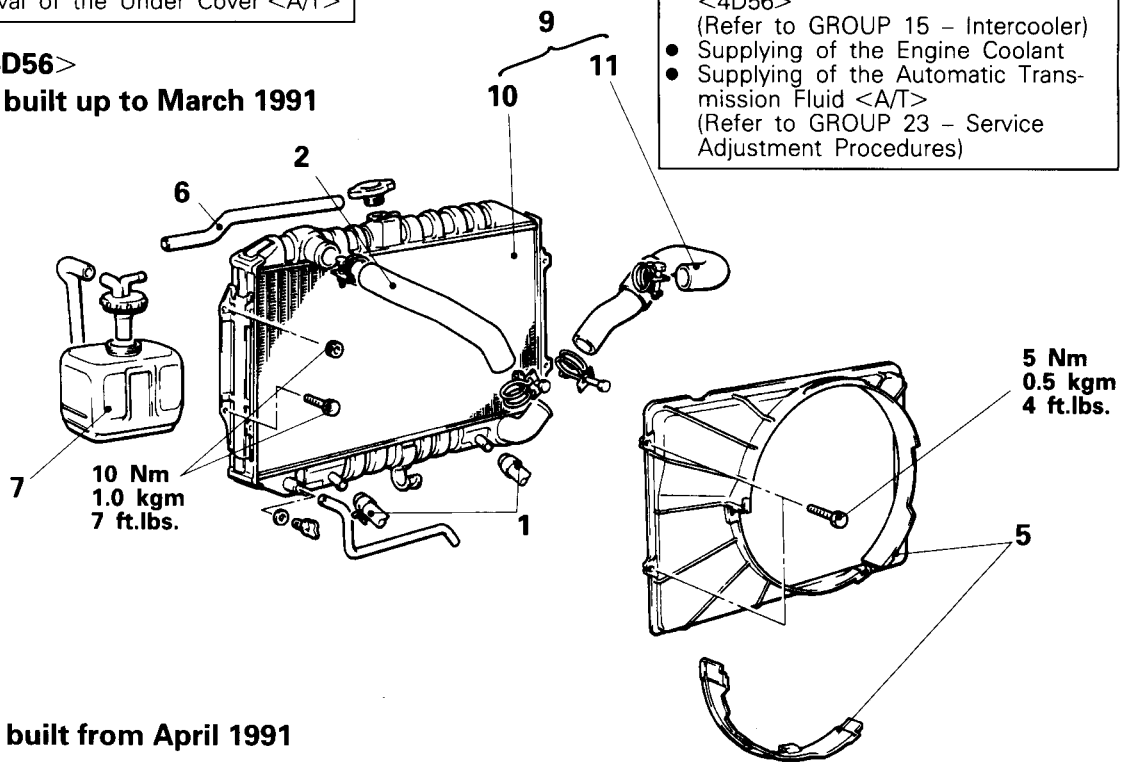
REMOVAL AND INSTALLATION

Pre-removal Operation
- Draining of the Engine Coolant
- Removal of the Intercooler <4D56> (Refer to GROUP 15 – Intercooler)
- Removal of the Cooling Fan <4G64, 4D56> (Refer to P.14-6.)
- Removal of the Under Cover <A/T>

Post-installation Operation
- Installation of the Under Cover <A/T>
- Installation of the Cooling Fan <4G64, 4D56> (Refer to P.14-6.)
- Installation of the Intercooler <4D56> (Refer to GROUP 15 – Intercooler)
- Supplying of the Engine Coolant
- Supplying of the Automatic Transmission Fluid <A/T> (Refer to GROUP 23 – Service Adjustment Procedures)

<4G64, 4D56>

Vehicles built up to March 1991



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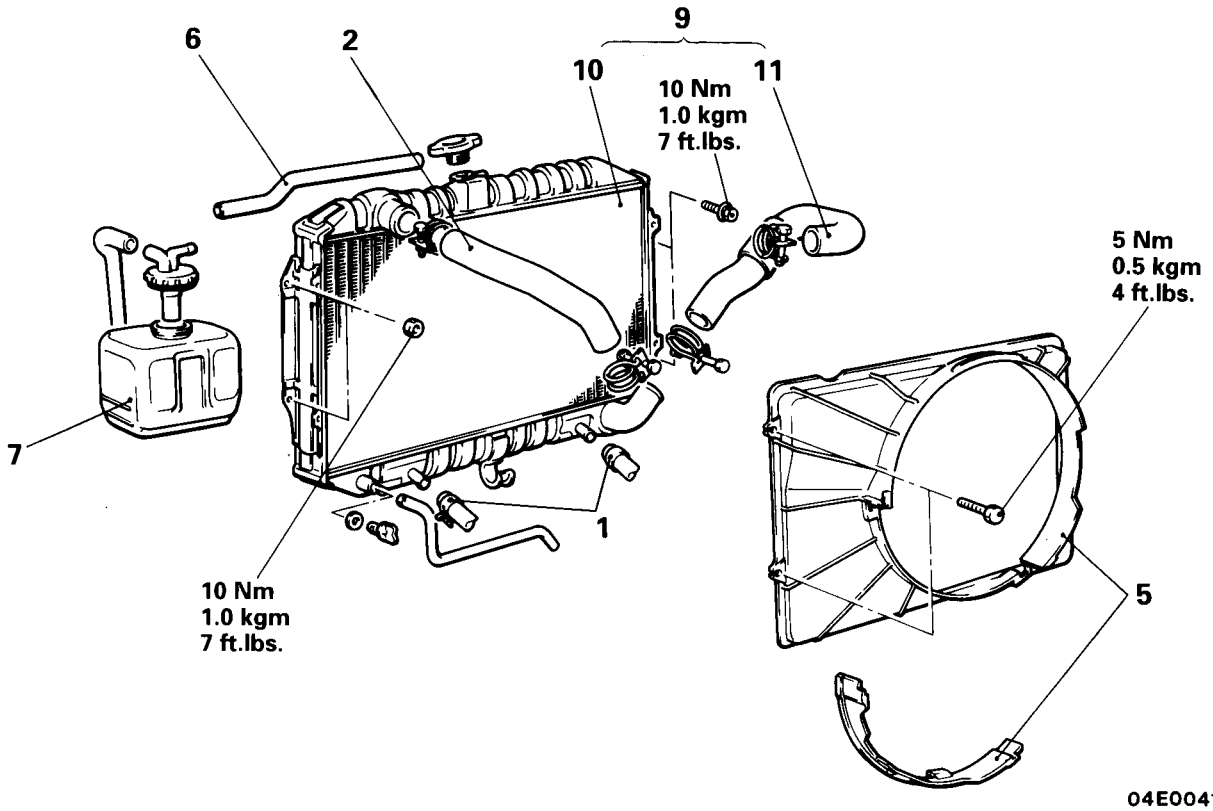
Vehicles built from April 1991



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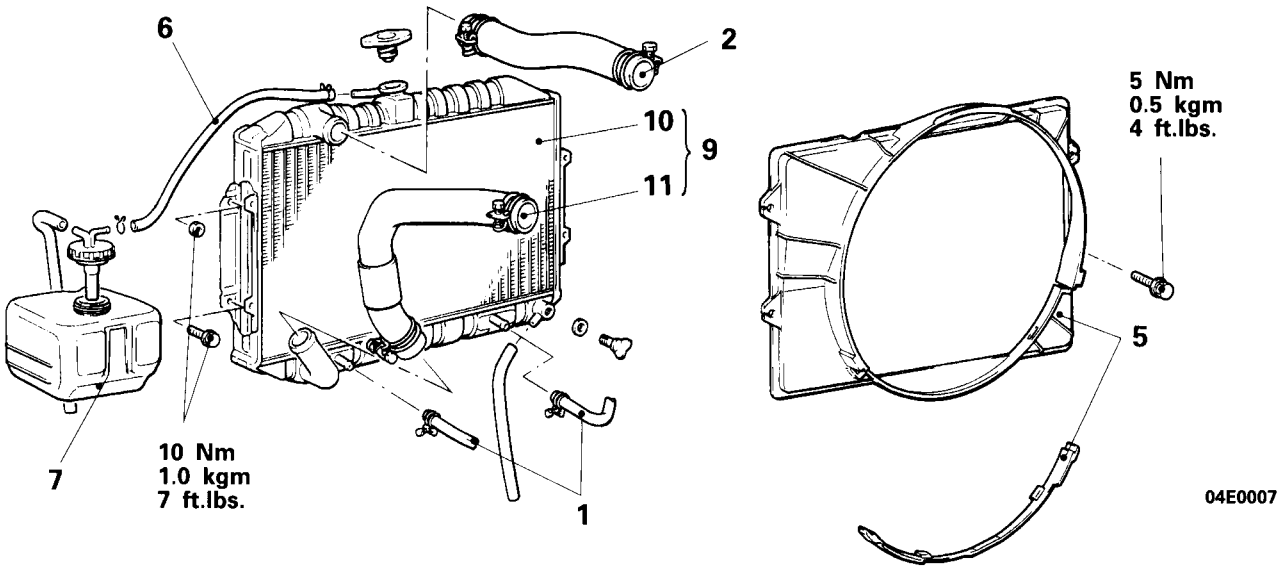
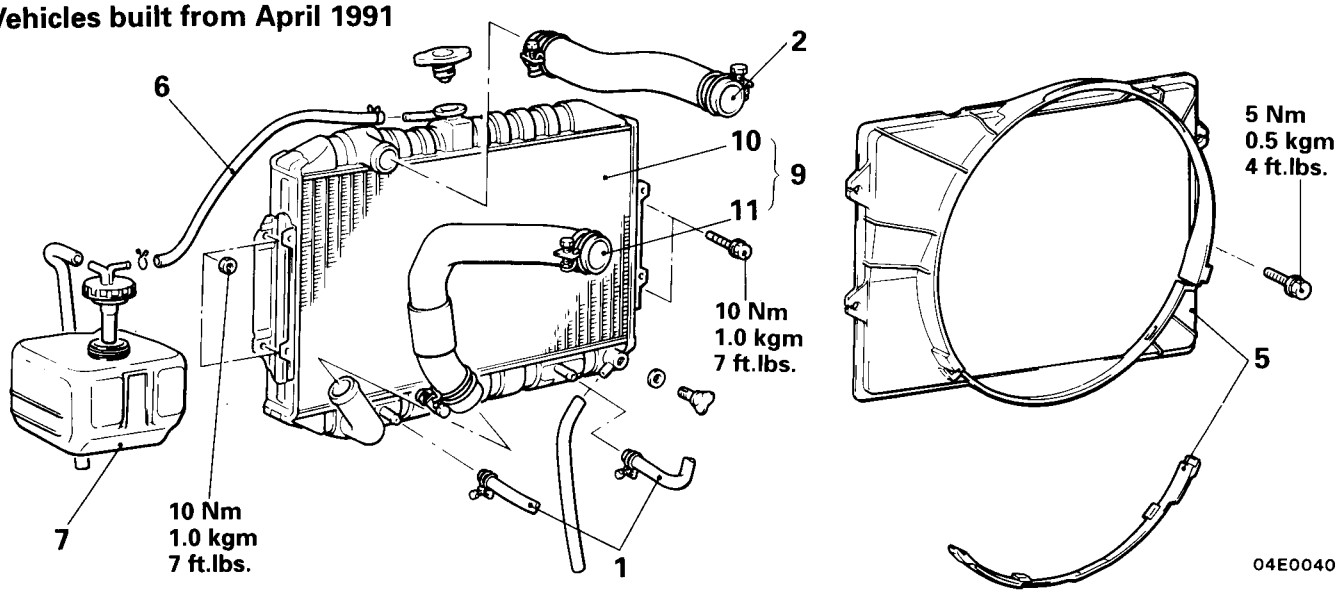
<6G72, 6G74>

Vehicles built up to March 1991



Vehicles built from April 1991



Removal steps

1. Automatic transmission oil cooler hose connection <A/T>
2. Radiator upper hose
5. Radiator shroud
6. Overflow hose
7. Reserve tank
9. Radiator and radiator lower hose
10. Radiator
11. Radiator lower hose

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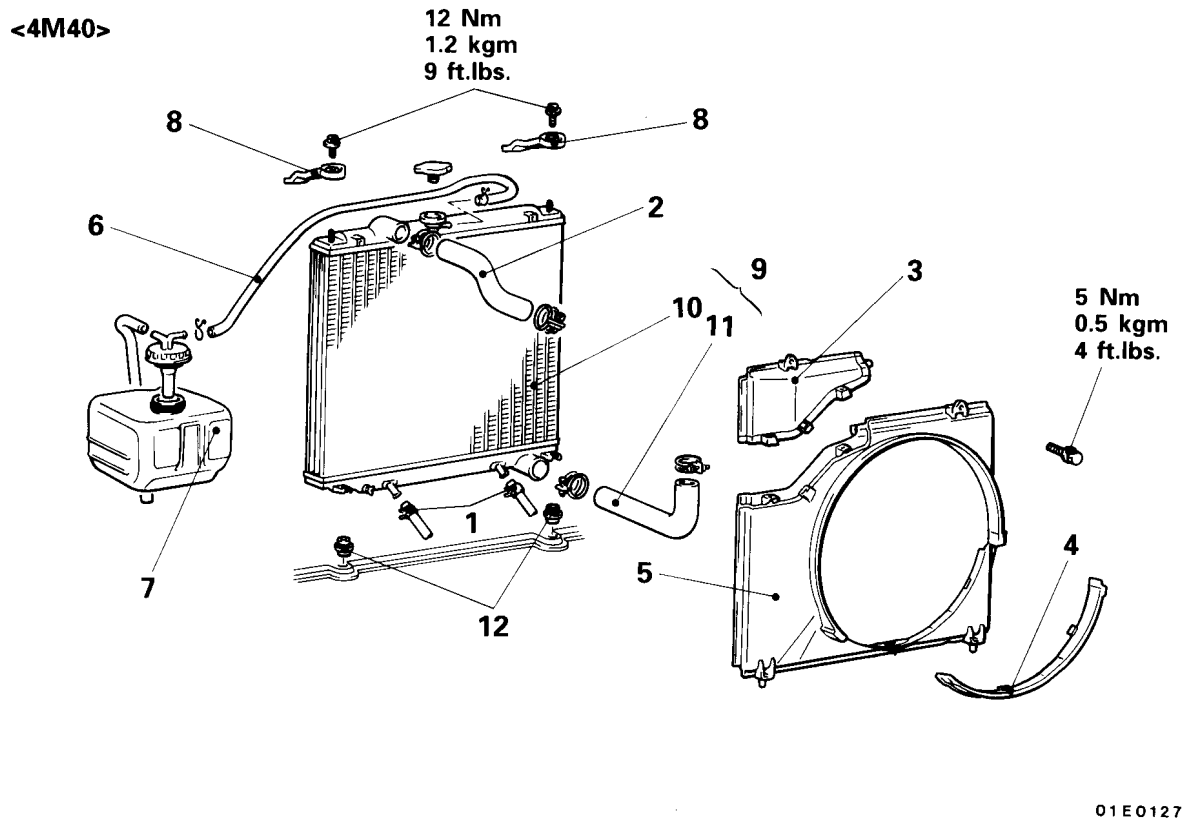
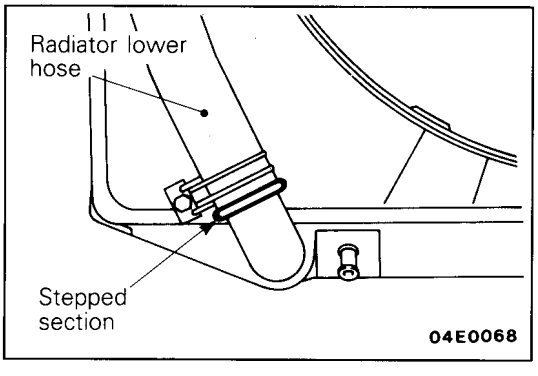


Removal steps

1. Automatic transmission oil cooler hose connection <A/T>
2. Radiator upper hose
3. Corner
4. Cover
5. Radiator shroud
6. Overflow hose
7. Reserve tank
8. Upper insulator
9. Radiator and radiator lower hose
10. Radiator
11. Radiator lower hose
12. Lower insulator

INSPECTION E14QCAL

- Check for foreign material between radiator fins.
- Check the radiator fins for bend or damage.
- Check the radiator for corrosion, damage, rust or scale.
- Check the radiator hoses for cracks, damage or deterioration.
- Check the reserve tank for damage.
- Check the spring of radiator cap for deterioration.
- Check the packing of radiator cap for damage or cracks.



11. INSTALLATION OF RADIATOR LOWER HOSE <6G74>

The radiator hose should be inserted just as far as the stepped section and then secured with the clamp.

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NOTES

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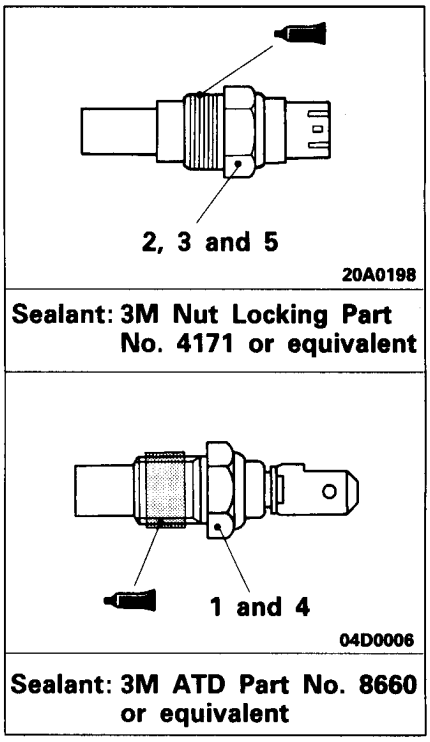
THERMO SWITCH, ENGINE COOLANT TEMPERATURE GAUGE UNIT, ENGINE COOLANT TEMPERATURE SENSOR AND ENGINE COOLANT TEMPERATURE SWITCH

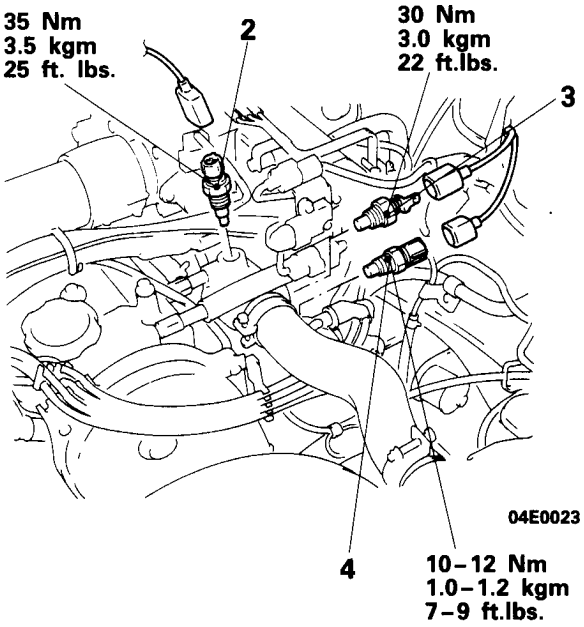
E14UA--

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Draining and Supplying of the Engine Coolant
- Removal and Installation of the Intercooler <4D56, 4M40> (Refer to group 15 – Intercooler)



<4G64>



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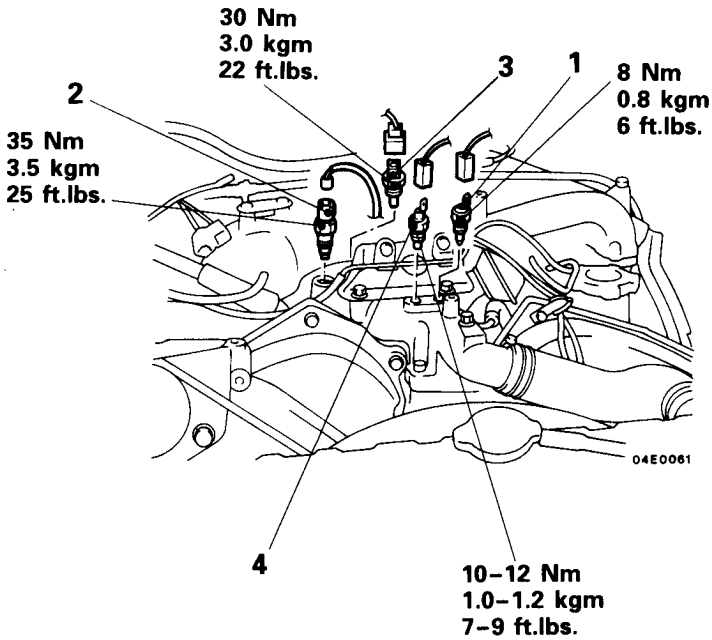
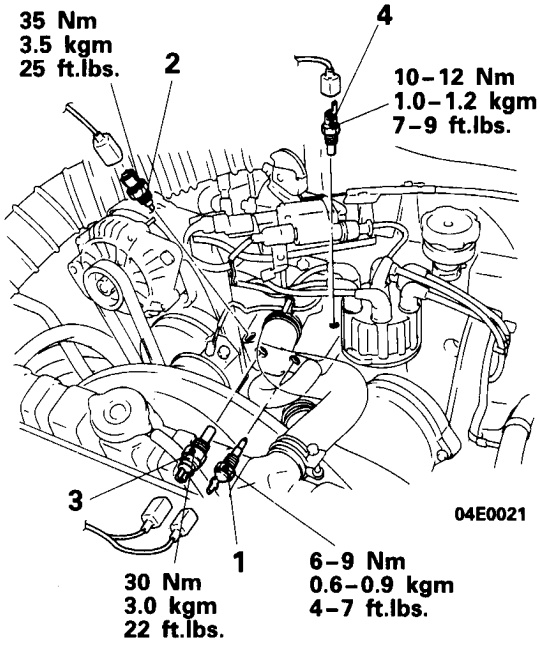
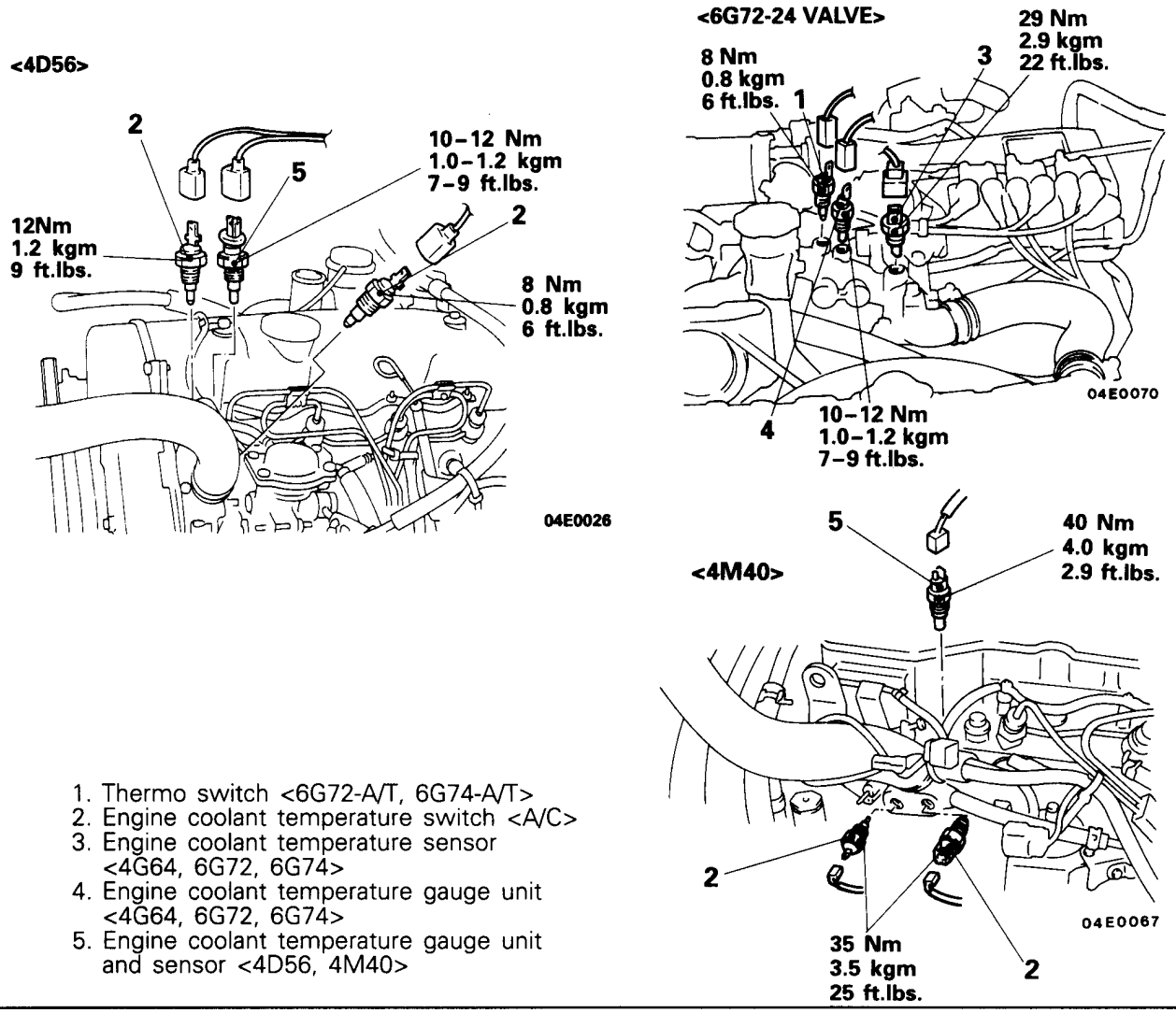
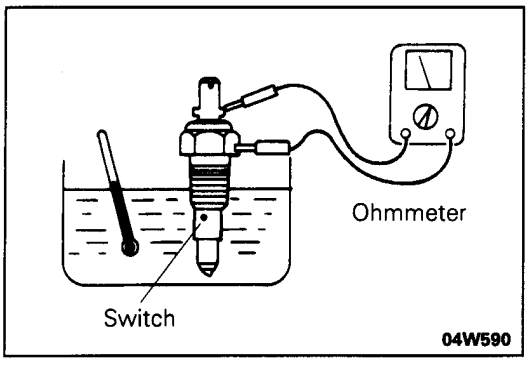


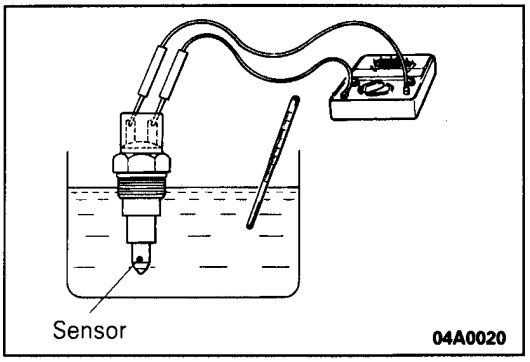
<6G72-12 VALVE>





1. Thermo switch <6G72-A/T, 6G74-A/T>
2. Engine coolant temperature switch <A/C>
3. Engine coolant temperature sensor <4G64, 6G72, 6G74>
4. Engine coolant temperature gauge unit <4G64, 6G72, 6G74>
5. Engine coolant temperature gauge unit and sensor <4D56, 4M40>





INSPECTION

E14UCAO

THERMO SWITCH <6G72-A/T, 6G74-A/T>

Raise the water temperature and check continuity when it reaches the specified temperature.

Standard value:

<6G72-12 VALVE, 6G74>	
50°C (122°F) or more	**Continuity**
50°C (122°F) dimmer	**No continuity**
<6G72-24 VALVE>	
35°C (95°F) or more	**Continuity**
35°C (95°F) dimmer	**No continuity**

ENGINE COOLANT TEMPERATURE SENSOR <4G64, 6G72, 6G74>

Raise the water temperature and measure the resistance if within the standard value.

Standard value: **2.37±0.24kΩ [at 20°C (68°F)]**
290±32Ω [at 80°C (176°F)]

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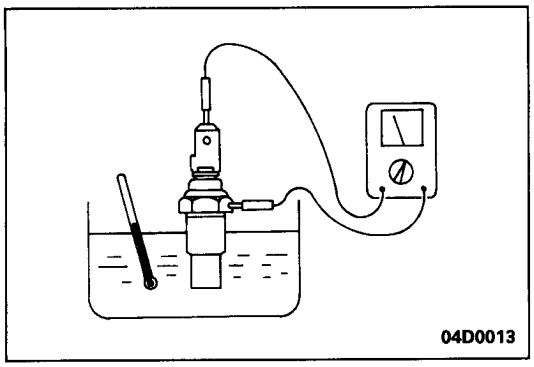
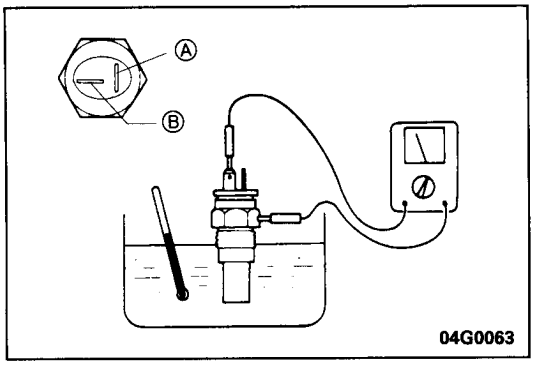


ENGINE COOLANT TEMPERATURE GAUGE UNIT <4G64, 6G72, 6G74>

Immerse the gauge unit in hot water at 70°C (158°F) and measure the resistance value with an ohmmeter.

Standard value: **104 ± 13.5Ω [at 70°C (158°F)]**



ENGINE COOLANT TEMPERATURE GAUGE UNIT AND SENSOR <4D56, 4M40>

Raise the water temperature and measure the resistance if within the standard value.

Standard value:

Terminal A	**104 ± 13.5Ω [at 70°C (158°F)]**
Terminal B	**3.25 ± 0.33kΩ [at 20°C (68°F)]**
	300Ω [at 80°C (176°F)]

NOTE
Terminal A is for engine coolant temperature gauge. Terminal B is for glow and EGR control.

ENGINE COOLANT TEMPERATURE SWITCH <A/C>

Refer to GROUP 55-Engine Coolant Temperature Switch.

INTAKE AND EXHAUST

CONTENTS

E15AA--

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- Supercharging Pressure Relief Solenoid Valve Inspection <Vehicles with Supercharging Pressure Relief Solenoid Valve> 3-1
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EXHAUST PIPE, MUFFLER AND CATALYTIC CONVERTER <6G72 – 24 VALVE, 6G74> 12

EXHAUST PIPE AND MUFFLER <4M40> 13

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SPECIFICATIONS

GENERAL SPECIFICATIONS

E15CA--

Items	Specifications
Air filter	
Type	Dry type
Element	Unwoven cloth type
Exhaust system	
Front exhaust pipe	
<4G64, 6G72, 6G74>	Dual type
<4D56, 4M40>	Single type
Muffler	Expansion resonance type
Coupling	Spherical coupling and flat coupling
Suspension system	Rubber hangers and rubber suspenders
Turbocharger	
Type	Exhaust gas turbine type
Identification No.	
<4D56>	TD04–11G–4
<4M40>	TD04–12T–4
Supercharging pressure control	Waste gate actuator
Intercooler	
Type	Air cooled type

SERVICE SPECIFICATIONS

E15CB--

Items	Standard	Limit
Intake and exhaust manifolds		
Distortion of cylinder head contacting surface mm (in.)	Less than 0.15 (0.0059)	0.3 (0.012)
Turbocharger		
Initial starting pressure of waste gate actuator kPa (kg/cm^2, psi)		
<4D56>	82 (0.84, 12)	—
<4M40>	89 (0.91, 13)	—

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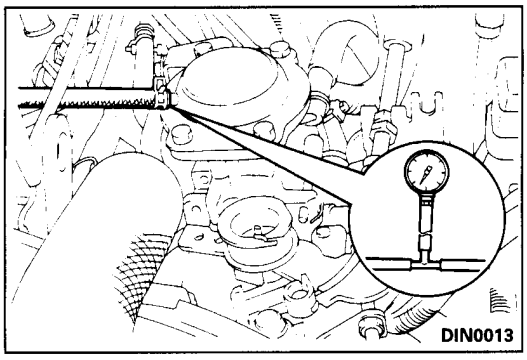


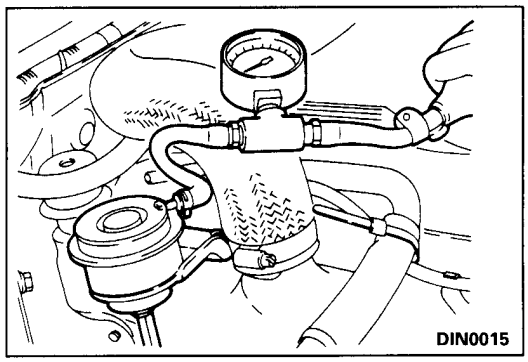
SERVICE ADJUSTMENT PROCEDURES

TURBOCHARGER SUPERCHARGING PRESSURE INSPECTION <4D56> E15FDAC

Caution
The driving test should be carried out by two people at a place where fully-open acceleration can be done, and reading of the measurement values on the pressure gauge should be made by the person in the passenger seat.

(1) Remove the hose that is connected to the fuel injection pump boost compensator, and install the pressure gauge via the T-joint, as shown in the illustration.
(2) Accelerate the vehicle in second gear (M/T) or L range (A/T) with the throttle fully open, and take a reading of the measurement value on the pressure gauge when the engine speed reaches approximately 3,000 r/min.
(3) If the pressure is not positive pressure, the reason is probably one of the following, so carry out the following inspection.
- Waste gate actuator is defective
- Leaking turbo pressure
- Turbocharger is defective

(4) If the turbo pressure is 82 kPa (0.84 kg/cm², 12 psi.), the reason is probably an abnormality in the turbo pressure control, so carry out the following inspection.
- Waste gate actuator rubber hose is disconnected or burst
- Waste gate actuator is defective
- Waste gate valve is defective



WASTE GATE ACTUATOR INSPECTION <4D56, 4M40> E15FEAD

(1) Connect a hand pump (pressurization type) to the nipple.
(2) While gradually increasing the pressure, check the pressure where the waste gate actuator rod begins to move [approx. 1mm (0.04 in.) stroke)]

Standard value:

<4D56>	**82 kPa (0.84 kg/cm², 12 psi.)**
<4M40>	**89 kPa (0.91 kg/cm², 13 psi.)**

Caution
To prevent damage to the diaphragm, do not apply pressure more than 90 kPa (0.9 kg/cm², 13 psi.) <4D56> or more than 115 kPa (1.17 kg/cm², 17 psi.) <4M40>.

(3) If the value is widely outside the standard value, inspect the actuator or the waste gate valve, and replace if necessary.

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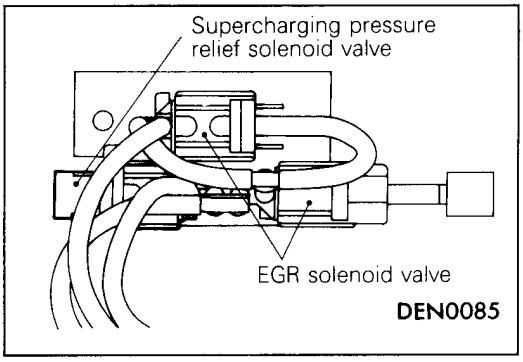


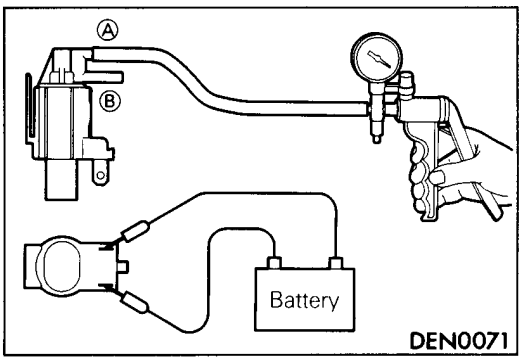
INTAKE MANIFOLD VACUUM INSPECTION E15FBAB

Refer to GROUP 11 – Service Adjustment Procedures.

SUPERCHARGING PRESSURE CONTROL SYSTEM INSPECTION <Vehicles with supercharging pressure relief solenoid valve>

(1) Remove the vacuum hose (yellow) from the supercharging pressure relief solenoid valve and plug the hose.
(2) Connect a hand vacuum pump to the supercharging pressure relief solenoid valve.
(3) Check the vacuum condition.

Engine condition	Normal condition
Idling	0 mmHg
2,000 r/min.	300 mmHg (12 in.Hg) or more

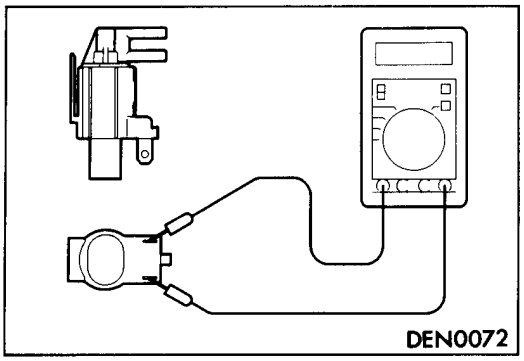


SUPERCHARGING PRESSURE RELIEF SOLENOID VALVE INSPECTION <Vehicles with supercharging pressure relief solenoid valve>

OPERATION INSPECTION

(1) Connect a hand vacuum pump to the solenoid valve nipple Ⓐ (see the illustration to the left).
(2) Using a jumper wire, connect between the solenoid valve terminal and battery terminal.
(3) Connecting and disconnecting the jumper wire at the battery negative terminal to apply a negative pressure, check tightness.

Jumper wire	Ⓑ nipple condition	Normal condition
Connected	Open	Negative pressure leaks.
	Close	Negative pressure is held.
Disconnected	Open	Negative pressure is held.



COIL RESISTANCE INSPECTION

Measure resistance between solenoid valve terminals.

Standard value: 36 – 44 Ω [at 20°C (68°F)]

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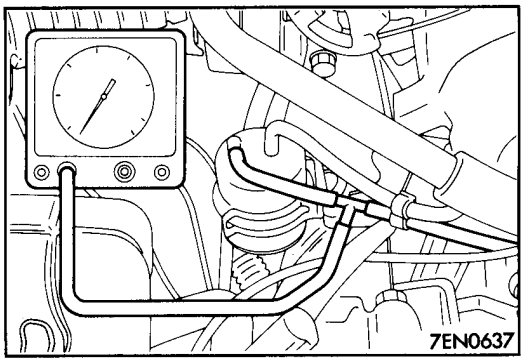
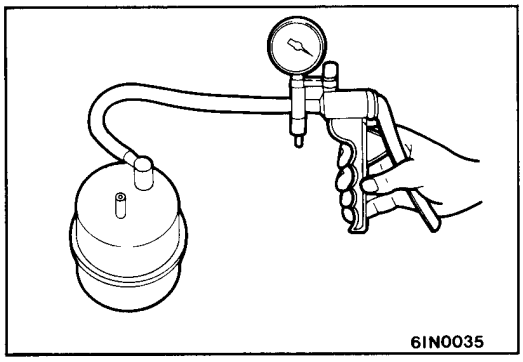


VARIABLE INDUCTION CONTROL SYSTEM INSPECTION <6G74>

(1) Warm up the engine.
(2) Connect a tachometer.
(3) Use a three-way joint to connect a vacuum gauge between the variable induction control solenoid valve and the vacuum motor.
(4) Start the engine, check to be sure that vacuum is applied to the vacuum gauge and check the following items.

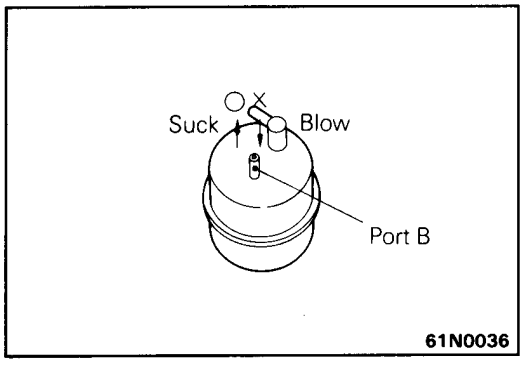
Engine revolution	Normal condition	Solenoid valve
3200 r/min or less	Vacuum maintained	Closed
Race the engine suddenly at 3200 r/min or less	Vacuum does not change	Closed
3400 r/min or more	Vacuum leaks	Open

(5) Check to be sure that the rod of vacuum motor is operating during these checks.

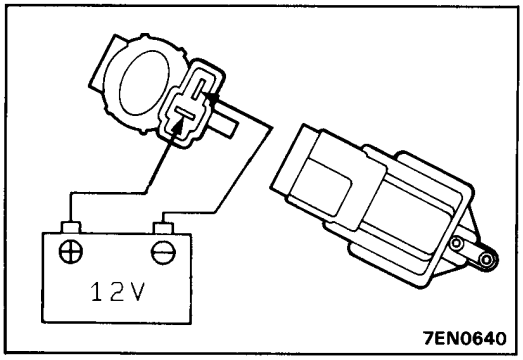


VACUUM TANK INSPECTION

(1) Install a hand vacuum pump to port A and check to be sure that air-tightness is maintained when 503 mmHg of negative pressure is applied.
After checking, remove the hand vacuum pump.



(2) Check to be sure that air passes through when port B is sucked, and that air does not pass through when port B is blown.

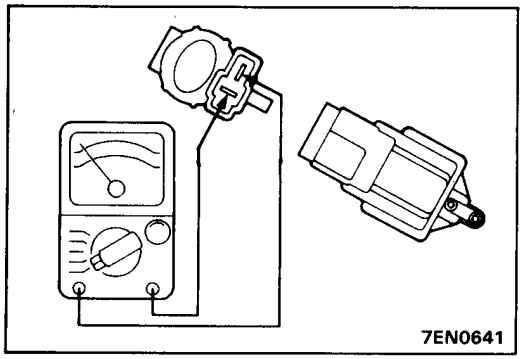


VARIABLE INDUCTION CONTROL SOLENOID VALVE INSPECTION

OPERATION CHECK

(1) Use a hand vacuum pump to apply vacuum to the vacuum tank (white vacuum hose connected) side nipple.
(2) Check air-tightness by applying voltage to the solenoid valve terminals.

Battery voltage	The other nipple of the valve	Normal condition
Applied	Open	Vacuum leaks
	Close with a finger	Vacuum maintained
Not applied	Open	Vacuum maintained



COIL CONTINUITY CHECK

Use an ohmmeter to measure the resistance.

Standard value: 36 – 44 Ω (at 20°C)

NOTES

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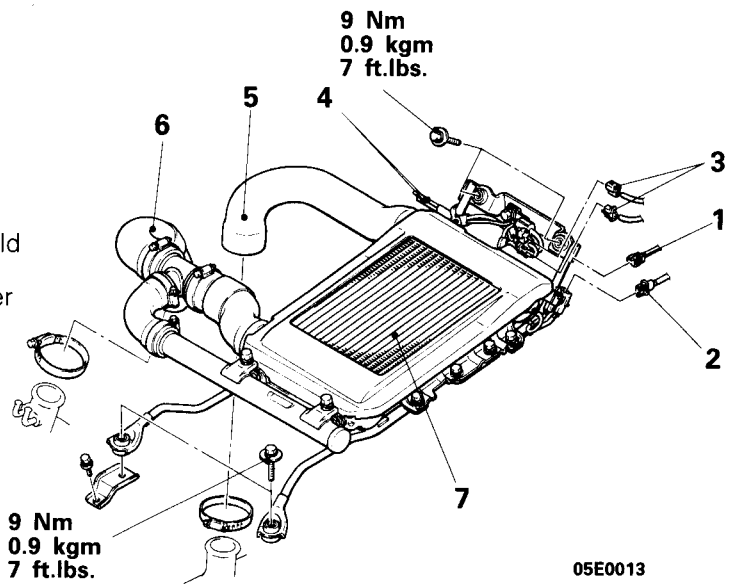
INTERCOOLER <4D56>

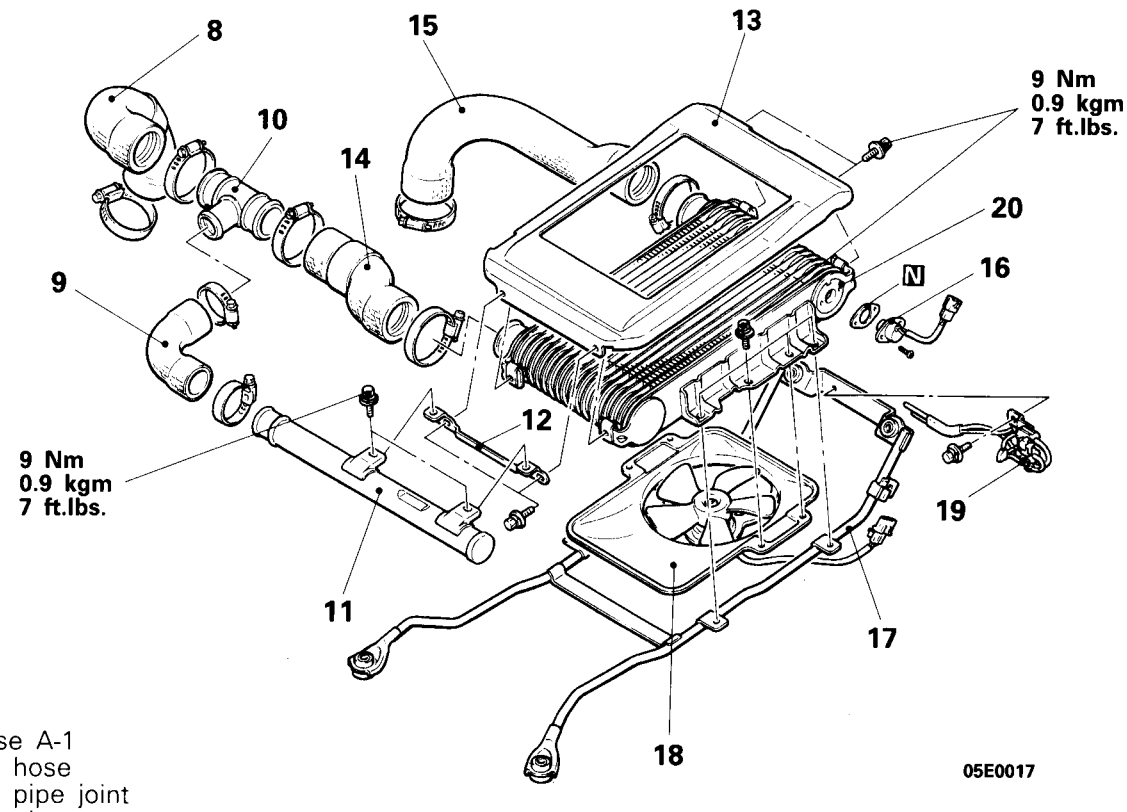
REMOVAL AND INSTALLATION

E15HA--

Removal steps

1. Air temperature switch connector
2. Intercooler fan motor connector
3. EGR solenoid valve connector <Vehicles with EGR system>
4. Vacuum hose connection <Vehicles with EGR system>
5. Air hose B connection (Intake manifold side)
6. Air hose A-1 connection (Turbocharger side)
7. Intercooler and bracket assembly



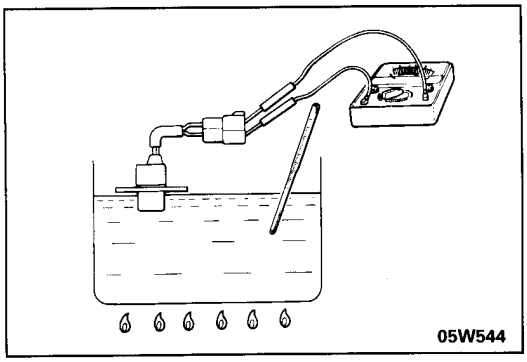


8. Air hose A-1
9. Blanch hose
10. Blanch pipe joint
11. Blanch pipe
12. Blanch pipe bracket
13. Intercooler cover
14. Air hose A-2
15. Air hose B
16. Air temperature switch
17. Intercooler bracket
18. Fan and motor assembly
19. EGR solenoid valve <Vehicles with EGR system>
20. Intercooler

INSPECTION

E15HCAC

- Check the intercooler fins for bending damage or foreign matter.
- Check the intercooler hoses for cracking, damage or wear.



CHECKING AIR TEMPERATURE SWITCH

(1) Immerse the air temperature switch in the hot water shown in the figure.
(2) When changine the water temperature, check for continuity between the terminals with the circuit tester.

50±5°C (122±9°F) or less	Continuity
60±3°C (140±5°F) or more	No continuity

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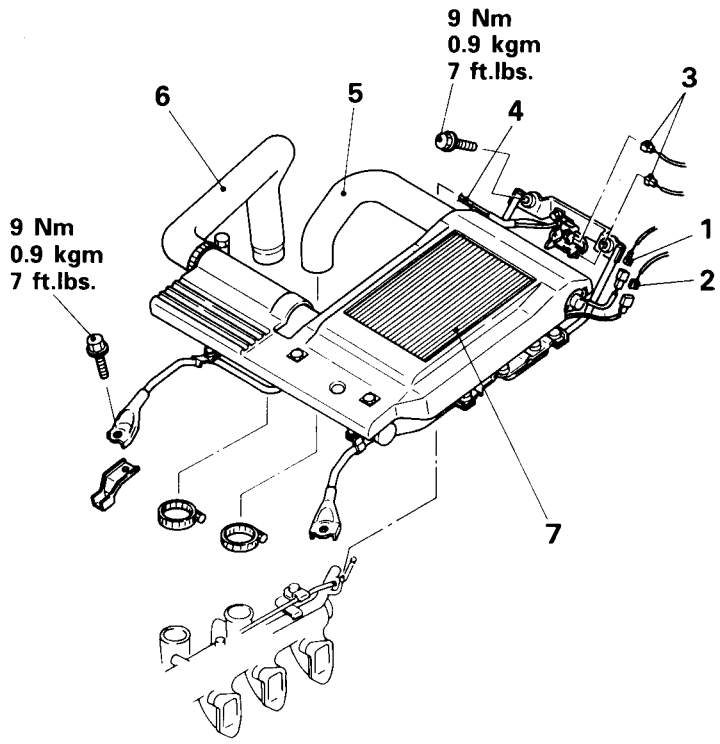
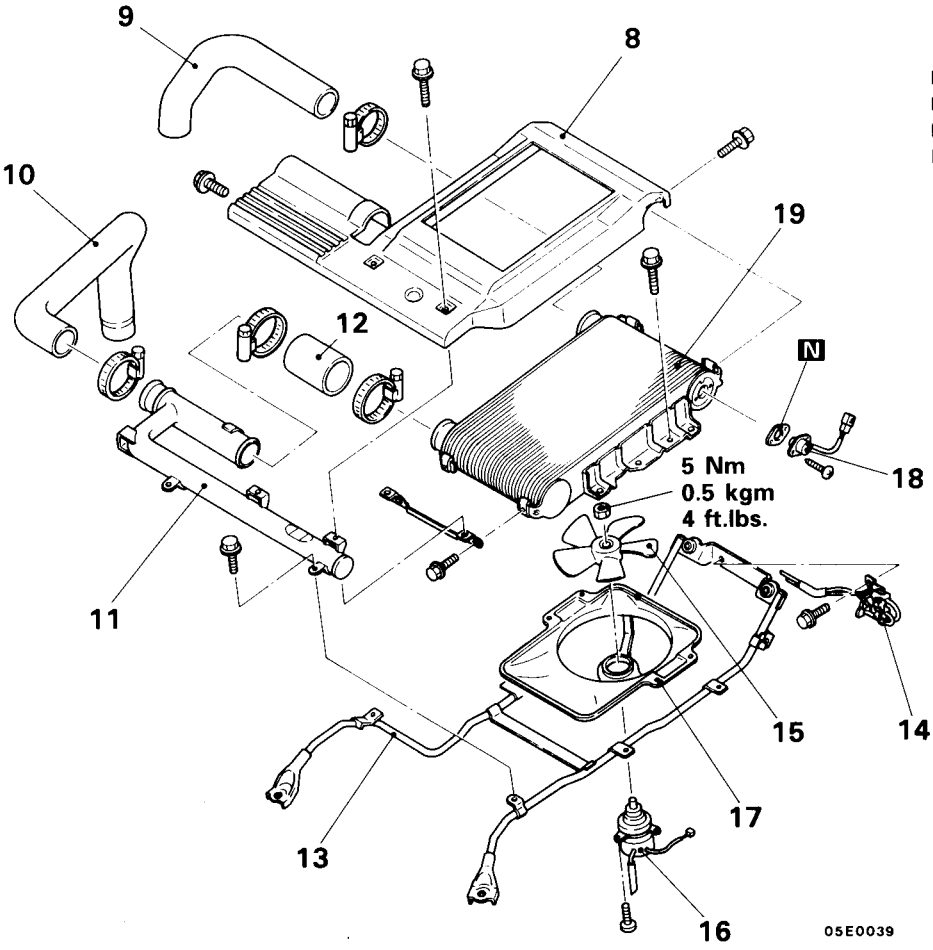
INTERCOOLER <4M40>

REMOVAL AND INSTALLATION

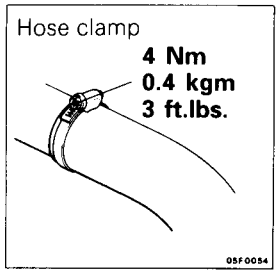


Removal steps

1. Air temperature switch connector
2. Intercooler fan motor connector
3. EGR solenoid valve connector
4. Vacuum hose
5. Air hose A connection (Intake manifold side)
6. Air hose B connection (Turbocharger side)
7. Intercooler and bracket assembly



8. Intercooler cover
◆◆ 9. Air hose A
◆◆ 10. Air hose B
◆◆ 11. Branch pipe
◆◆ 12. Branch hose
13. Intercooler bracket
14. EGR solenoid valve
15. Fan
16. Fan motor
17. Fan shroud
18. Air temperature switch
19. Intercooler



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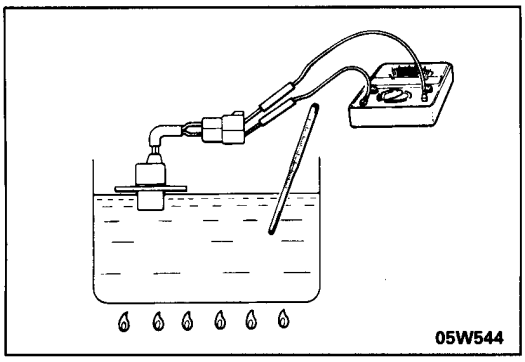
INSPECTION

E15HCAC

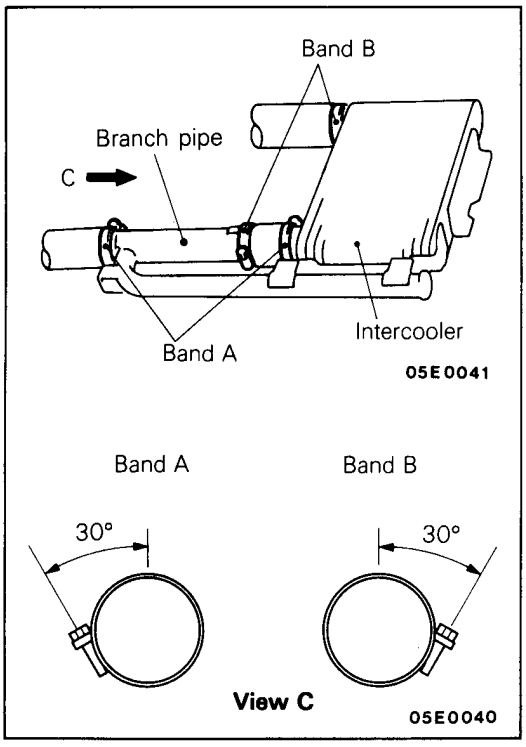
- Check the intercooler fins for bending damage or foreign matter.
- Check the intercooler hoses for cracking, damage or wear.



AIR TEMPERATURE SWITCH

(1) Immerse the air temperature switch in the hot water shown in the figure.
(2) When changine the water temperature, check for continuity between the terminals with the circuit tester.

50 ± 5°C or less	No continuity
60 ± 3°C or more	Continuity



SERVICE POINTS OF INSTALLATION

12.INSTALLATION OF BRANCH HOSE/11. BRANCH PIPE/10. AIR HOSE B/9. AIR HOSE A

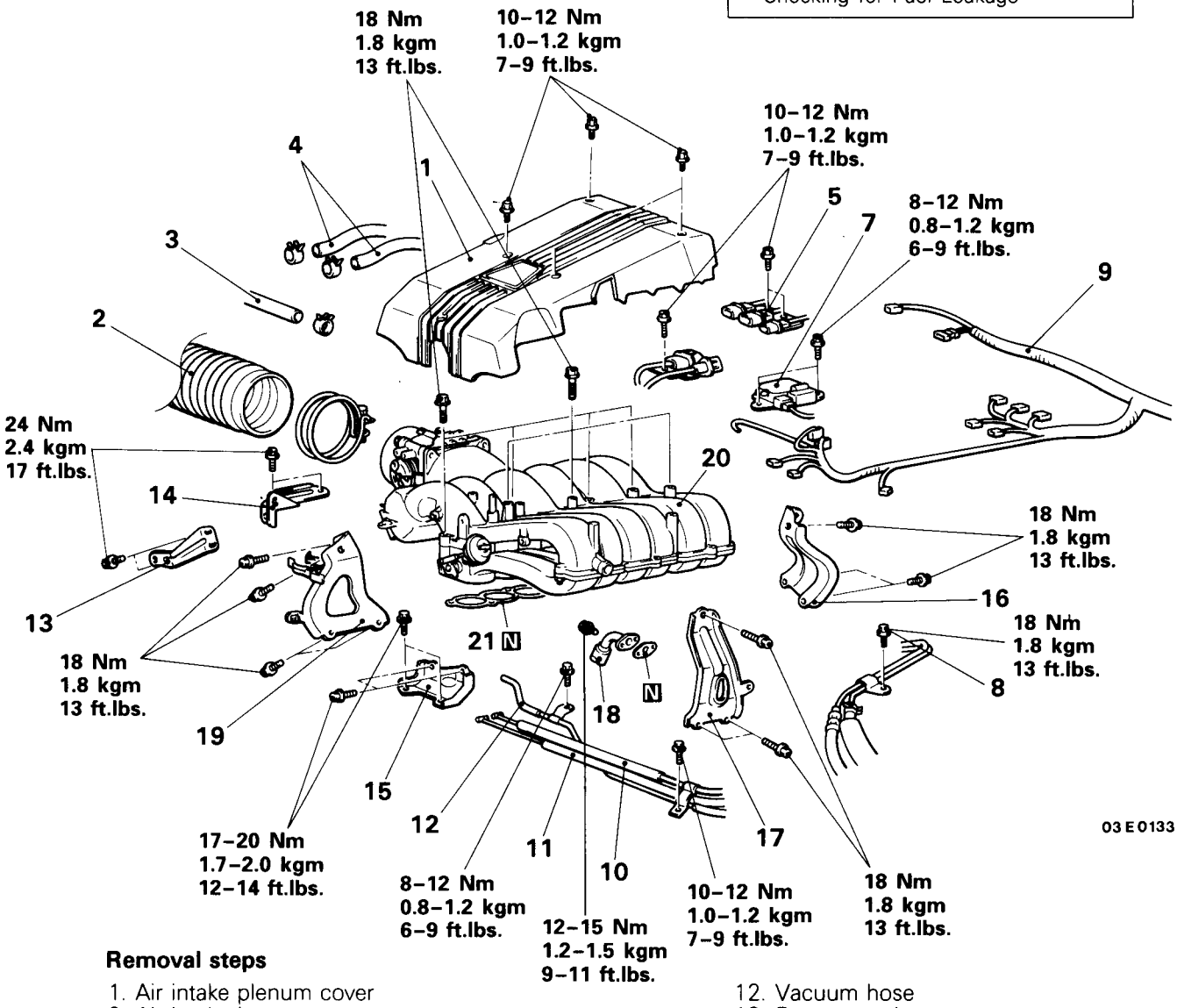
Install the hose bands so that they are at the indicated positions.

INTAKE MANIFOLD <6G74>

REMOVAL AND INSTALLATION

Pre-removal Operation
- Release of Residual Pressure from High Pressure Hose (Refer to GROUP 13 – Service Adjustment Procedure.)
- Draining of Engine Coolant (Refer to GROUP 14 – Coolant Replacement.)

Post-installation Operation
- Filling of Engine Coolant (Refer to GROUP 14 – Coolant Replacement.)
- Adjustment of Accelerator Cable (Refer to GROUP 13 – Service Adjustment Procedures.)
- Adjustment of Throttle Cable (Refer to GROUP 23 – Service Adjustment Procedures.)
- Checking for Fuel Leakage



Removal steps

1. Air intake plenum cover
2. Air intake hose
3. Brake booster vacuum hose connection
4. Water hose connection
5. Connector bracket A
6. Connector bracket B
7. Power transistor
8. Fuel hose clamp mounting bolt
9. Engine control harness
10. Accelerator cable connection
11. Cruise control cable connection
12. Vacuum hose
13. Power steering pump stay
14. Accessory mount stay
15. Water outlet fitting bracket
16. Air intake plenum stay (rear)
17. Air intake plenum stay (LH)
18. EGR pipe
19. Air intake plenum stay (RH)
20. Air intake plenum
◆◆ 21. Air intake plenum gasket

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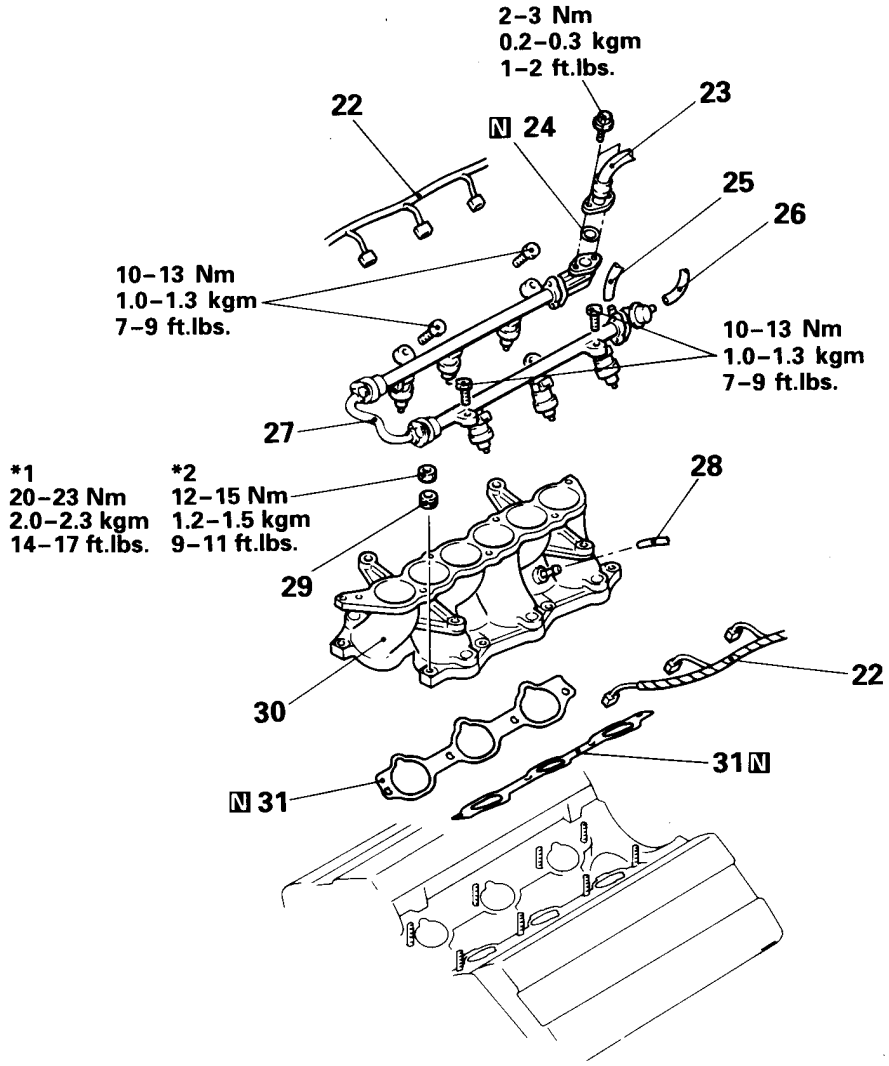
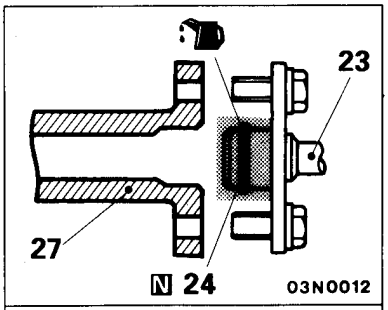


03E0123

22. Connection of injector harness
◆◆ 23. Connection for high-pressure fuel hose
24. O-ring
25. Connection for fuel return hose
26. Connection for vacuum hose
27. Delivery pipe (with injector)
28. PCV hose
◆◆ 29. Cone disc spring
◆◆ 30. Intake manifold
◆◆ 31. Intake manifold gasket

NOTE
*1: Green cone disc spring
*2: Black cone disc spring

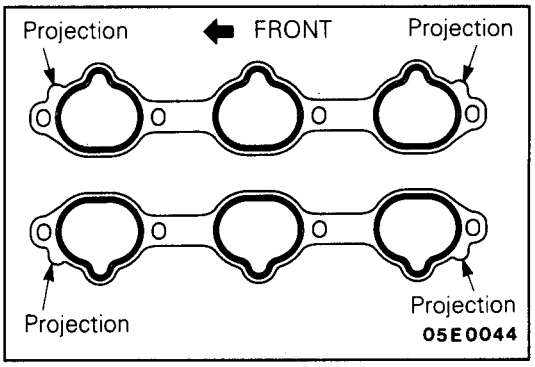


Engine oil

INSPECTION M15MCAN

Check the following points; replace the part if a problem is found.

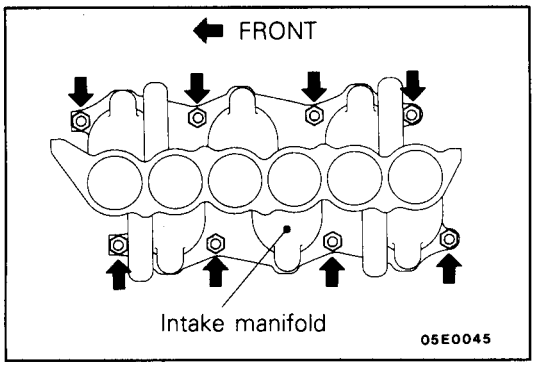
(1) Damage or cracking of any part.
(2) Clogging of the negative pressure (vacuum) outlet port, or clogging of the water or gas passages.



SERVICE POINTS OF INSTALLATION

31. INSTALLATION OF INTAKE MANIFOLD GASKET

Install the gaskets so that the projections face in the directions shown in the illustration.



30. INSTALLATION OF INTAKE MANIFOLD / 29. CONE DISC SPRING

Tighten the intake manifold mounting nuts one bank after the other by the following procedure.

<For green cone disc spring>

(1) Tighten the nuts in the right bank to 7 Nm (0.7 kgm, 5 ft.lbs.).
(2) Tighten the nuts in the left bank to 20 to 23 Nm (2.0 to 2.3 kgm, 14 to 17 ft.lbs.)
(3) Tighten the nuts in the right bank to 20 to 23 Nm (2.0 to 2.3 kgm, 14 to 17 ft.lbs.)
(4) Repeat steps (2) and (3) one more time respectively.

<For black cone disc spring>

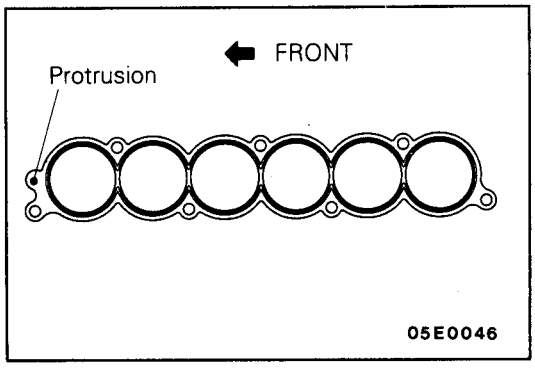
(1) Tighten the nuts in the right bank to 3 to 5 Nm (0.3 to 0.5 kgm, 2.2 to 3.6 ft.lbs.).
(2) Tighten the nuts in the left bank to 12 to 15 Nm (1.2 to 1.5 kgm, 9 to 11 ft.lbs.).
(3) Tighten the nuts in the right bank to 12 to 15 Nm (1.2 to 1.5 kgm, 9 to 11 ft.lbs.).
(4) Repeat steps (2) and (3) one more time respectively.

23. INSTALLATION OF HIGH-PRESSURE FUEL HOSE

(1) Apply a little amount of new engine oil to the O-ring.

Caution
Be sure to prevent the engine oil from entering into the delivery pipe.

(2) Insert the hose, being careful not to damage the O-ring, and tighten securely.



21. INSTALLATION OF AIR INTAKE PLENUM GASKET

Install with gasket protrusions in the position illustrated.

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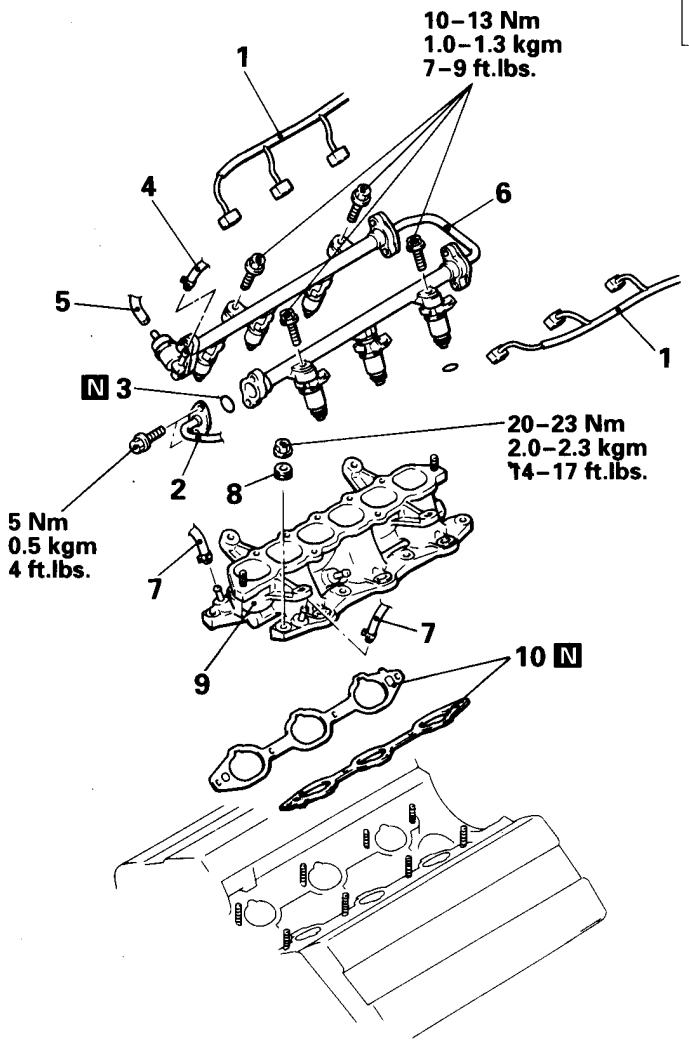
INTAKE MANIFOLD <6G72 – 24 VALVE>

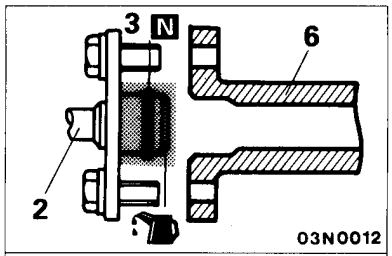
REMOVAL AND INSTALLATION

Pre-removal Operation
- Release of Residual Pressure from High Pressure Hose (Refer to GROUP 13 – Service Adjustment Procedure.)
- Draining of Engine Coolant (Refer to GROUP 14 – Coolant Replacement.)
- Removal of Air Intake Plenum

Post-installation Operation
- Installation of Air Intake Plenum
- Filing of Engine Coolant (Refer to GROUP 14 – Coolant Replacement.)
- Adjustment of Accelerator Cable (Refer to GROUP 13 – Service Adjustment Procedures.)
- Adjustment of Throttle Cable (Refer to GROUP 23 – Service Adjustment Procedures.)
- Checking for Fuel Leakage



05E0064



Engine oil

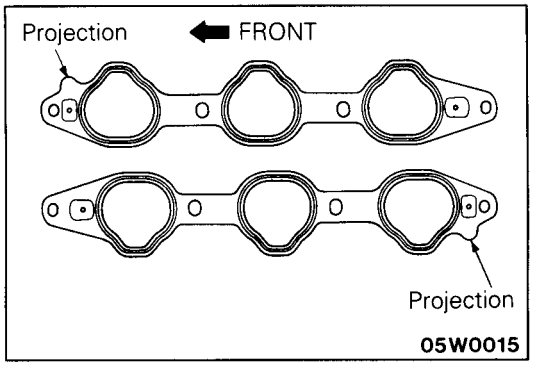
1. Connection of injector harness
2. Connection for high-pressure fuel hose
3. O-ring
4. Connection for fuel return hose
5. Connection for vacuum hose
6. Delivery pipe (with injector)
7. Connection for water hose
8. Cone disc spring
9. Intake manifold
10. Intake manifold gasket

INSPECTION

M15MCAN

Check the following points; replace the part if a problem is found.

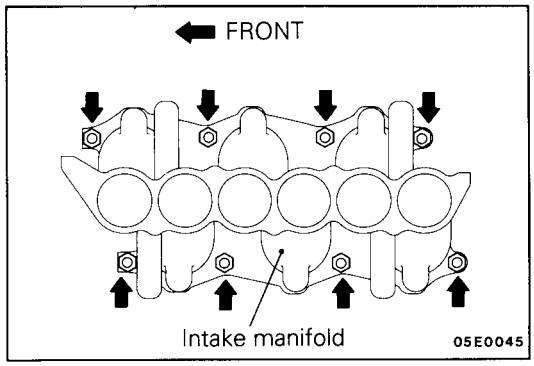
(1) Damage or cracking of any part.
(2) Clogging of the negative pressure (vacuum) outlet port, or clogging of the water or gas passages.



SERVICE POINTS OF INSTALLATION

10. INSTALLATION OF INTAKE MANIFOLD GASKET

Install the gaskets so that the projections face in the directions shown in the illustration.



9. INSTALLATION OF INTAKE MANIFOLD / 8. CONE DISC SPRING

Tighten the intake manifold mounting nuts one bank after the other by the following procedure.

(1) Tighten the nuts in the right bank to 7 Nm (0.7 kgm, 5 ft.lbs.).
(2) Tighten the nuts in the left bank to 20 to 23 Nm (2.0 to 2.3 kgm, 14 to 17 ft.lbs.).
(3) Tighten the nuts in the right bank to 20 to 23 Nm (2.0 to 2.3 kgm, 14 to 17 ft.lbs.)
(4) Repeat steps (2) and (3) one more time respectively.

2. INSTALLATION OF HIGH-PRESSURE FUEL HOSE

(1) Apply a little amount of new engine oil to the O-ring.

Caution
Be sure to prevent the engine oil from entering into the delivery pipe.

(2) Insert the hose, being careful not to damage the O-ring, and tighten securely.

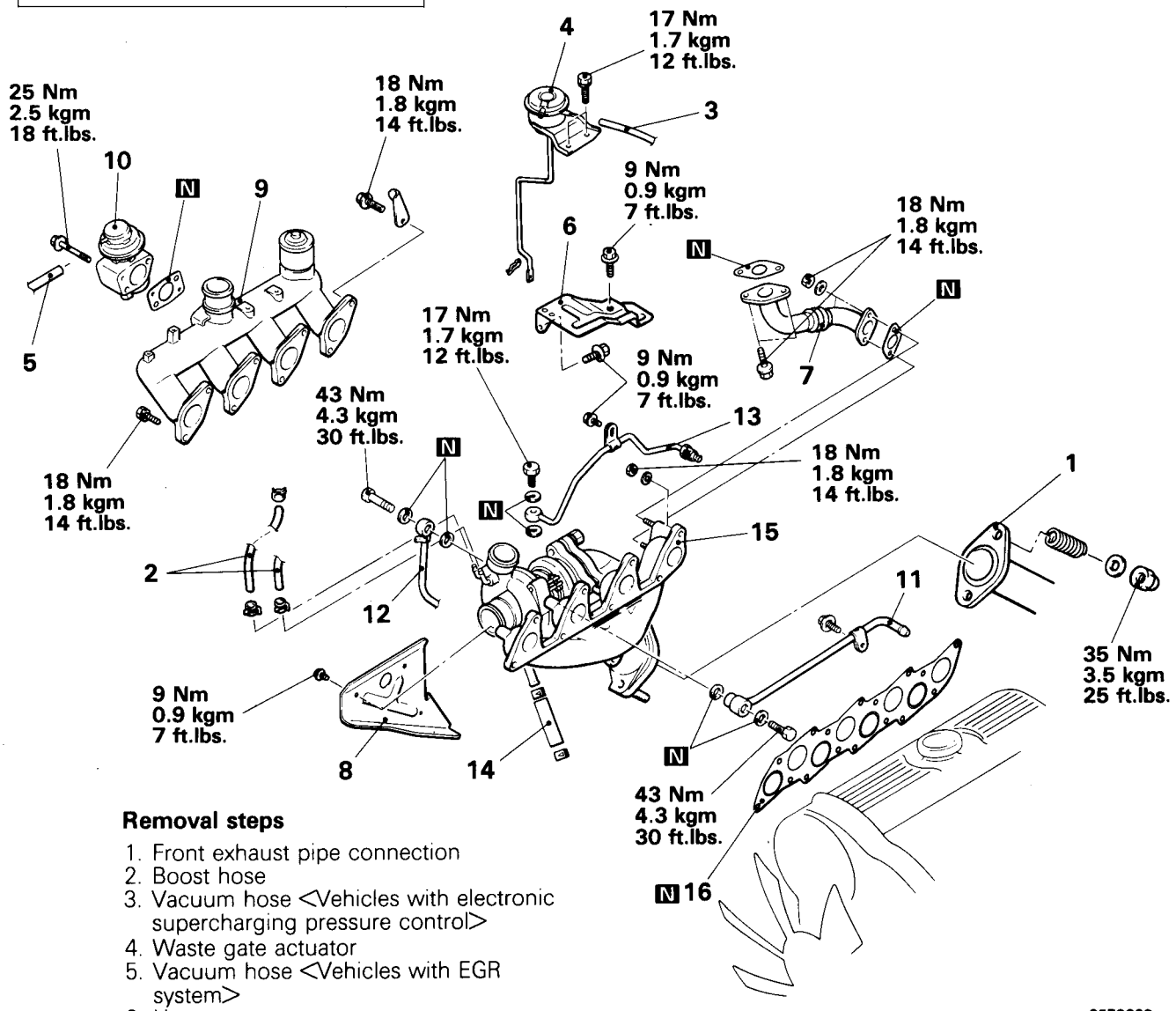
NOTES

TURBOCHARGER AND EXHAUST MANIFOLD <4D56>

REMOVAL AND INSTALLATION

E15L8AD

Pre-removal and Post-installation Operation
- Removal and installation of the air cleaner cover and air intake hose
- Removal and installation of the intercooler (Refer to P.15-4.)
- Removal and installation of the brake master cylinder heat protector <R.H. drive Vehicles>
- Draining and Supplying of the Engine Coolant <Vehicles with Water Cooled Turbocharger>



Removal steps

1. Front exhaust pipe connection
2. Boost hose
3. Vacuum hose <Vehicles with electronic supercharging pressure control>
4. Waste gate actuator
5. Vacuum hose <Vehicles with EGR system>
6. Heat protector
7. EGR pipe <Vehicles with EGR system>
8. Heat protector
9. Intake manifold
10. EGR valve
11. Water pipe A
12. Water pipe B connection } <Vehicles with water cooled turbocharger>
13. Oil pipe
14. Oil return hose connection
15. Exhaust manifold and turbocharger assembly
16. Intake and exhaust manifold gasket

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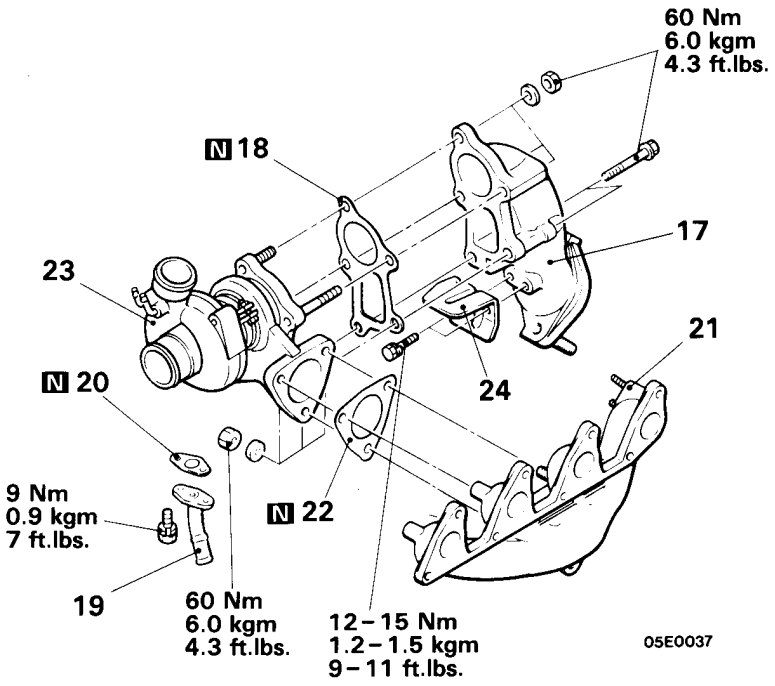
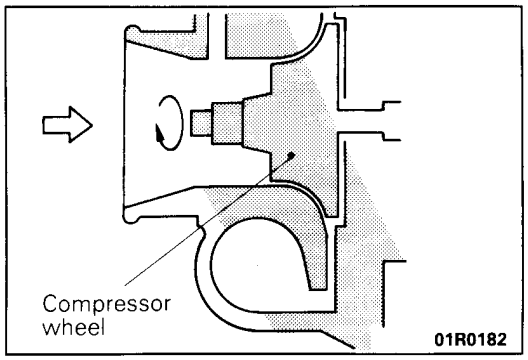
17. Exhaust fitting
18. Exhaust fitting gasket
19. Oil return pipe
20. Oil return pipe gasket
21. Exhaust manifold
22. Turbocharger gasket
23. Turbocharger assembly
24. Heat protector





INSPECTION E15LCAF

TURBOCHARGER ASSEMBLY CHECK

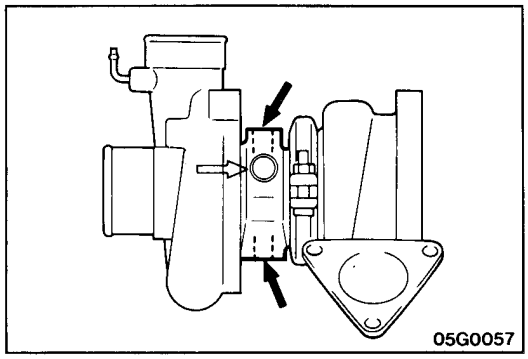
- Visually check the turbine wheel and the compressor wheel for cracking or other damage.
- Check whether the turbine wheel and the compressor wheel can be easily turned by hand.
- Check for oil leakage from the turbocharger assembly.
- Check whether or not the waste gate valve remains open. If any problem is found, replace the part after disassembly.

OIL PIPE AND OIL-RETURN PIPE CHECK

Check the oil pipe and oil-return pipe for clogging, bending, or other damage.
If there is clogging, clean it.

EXHAUST MANIFOLD CHECK

- Damage or cracking of any part.



SERVICE POINT OF INSTALLATION E15LDAD

23.INSTALLATION OF TURBOCHARGER ASSEMBLY

(1) Clean the alignment surfaces shown in the illustration.
(2) Supply clean engine oil from the oil pipe mounting hole of the turbocharger assembly.

Caution
When cleaning, take care that no foreign material gets into the engine coolant or oil passages hole.

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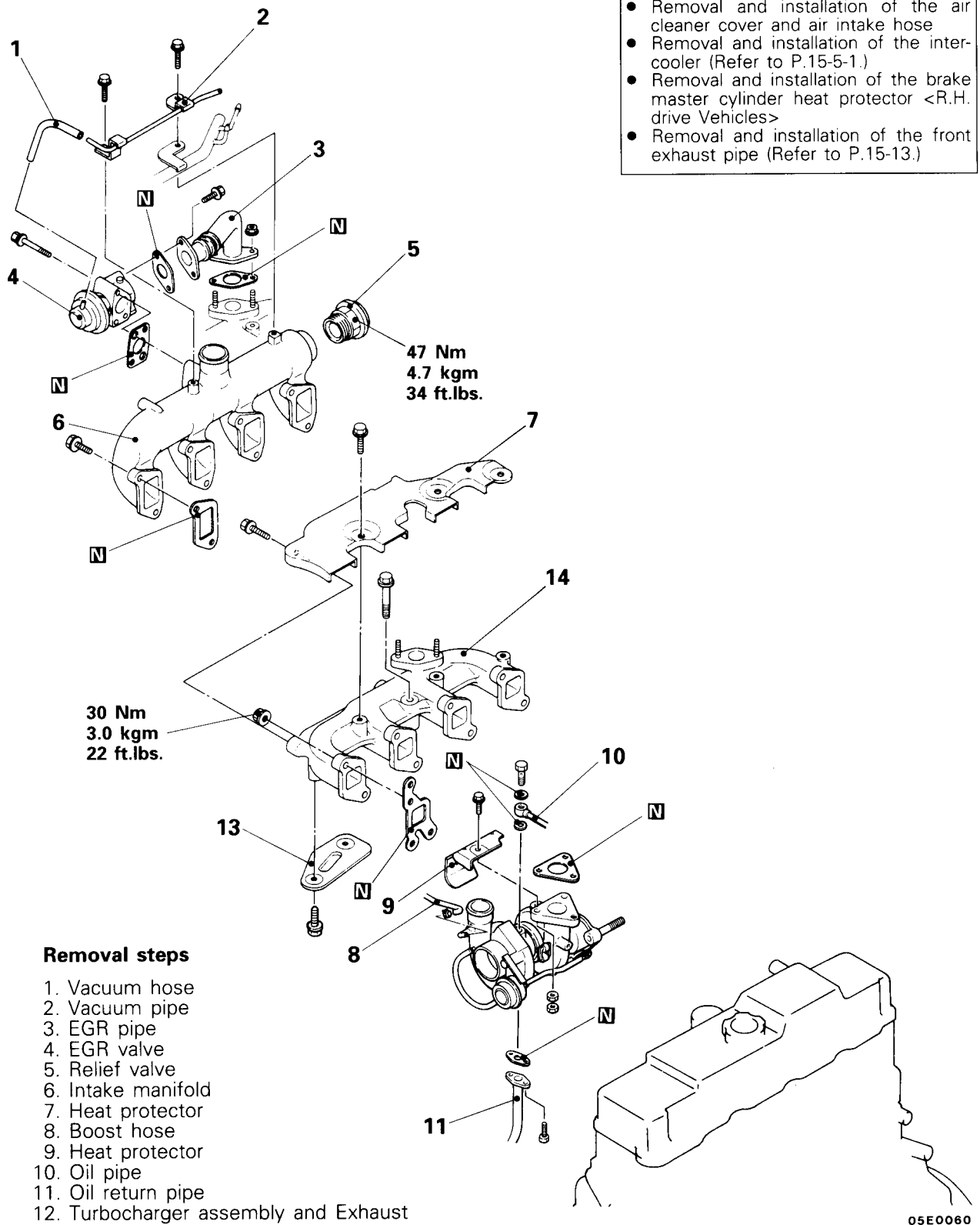
TURBOCHARGER AND EXHAUST MANIFOLD <4M40>

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Removal and installation of the air cleaner cover and air intake hose
- Removal and installation of the inter-cooler (Refer to P.15-5-1.)
- Removal and installation of the brake master cylinder heat protector <R.H. drive Vehicles>
- Removal and installation of the front exhaust pipe (Refer to P.15-13.)



Removal steps

1. Vacuum hose
2. Vacuum pipe
3. EGR pipe
4. EGR valve
5. Relief valve
6. Intake manifold
7. Heat protector
8. Boost hose
9. Heat protector
10. Oil pipe
11. Oil return pipe
12. Turbocharger assembly and Exhaust fitting
13. Heat protector
14. Exhaust manifold

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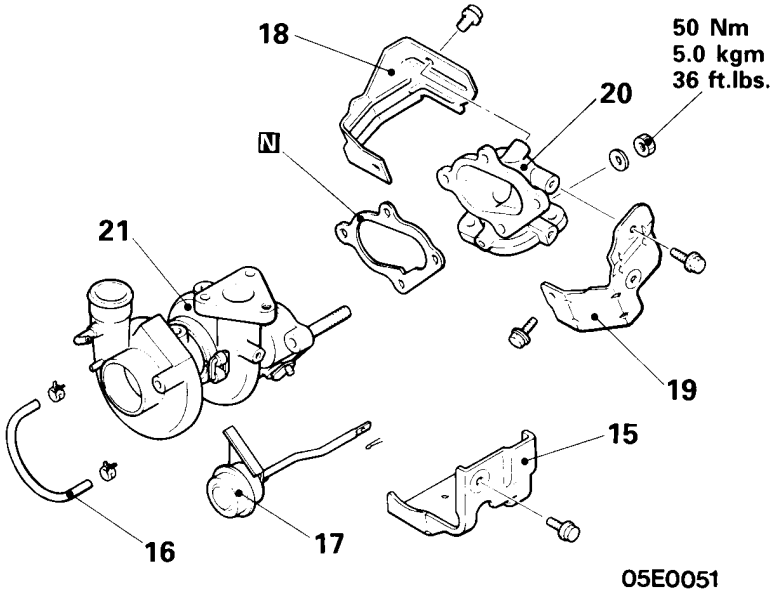
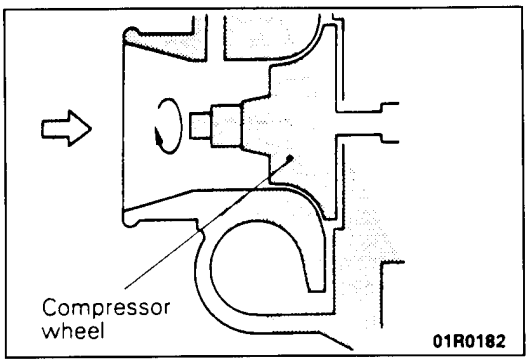
15. Heat protector
16. Boost hose
17. Waste gate actuator
18. Heat protector
19. Heat protector
20. Exhaust fitting
◆◆ 21. Turbocharger assembly





INSPECTION

TURBOCHARGER ASSEMBLY CHECK

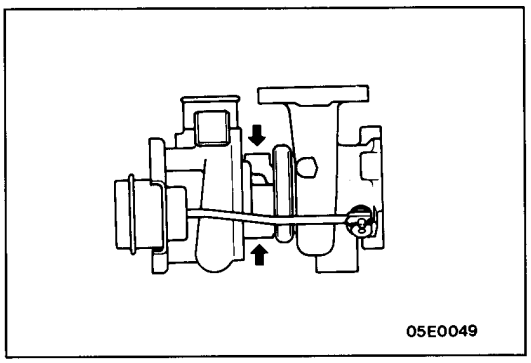
- Visually check the turbine wheel and the compressor wheel for cracking or other damage.
- Check whether the turbine wheel and the compressor wheel can be easily turned by hand.
- Check for oil leakage from the turbocharger assembly.
- Check whether or not the waste gate valve remains open. If any problem is found, replace the part after disassembly.

OIL PIPE AND OIL-RETURN PIPE CHECK

Check the oil pipe and oil-return pipe for clogging, bending or other damage.
If there is clogging, clean it.

EXHAUST MANIFOLD CHECK

- Damage or cracking of any part.



SERVICE POINT OF INSTALLATION E15LDAD

21. INSTALLATION OF TURBOCHARGER ASSEMBLY

(1) Clean the alignment surfaces shown in the illustration.
(2) Supply clean engine oil from the oil pipe mounting hole of the turbocharger assembly.

Caution
When cleaning, take care that no foreign material gets into the engine coolant or oil passages hole.

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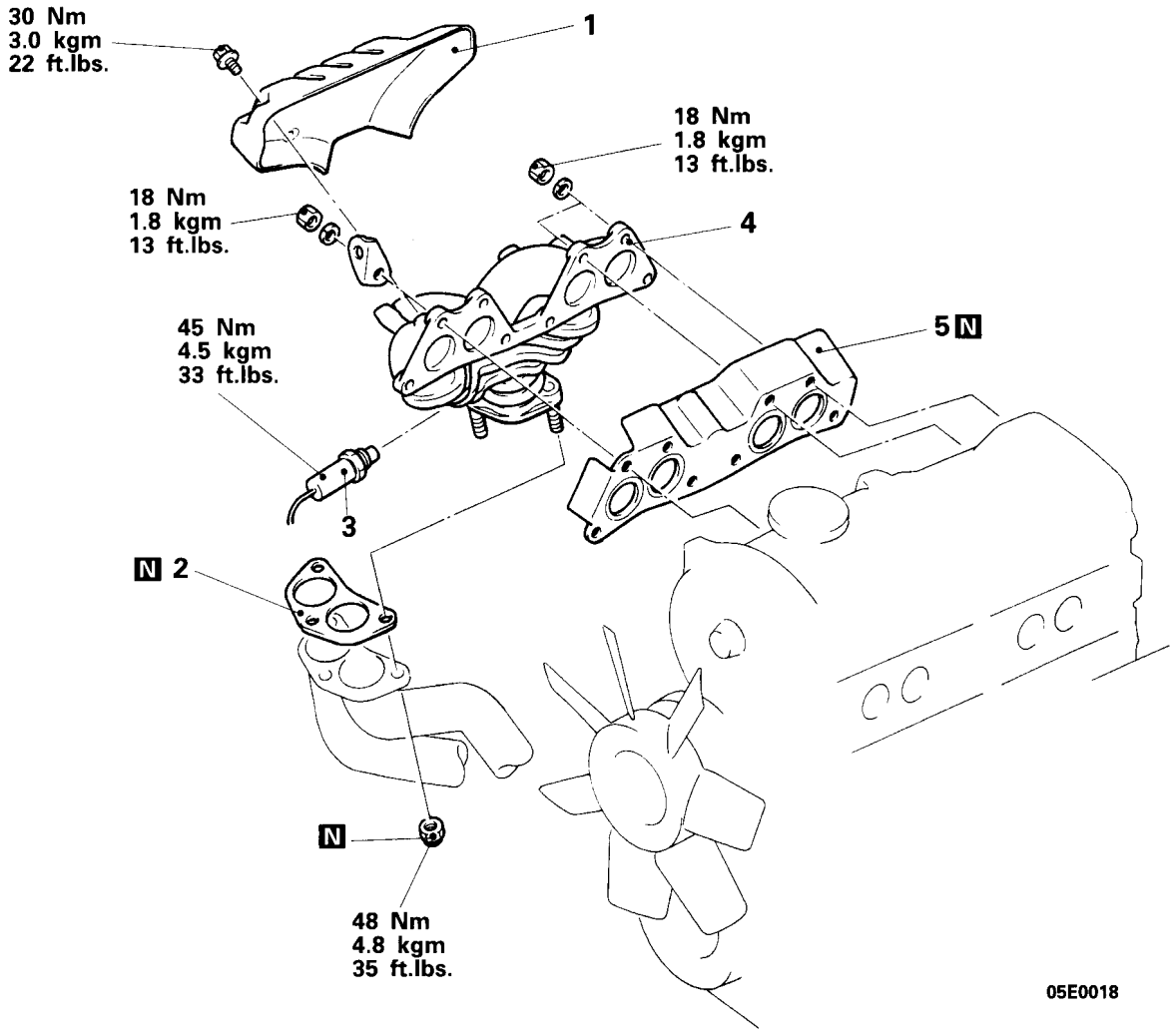
EXHAUST MANIFOLD <4G64>

REMOVAL AND INSTALLATION

E15NA-1



Removal steps

1. Exhaust manifold cover
2. Gasket
3. Oxygen sensor
4. Exhaust maniofld
5. Exhaust manifold gasket

INSPECTION

E15NCAE1

EXHAUST MANIFOLE

- Damage or cracking of any part.

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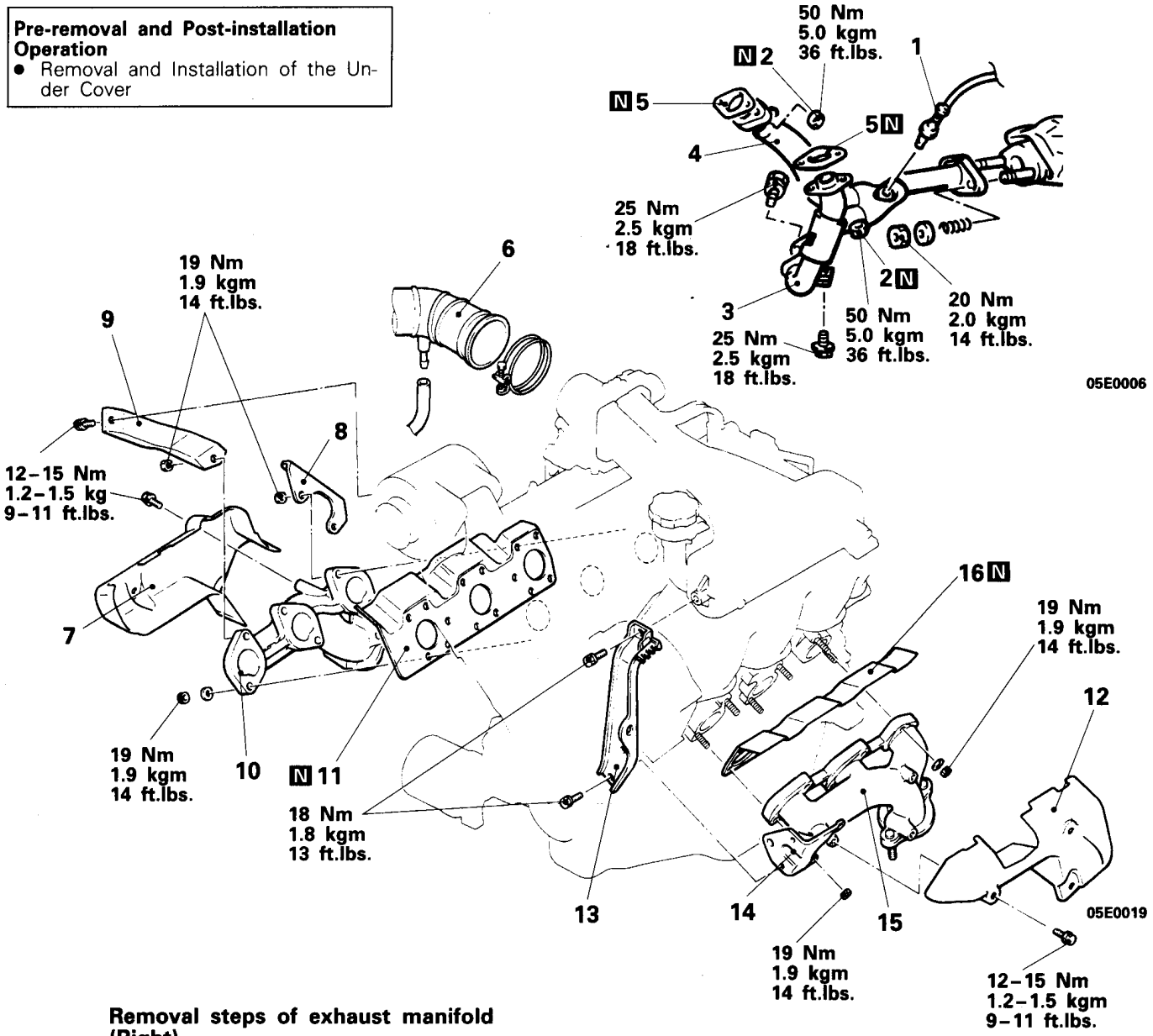
EXHAUST MANIFOLD <6G72 – 12 VALVE>

REMOVAL AND INSTALLATION

E15NA-2

Pre-removal and Post-installation Operation
- Removal and Installation of the Under Cover



Removal steps of exhaust manifold (Right)
1. Oxygen sensor
2. Self-locking nut
3. Front exhaust pipe (L.H.)
4. Front exhaust pipe (R.H.)
5. Gasket
6. Air duct
7. Heat protector
8. Engine hanger
9. Alternator stay
10. Exhaust manifold
11. Exhaust manifold gasket

Removal steps of exhaust manifold (Left)
3. Front exhaust pipe (L.H.)
5. Gasket
12. Heat protector
13. Air intake plenum stay (front)
14. Bracket
15. Exhaust manifold
16. Exhaust manifold gasket

INSPECTION

E15NCAE2

EXHAUST MANIFOLD

- Damage or cracking of any part.

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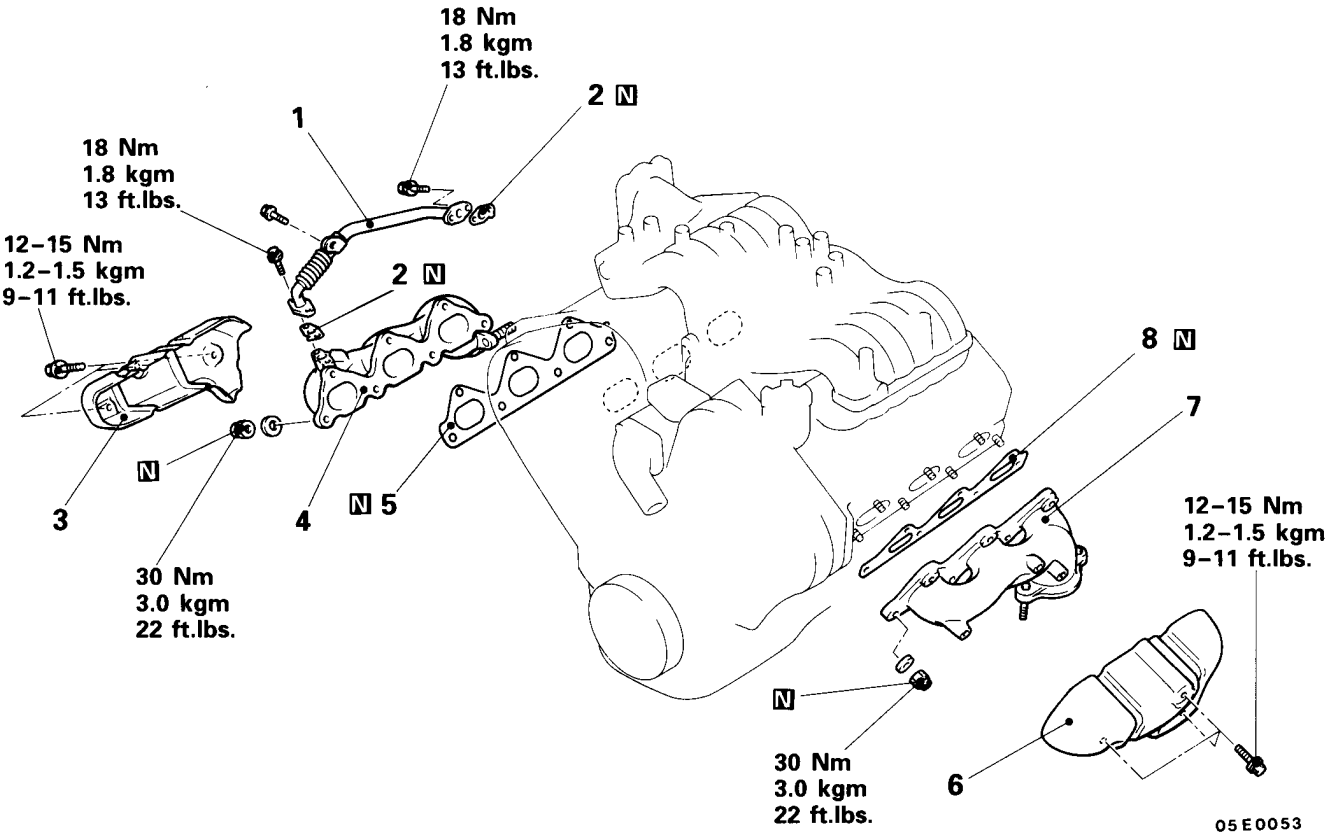
EXHAUST MANIFOLD <6G74>

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Removal and Installation of front exhaust pipe (Refer to P.15-12)



Removal steps of exhaust manifold (Right)
- Air cleaner cover and intake hose

1. EGR pipe
2. Gasket
3. Heat protector
4. Exhaust manifold
5. Exhaust manifold gasket

Removal steps of exhaust manifold (Left)
- Battery and battery tray

6. Heat protector
7. Exhaust manifold
8. Exhaust manifold gasket

INSPECTION

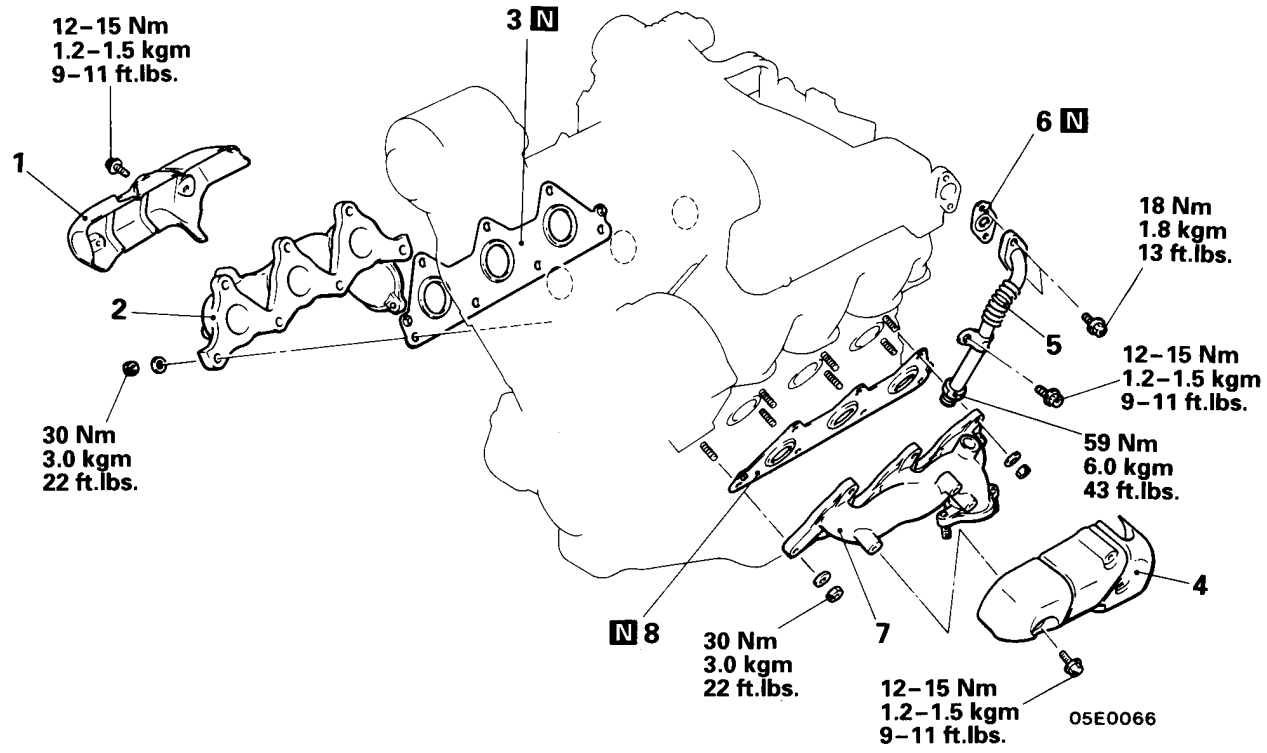
EXHAUST MANIFOLD

- Damage or cracking of any part.

EXHAUST MANIFOLD <6G72 – 24 VALVE>

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Removal and Installation of Front Exhaust Pipe (Refer to P.15-12).



Removal steps of exhaust manifold (Right)
- Air duct and air cleaner cover
1. Heat protector (R.H.)
2. Exhaust manifold (R.H.)
3. Gasket

Removal steps of exhaust manifold (Left)
- Battery and battery tray
4. Heat protector (L.H.)
5. EGR pipe
6. Gasket
7. Exhaust manifold (L.H.)
8. Gasket

INSPECTION

EXHAUST MANIFOLD

- Damage or cracking of any part.

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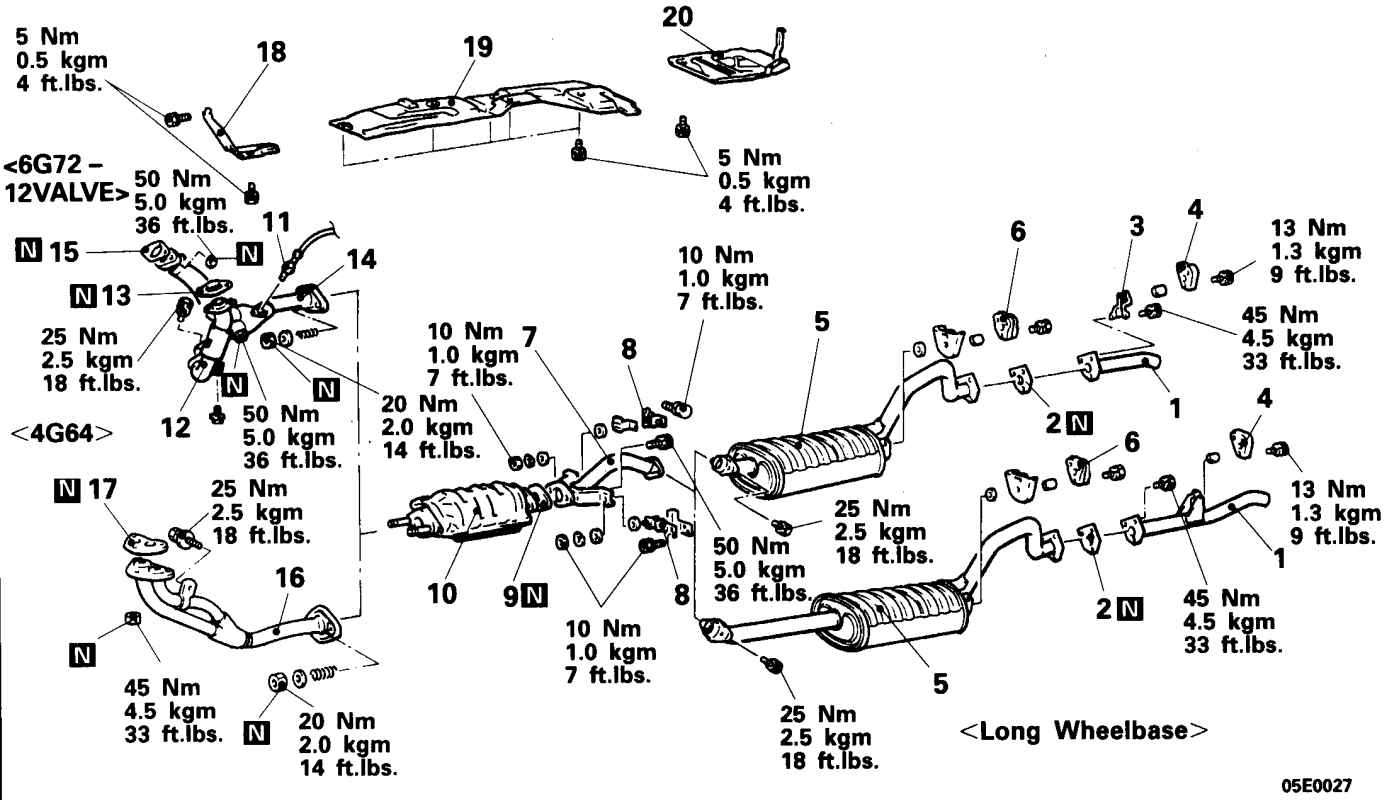
EXHAUST PIPE, MUFFLER AND CATALYTIC CONVERTER <4G64, 6G72 – 12 VALVE>

REMOVAL AND INSTALLATION

E15RA--

Pre-removal and Post-installation Operation
- Removal and installation of the under cover



05E0027

Removal steps
1. Tail pipe
2. Gasket
3. Hanger bracket
4. Hanger
5. Main muffler
6. Hanger
7. Center exhaust pipe
8. Suspender
9. Gasket
10. Catalytic converter
11. Oxygen sensor
12. Front exhaust pipe (L.H.) } <6G72>
13. Gasket
14. Front exhaust pipe (R.H.) }
15. Gasket
16. Front exhaust pipe } <4G64>
17. Gasket }
18. Heat protector
19. Front panel heat protector
20. Rear heater heat protector <Vehicles with rear heater>

INSPECTION

E15RCAI

- Check the mufflers and pipes for corrosion or damage.
- Check the rubber hangers and rubber suspenders for deterioration or damage.
- Check for gas leakage from mufflers and pipes.

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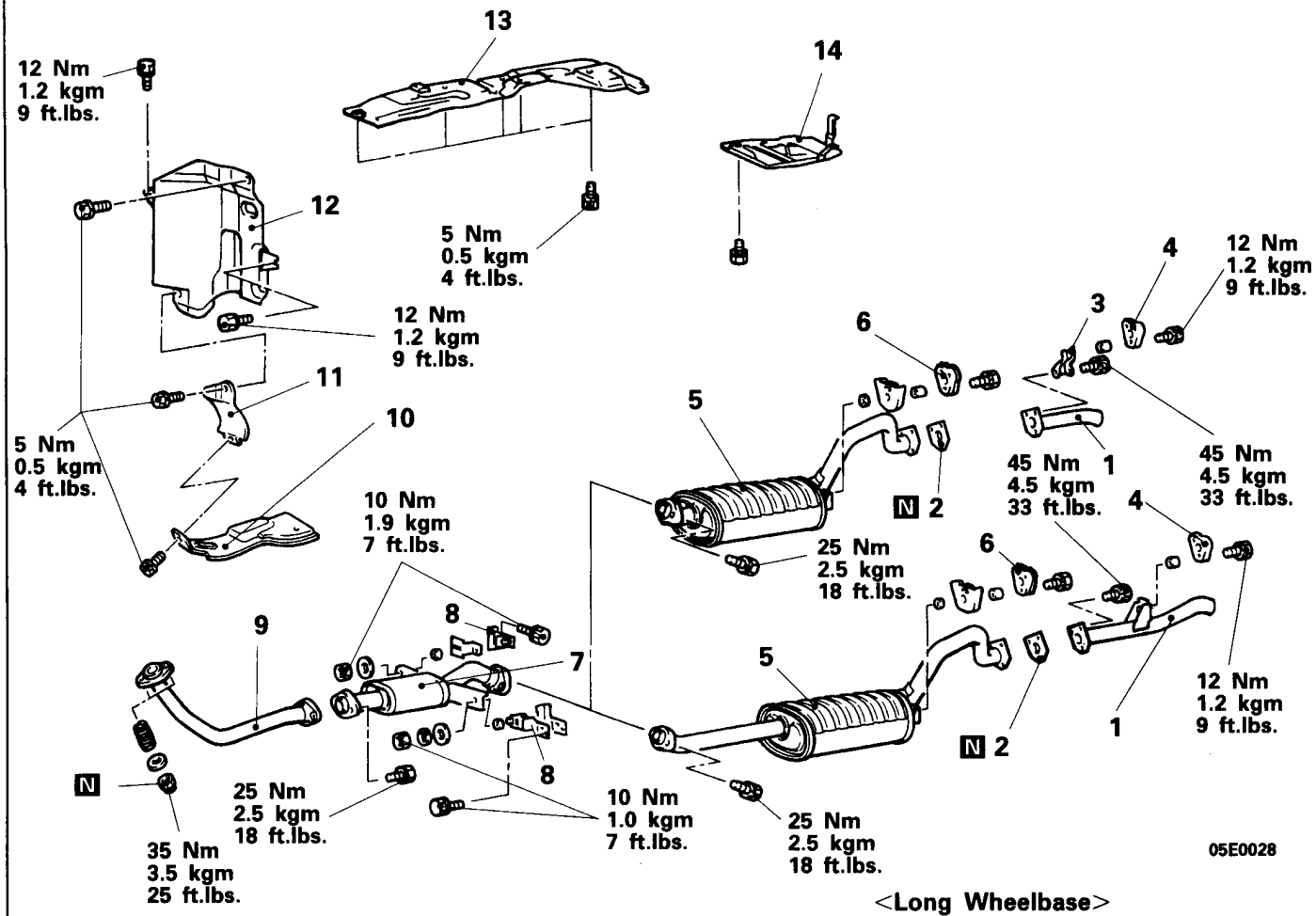
EXHAUST PIPE AND MUFFLER <4D56>

REMOVAL AND INSTALLATION

E15RA--

Pre-removal and Post-installation Operation
- Removal and installation of the brake master cylinder heat protector <R.H. drive vehicles>



<Long Wheelbase>

Removal steps

1. Tail pipe
2. Gasket
3. Hanger bracket
4. Hanger
5. Main muffler
6. Hanger
7. Pre muffler
8. Suspender
9. Front exhaust pipe
10. Dash panel heat protector
11. Heat protector
12. Dash panel heat protector upper
13. Front panel heat protector
14. Rear heater heat protector <Vehicles with Rear heater>

INSPECTION

E15RCAI

- Check the mufflers and pipes for corrosion or damage.
- Check the rubber hangers and rubber suspenders for deterioration or damage.
- Check for gas leakage from mufflers and pipes.

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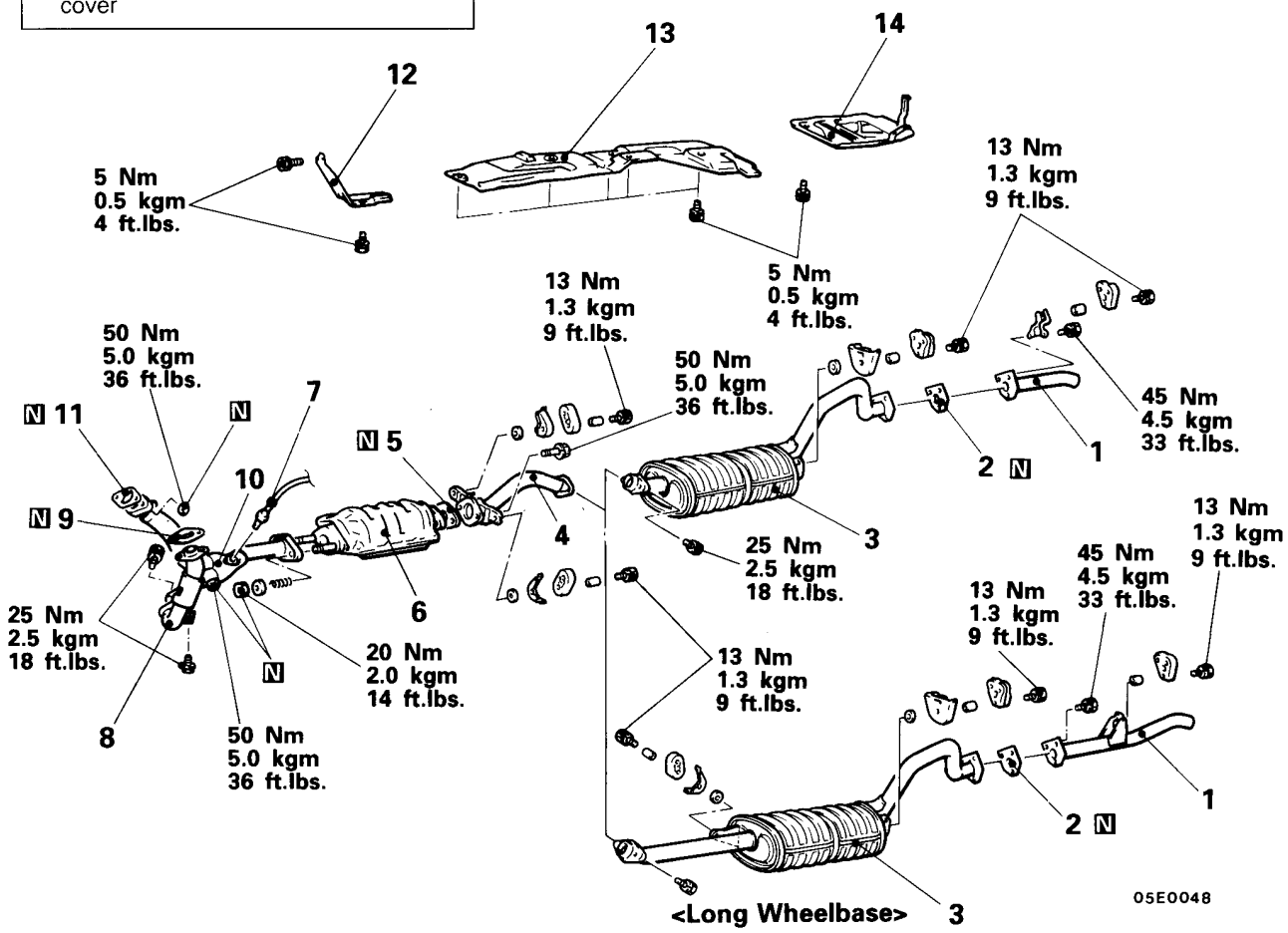
EXHAUST PIPE, MUFFLER AND CATALYTIC CONVERTER <6G72 – 24 VALVE, 6G74>

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Removal and installation of the under cover



Removal steps

1. Tail pipe
2. Gasket
3. Main muffler
4. Center exhaust pipe
5. Gasket
6. Catalytic converter
7. Oxygen sensor
8. Front exhaust pipe (L.H.)
9. Gasket
10. Front exhaust pipe (R.H.)
11. Gasket
12. Heat protector
13. Front panel heat protector
14. Rear heater heat protector <Vehicles with rear heater>

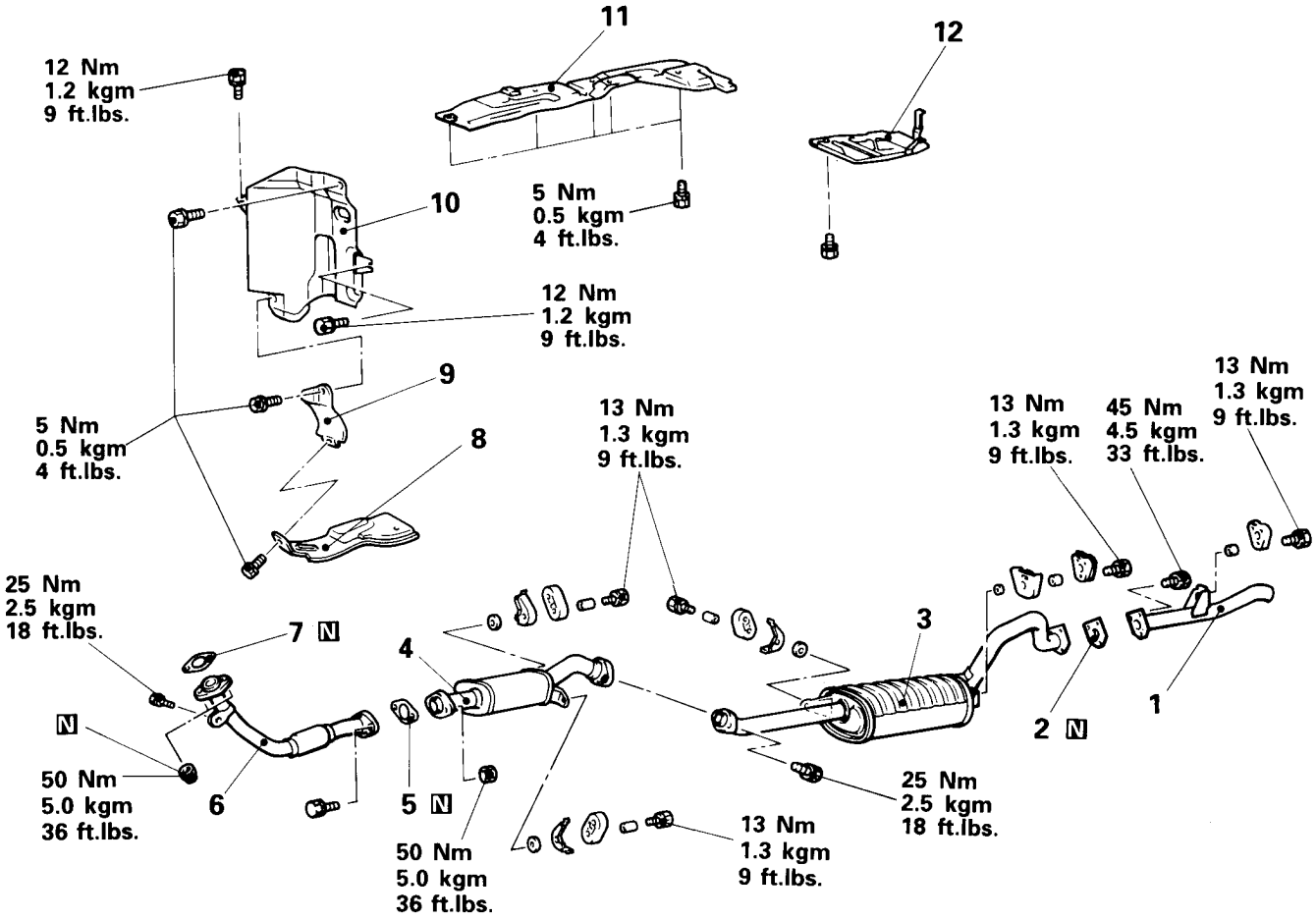
INSPECTION

- Check the mufflers and pipes for corrosion or damage.
- Check the rubber hangers and rubber suspenders for deterioration or damage.
- Check for gas leakage from mufflers and pipes.

EXHAUST PIPE AND MUFFLER <4M40>

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Removal and installation of the brake master cylinder heat protector <R.H. drive vehicles>



05E0047

Removal steps

1. Tail pipe
2. Gasket
3. Main muffler
4. Pre muffler
5. Gasket
6. Front exhaust pipe
7. Gasket
8. Dash panel heat protector
9. Heat protector
10. Dash panel heat protector upper
11. Front panel heat protector
12. Rear heater heat protector <Vehicles with rear heater>

INSPECTION E15RCAI

- Check the mufflers and pipes for corrosion or damage.
- Check the rubber hangers and rubber suspenders for deterioration or damage.
- Check for gas leakage from mufflers and pipes.

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ENGINE ELECTRICAL

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NOTES

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CHARGING SYSTEM

SPECIFICATIONS

GENERAL SPECIFICATIONS

E16BA--

ALTERNATOR

<4G64>

Items	Canvas top & Wagon	Wagon	Cold climate zone
Type	Battery voltage sensing	Battery voltage sensing	Battery voltage sensing
Rated output V/A	12/65	12/75	12/90
Voltage regulator	Electronic built-in type	Electronic built-in type	Electronic built-in type

<6G72-12 VALVE>

Items	M/T	M/T (Cold climate zone), A/T
Type	Battery voltage sensing	Battery voltage sensing
Rated output V/A	12/75	12/90
Voltage regulator	Electronic built-in type	Electronic built-in type

<6G74, 6G72-24 VALVE>

Items	Specifications
Type	Battery voltage sensing
Rated output V/A	12/90
Voltage regulator	Electronic built-in type

<4D56>

Items	Canvas top & Wagon	Wagon	Cold climate zone & Vehicles with super-charging pressure relief solenoid valve
Type	Battery voltage sensing	Battery voltage sensing	Battery voltage sensing & Alternator-generation-voltage sensing type
Rated output V/A	12/65	12/75	12/90
Voltage regulator	Electronic built-in type	Electronic built-in type	Electronic built-in type

<4M40>

Items	Standard	Cold climate zone & Vehicle with supercharging pressure relief solenoid valve
Type	Battery voltage sensing	Battery voltage sensing
Rated output V/A	12/75	12/90
Voltage regulator	Electronic built-in type	Electronic built-in type

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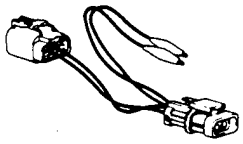
SERVICE SPECIFICATIONS

E16BB--

Item	Specifications
Standard value Alternator regulated voltage Ambient temp. at voltage regulator V – 20°C (– 4°F) 20°C (68°F) 60°C (140°F) 80°C (176°F)	 14.2–15.4 13.9–14.9 13.4–14.6 13.1–14.5
Limit Output current	 70% of nominal output current

SPECIAL TOOL

E16BF--

Tool	Number	Name	Use
	MD998467	Alternator harness connector	Checking the alternator (S terminal voltage)

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NOTES

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SERVICE ADJUSTMENT PROCEDURES

E16BGAG

VOLTAGE DROP TEST OF ALTERNATOR OUTPUT LINE

This test determines whether the wiring from the alternator "B" terminal to the battery (+) terminal (including the fusible link) is in a good condition or not.

(1) Always be sure to check the following before the test.
- Alternator installation
- Alternator drive belt tension (Refer to GROUP 11 – Service Adjustment Procedures.)
- Fusible link
- Abnormal noise from the alternator while the engine is running

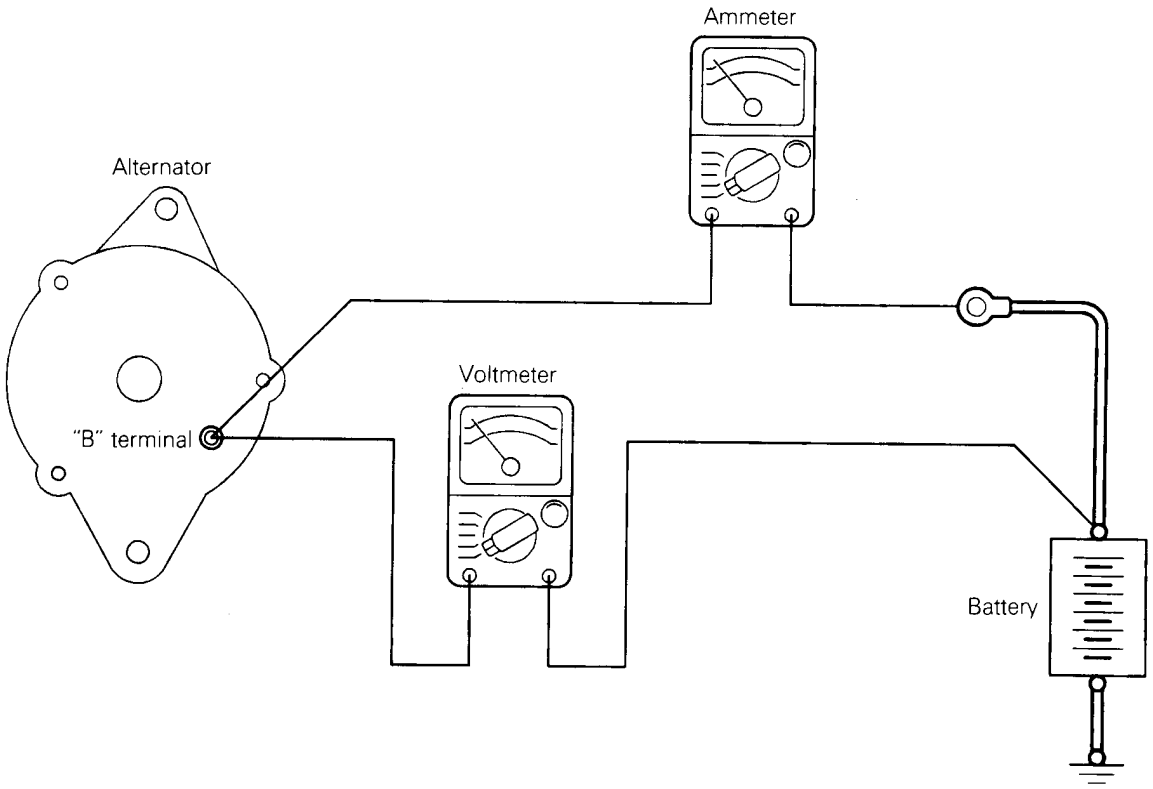
(2) Turn the ignition switch to the OFF position.

(3) Disconnect the negative battery cable.

(4) Disconnect the alternator output wire from the alternator "B" terminal and connect a DC test ammeter with a range of 0 – 100 A in series between the "B" terminal and the disconnected output wire. (Connect the (+) lead of the ammeter to the "B" terminal, and then connect the (–) lead of the ammeter to the disconnected output wire.)

NOTE
A clamp-type ammeter which enables measurements to be taken without disconnecting the alternator output wire should be recommended. Because, if a vehicle in which the voltage may have dropped due to an imperfect connection at the alternator "B" terminal is being inspected, and so if the alternator "B" terminal is loosened and a test ammeter is connected, the connection will be complete at the time of connection and the possibility of finding problems will be reduced.

(5) Connect a digital-type voltmeter between the alternator "B" terminal and the battery (+) terminal. (Connect the (+) lead of the voltmeter to the "B" terminal, and then connect the (–) lead of the voltmeter to the battery (+) cable.)



6EN0892

(6) Connect a tachometer. (For the procedure for connecting the tachometer, refer to GROUP 11 – Service Adjustment Procedures.)
(7) Reconnect the negative battery cable.
(8) Leave the hood open.
(9) Start the engine.
(10) With the engine running at 2500 r/min., turn the headlamps and other lamps on and off to adjust the alternator load so that the value displayed on the ammeter is slightly above 30A.
Adjust the engine speed by gradually decreasing it until the value displayed on the ammeter is 30A. Take a reading of the value displayed on the voltmeter at this time.

Limit value: Max. 0.3 V

NOTE
When the alternator output is high and the value displayed on the ammeter does not decrease until 30A, set the value to 40A. Read the value displayed on the voltmeter at this time.
In this case the limit value becomes max. 0.4V.

(11) If the value displayed on the voltmeter is above the limit value, there is probably a malfunction in the alternator output wire, so check the wiring between the alternator "B" terminal and the battery (+) terminal (including fusible link).
If a terminal is not sufficiently tight or if the harness has become discolored due to overheating, repair and then test again.
(12) After the test, run the engine at idle.
(13) Turn off all lamps and turn the ignition switch to the OFF position.
(14) Disconnect the negative battery cable.
(15) Disconnect the ammeter, voltmeter and tachometer.
(16) Connect the alternator output wire to the alternator "B" terminal.
(17) Connect the negative battery cable.

OUTPUT CURRENT TEST

This test determines whether the alternator outputs normal current.
(1) Before the test, always be sure to check the following.
- Alternator installation
- Battery (Refer to GROUP 54 – Battery.)

NOTE
The battery to be used should be slightly discharged. The load in a fully-charged battery will be insufficient and the test may not be able to be carried out correctly.

- Alternator drive belt tension (Refer to GROUP 11 – Service Adjustment Procedures.)
- Fusible link
- Abnormal noise from the alternator while the engine is running.

(2) Turn the ignition switch to the OFF position.
(3) Disconnect the negative battery cable.
(4) Disconnect the alternator output wire from the alternator "B" terminal and connect a DC test ammeter with a range of 0 – 100A in series between the "B" terminal and the disconnected output wire. (Connect the (+) lead of the ammeter to the "B" terminal, and then connect the (–) lead of the ammeter to the disconnected output wire.)

Caution
Never use clips but tighten bolts and nuts to connect the line. Otherwire loose connections (e.g. using clips) will lead to a serious accident because of high current.

NOTE
A clamp-type ammeter which enables measurements to be taken without disconnecting the alternator output wire should be recommended.
(5) Connect a voltmeter with a range of 0 – 20 V between the alternator "B" terminal and the earth. (Connect the (+) lead of the voltmeter to the "B" terminal, and then connect the (–) lead of the voltmeter to the earth.)

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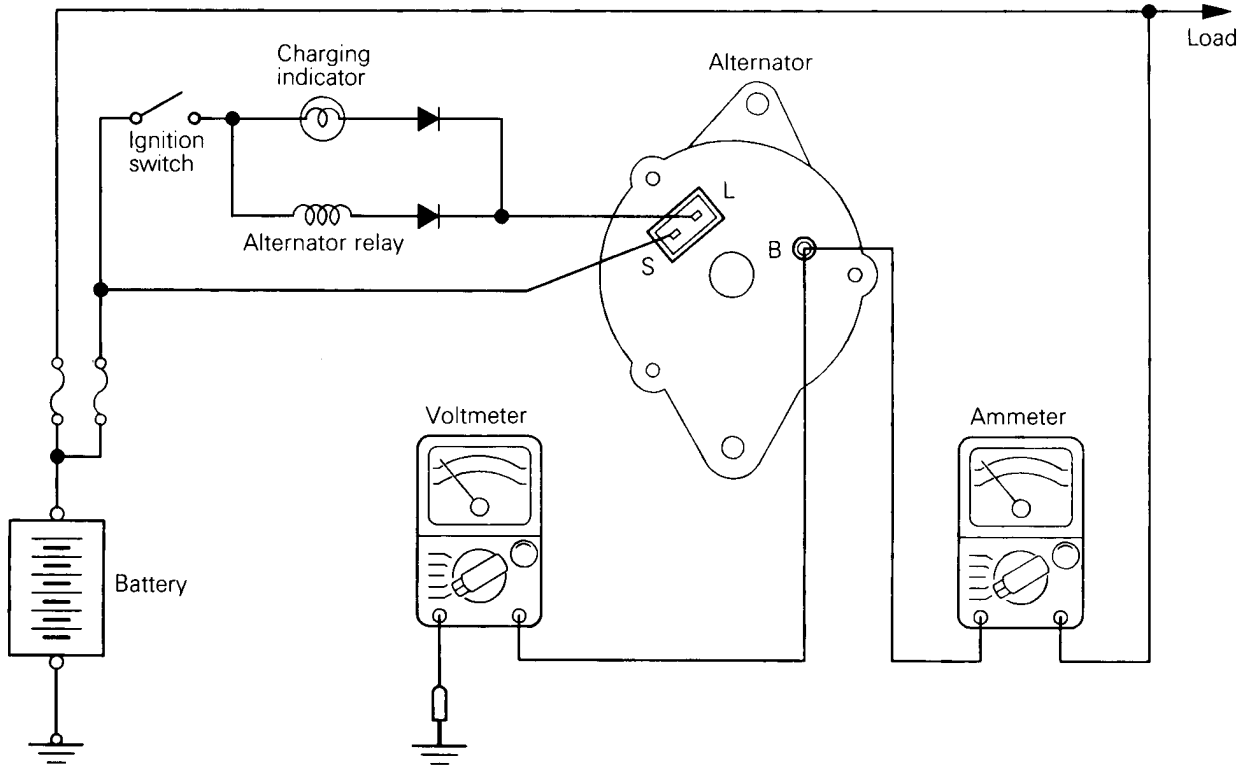
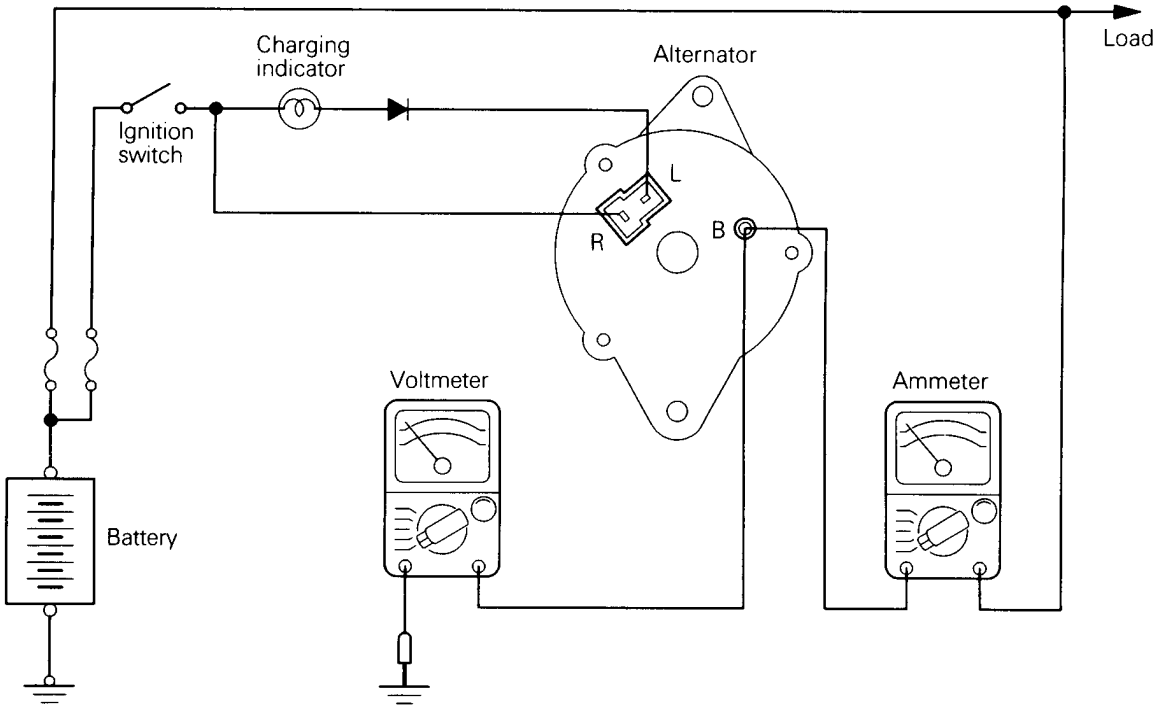
Battery-voltage sensing type



6EN0893

Alternator-generation-voltage sensing type



6EN0912

(6) Connect a tachometer. (For the procedure for connecting the tachometer, refer to GROUP 11 – Service Adjustment Procedures.)
(7) Connect the negative battery cable.
(8) Leave the hood open.
(9) Check to be sure that the reading on the voltmeter is equal to the battery voltage.

NOTE
If the voltage is 0 V, the cause is probably an open circuit in the wire or fusible link between the alternator "B" terminal and the battery (+) terminal.

(10) After turning the light switch on and turning on the headlamps, start the engine.
(11) Immediately after setting the headlamps to high beam and turning the heater blower switch to the high revolution position, increase the engine speed to 2,500 r/min. and read the maximum current output value displayed on the ammeter.
Limit value: 70% of normal current output

NOTE
- For the nominal current output, refer to the Alternator Specifications.
- Because the current from the battery will soon drop after the engine is started, the above step should be carried out as quickly as possible in order to obtain the maximum current output value.
- The current output value will depend on the electrical load and the temperature of the alternator body.
- If the electrical load is small while testing, the specified level of current may not be output even though the alternator is normal. In such cases, increase the electrical load by leaving the headlamps turned on for some time to discharge the battery or by using the lighting system in another vehicle, and then test again.
- The specified level of current also may not be output if the temperature of the alternator body or the ambient temperature is too high. In such cases, cool the alternator and then test again.

(12) The reading on the ammeter should be above the limit value. If the reading is below the limit value and the alternator output wire is normal, remove the alternator from the engine and check the alternator.
(13) Run the engine at idle speed after the test.
(14) Turn the ignition switch to the OFF position.
(15) Disconnect the negative battery cable.
(16) Disconnect the ammeter, voltmeter and tachometer.
(17) Connect the alternator output wire to the alternator "B" terminal.
(18) Connect the negative battery cable.

REGULATED VOLTAGE TEST

This test determines whether the voltage regulator is correctly controlling the alternator output voltage.
(1) Always be sure to check the following before the test.
- Alternator installation
- Check to be sure that the battery installed in the vehicle is fully charged. (Refer to GROUP 54 – Battery.)
- Alternator drive belt tension (Refer to GROUP 11 – Service Adjustment Procedures.)
- Fusible link
- Abnormal noise from the alternator while the engine is running

(2) Turn the ignition switch to the OFF position.
(3) Disconnect the negative battery cable.
(4) Connect the digital-type voltmeter.

<Battery-voltage sensing type>

Use the special tool (alternator harness connector MD998467) to connect the alternator "S" terminal to the earth. (Use the special tool to connect the (+) lead of the voltmeter to the "S" terminal, and then connect the (−) lead of the voltmeter to an earth.)

<Alternator generation-voltage sensing type>

Connect the alternator "L" terminal to the earth. (Connect the (+) lead of the voltmeter to the "L" terminal, and then connect the (−) lead of the voltmeter to an earth.)

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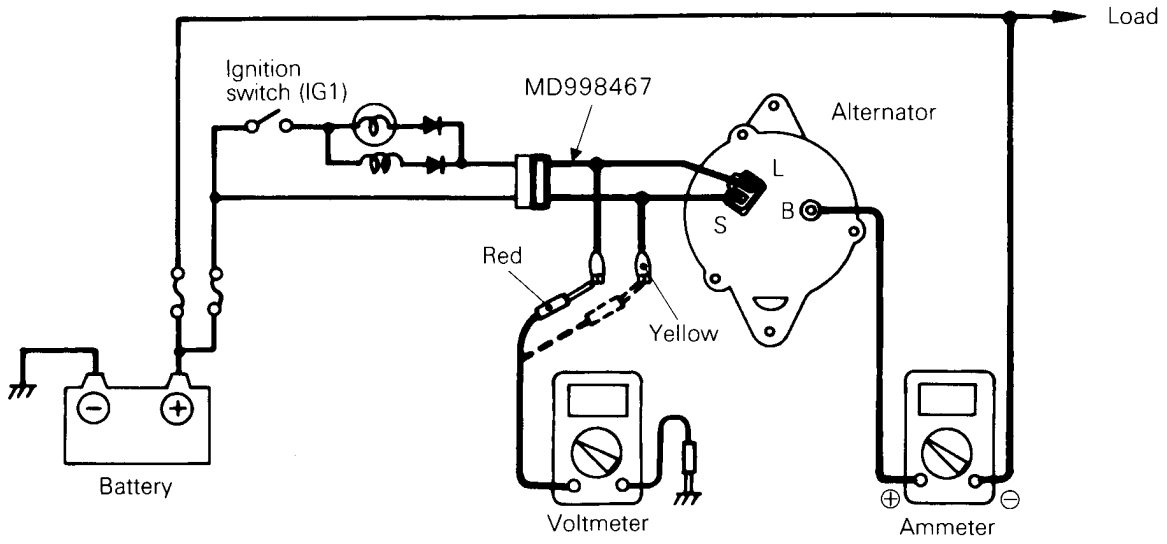
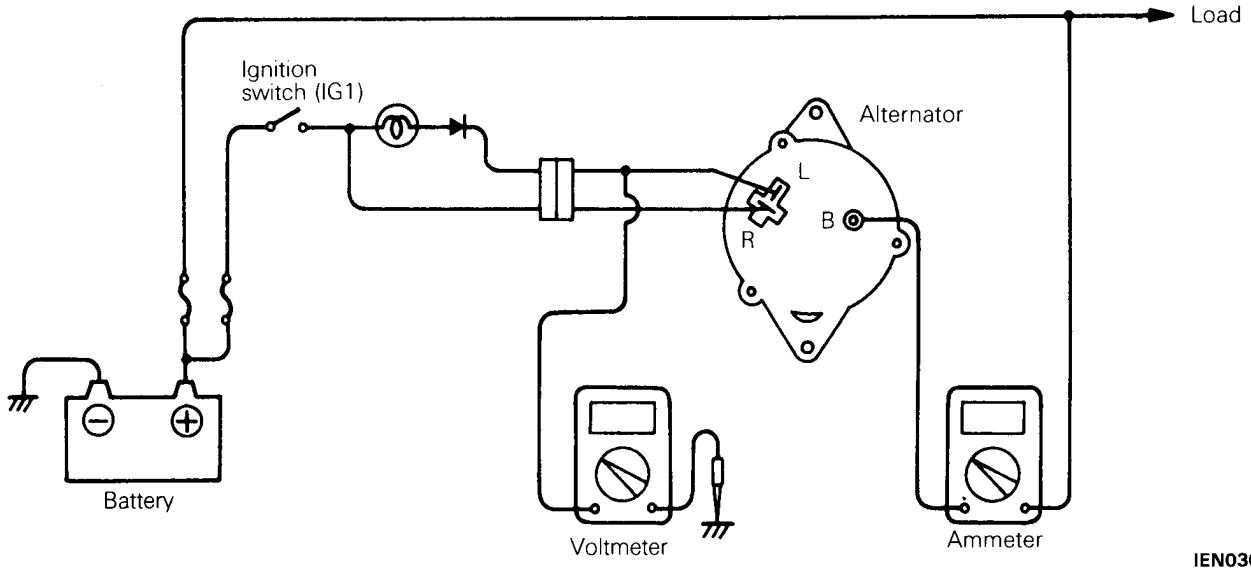
(5) Disconnect the alternator output wire from the alternator "B" terminal.
(6) Connect a DC test ammeter with a range of 0–100 A in series between the "B" terminal and the disconnected output wire. (Connect the (+) lead of the ammeter to the "B" terminal, and then connect the (–) lead of the ammeter to the disconnected output wire.)

Battery-voltage sensing type



01R0467

Alternator-generation-voltage sensing type



IEN0303

(7) Connect a tachometer. (Refer to GROUP 11 – Service Adjustment Procedures.)
(8) Reconnect the negative battery cable.
(9) Turn the ignition switch to the ON position and check that the reading on the voltmeter is equal to the battery voltage.

NOTE
If the voltage is 0 V, the cause is probably an open circuit in the wire or fusible link between the alternator "S" terminal and the battery (+) terminal.

(10) Check to be sure that all lamps and accessories are off.

(11)Start the engine.
(12)Increase the engine speed to 2,500 r/min.
(13)Read the value displayed on the voltmeter when the current output by the alternator becomes 10 A or less.
(14)If the voltage reading conforms to the value in the voltage regulation table, then the voltage regulator is operating normally.
If the voltage is outside the standard value, there is a malfunction of the voltage regulator or of the alternator.

Voltage Regulation Table

Inspection terminal	Voltage regulator ambient temperature °C (°F)	Standard value V
Terminal "S" <Battery-voltage sensing type>	-20	14.2–15.4
	20	13.9–14.9
	60	13.4–14.6
	80	13.1–14.5
Terminal "L" <Alternator-generation-voltage sensing type>	-20	14.4–15.6
	20	14.2–15.2
	60	13.8–15.1
	80	13.6–15.0

(15)After the test, lower the engine speed to the idle speed.
(16)Turn the ignition switch to the "OFF" position.
(17)Disconnect the negative battery cable.
(18)Disconnect the ammeter, voltmeter and tachometer.
(19)Connect the alternator output wire to the alternator "B" terminal.
(20)Connect the negative battery cable.

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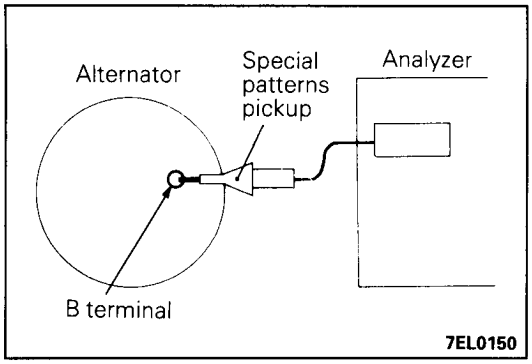


CHECKING WITH AN ANALYZER

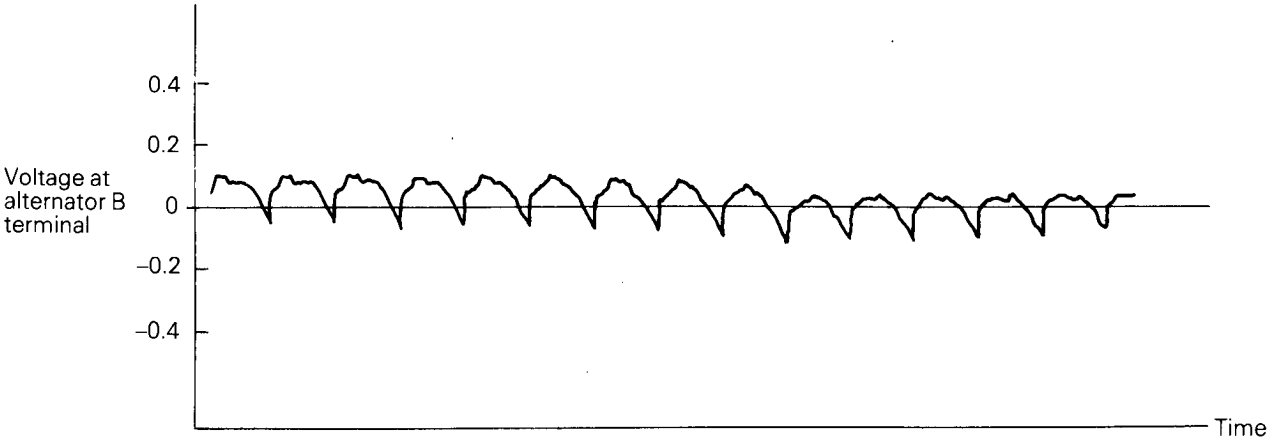
MEASUREMENT METHOD

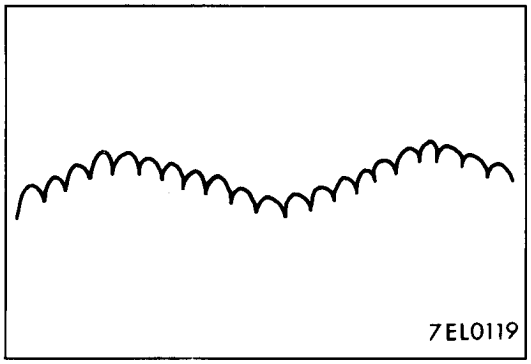
Connect the analyzer special patterns pick-up to the alternator B terminal.

STANDARD WAVEFORM

Observation Conditions

Function	Special patterns
Pattern height	Variable
Variable knob	Adjust while viewing the wave pattern
Pattern selector	Raster
Engine revolutions	Idle (4G64:750r/min., 6G72:700r/min.)





NOTE

Furthermore, the voltage waveform of the alternator B terminal can undulate as shown at left. This waveform is produced when the regulator operates according to fluctuations in the alternator load (current), and is normal for the alternator.

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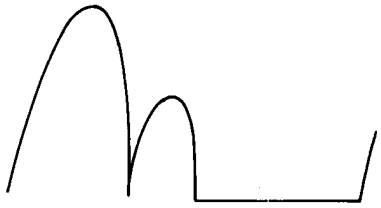
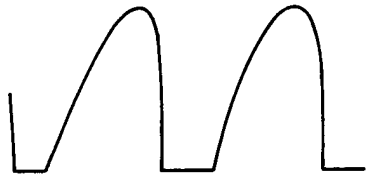
EXAMPLES OF ABNORMAL WAVEFORMS

NOTE
1. The size of the waveform patterns differs largely depending on the adjustment of the variable knob on the analyzer.
2. Identification of abnormal waveforms is easier when there is a large output current (regulator is not operating). (Waveforms can be observed when the headlamps are illuminated.)
3. Check the conditions of the charge lamp (illuminated/ not illuminated) also, and carry out a total check.

Abnormal waveforms	Problem cause
Example 1 7EL0120	• Open diode
Example 2  7EL0121	• Short in diode
Example 3  7EL0122	• Broken wire in stator coil
Example 4 7EL0123	• Short in stator coil
Example 5 NOTE: At this time, the charge lamp is illuminated. 7EL0124	• Open supplementary diode

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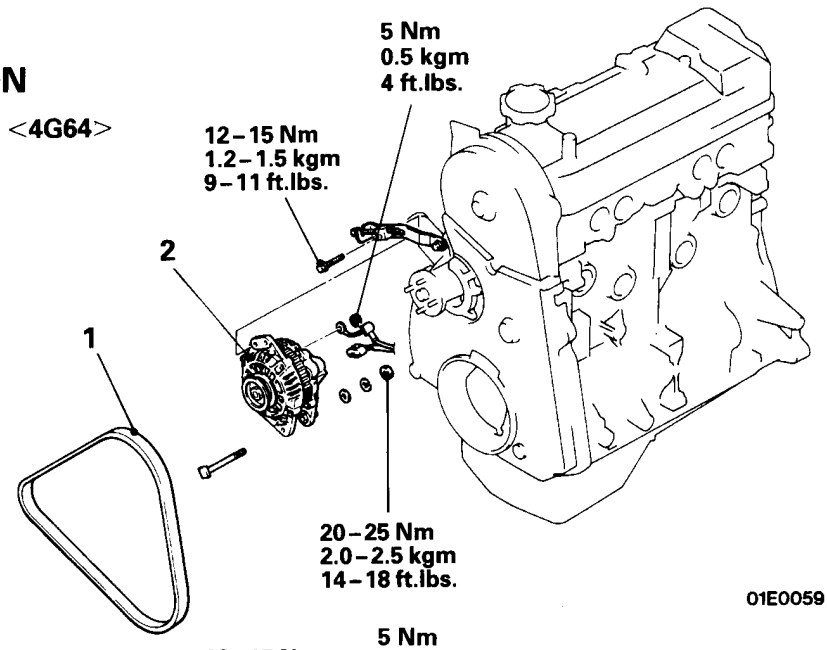
ALTERNATOR

REMOVAL AND INSTALLATION

Post-installation Operation
- Drive Belt Tension Adjustment (Refer to GROUP 11 – Service Adjustment Procedures)

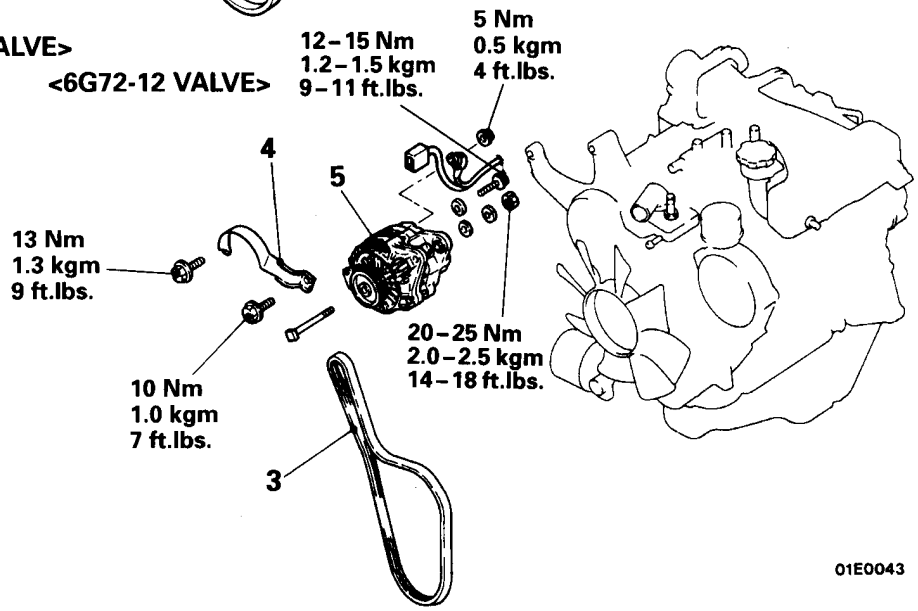
<4G64>



Removal steps <4G64>
1. Drive Belt
2. Alternator

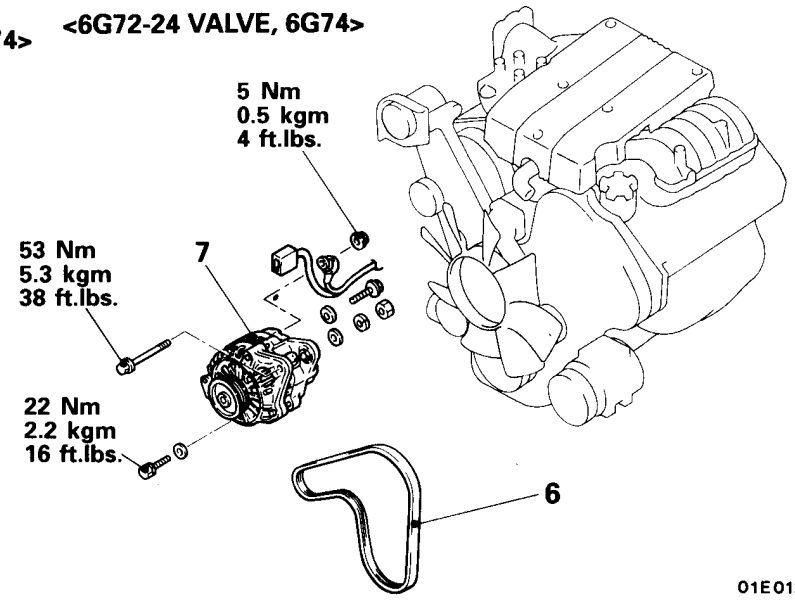
Removal steps <6G72-12 VALVE>
3. Drive Belt
4. Alternator cover
5. Alternator

<6G72-12 VALVE>



Removal steps <6G72-24 VALVE, 6G74>
- Air cleaner case
6. Drive Belt
7. Alternator

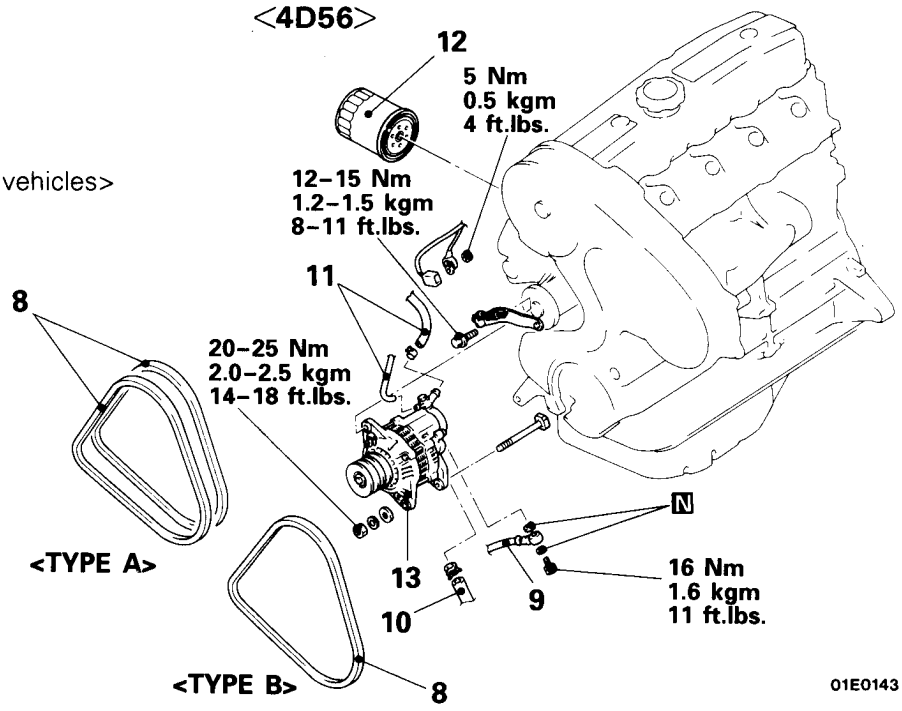
<6G72-24 VALVE, 6G74>



Removal steps <4D56>

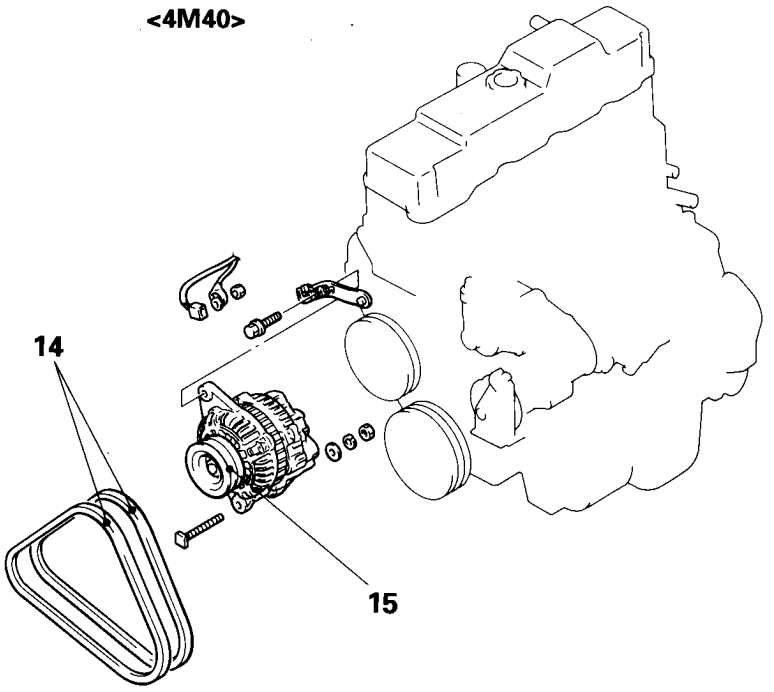
- Air intake hose
- Under cover

8. Drive belt
9. Oil pipe
10. Oil return hose
11. Vacuum hose
12. Oil filter <R.H. drive vehicles>
13. Alternator



Removal steps <4M40>

14. Drive Belt
15. Alternator



Caution
When replacing a drive belt, both belts should be replaced at the same time.

NOTES

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STARTING SYSTEM

SPECIFICATIONS

GENERAL SPECIFICATIONS

E16CA--

STARTER MOTOR

<4G64, 6G72, 6G74>

Items	4G64 (Standard specification)	4G64 (Cold climate zone)	6G72, 6G74
Type	Direct drive	Planetary gear reduction drive	Planetary gear reduction drive
Rated output kW/V	0.9/12	1.2/12	1.2/12
No. of pinion teeth	8	8	8

<4D56>

Items	M/T	M/T (cold climate zone)	A/T
Type	Spur gear reduction drive	Spur gear reduction drive	Spur gear reduction drive
Rated output kW/V	2.0/12	2.2/12	2.2/12
No. of pinion teeth	13	13	13

<4M40>

Items	Specifications
Type	Spur gear reduction drive
Rated output kW/V	2.2/12
No. of pinion teeth	10

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IGNITION SYSTEM

SPECIFICATIONS

GENERAL SPECIFICATIONS

E16DA--

DISTRIBUTOR

Items \ Engine	4G64	6G72-12 VALVE
Type	Contact pointless	Contact pointless
Advance mechanism	Electronic	Electronic
Firing order	1-3-4-2	1-2-3-4-5-6

IGNITION COIL

Items \ Engine	4G64	6G72 12 VALVE	6G72 24 VALVE	6G74
Type	Mold type	Mold type	Mold 3 coil	Mold 3 coil
Identification No.	F-088	F-504	F-608	F-722

SPARK PLUG

Items \ Engine	4G64	6G72 12 VALVE	6G72 24 VALVE	6G74
NGK	BPR6ES-11	BPR5ES-11	PFR6J-11	PFR5J-11
NIPPON DENSO	W20EPR11	W16EPR11	PK20PR-P11	PK16PR-P11
CHAMPION	RN9YC4	RN11YC4	–	–

SERVICE SPECIFICATIONS

E16DB--

Items		4G64, 6G72-12 VALVE	6G74
Ignition coil			
Primary coil resistance	Ω	0.72–0.88	0.69–0.85
Secondary coil resistance	kΩ	10.29–13.91	15.3–20.7
Spark plug gap	mm (in.)	1.0–1.1 (0.039–0.043)	1.0–1.1 (0.039–0.043)

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SERVICE ADJUSTMENT PROCEDURES

E16DGAS

SPARK PLUG CHECK AND CLEANING

<4G64, 6G72-12 VALVE>

(1) Remove the spark plug cables.

Caution
When pulling off the spark plug cable from the plug, always hold the cable cap, not the cable.

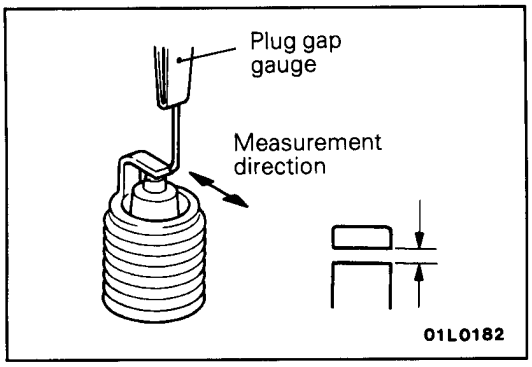
(2) Remove the spark plugs.
(3) Check for burned out electrode or damaged insulator. Check for even burning.
(4) Remove carbon deposits with wire brush or plug cleaner. Remove sand from plug screw with compressed air.
(5) Use a plug gap gauge to check that the plug gap is within the standard value range.

Standard value: 1.0–1.1 mm (0.039–0.043 in.)

If the plug gap is not within the standard value range, adjust by bending the earth electrode.
(6) Clean the engine plug holes.

Caution
Use care not to allow foreign matter in cylinders.

(7) Install the spark plugs.



<6G74, 6G72-24 VALVE>

(1) Remove the spark plugs.
(2) Check the plug gap and replace if the limit is exceeded.

Standard value: 1.0–1.1 mm (0.039–0.043 in.)
Limit: 1.3 mm (0.051 in.)

Caution
1. **Do not attempt to adjust the gap of the platinum plug.**
2. **Cleaning of the platinum plug may result damage the platinum tip. Therefore, if carbon deposits must be removed, use a plug cleaner and complete cleaning within 20 seconds for protection of the electrode. Do not use wire brushes.**

HIGH TENSION CABLE SPARK TEST

(1) Disconnect the high-tension cable from the distributor cap.
(2) Hold the high tension cable about 6–8 mm (0.24–0.31 in.) away from engine (proper earth portion such as cylinder block) and crank engine to verify that sparks are produced.

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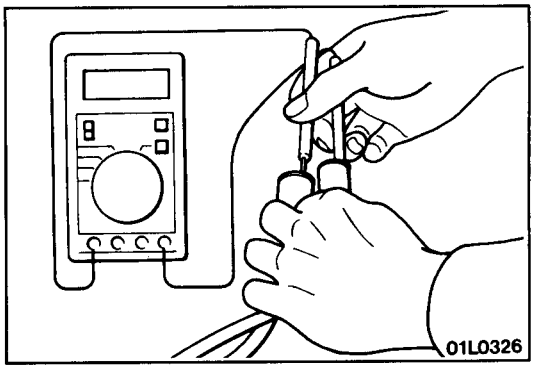
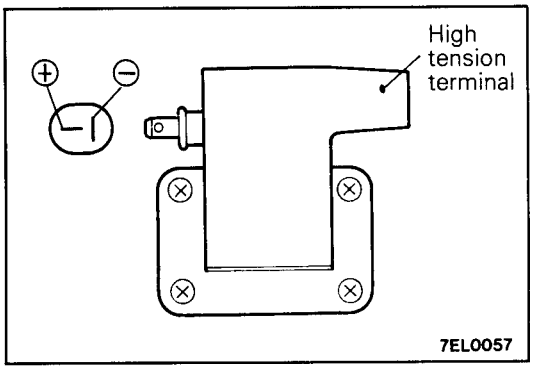


RESISTIVE CODE INSPECTION

Measure the resistance of the high tension cable and all spark plug leads.

(1) Check cap and coating for cracks.
(2) Measure resistance.

Limit: Max. 26 kΩ



IGNITION COIL INSPECTION

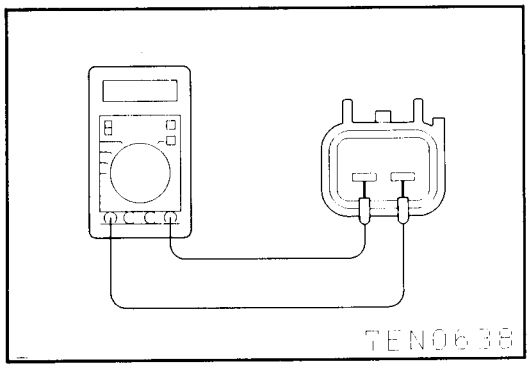
<4G64, 6G72-12 VALVE>

(1) Measurement of the primary coil resistance
Measure the resistance of the positive (+) terminal and negative (–) terminal of the ignition coil.

Standard value: 0.72–0.88 Ω

(2) Measurement of the secondary coil resistance
Measure the resistance between the ignition coil's positive (+) terminal and the high tension terminal.

Standard value: 10.29–13.91 kΩ



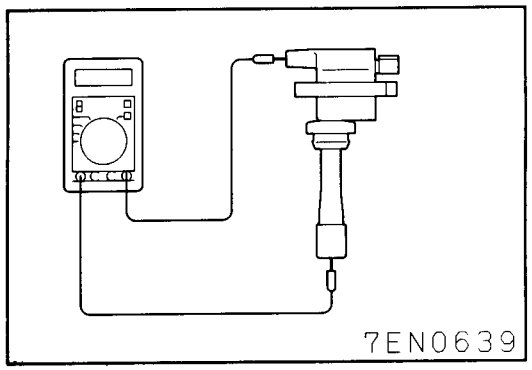
<6G74, 6G72-24 VALVE>

(1) Measurement of the primary coil resistance.
Measure the resistance between the terminals for each cylinder (No. 1 – No. 4, No. 2 – No. 5, No. 3 – No. 6) of the ignition coil as shown in the illustration.

Standard value: 0.69 – 0.85 Ω

(2) Measurement of the secondary coil resistance.
Measure the resistance between the high-voltage terminals for each cylinder (No. 1 – No. 4, No. 2 – No. 5, No. 3 – No. 6) of the ignition coil as shown in the illustration.

Standard value: 15.3 – 20.7 kΩ



POWER TRANSISTOR INSPECTION

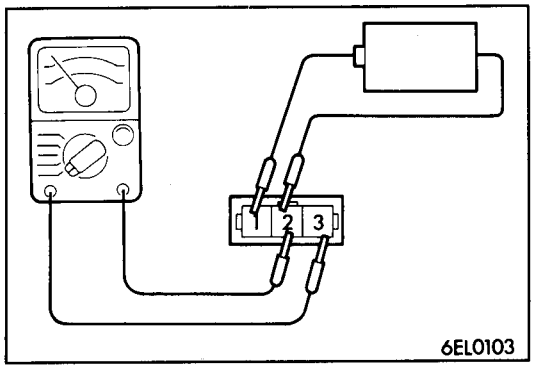
<4G64, 6G72-12 VALVE>

NOTE
1. An analogue type of circuit tester should be used.
2. Connect the circuit tester (–) probe (black) to terminal (3).

(1) Connect the negative (–) terminal of the 1.5V power supply to terminal (2) of the power transistor: then check whether there is continuity between terminal (3) and terminal (2) when terminal (1) and the positive (+) terminal are connected and disconnected.

Terminal (1) and (+) terminal	Terminal (3) and terminal (2)
Connected	Continuity
Unconnected	No continuity

(2) Replace the power transistor if there is a malfunction.



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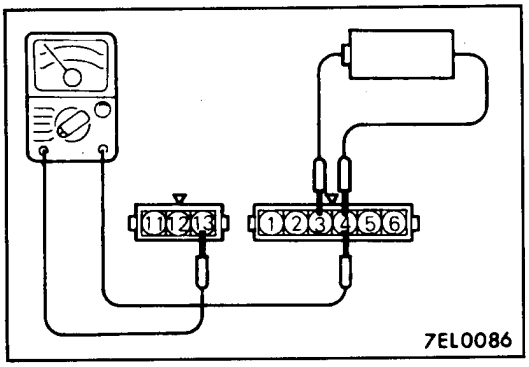


<6G74, 6G72-24 VALVE>

NOTE
An analog-type circuit tester should be used.

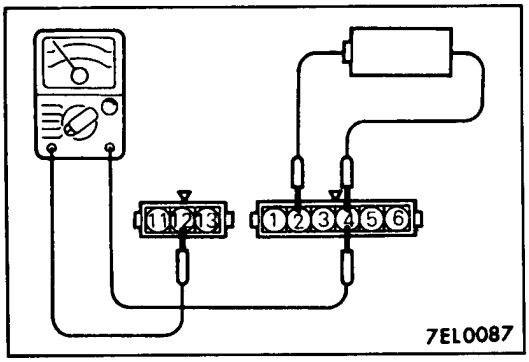
No. 1 – No. 4 coil side

(1) Connect the negative (–) terminal of the 1.5V power supply to terminal ④ of the ignition power transistor; then check whether there is continuity between terminal ⑬ and terminal ④ when terminal ③ and the positive (+) terminal are connected and disconnected.

NOTE
Connect the (–) probe of the circuit tester to terminal ⑬.

Terminal 3 and (+) terminal	Terminal 13 and terminal 4
Connected	Continuity
Unconnected	No continuity

(2) Replace the ignition power transistor if there is a malfunction.



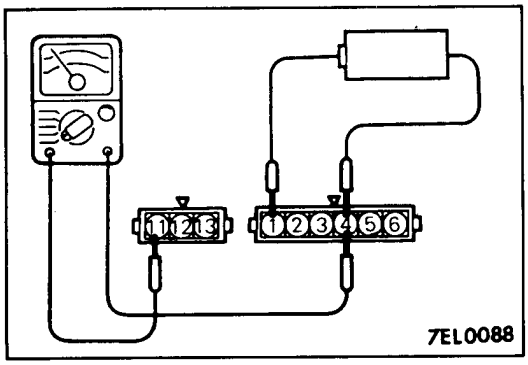
No. 2 – No. 5 coil side

(1) Connect the negative (–) terminal of the 1.5V power supply to terminal ④ of the ignition power transistor; then check whether there is continuity between terminal ⑫ and terminal ④ when terminal ② and the positive (+) terminal are connected and disconnected.

NOTE
Connect the (–) probe of the circuit tester to terminal ⑫.

Terminal 2 and (+) terminal	Terminal 12 and terminal 4
Connected	Continuity
Unconnected	No continuity

(2) Replace the ignition power transistor if there is a malfunction.



No. 3 – No. 6 coil side

(1) Connect the negative (–) terminal of the 1.5V power supply to terminal ④ of the ignition power transistor; then check whether there is continuity between terminal ⑪ and terminal ④ when terminal ① and the positive (+) terminal are connected and disconnected.

NOTE
Connect the (–) probe of the circuit tester to terminal ⑪.

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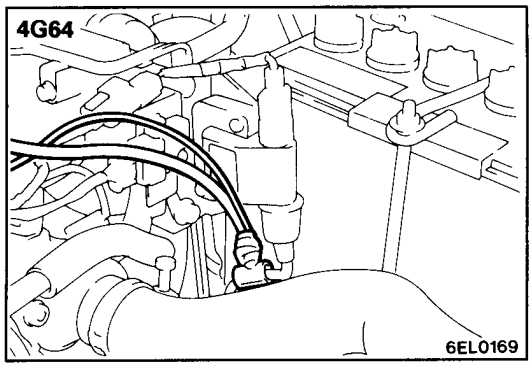
Terminal 1 and (+) terminal	Terminal 11 and terminal 4
Connected	Continuity
Unconnected	No continuity

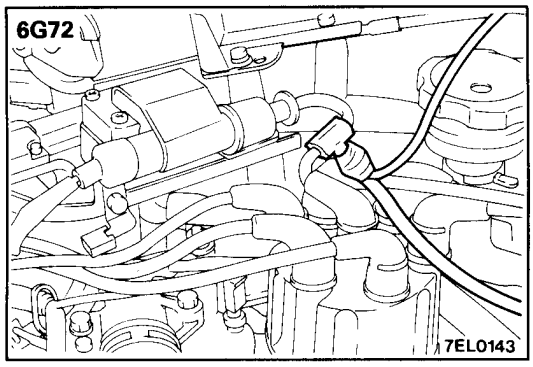
(2) Replace the ignition power transistor if there is a malfunction.

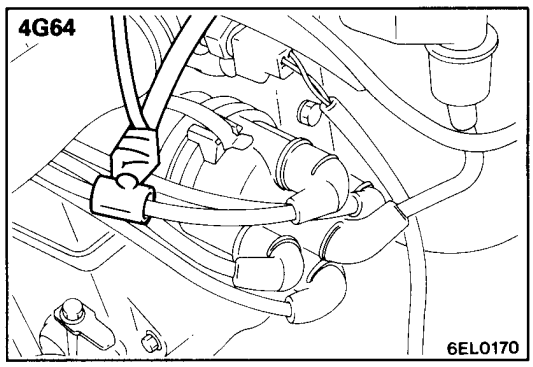
CHECKING THE DETONATION SENSOR <6G74>

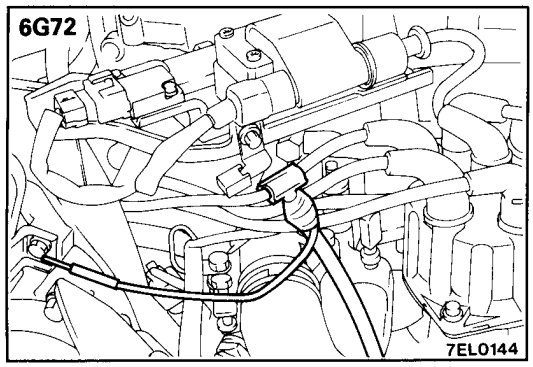
Check the detonation sensor circuit if self-diagnosis code, No. 31 is shown.

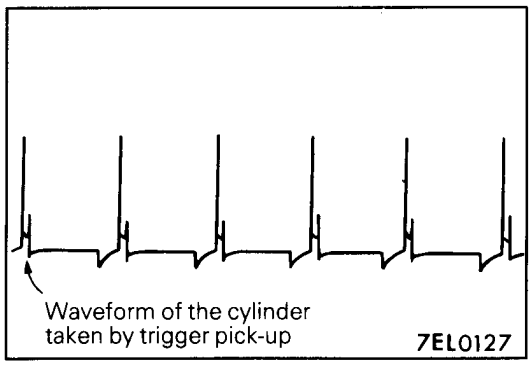
NOTE
For information concerning the self-diagnosis codes, refer to GROUP 13 – Troubleshooting.











INSPECTION USING AN ANALYZER (SECONDARY AND PRIMARY IGNITION VOLTAGE WAVEFORMS)

INSPECTION OF SECONDARY IGNITION VOLTAGE <4G64, 6G72-12 VALVE>

MEASUREMENT METHOD

(1) Clamp the high tension cable.

(2) Clamp the spark plug cable with the trigger pickup. (Basically, clamp the No.1 cylinder spark plug cable.)

(3) The cylinder waveform taken by the trigger pickup appears from the left side of the screen.

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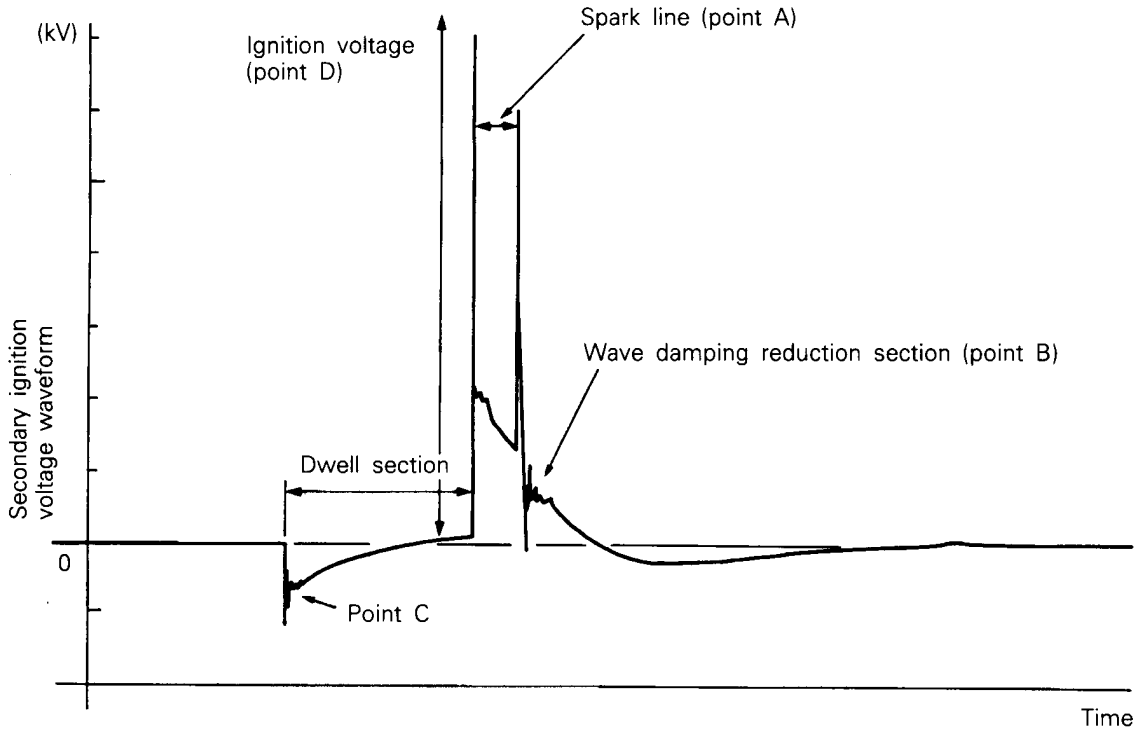
STANDARD WAVEFORM

Observation Conditions

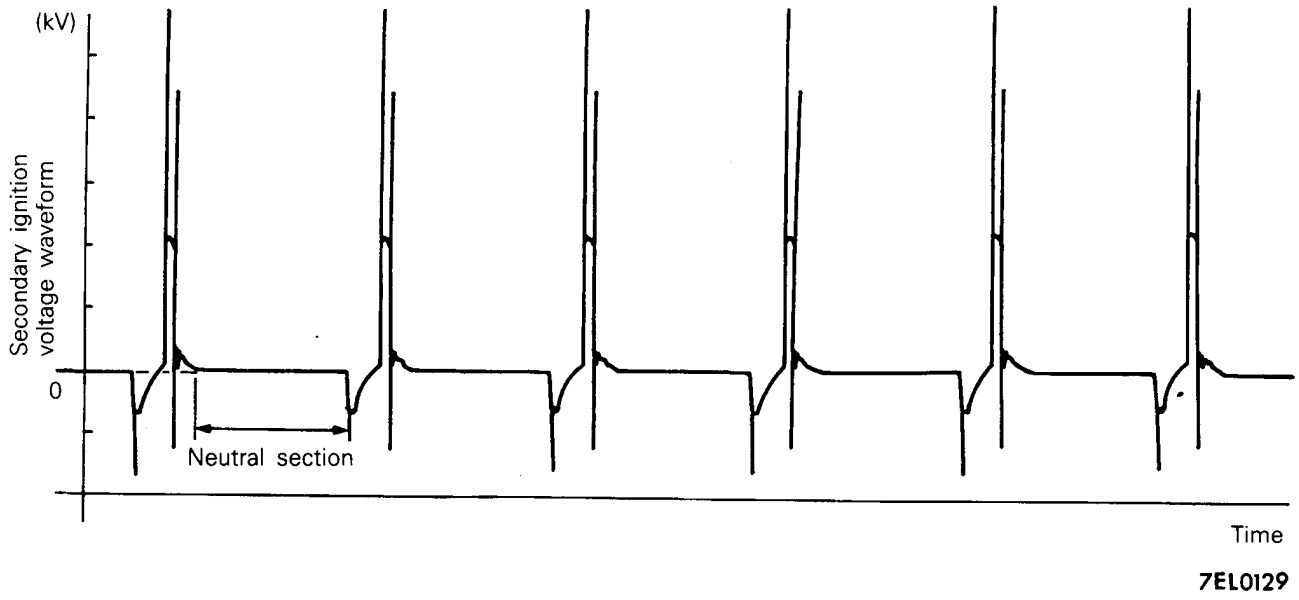
Function	Secondary
Pattern height	HIGH (or LOW)
Pattern selector	Raster
Engine revolutions	Curb idle speed



7EL0128

Observation Condition (Only PATTERN SELECTOR below changes from the above conditions.)

PATTERN SELECTOR	DISPLAY



7EL0129

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WAVEFORM OBSERVATION POINTS

Point A : The height, length and slope of the spark line (refer to abnormal waveform examples 1, 2, 3 and 4) show the following trends.

Spark line		Plug gap	Condition of electrode	Compression force	Concentration of air mixture	Ignition timing	Spark plug cable
Length	Long	Small	Normal	Low	Rich	Advanced	Leak
	Short	Large	Large wear	High	Lean	Retarded	High resistance
Height	High	Large	Large wear	High	Lean	Retarded	High resistance
	Low	Small	Normal	Low	Rich	Advanced	Leak
Slope		Large	Plug is fouled	–	–	–	–

Point B : Number of vibrations in reduction vibration section (Refer to abnormal waveform example 5)

Number of vibrations	Coil and condenser
Three or more	Normal
Except above	Abnormal

Point C : Number of vibrations at beginning of dwell section (Refer to abnormal waveform example 5)

Number of vibrations	Coil
5–6 or higher	Normal
Except above	Abnormal

Point D : Ignition voltage height (distribution per each cylinder) shows the following trends.

Ignition voltage	Plug gap	Condition of electrode	Compression force	Concentration of air mixture	Ignition timing	Spark plug cable
High	Large	Large wear	High	Lean	Retarded	High resistance
Low	Small	Normal	Low	Rich	Advanced	Leak

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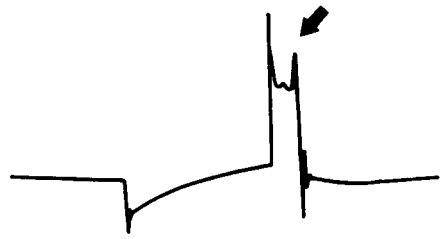
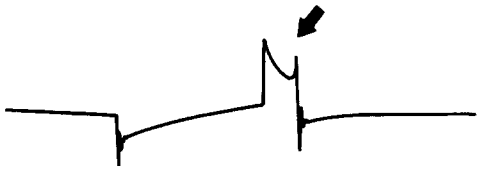
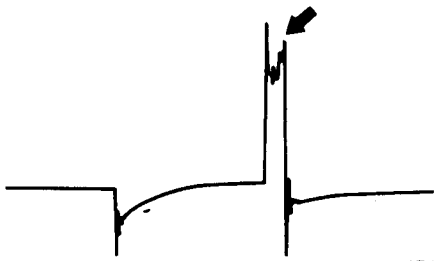
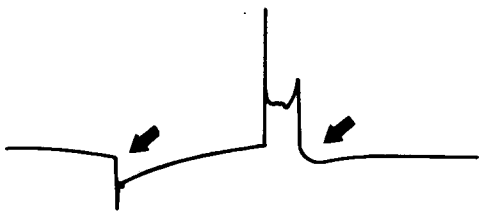
EXAMPLES OF ABNORMAL WAVEFORMS

Abnormal waveform	Wave characteristics	Cause of probrem
Example 1  01P0215	Spark line is high and short.	Spark plug gap is too large.
Example 2 01P0216	Spark line is low and long, and is sloping. ALso, the second half of the spark line is distorted. This could be a result of mis-firing.	Spark plug gap is too small.
Example 3  01P0217	Spark line is low and long, and is sloping. However, there is almost no spark line distortion.	Spark plug gap is fouled.
Example 4  01P0218	Spark line is high and short. Difficult to distinguish between this and abnormal wave pattern example 1.	Spark plug cable is nearly falling off. (Causing a dual ignition)
Example 5  01P0219	No waves in wave damping section.	Rare short in ignition coil.

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INSPECTION OF SECONDARY IGNITION VOLTAGE <6G74, 6G72-24 VALVE>

MEASUREMENT METHOD

(1) Clamp the spark plug cable (No. 1, No. 3 or No. 5) with the secondary pickup.

NOTE
1. Because of the two-cylinder simultaneous ignition system, the waves for two cylinders in each group appear during wave observation. However, wave observation is carried out for the cylinder (No. 1, No. 3 or No. 5) with the spark plug cable which has been clamped by the secondary pickup.
2. Identification of which cylinder waveform is displayed can be difficult, but the waveform of the cylinder which is clamped by the secondary pickup will be stable, so this can be used as a reference for identification.

(2) Clamp the spark plug cable (No. 1, No. 3 or No. 5) with the trigger pickup.

NOTE
Clamp the same spark plug cable as the one which has been clamped by the secondary pickup.

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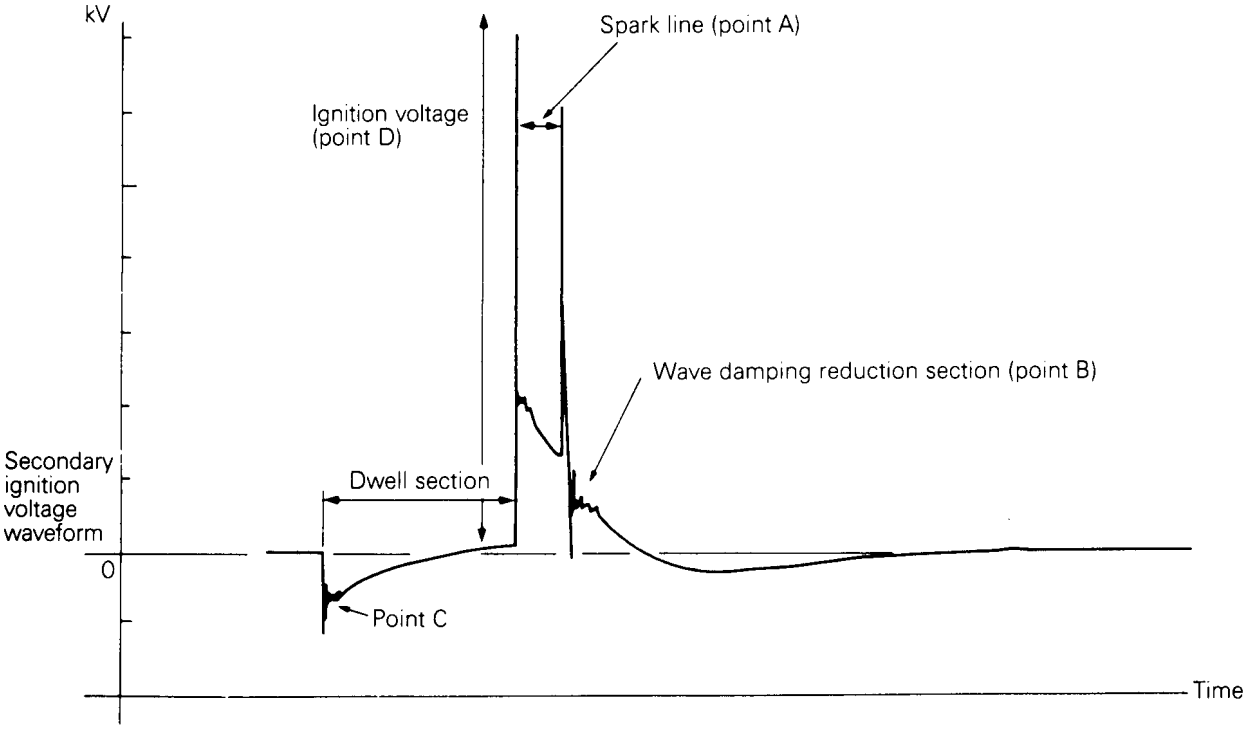
Standard Waveform

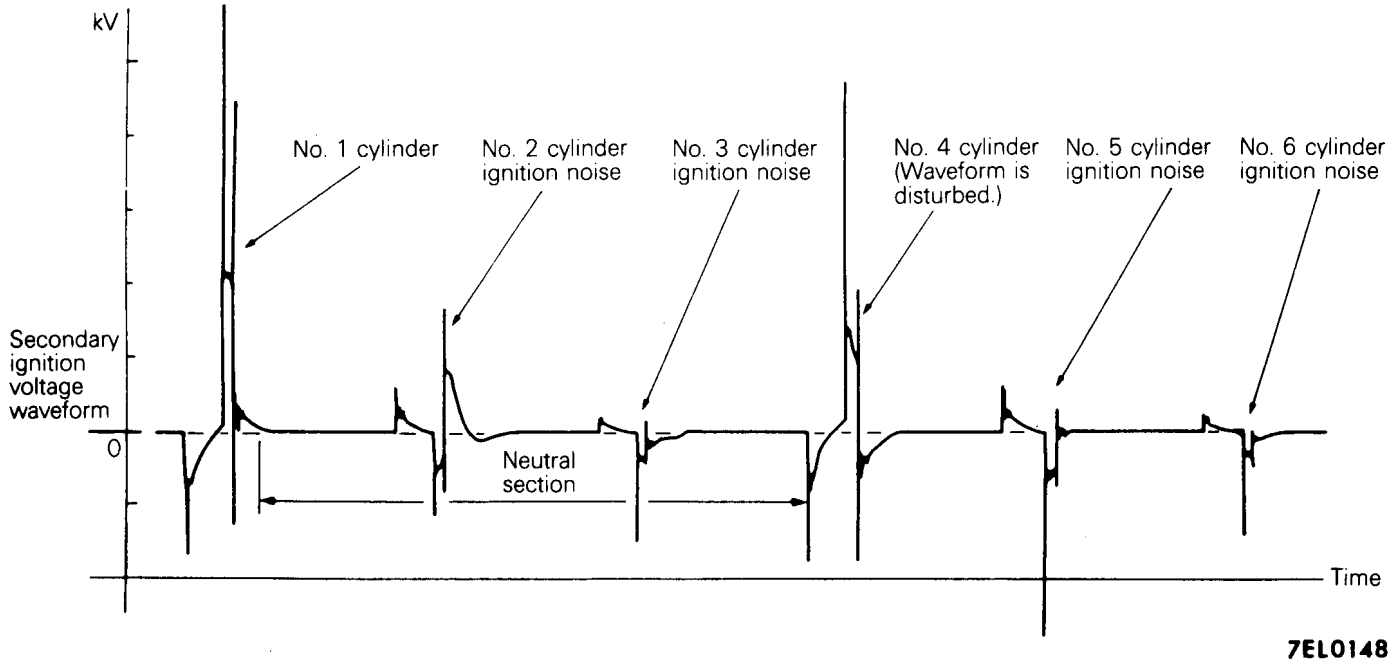
Observation conditions

FUNCTION	SECONDARY
PATTERN HEIGHT	HIGH (or LOW)
PATTERN SELECTOR	RASTER
Engine revolutions	Curb idle speed



Observation conditions (Only PATTERN SELECTOR below changes from the above conditions.)

PATTERN SELECTOR	DISPLAY



WAVEFORM OBSERVATION POINTS

For waveform observation points; refer to P.16-16.

EXAMPLES OF ABNORMAL WAVEFORMS

For examples of abnormal waveforms, refer to P.16-17.

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NOTES

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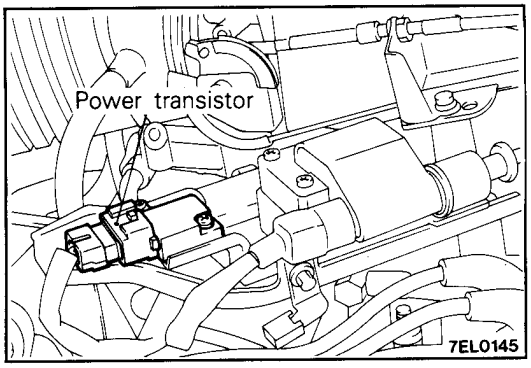
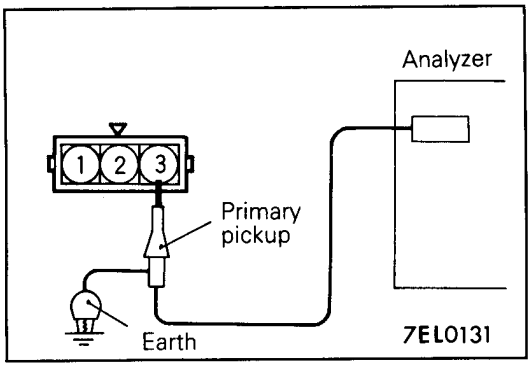




INSPECTION OF PRIMARY IGNITION VOLTAGE <4G64, 6G72-12 VALVE>

MEASUREMENT METHOD

(1) Remove the power transistor connector and connect the special tool (Harness connector: MB991348) in between. All terminals should be connected.

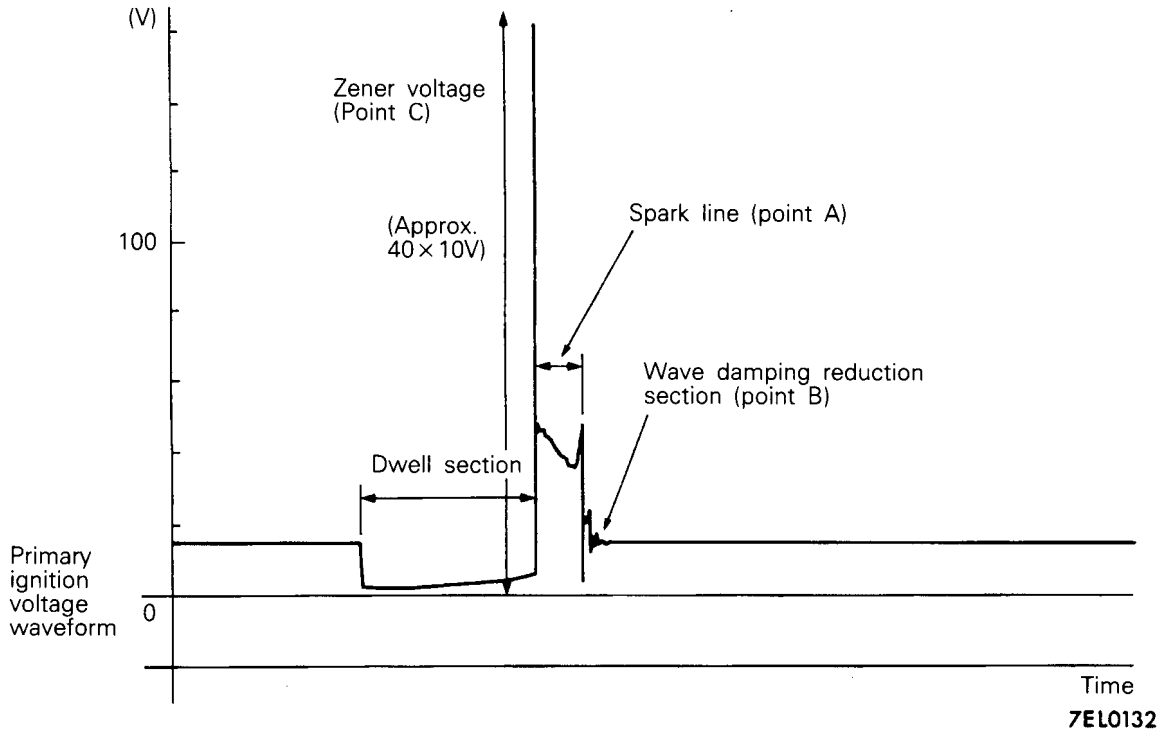
(2) Connect the primary pickup of the adjuster to the power transistor connector terminal (3).
(3) Earth the primary pickup earth terminal.
(4) Clamp the spark plug cable with the primary pickup.

NOTE
The waveform of the cylinder clamped by the trigger pickup appears from the left side of the screen.

STANDARD WAVEFORM

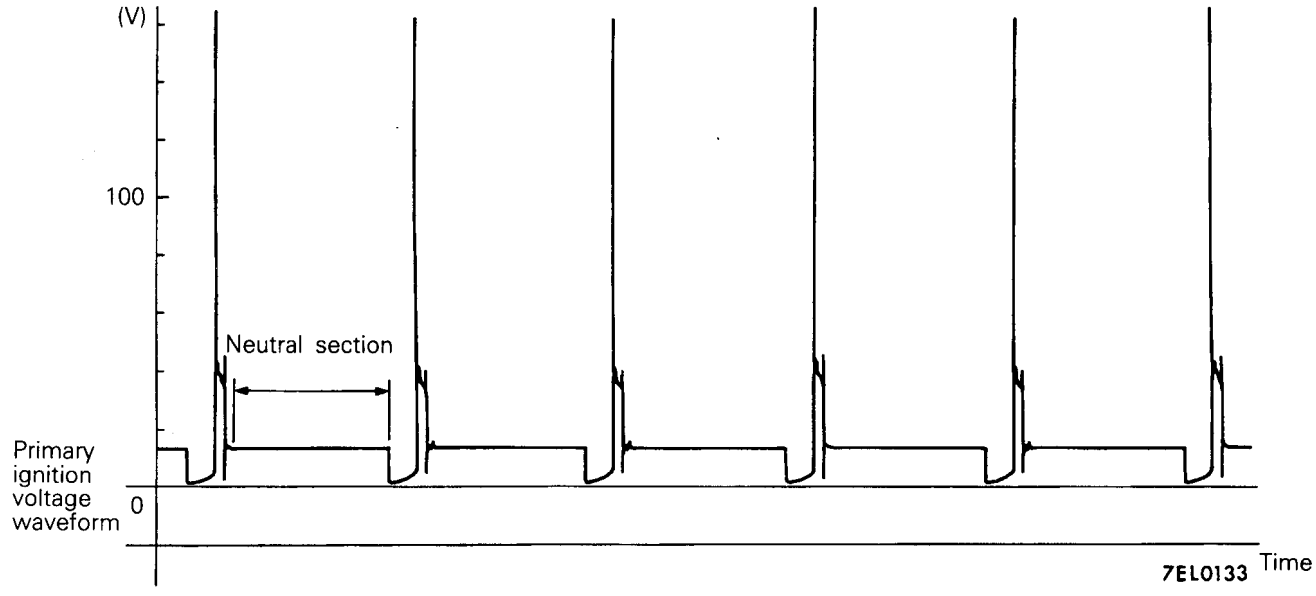
Observation Conditions

Function	Secondary
Pattern height	HIGH (or LOW)
Pattern selector	Raster
Engine revolutions	Curb idle speed



Observation Conditions (Only PATTERN SELECTOR below changes from the above conditions.)

PATTERN SELECTOR	DISPLAY



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WAVEFORM OBSERVATION POINTS

Point A : The height, length and slope of the spark line (refer to abnormal waveform examples 1, 2, 3 and 4) show the following trends.

Spark line		Plug gap	Condition of electrode	Compression force	Concentration of air mixture	Ignition timing	High tension cable
Length	Long	Small	Normal	Low	Rich	Advanced	Leak
	Short	Large	Large wear	High	Lean	Retarded	High resistance
Height	High	Large	Large wear	High	Lean	Retarded	High resistance
	Low	Small	Normal	Low	Rich	Advanced	Leak
Slope		Large	Plug is fouled	–	–	–	–

Point B : Number of vibrations in reduction vibration section (Refer to abnormal waveform example 5)

Number of vibrations	Coil, condenser
3 or higher	Normal
Except above	Abnormal

Point C : Height of Zener voltage

Height of Zener voltage	Probable cause
High	Problem in Zener diode
Low	Abnormal resistance in primary coil circuit

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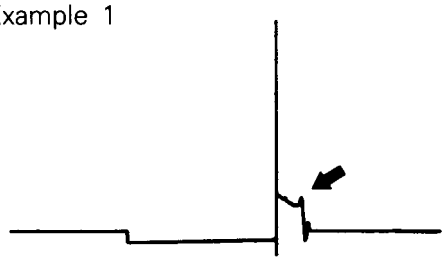
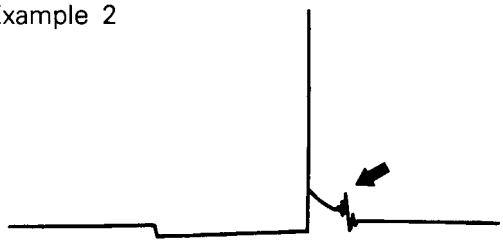
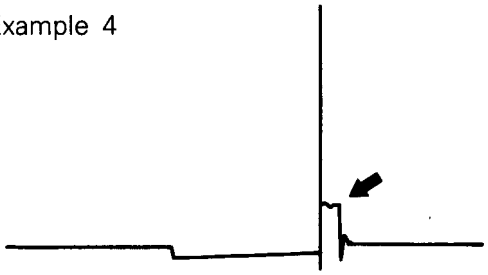
EXAMPLES OF ABNORMAL WAVEFORMS

Abnormal waveform	Wave characteristics	Cause of problem
Example 1  01P0210	Spark line is high and short.	Spark plug gap is too large.
Example 2  01P0211	Spark line is low and long, and is sloping. Also, the second half of the spark line is distorted. This could be a result of mis-firing.	Spark plug gap is too small.
Example 3 01P0212	Spark line is low and long, and is sloping. However, there is almost no spark line distortion.	Spark plug gap is fouled.
Example 4  01P0213	Spark line is high and short	Spark plug cable is nearly falling off. (Causing a dual ignition)
Example 5 01P0214	No waves in wave damping section.	Rare short in ignition coil.

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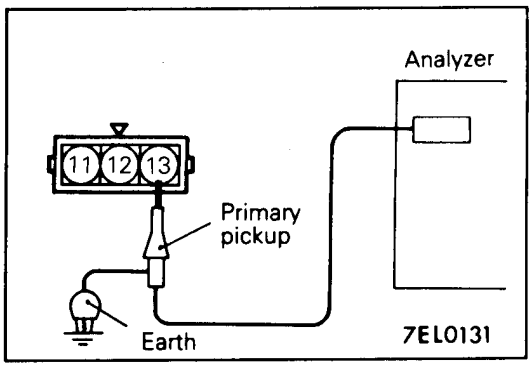


INSPECTION OF PRIMARY IGNITION VOLTAGE <6G74, 6G72-24 VALVE>

MEASUREMENT METHOD

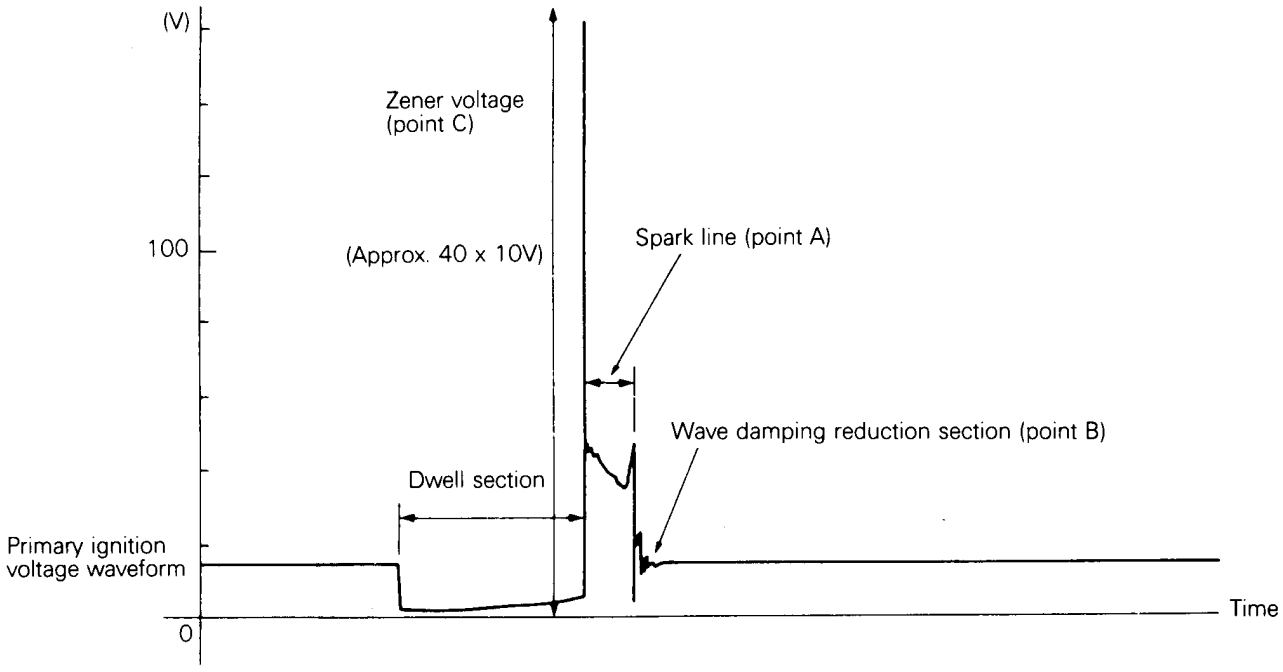
(1) Remove the ignition power transistor connector and connect the special tool (Harness connector: MB991348) in between. All terminals should be connected.
(2) When observing the No. 1 – No. 4 cylinder group, connect the primary pickup of the analyzer probe to the power transistor side connector terminal ⑬.
For the No. 2 – No. 5 cylinder group, connect to terminal ⑫ and for the No. 3 – No. 6 cylinder group, connect to terminal ⑪.
(3) Ground the primary pickup ground terminal.
(4) Clamp the spark plug cable with the trigger pickup.

NOTE
(1) Clamp the spark plug cable of cylinder No. 1, No. 3 or No. 5 which belongs to the same group of the cylinder to which the primary pickup is connected.
(2) The waveform of any cylinder in the same group is displayed on the left side of the screen.

Standard Waveform

Observation conditions

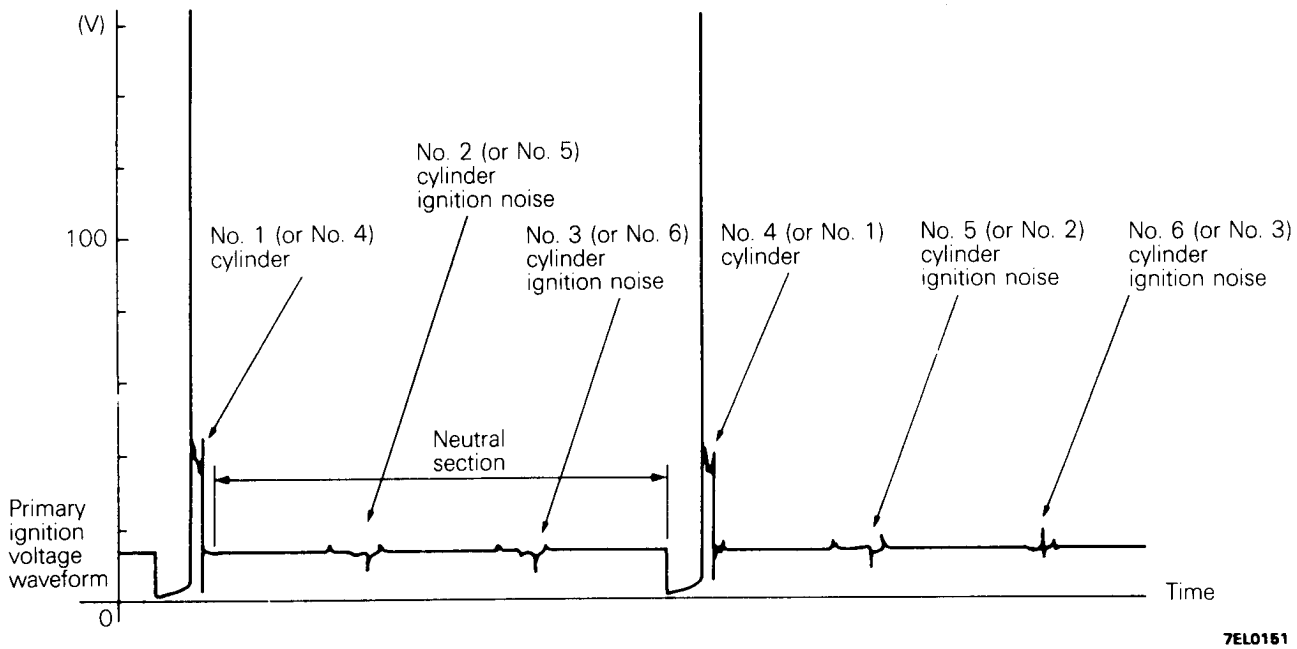
FUNCTION	PRIMARY
PATTERN HEIGHT	HIGH (or LOW)
PATTERN SELECTOR	RASTER
Engine revolutions	Curb idle speed



7EL0149

Observation conditions (Only PATTERN SELECTOR below changes from the above conditions.)

PATTERN SELECTOR	DISPLAY



WAVEFORM OBSERVATION POINTS

For waveform observation points, refer to P.16-20.

EXAMPLES OF ABNORMAL WAVEFORMS

For examples of abnormal waveforms, refer to P.16-21.

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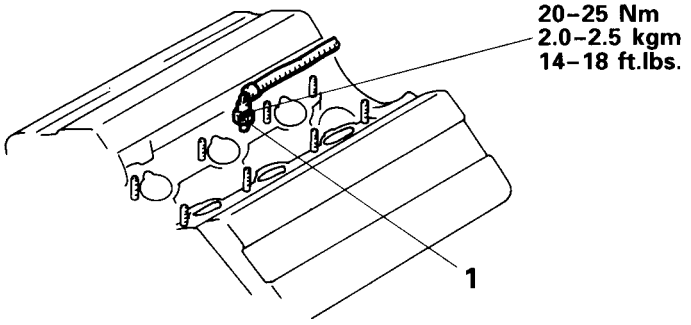
DETONATION SENSOR

REMOVAL AND INSTALLATION

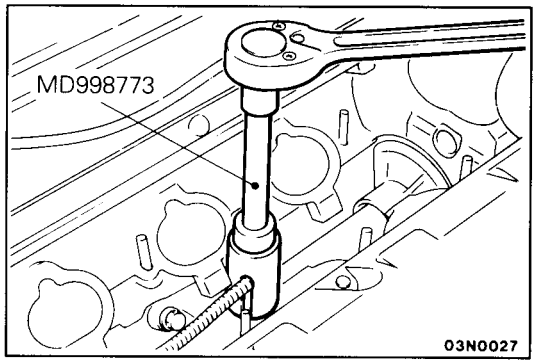
Pre-removal and Post-installation Operation
- Removal and installation of intake manifold (Refer to GROUP 15 – Intake Manifold)



Removal

◀■▶ ▶■◀ 1. Detonation sensor

Caution
Do not subject the detonation sensor to any shocks.



SERVICE POINT OF REMOVAL

1. REMOVAL OF DETONATION SENSOR

SERVICE POINT OF INSTALLATION

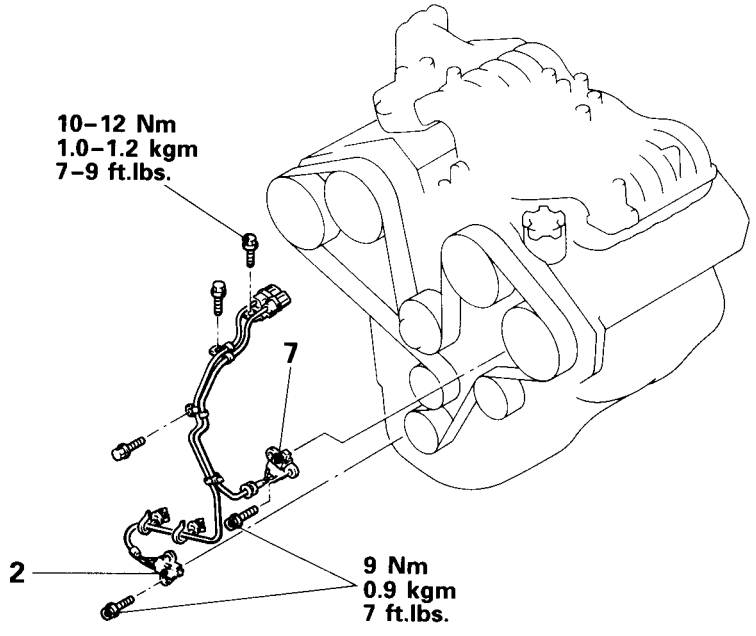
1. INSTALLATION OF DETONATION SENSOR

When the detonation sensor is installed, be sure to tighten it precisely to the specified torque as its installation affects the engine control.

CRANK ANGLE SENSOR AND CAM POSITION SENSOR

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Timing Belt Cover Removal and Installation (Refer to GROUP 11 – Timing Belt.)



Removal steps
1. Cam position sensor
2. Crank angle sensor

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NOTES

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GLOW SYSTEM

SPECIFICATIONS

SERVICE SPECIFICATIONS

E16EB--

Items		Specifications
For super quick glow system		
Glow plug resistance [at 5 – 35°C (41 – 95°F)]	Ω	0.20 – 0.26
Glow plug relay coil resistance	Ω	3
For auto glow system		
Glow plug resistance [at 5 – 35°C (41 – 95°F)]	Ω	0.22 – 0.28
Glow plug relay coil resistance	Ω	20
For self-regulating glow system		
Glow plug resistance [at 5 – 35°C (41 – 95°F)]	Ω	0.5
Glow plug relay coil resistance	Ω	approx. 3
Dropping resistor resistance	Ω	0.14 – 0.16

SEALANT

E16EE--

Item	Specified sealant	Remark
Engine coolant temperature sensor	3M Nut Locking Part No. 4171 or equivalent	Drying sealant

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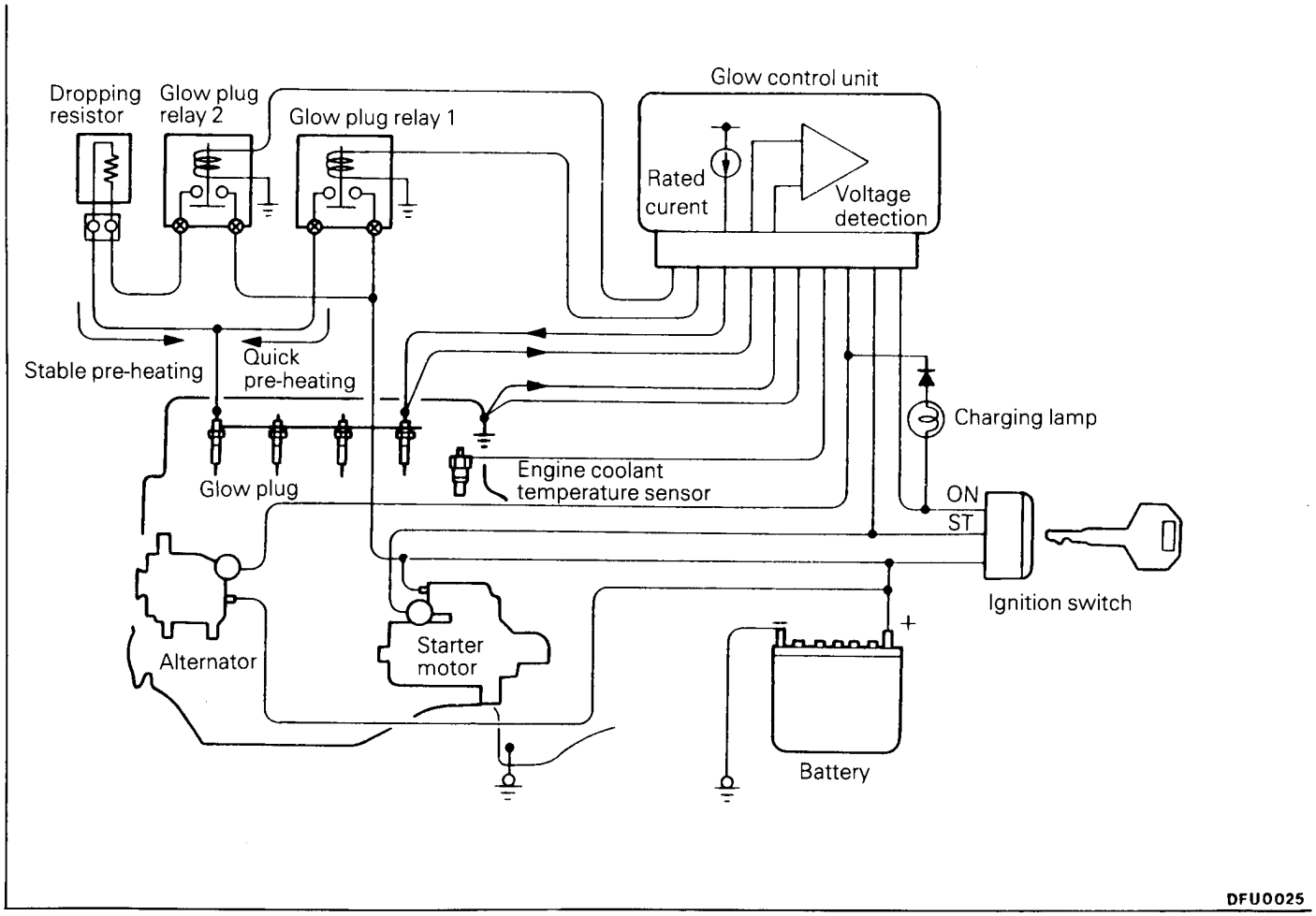
SERVICE ADJUSTMENT PROCEDURES

E16EGAI

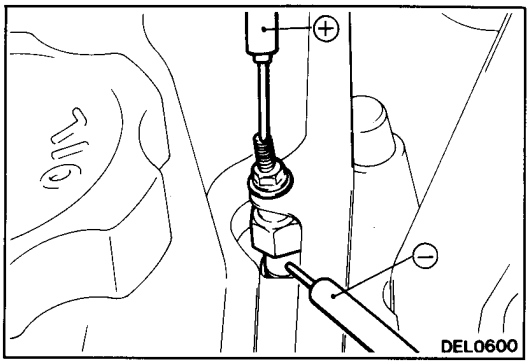
SUPER QUICK GLOW SYSTEM

SUPER QUICK GLOW SYSTEM INSPECTION



(1) Check that the battery voltage is 11-13V.
(2) Check that the engine coolant temperature is 20°C (68°F) or less.

NOTE
If the engine coolant temperature is too high, disconnect the engine coolant temperature sensor connector.



(3) Measure the resistance between the glow plug plate and the glow plug body (earth).

Standard value: 0.05–0.07 Ω [at 5–35°C (41–95°F)]

NOTE
The resistance value is the parallel resistance value for the four glow plugs.

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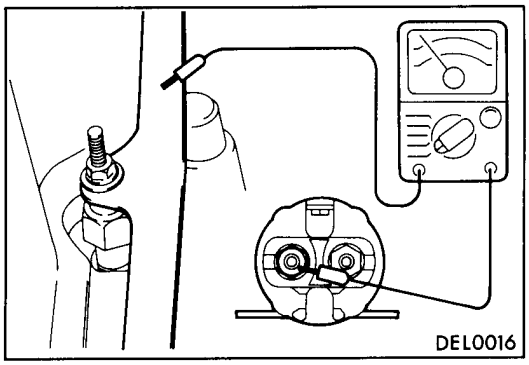
PWJE9086



(4) Measure the resistance between the (G) terminal of glow plug relay 2 and the glow plug plate.

Standard value: 0.14–0.16 Ω

Caution
Measure the resistance after checking that battery voltage is not applied to the (G) terminal.

(5) Connect the voltmeter between the glow plug plate and the glow plug body.

(6) Measure the voltage immediately after the ignition switch is turned to "ON" (without starting the engine).

Standard value: 9–11V (after approx. 2–4 seconds it drops to 0V)

NOTE
The time taken for the voltage to drop will vary depending on the temperature of the glow plugs and the voltage applied. (Refer to the reference illustration.)

(7) Measure the voltage while the engine is cranking.

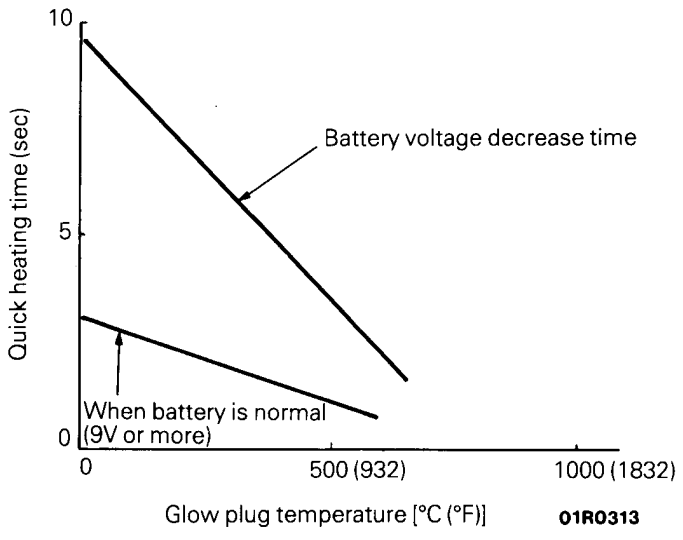
Standard value: 4V or more

(8) Start the engine and measure the voltage while the engine is warming up. However, if the engine coolant temperature increases to 30°C or more, or if 30 seconds have elapsed since the engine was started, the voltage will normally become 0V. (Refer to the reference illustration on the next page.)

Standard value: 5–8V

Reference

Relationship between glow plug temperature (resistance value) and current flow time



Example
① When battery voltage is normal (9V or above) and the glow plugs are cold, even to heat the plugs to 900°C (1652°F) or more takes approximately 3 seconds.
② On the other hand, when battery voltage is normal (9V or more) and the glow plugs are hot [500°C (932°F)] or more, the time taken for current to flow is reduced.

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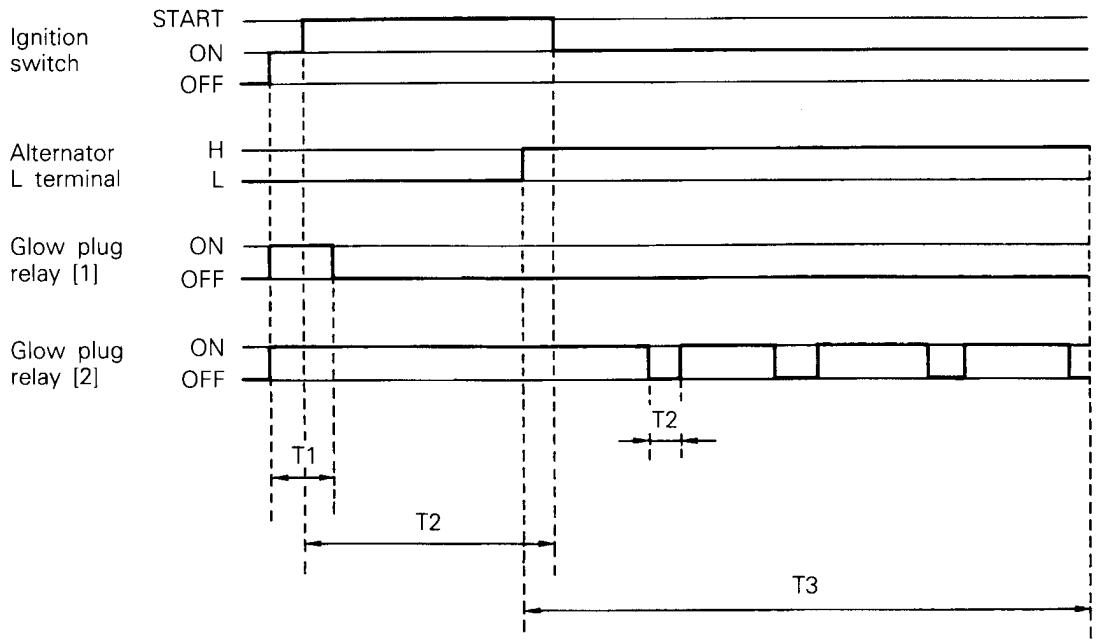
Reference

Glow plug current timing chart

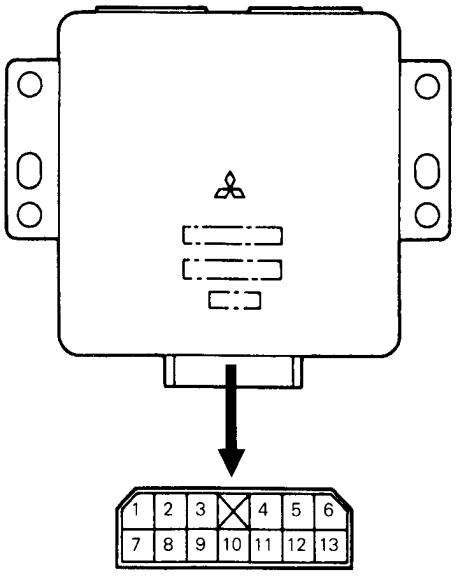


DEL0021

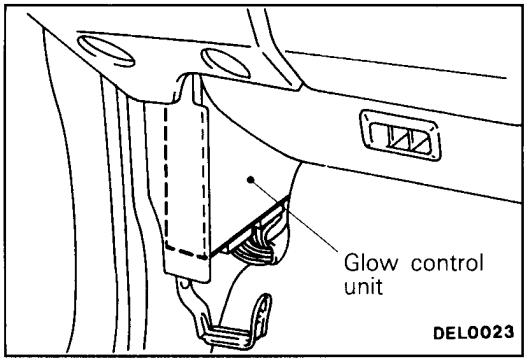
T1: Quick heating time
T2: Glow plug relay [2] drive time when engine is cranking
T3: Glow plug relay [2] drive time after engine starts
T4: Turns off when temperature rises too far

NOTE Afterglow occurs only when engine coolant temperature is 30°C (86°F) or less, and for approximately 30 seconds after the engine is started, turns ON and OFF to prevent the temperature of the glow plugs from exceeding the target temperature [approx. 1050°C (1922°F)].

GLOW CONTROL UNIT INSPECTION



DEL0034



DEL0023

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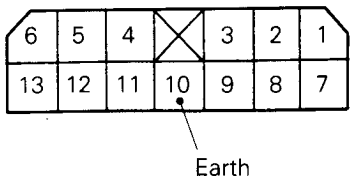
(1) Measure the voltage at the control unit terminals.
NOTE
(1) Inspect with the control unit connector connected.
(2) When measuring the voltage, connect the control unit terminal (10) to the earth.

Terminal Voltage Reference Table

Control unit inspection terminal	Inspection item	Inspection conditions		Standard value
1	Ignition switch (IG power supply)	Ignition switch	"OFF" → "ON"	Battery voltage
			"ON" → "OFF"	0 – 0.5V
2	Ignition switch (ST power supply)	Ignition switch	"OFF" → "START"	More than 8V
6	Alternator L-terminal	Ignition switch	"OFF" → "ON"	1 – 4V
		Idle		More than 11V
7	Glow plug relay 1	Ignition switch	"OFF → "ON"	9 – 12V After approx. 3 seconds 0 – 0.5V
8	Glow plug relay 2	Ignition switch	"OFF" → "ON"	9 – 12V After approx. 3 seconds 0 – 0.5V
13	Engine coolant temperature sensor	Ignition switch "OFF → "ON"	When engine coolant temperature is −20°C (−4°F)	4.3 – 4.5V
			When engine coolant temperature is 0°C (32°F)	3.7 – 3.9V
			When engine coolant temperature is 20°C (68°F)	2.8 – 3.0V
			When engine coolant temperature is 40°C (104°F)	1.9 – 2.1V
			When engine coolant temperature is 80°C (176°F)	0.5 – 0.7V

View of harness-side connector of glow control unit from terminal side (13P)



DEL0602

(2) Remove the control unit connector and check the continuity between the harness-side connector terminals.

Inspection terminal	Inspection item	Continuity (resistance value)
4 – 10	Glow plug constant current circuit	Continuity (approx. 0.06Ω)
5 – 11	Glow plug voltage measurement circuit	Continuity (approx. 0.06Ω)
7 – 10	Glow plug relay 1	Continuity (approx. 3Ω)
8 – 10	Glow plug relay 2	Continuity (approx. 3Ω)

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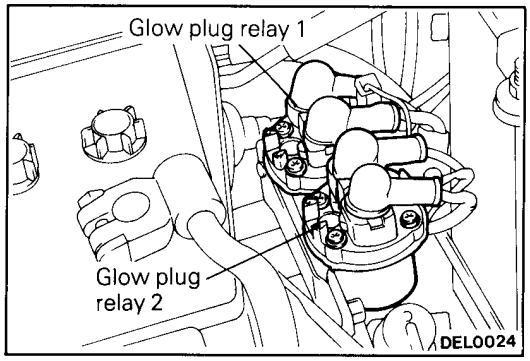


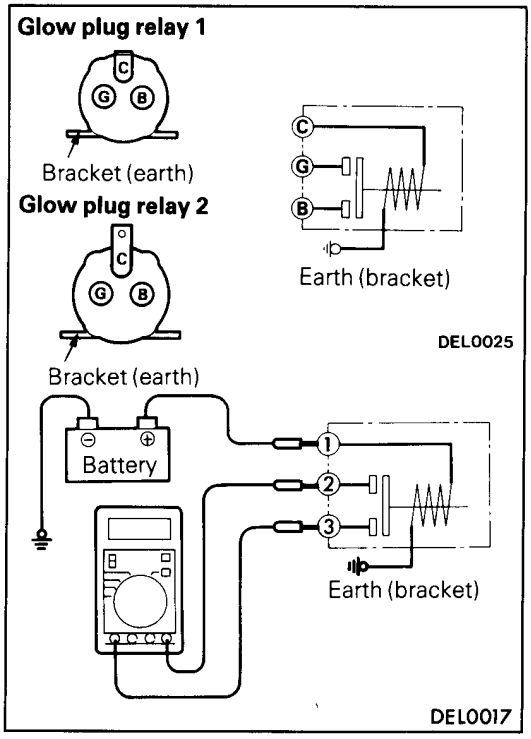
GLOW PLUG RELAYS 1 AND 2 INSPECTION

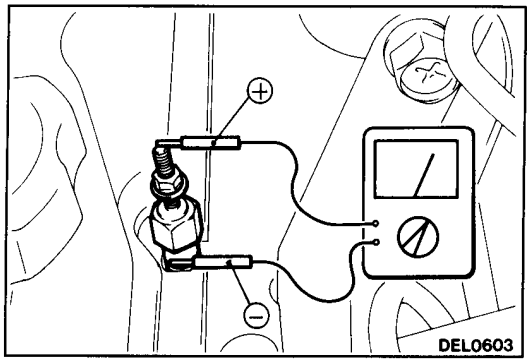
(1) Check that there is continuity (approx. 3 Ω between the glow plug relay (C) terminal and the bracket (earth).
(2) Use jumper leads to connect the glow plug relay terminal (C) with the battery (+) terminal and the bracket with the battery (–) terminal.

Caution
(1) Before using the jumper leads, the harnesses connected to glow plug relay (B) and (G) Terminals must always be removed.
(2) Do not short out the disconnected harness-side terminals to the earth.
(3) Be extremely careful when connecting the jumper leads, as if the terminals are connected incorrectly, it will damage the relays.

(3) Check the continuity between glow plug relay (B) and (G) terminals with the jumper lead connected from the battery (–) terminal and with the jumper lead disconnected.

Jumper lead from battery (–) terminal	Continuity between (B) and (G) terminals
Connected	Continuity (0.01 Ω or less)
Disconnected	No continuity (∞ Ω)

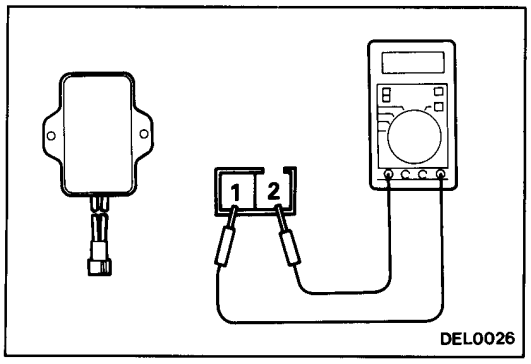




GLOW PLUG INSPECTION

(1) Remove the glow plug plate.
(2) Measure the resistance between the glow plug terminals and the body.

Standard value: 0.20–0.26 Ω [at 5–35°C (41–95°F)]



DROPPING RESISTOR INSPECTION

(1) Disconnect the dropping resistor connector.
(2) Measure the resistance between the dropping resistor terminals.

Standard value: 0.14–0.16 Ω

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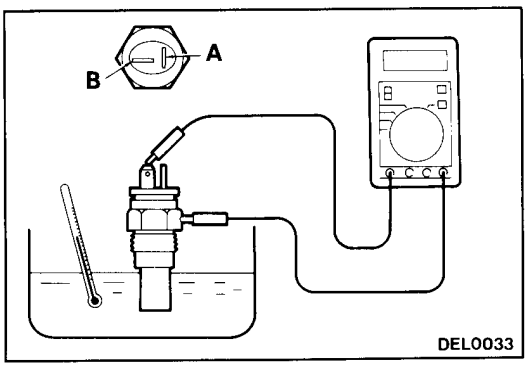


ENGINE COOLANT TEMPERATURE SENSOR INSPECTION

(1) Remove the engine coolant temperature sensor.
(2) While the sensor section of the engine coolant temperature sensor is submerged, measure the resistance between (B) terminal and the body.

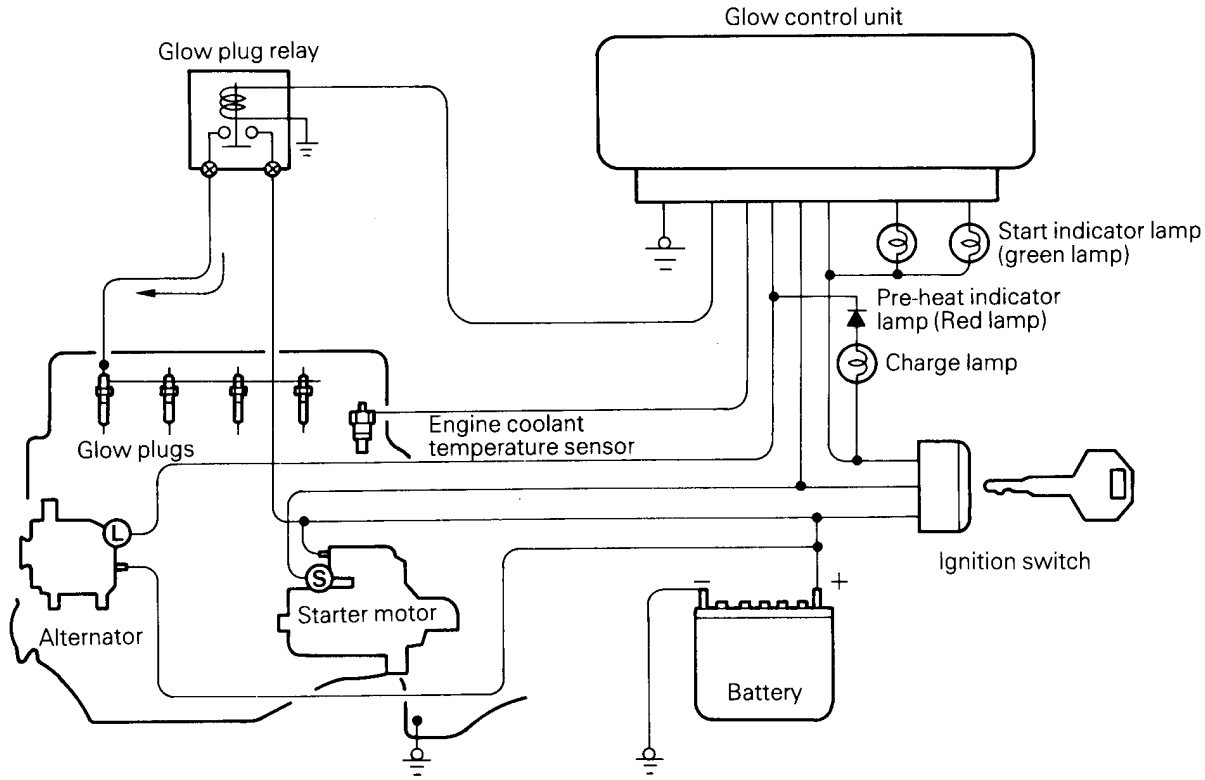
Temperature [°C (°F)]	Resistance value (k Ω)
−20 (−4)	24.8 ± 2.5
0 (32)	8.6
20 (68)	3.25 ± 0.33
40 (104)	1.5
80 (176)	0.3

(3) After applying specified sealant to the thread, tighten to the specified torque.

Specified sealant: 3M Nut Locking Part No. 4171 or equivalent
Tightening torque: 30 Nm (3kgm, 22 ft.lbs.)

AUTO GLOW SYSTEM

AUTO GLOW SYSTEM INSPECTION



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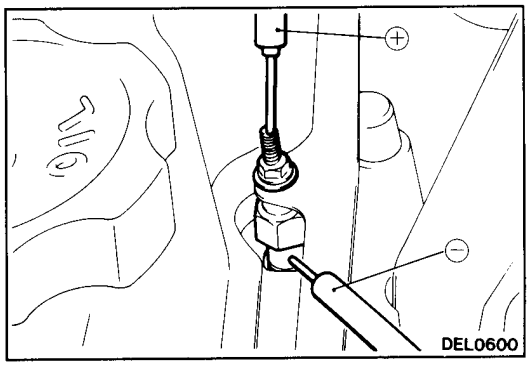

(1) Check that the battery voltage is 11-13V.
(2) Measure the resistance between the glow plug plate and the glow plug body (earth).

Standard value: 0.05–0.07 Ω [at 5–35°C (41–95°F)]

NOTE
The resistance value is the parallel resistance value for the four glow plugs.

(3) Connect the voltmeter between the glow plug plate and the glow plug body (earth).
(4) Measure the voltage immediately after the ignition switch is turned to "ON" (without starting the engine).

Standard value: 9–11V (after 30–60 seconds it drops to 0V)

Furthermore, check that the pre-heat indicator lamp (red) illuminates immediately after the ignition switch is turned to "ON", and that as soon as it switches off the start indicator lamp (green) illuminates.

NOTE
The time taken for the voltage to appear (current flow time) will vary depending on the engine coolant temperature.

(5) Measure the voltage while the engine is cranking.

Standard value: 6V or more

(6) Start the engine and measure the voltage while the engine is warming up. However, the voltage will normally become 0V between 1 – 30 seconds after the engine was started. (Refer to the reference illustration on the next page.)

Standard value: 12–15V

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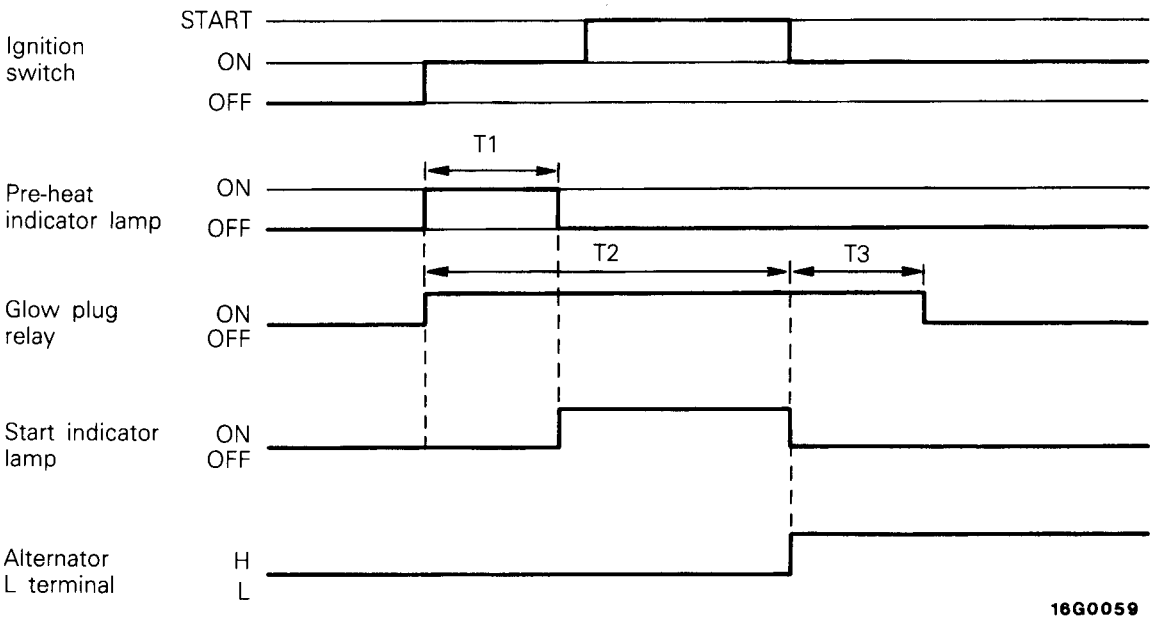
Reference

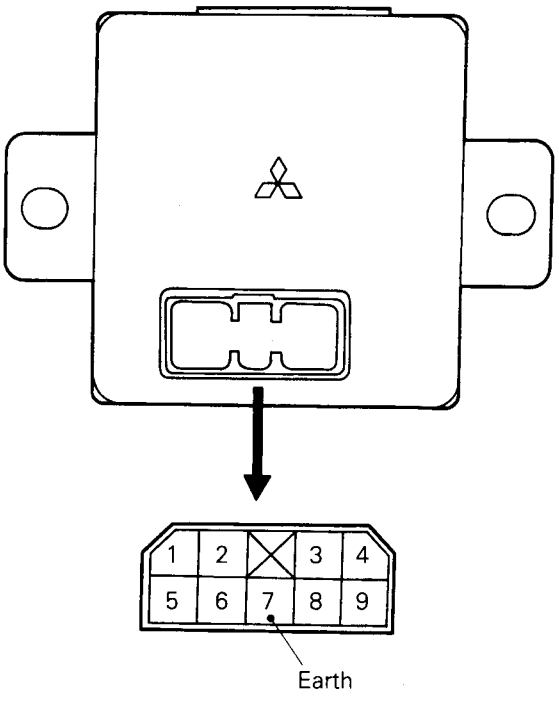
Glow plug current timing chart

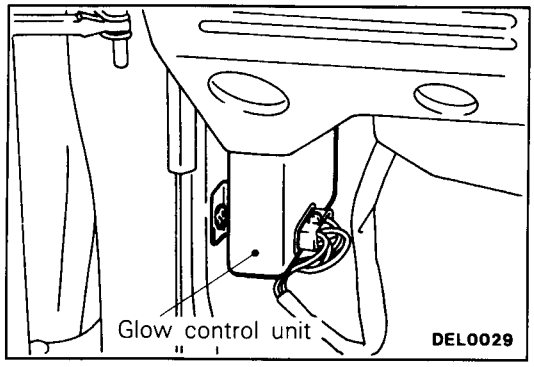


T1: Pre-heating indicator lamp
T2: Glow plug relay drive time after power is ON
T3: Glow plug relay drive time after combustion is completed (afterglow)

NOTE The lower the engine coolant temperature, the longer the after-glow time for T3.

GLOW CONTROL UNIT INSPECTION





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(1) Measure the voltage at the control unit terminals.
NOTE
1. Inspect with the glow control unit connector connected.
2. When measuring, connect the glow control unit terminal ⑦ to the earth.

Terminal Voltage Reference Table

Control unit inspection terminal	Inspection item	Inspection conditions		Standard value
1	Ignition switch (IG power supply)	Ignition switch	"OFF" → "ON"	Battery voltage
			"ON" → "OFF"	0 – 0.5V
3	Pre-heat display lamp	Ignition switch	"OFF" → "ON"	0 – 1V After approx. 6 seconds [when engine coolant temperature is 20°C (68°F)] 11 – 13V
4	Alternator L-terminal	Ignition switch	"OFF" → "ON"	1 – 4V
		Idle		More than 11V
5	Glow plug relay 1	Ignition switch	"OFF" → "ON"	9 – 12V After approx. 36 seconds [when engine coolant temperature is 20°C (68°F)] 0 – 0.5V
6	Ignition switch (ST power supply)	Ignition switch	"OFF" → "START"	More than 8V
8	Start display lamp	Ignition switch	After "OFF" → "ON" After approx. 6 seconds have passed [when engine coolant temperature is 20+DO+C (68°F)]	0 – 1V After approx. 30 seconds [when engine coolant temperature is 20°C (68°F)] 11 – 13V
9	Engine coolant temperature sensor	Ignition switch "OFF" → "ON"	When engine coolant temperature is −20°C (−4°F)	4.3 – 4.5V
			When engine coolant temperature is 0°C (32°F)	3.7 – 3.9V
			When engine coolant temperature is 20°C (68°F)	2.8 – 3.0V
			When engine coolant temperature is 40°C (104°F)	1.9 – 2.1V
			When engine coolant temperature is 80°C (176°F)	0.5 – 0.7V

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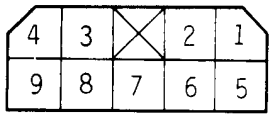
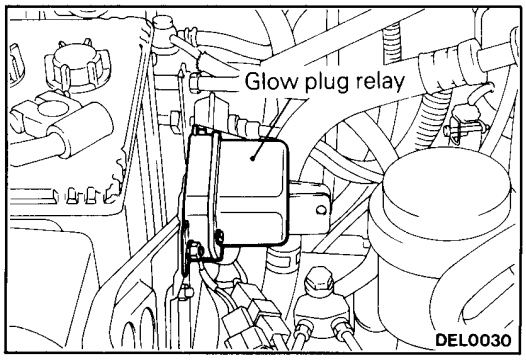
Glow control unit harness-side connector seen from terminal side



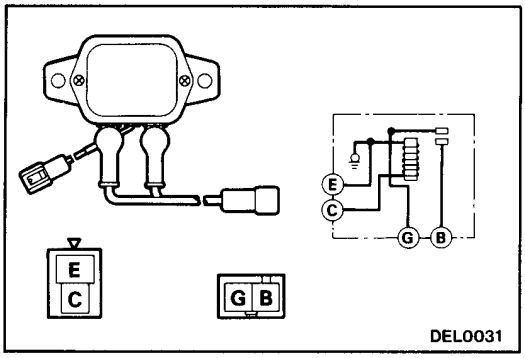
16G0053

(2) Disconnect the glow control unit connector and check the continuity between the harness-side connector terminals.

Inspection terminal	Inspection item	Continuity (resistance value)
5–7	Glow plug relay	Continuity (approx. 20Ω)



DEL0030



DEL0031

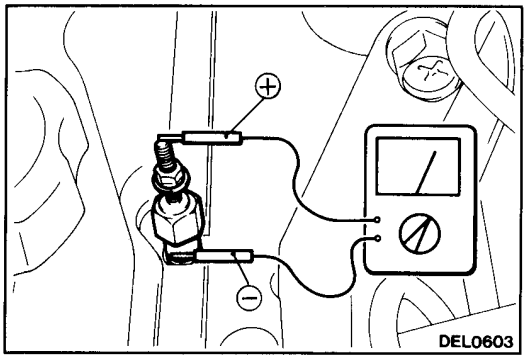
GLOW PLUG RELAY INSPECTION

(1) Check that there is continuity (20 between glow plug relay terminal (C) and terminal (E).
(2) Use jumper leads to connect the glow plug relay terminal (C) with the battery (+) terminal and terminal (E) with the battery (–) terminal.

Caution
(1) Before using the jumper leads, the harnesses connected to glow plug relay (B) and (G) terminals must always be removed.
(2) Do not short out the disconnected harness-side terminals to the earth.
(3) Be extremely careful when connecting the jumper leads, as if the terminals are connected incorrectly, it will damage the relays.

(3) Check the continuity between glow plug relay (B) and (G) terminals with the jumper lead connected from the battery (–) terminal and with the jumper lead disconnected.

Jumper lead from battery (–) terminal	Continuity between (B) and (G) terminals
Connected	Continuity (0.01 Ω or less)
Disconnected	No continuity (∞ Ω)



DEL0603

GLOW PLUG INSPECTION

(1) Remove the glow plug plate.
(2) Measure the resistance between the glow plug terminals and the body.

Standard value: 0.22–0.28Ω [at 5–35°C (41–95°F)]

ENGINE COOLANT TEMPERATURE SENSOR INSPECTION

Refer to P.16-28.

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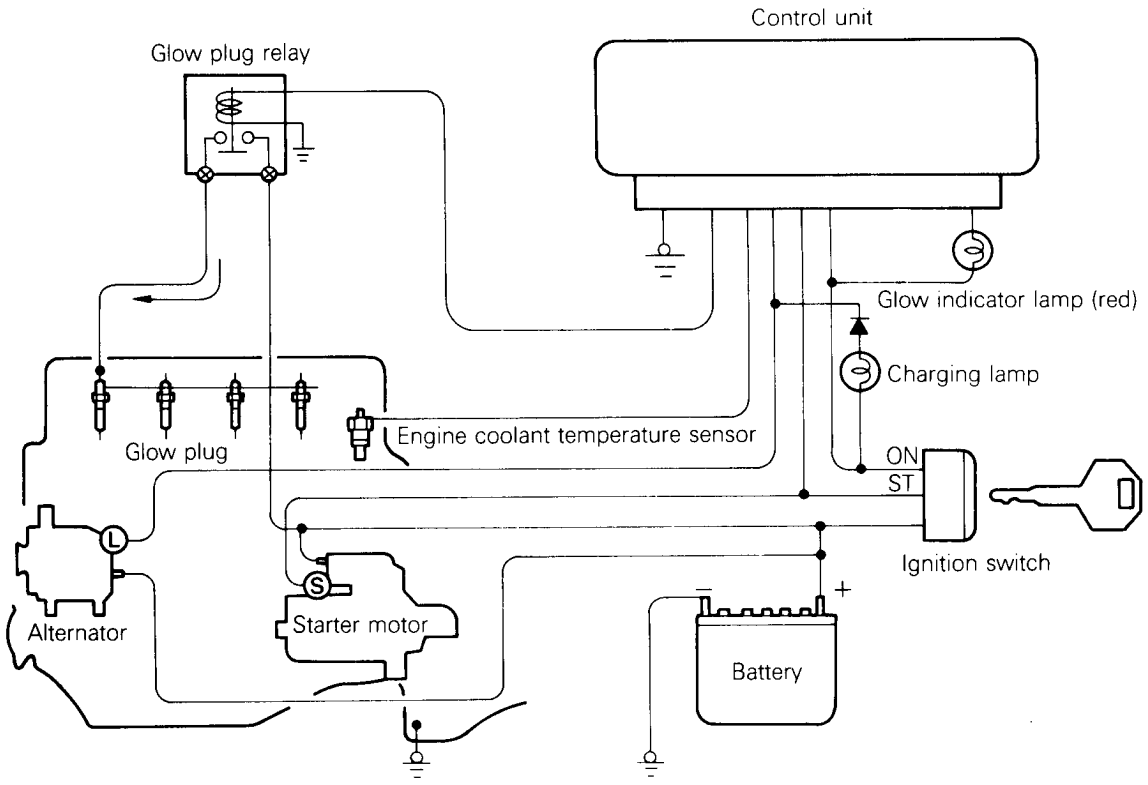
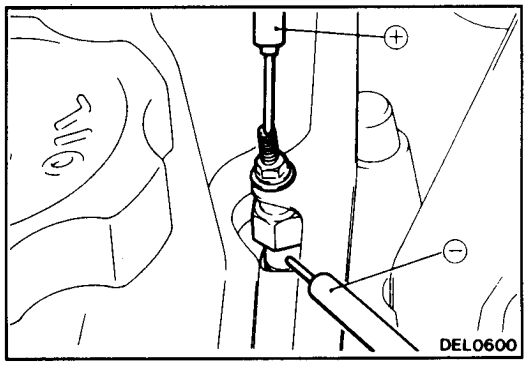
SELF-REGULATING GLOW SYSTEM

SELF-REGULATING GLOW SYSTEM INSPECTION





(1) Check to be sure that the battery voltage is 11 – 13V.
(2) Check to be sure that the engine coolant temperature is 40°C (104°F) or less.

NOTE
If the engine coolant temperature is too high, disconnect the engine coolant temperature sensor connector.

(3) Measure the resistance between the glow plug plate and the glow plug body (earth).

Standard value : 0.10–0.15 Ω [at 20°C (68°F)]

NOTE
The resistance value is the parallel resistance value for the four glow plugs.

(4) Connect a voltmeter between the glow plug plate and the glow plug body (earth).

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(5) Measure the voltage immediately after the ignition switch is turned to ON (without starting the engine).

Standard value : 9–11V
Drops to 0 V after 4-8 seconds have passed)

In addition, check to be sure that the glow indicator lamp (red) illuminates and then switches off immediately after the ignition switch is turned to ON.

NOTE
The time during which the voltage appears (energising time) will depend on the engine coolant temperature.

(6) Measure the voltage while the engine is cranking.

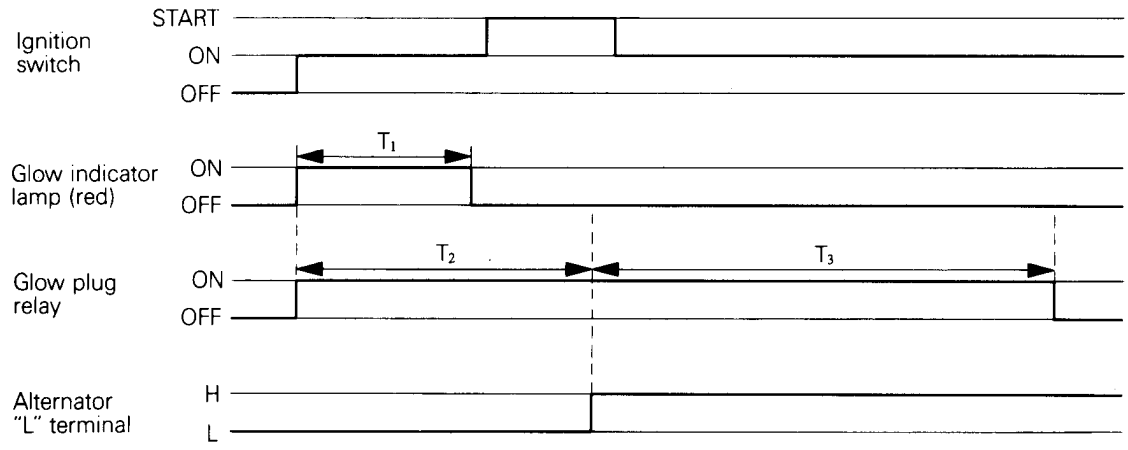
Standard value: 6 V or more

(7) Start the engine and measure the voltage while the engine is warming up.
However, if the engine coolant temperature rises above 60°C (140°F) or when 180 seconds have passed since the engine was started, the voltage will normally return to 0 V. (Refer to the Glow Plug Energisation Timing Chart.)

Standard value: 12–15 V

<Reference>

Glow Plug Energisation Timing Chart



DEN0063

T_1 : Glow indicator lamp
T_2 : Glow plug relay drive time after ignition switch is turned ON
T_3 : Glow plug relay drive time after engine starts (afterglow)

NOTE
Afterglow time T_3 becomes longer as the engine coolant temperature drops.

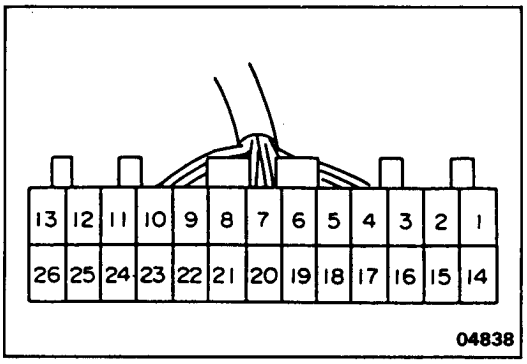
GLOW & EGR CONTROL UNIT INSPECTION

<TERMINAL VOLTAGE MEASUREMENT>

NOTE
1. Inspect with the glow & EGR control unit connector connected.
2. Connect glow & EGR control unit terminal ㉖ to the earth.

Terminal Voltage Quick-Reference Table

Glow & EGR ECU inspection terminal	Inspection item	Inspection condition		Standard value
5	Engine coolant temperature sensor (Engine coolant temperature detection)	Ignition switch "ON" → "OFF"	Engine coolant temperature: –20°C (–4°F)	4.3 – 4.5V
			Engine coolant temperature: 0°C (32°F)	3.7 – 3.9V
			Engine coolant temperature: 20°C (68°F)	2.8 – 3.0V
			Engine coolant temperature: 40°C (104°F)	1.9 – 2.0V
			Engine coolant temperature: 80°C (176°F)	0.5 – 0.7V
12	Ignition switch (power supply)	Ignition switch "OFF" → "START"		8V or more
14	Glow plug relay (glow time control)	Ignition switch "OFF" → "ON" Engine coolant temperature: 40°C (104°F) or less (Pre-glow function inspection)		9–12V ↓ 0–0.5V after approx. 8 sec. (when engine coolant temperature is 20°C (68°F))
17	Glow indicator lamp	Ignition switch "OFF" → "ON" Engine coolant temperature: 40°C (104°F) or less		0–1V ↓ 11–13V after approx. 1 sec. (when engine coolant temperature is 20°C (68°F))
23	Alternator charging signal ("L" terminal)	Ignition switch "OFF" → "ON"		1 – 4V
		Engine is idling		11V or more
26	Earth	—		—



<HARNESS CONTINUITY INSPECTION>

(1) Disconnect the glow & EGR control unit connector.
(2) Check the continuity between the harness-side connector terminals.

Inspection terminals	Inspection item	Continuity
14 – 26	Glow plug relay	Continuity (approx. 3Ω)

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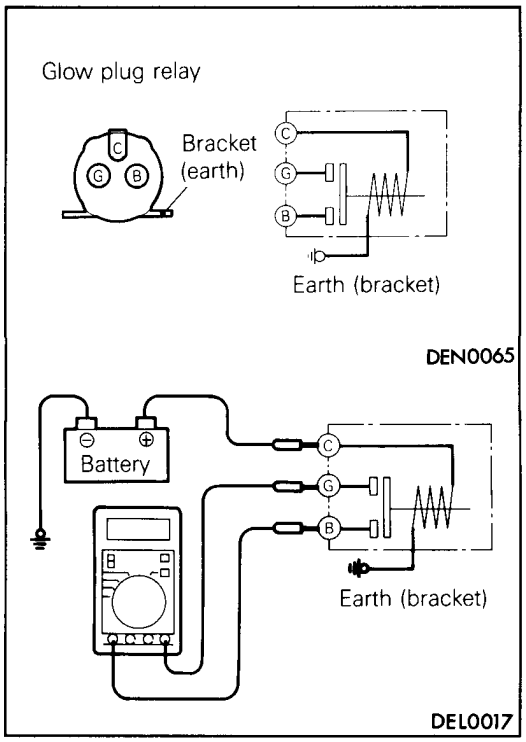
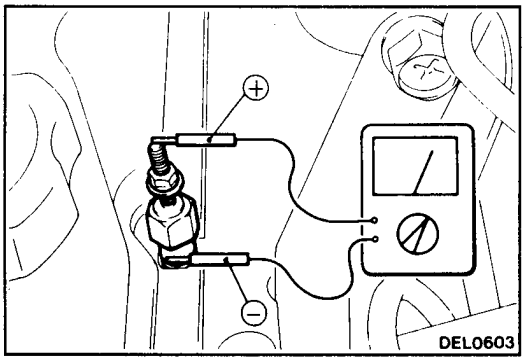
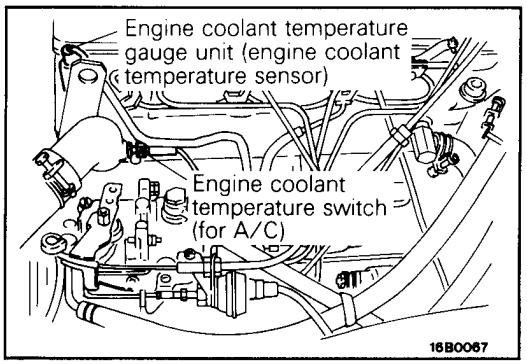
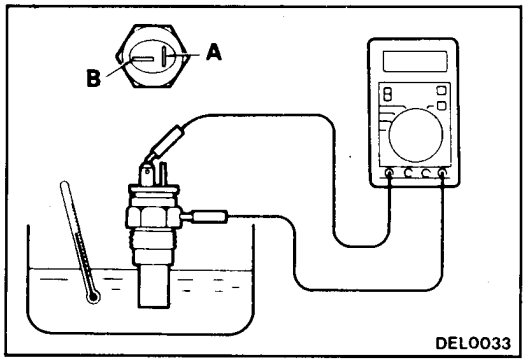
ADDED









GLOW PLUG RELAY INSPECTION

(1) Check to be sure that there is continuity (approx. 3Ω) between the glow plug relay Ⓒ terminal and the bracket (earth).

(2) Use jumper leads to connect the glow plug relay terminal Ⓒ with the battery (+) terminal and the bracket with the battery (–) terminal.

Caution

(1) Before using the jumper leads, the harnesses connected to glow plug relay terminals Ⓑ and Ⓖ must always be disconnected.

(2) Do not short the disconnected harness-side terminals to the earth.

(3) Do not connect the jumper leads to a wrong terminal, or the relays may be damaged.

(3) Check the continuity between glow plug relay terminals Ⓑ – Ⓖ with the jumper lead connected from the battery (+) terminal and with the jumper lead disconnected.

Jumper lead from battery (–) terminal	Continuity between terminals (B) – (G)
Connected	Continuity (0.01Ω or less)
Disconnected	No continuity (∞Ω)

GLOW PLUG INSPECTION

(1) Remove the glow plug plate.

(2) Measure the resistance between the glow plug terminals and the body.

Standard value : 0.5 Ω [at 20°C (68°F)]

ENGINE COOLANT TEMPERATURE SENSOR INSPECTION

(1) Remove the engine coolant temperature sensor.

(2) Measure the resistance between terminal Ⓐ and the body while immersing the engine coolant temperature sensor in warm water.

Temperature [°C (°F)]	Resistance value kΩ
–20 (–4)	24.8 ± 2.5
0 (32)	8.6
20 (68)	3.25 ± 0.33
40 (104)	1.5
80 (176)	0.3

(3) After applying specified sealant to the thread section, tighten the sensor to the specified torque.

Dry sealant: 3M Nut Locking Part No. 4171 or equivalent

Tightening torque : 30 Nm (3.0 kgm, 22 ft.lbs.)

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EMISSION CONTROL

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E17AA--

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SPECIFICATIONS

GENERAL SPECIFICATIONS

E17CA--

6G72 Engine

Items	Name	Specifications
Crankcase emission control system	Positive crankcase ventilation (PCV) valve	Variable flow type (Purpose: HC reduction)
Evaporative emission control system	Canister 2-way valve Purge control solenoid valve	Equipped Equipped ON-OFF solenoid valve (Purpose: HC reduction)
Exhaust emission control system	Air-fuel ratio control device-MPI system	Oxygen sensor feedback type (Purpose: CO, HC, NOx reduction)
	Catalytic converter	Monolith type (Purpose: CO, HC, NOx reduction)
	Exhaust gas recirculation system <24 valve engine> EGR valve EGR solenoid	 Single type Duty cycle type solenoid valve (Purpose: NOx reduction)

6G74 Engine

Items	Name	Specifications
Crankcase emission control system	Positive crankcase ventilation (PCV) valve	Variable flow type (Purpose: HC reduction)
Evaporative emission control system	Canister 2-way valve Purge control solenoid valve	Equipped Equipped ON-OFF solenoid valve (Purpose: CO, HC, NOx reduction)
Exhaust emission control system	Air-fuel ratio control device–MPI system	Oxygen sensor feedback type (Purpose: CO, HC, NOx reduction)
	Catalytic converter	Monolith type (Purpose: CO, HC, NOx reduction)
	Exhaust gas recirculation system EGR valve EGR solenoid	 Single type Duty cycle type solenoid valve (Purpose: NOx reduction)

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4G64 Engine

Items	Name	Specifications
Crankcase emission control system	Positive crankcase ventilation (PCV) valve	Variable flow type (Purpose: HC reduction)
Evaporative emission control system	Canister 2-way valve Purge control solenoid valve	Equipped Equipped ON-OFF solenoid valve (Purpose: HC reduction)
Exhaust emission control system	Air-fuel ratio control device–MPI system	Oxygen sensor feedback type (Purpose: CO, HC, NOx reduction)
	Catalytic converter	Monolith type (Purpose: CO, HC, NOx reduction)
	Exhaust gas recirculation system EGR valve Thermo valve	 Single type Bimetal type (Purpose: NOx reduction)

4D56 Engine

Item	Name	Specifications
Evaporative emission control system	2-way valve	Equipped
Exhaust emission control system <Vehicles for Switzerland>	Exhaust gas recirculation system EGR valve EGR control solenoid valve	 Single type ON-OFF and duty solenoid valve (Purpose: NOx reduction)

4M40 Engine

Items	Name	Specifications
Exhaust emission control system	Exhaust gas recirculation system EGR valve EGR control solenoid valve	 Single type ON-OFF and duty solenoid valve

SERVICE SPECIFICATIONS

E17CB--

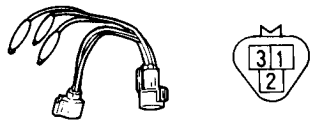
Items		Specifications
<6G72, 6G74 Engine>		
Purge control solenoid valve coil resistance [at 20°C (68°F)]	Ω	36 – 44
EGR solenoid valve coil resistance [at 20°C (68°F)]	Ω	36 – 44
<4G64 Engine>		
EGR valve opening vacuum	mmHg (in. Hg)	30 (1.2)
Thermo valve opening temperature	°C (°F)	65 (149)
<4D56, 4M40 Engine>		
EGR control solenoid valve		
No. 1 and No. 2 resistance [at 20°C (68°F)]	Ω	36 – 44
Lever position sensor output voltage	V	
Idle position		0.3 – 1.5
Fully open		3.7 – 4.9
Speed sensor resistance	kΩ	1.3 – 1.9
Engine coolant temperature sensor resistance [at 20°C (68°F)] [at 80°C (176°F)]	kΩ	3.3 0.3

SEALANTS

E17CE--

Items	Specified sealant	Quantity
Thermo valve thread	3M Nut Locking Part No. 4171 or equivalent	As required

SPECIAL TOOLS

Tool	Number	Name	Use
	MD998478	Test harness	Lever position sensor check

SERVICE ADJUSTMENT PROCEDURES

E17FDAF

EMISSION CONTROL DEVICE REFERENCE TABLE

6G72 Engine

Emission control system / Related parts	Crankcase emission control system	Evaporative emission control system	Air fuel ratio control system	Catalytic converter	Exhaust emission control system	Reference page for each part inspection
PCV valve	×					17-11
Purge control solenoid valve		×				17-14
2-way valve		×				17-15
MPI system component		×	×			Fuel (Group 13)
EGR control solenoid valve <24valve engine>					×	17-18-3
Catalytic converter				×		17-16

6G74 Engine

Emission control system / Related parts	Crankcase emission control system	Evaporative emission control system	Air fuel ratio control system	Catalytic converter	Exhaust emission control system	Reference page for each part inspection
PCV valve	×					17-11-1
Purge control solenoid valve		×				17-14
2-way valve		×				17-15
MPI system component		×	×			Fuel (Group 13)
EGR control solenoid valve					×	17-18-3
Catalytic converter				×		17-16

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4G64 Engine

Emission control system / Related parts	Crankcase emission control system	Evaporative emission control system	Air fuel ratio control system	Catalytic converter	Exhaust emission control system	Reference page for each part inspection
PCV valve	×					17-12
Purge control solenoid valve		×				17-14
2-way valve		×				17-15
MPI system component		×	×			Fuel (Group 13)
Catalytic converter				×		17-16
EGR valve					×	17-17
Thermo valve					×	17-18

4D56 Engine

Emission Control system / Related parts	Evaporative emission control system	Exhaust emission control system	Reference page for each part inspection
2–way valve	x		17–15
EGR valve		x	17–19
EGR solenoid valve No. 1/No. 2		x	17–19
Lever position sensor		x	17–20
Engine speed sensor		x	17–21
Engine coolant temperature sensor		x	17–21

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4M40 Engine

Emission control system / Related parts	Evaporative emission control system	Exhaust emission control system	Reference page for each part inspection
2-way valve	×		17-15
EGR valve		×	17-25
EGR solenoid valve No. 1/No. 2		×	17-25
Lever position sensor		×	17-26
Engine speed sensor		×	17-27
Engine coolant temperature sensor		×	17-27

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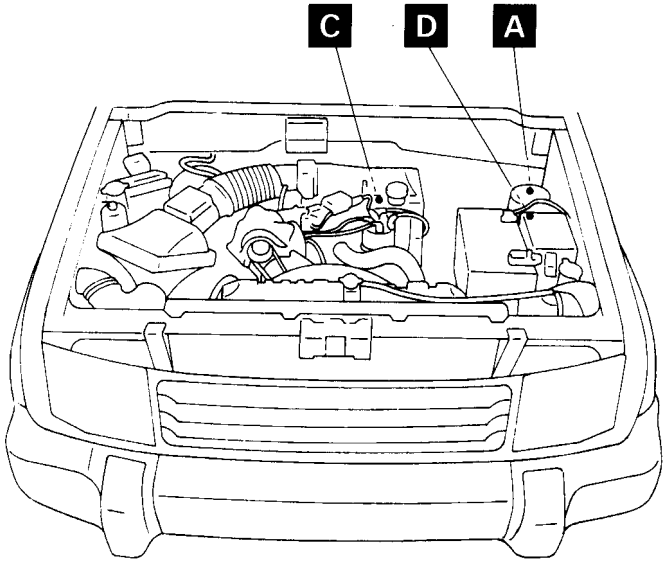
COMPONENT LAYOUT

6G72 – 12Valve Engine



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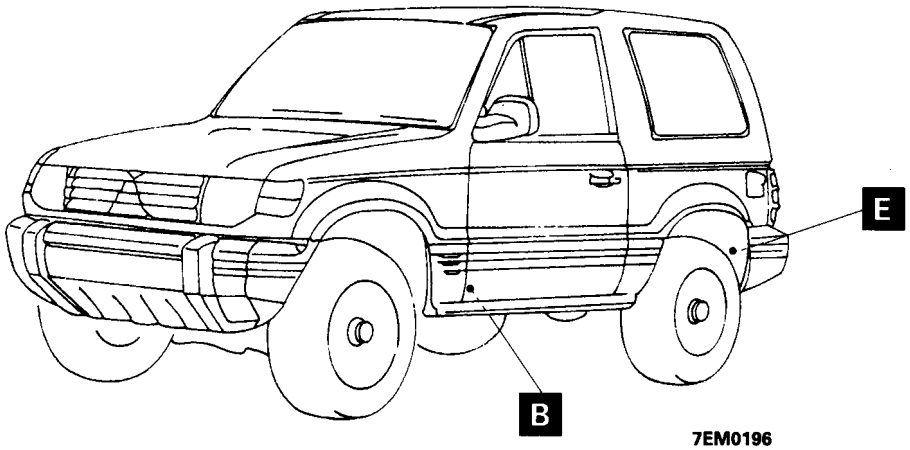
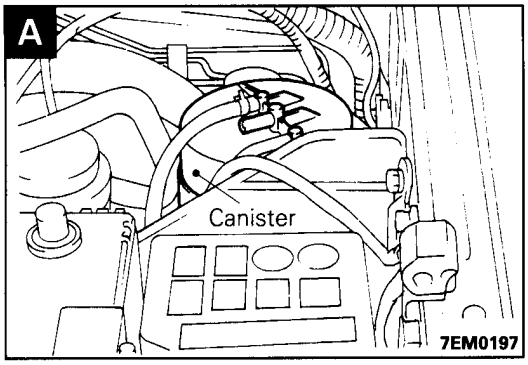


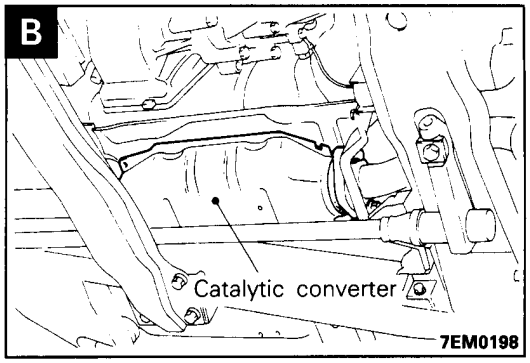
7EM0196

Parts name	Symbol
Canister	A
Catalytic converter	B
PCV valve	C
Purge control solenoid valve	D
2-way valve	E

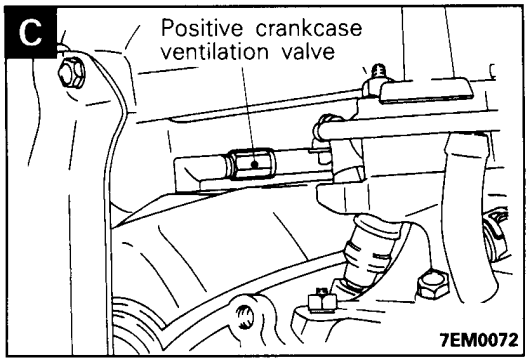
A



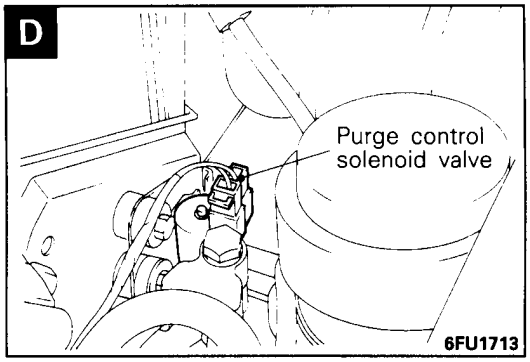
B



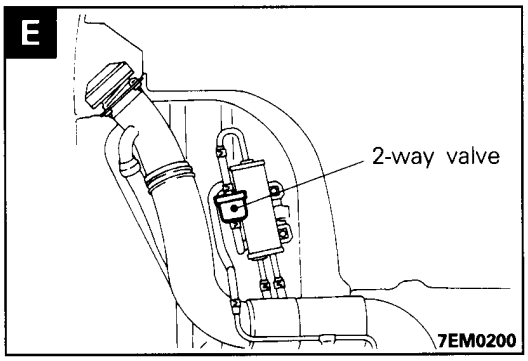
C



D



E



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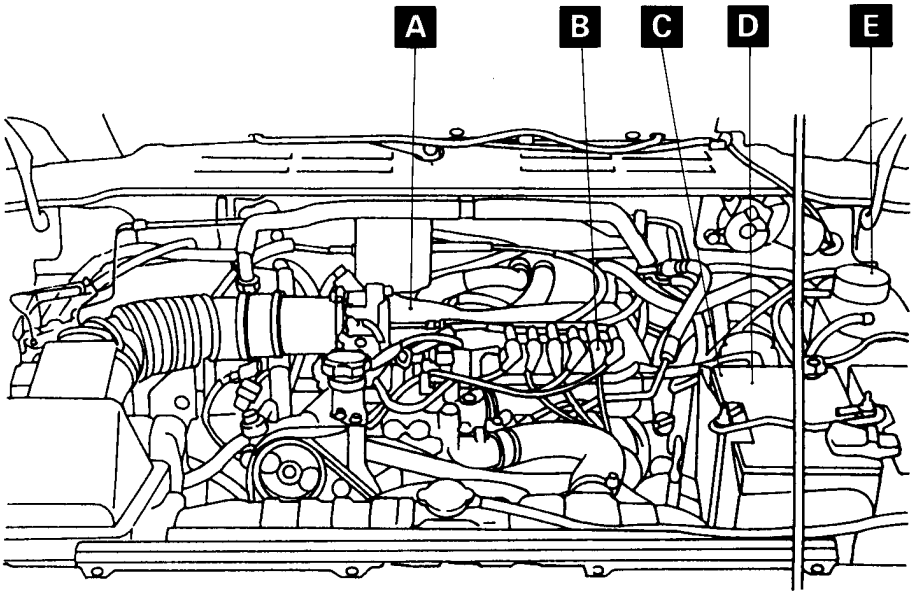
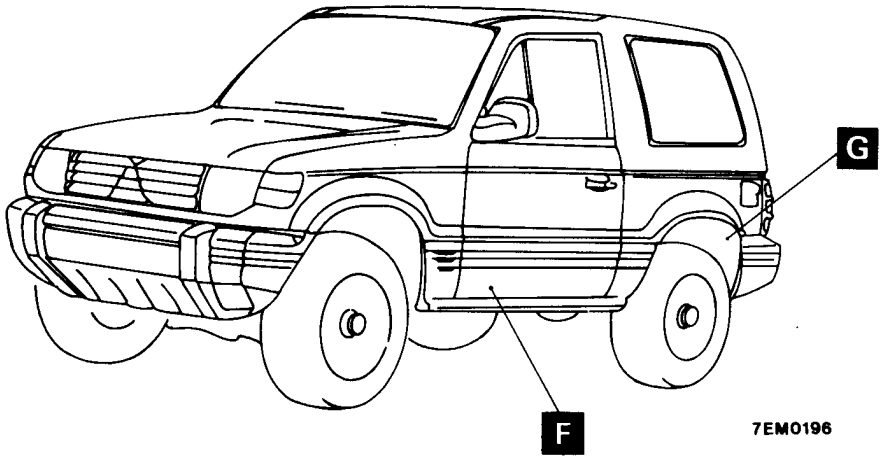
6G72 – 24Valve Engine



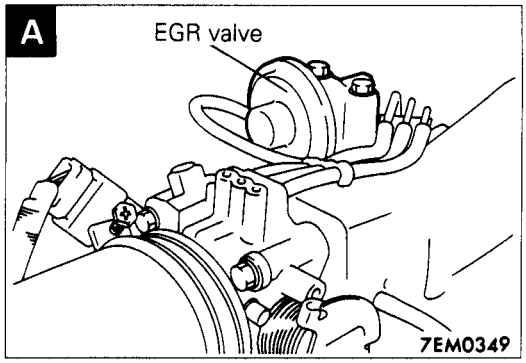
7EM0348



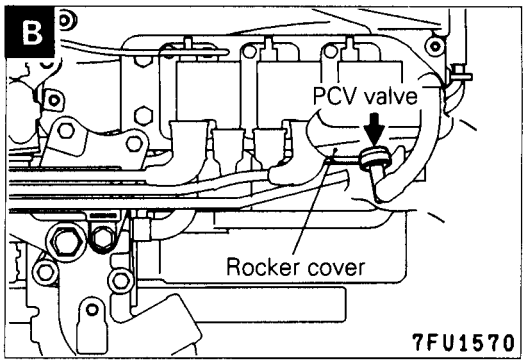
7EM0196

Parts name	Symbol
Canister	E
Catalytic converter	F
EGR valve	A
PCV valve	B
Purge control solenoid valve	D
EGR control solenoid valve	C
2-way valve	G

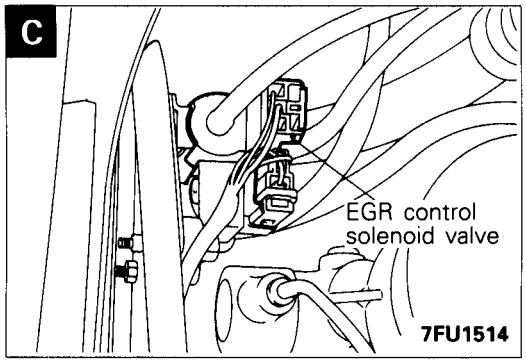
A


EGR valve
7EM0349

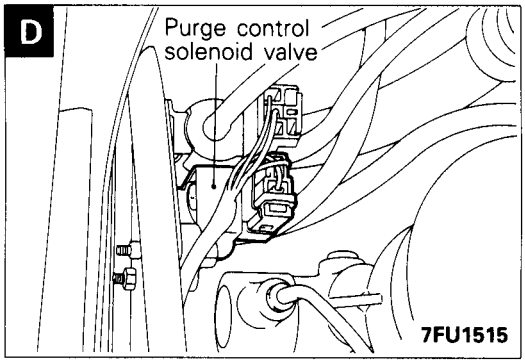
B


PCV valve
Rocker cover
7FU1570

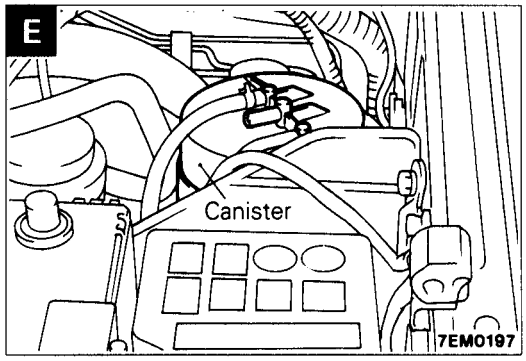
C


EGR control solenoid valve
7FU1514

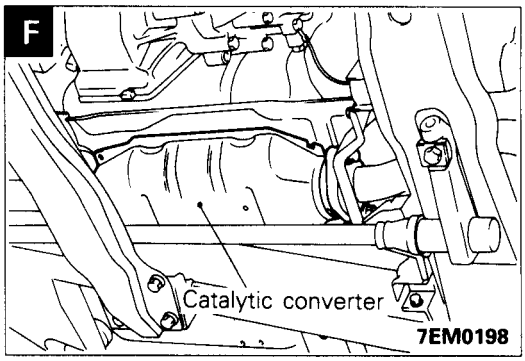
D


Purge control solenoid valve
7FU1515

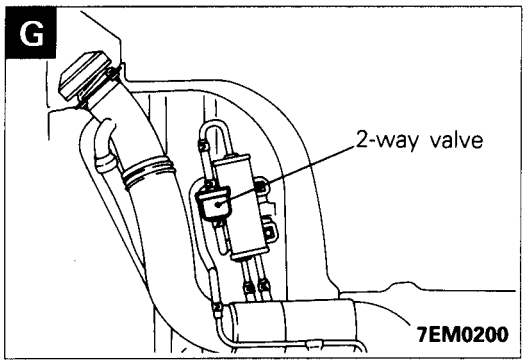
E


Canister
7EM0197

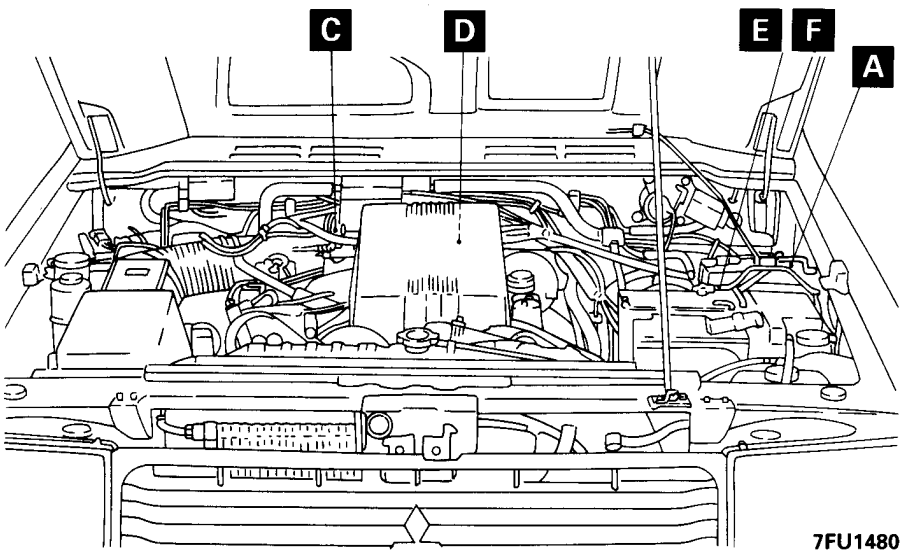
F

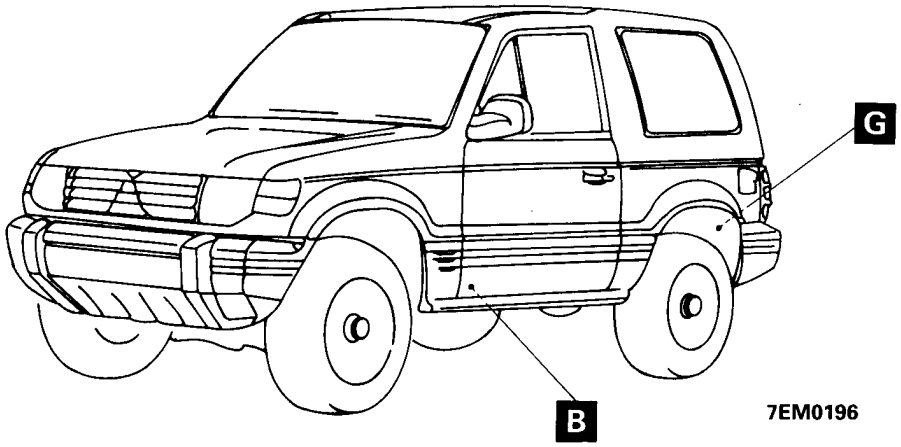

Catalytic converter
7EM0198

G


2-way valve
7EM0200

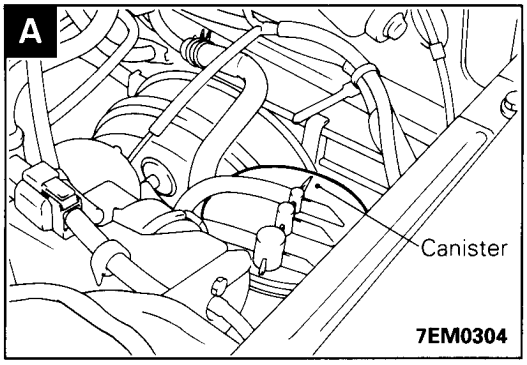
6G74 Engine



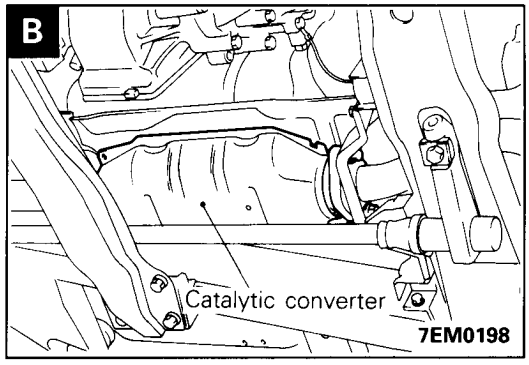


Parts name	Symbol
Canister	A
Catalytic converter	B
EGR valve	C
PCV valve	D
Purge control solenoid valve	E
EGR control solenoid valve	F
2-way valve	G

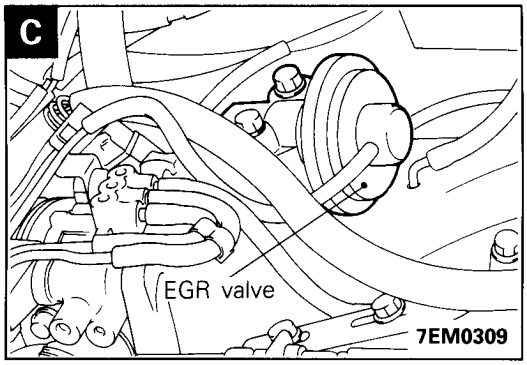
A


Canister
7EM0304

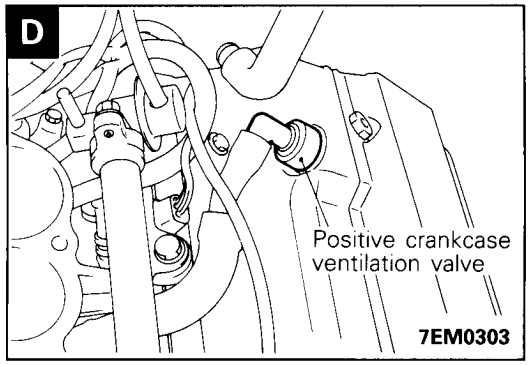
B


Catalytic converter
7EM0198

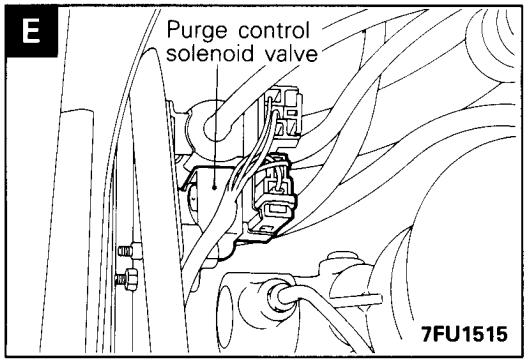
C


EGR valve
7EM0309

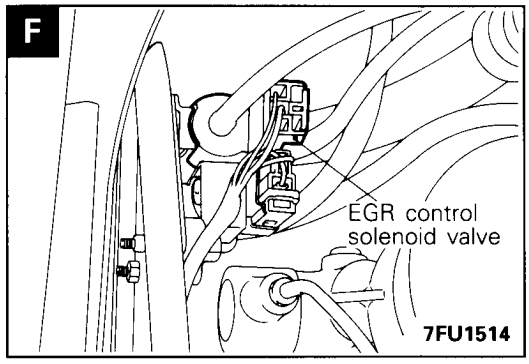
D


Positive crankcase ventilation valve
7EM0303

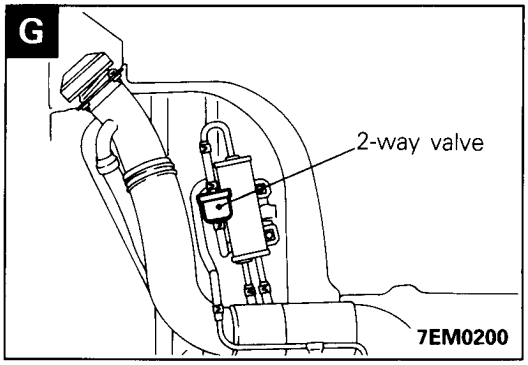
E


Purge control solenoid valve
7FU1515

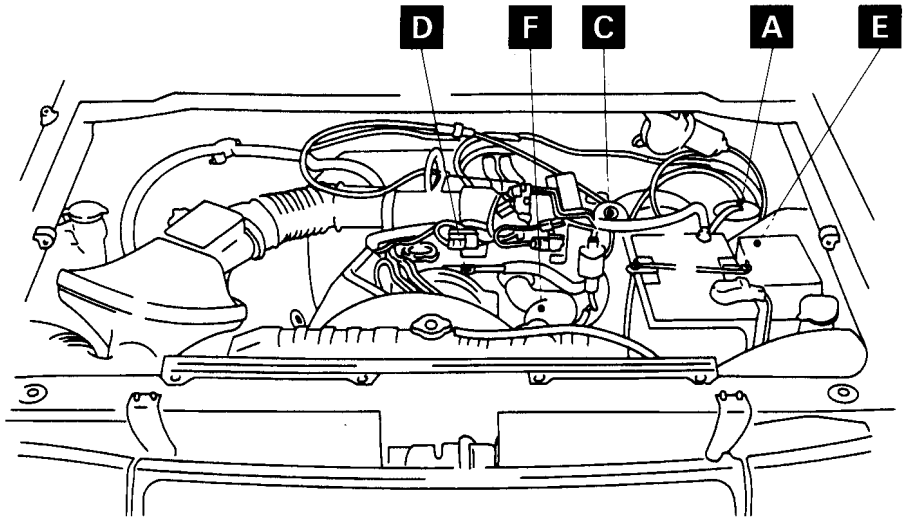
F


EGR control solenoid valve
7FU1514

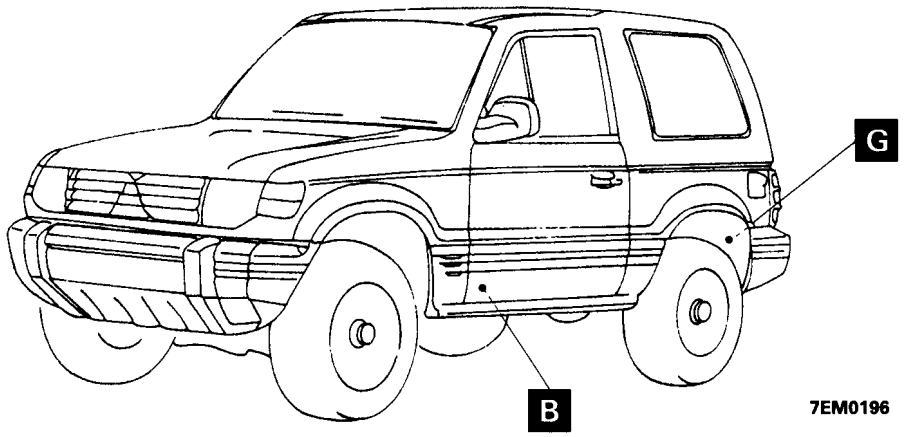
G


2-way valve
7EM0200

4G64 Engine



6FU1704



7EM0196

Parts name	Symbol
Canister	A
Catalytic converter	B
EGR valve	C
PCV valve	D
Purge control solenoid valve	E
Thermo valve	F
2-way valve	G

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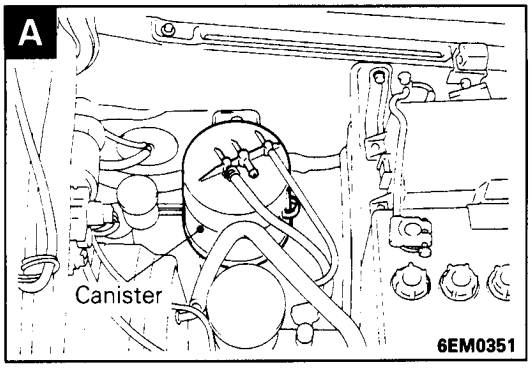
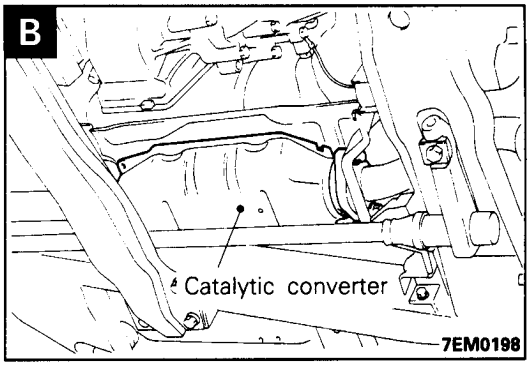
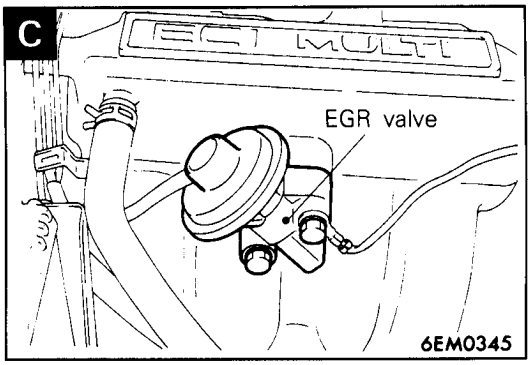
A



B



C



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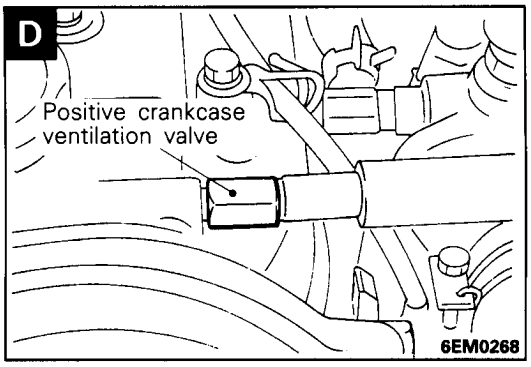
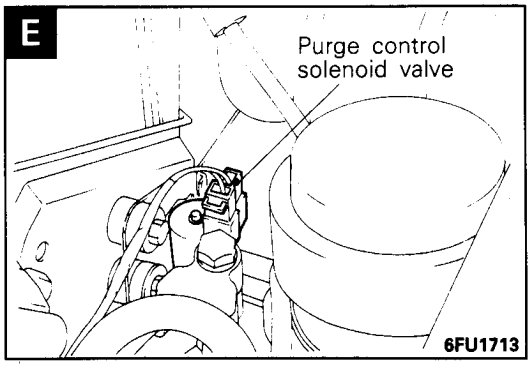


E



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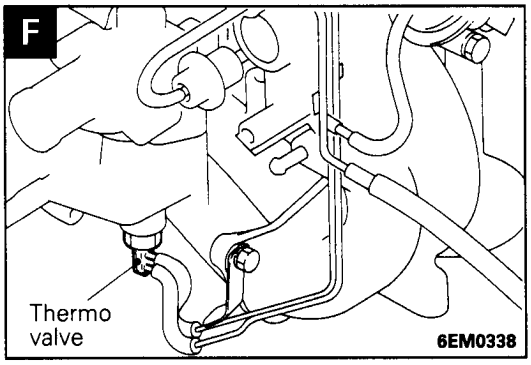
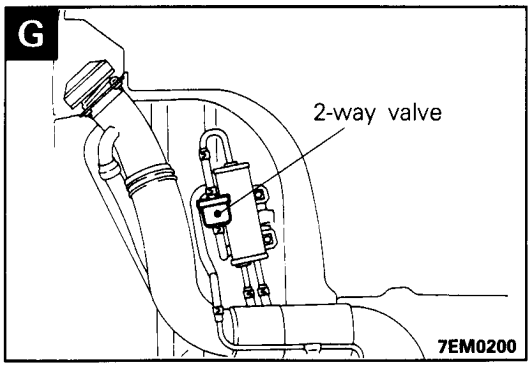


G



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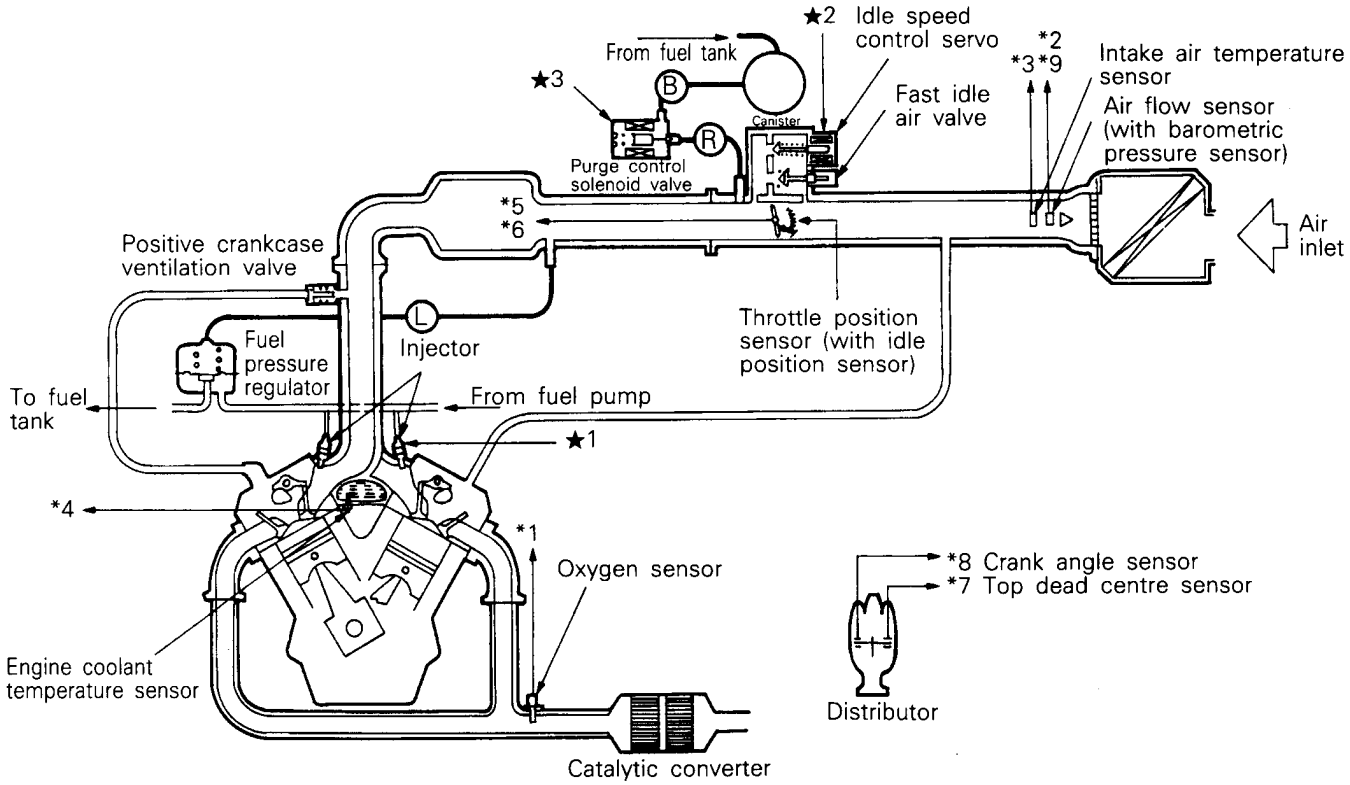
VACUUM HOSE PIPING DIAGRAM

E17FE--

6G72 – 12Valve Engine

*1 Oxygen sensor *2 Air-flow sensor *3 Intake air temperature sensor *4 Engine coolant temperature sensor *5 Throttle position sensor *6 Idle position switch *7 Top dead centre sensor *8 Crank angle sensor *9 Barometric pressure sensor	• Ignition switch – ST • Ignition switch – IG1 • Power supply • Vehicle-speed sensor • Air conditioner switch • Inhibitor switch <A/T>	⇨ Engine control unit ⇨	★1 Injector ★2 Idle speed control servo ★3 Purge control solenoid valve • Fuel pump control (control relay) • Air conditioner power relay • Ignition timing control • Self-diagnosis circuit • Engine warning lamp

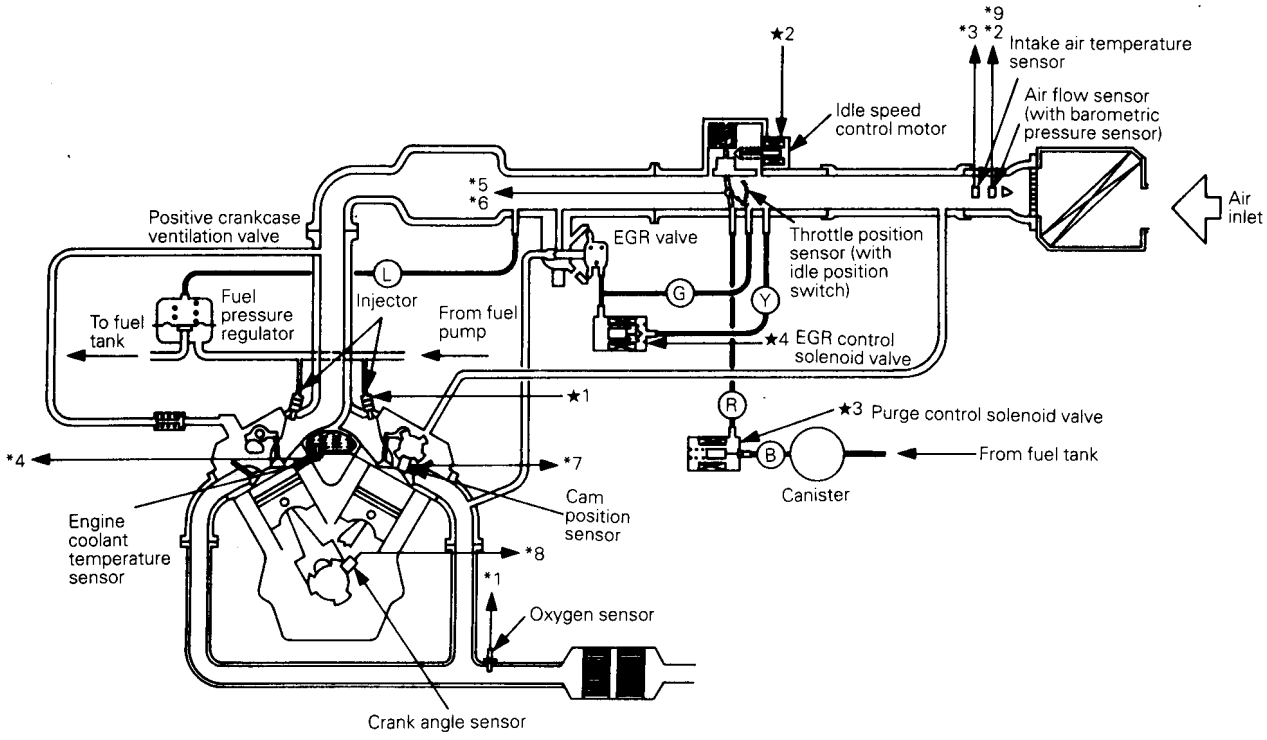


Vacuum hose colour
R: Red
B: Black
L: Light blue

7FU1163

6G72 – 24Valve Engine

*1 Oxygen sensor *2 Volume air flow sensor *3 Intake air temperature sensor *4 Engine coolant temperature sensor *5 Throttle position sensor *6 Idle position switch *7 Cam position sensor *8 Crank angle sensor *9 Barometric pressure sensor	• Ignition switch-ST • Ignition switch-IG_1 • Power supply • Vehicle speed sensor • Air conditioner switch • Power steering fluid pressure switch • Inhibitor switch	⇨ Engine control unit ⇨	★1 Injector ★2 Idle speed control motor ★3 Purge control solenoid valve ★4 EGR control solenoid valve • Fuel pump control (control relay) • Air conditioner power relay • Ignition timing control • Self diagnosis circuit • Engine warning lamp

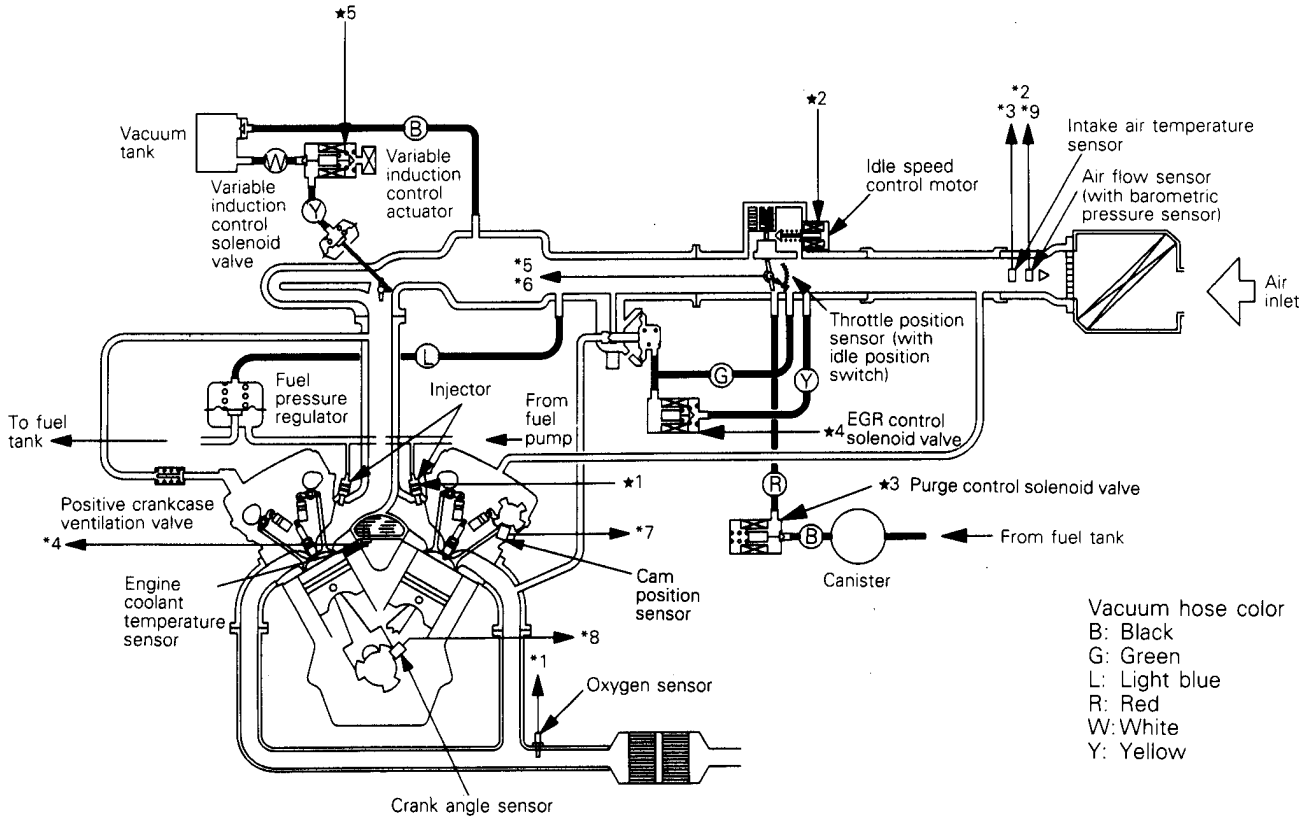


Vacuum hose color
B: Black
G: Green
L: Light blue
R: Red
Y: Yellow

7FU1738

6G74 Engine

*1 Oxygen sensor *2 Volume air flow sensor *3 Intake air temperature sensor *4 Engine coolant temperature sensor *5 Throttle position sensor *6 Idle position switch *7 Cam position sensor *8 Crank angle sensor *9 Barometric pressure sensor	• Ignition switch-ST • Ignition switch-IG1 • Power supply • Vehicle speed sensor • Air conditioner switch • Power steering fluid pressure switch • Inhibitor switch • Detonation sensor	⇨ Engine control unit ⇨	★1 Injector ★2 Idle speed control motor ★3 Purge control solenoid valve ★4 EGR control solenoid valve ★5 Variable induction control solenoid valve • Fuel pump control (control relay) • Air conditioner power relay • Ignition timing control • Self diagnosis circuit • Engine warning lamp



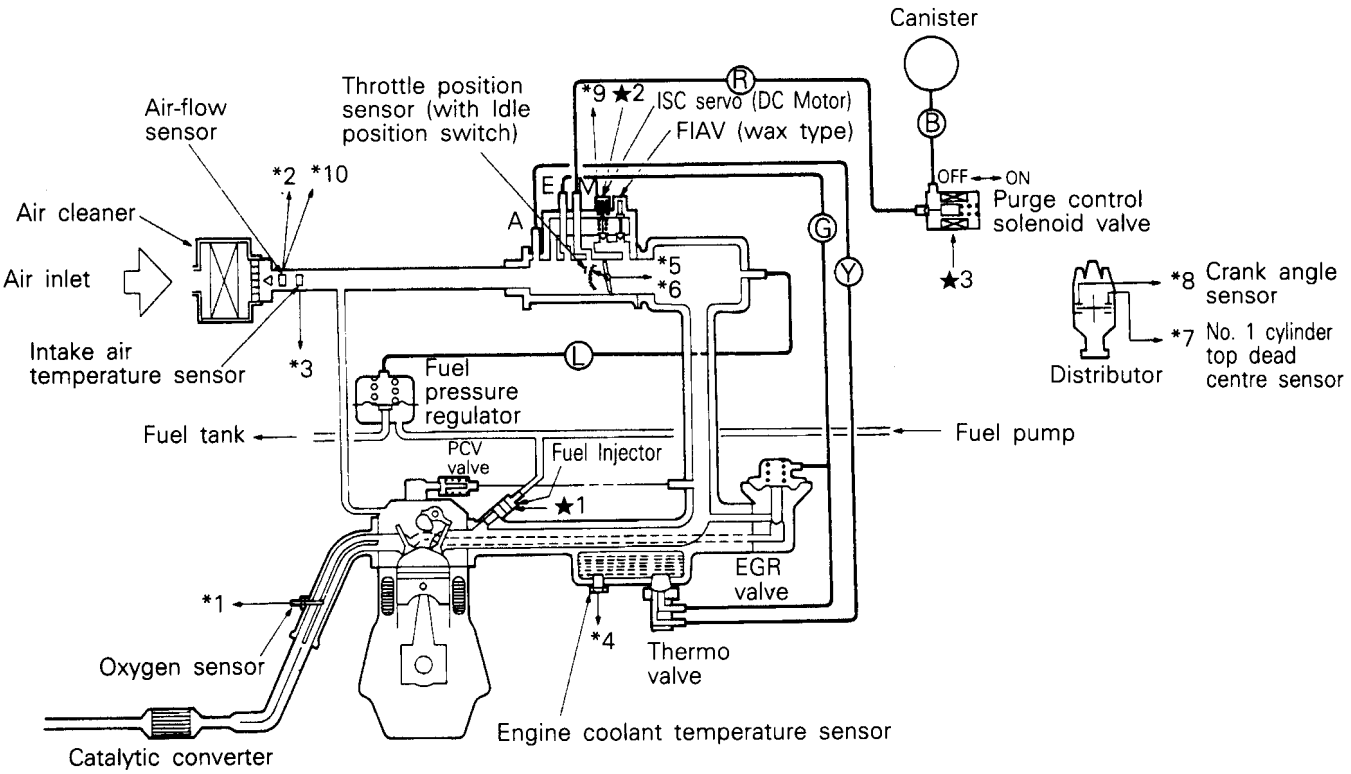
7FU1510

4G64 Engine

*1 Oxygen sensor *2 Air-flow sensor *3 Intake air temperature sensor *4 Engine coolant temperature sensor *5 Throttle position sensor *6 Idle position switch *7 No. 1 cylinder top dead centre sensor *8 Crank angle sensor *9 Motor position sensor	*10 Barometric pressure sensor ● Ignition switch – ST ● Power supply ● Vehicle-speed sensor ● Air conditioner switch

⇨ Engine control unit ⇨

★1 Injector
★2 Idle speed control servo
★3 Purge control solenoid valve
● Fuel pump control (control relay)
● Air conditioner power relay
● Ignition timing control
● Self-diagnosis output
● Engine warning lamp



Vacuum hose colour
G: Green
Y: Yellow
L: Light blue
R: Red
B: Black

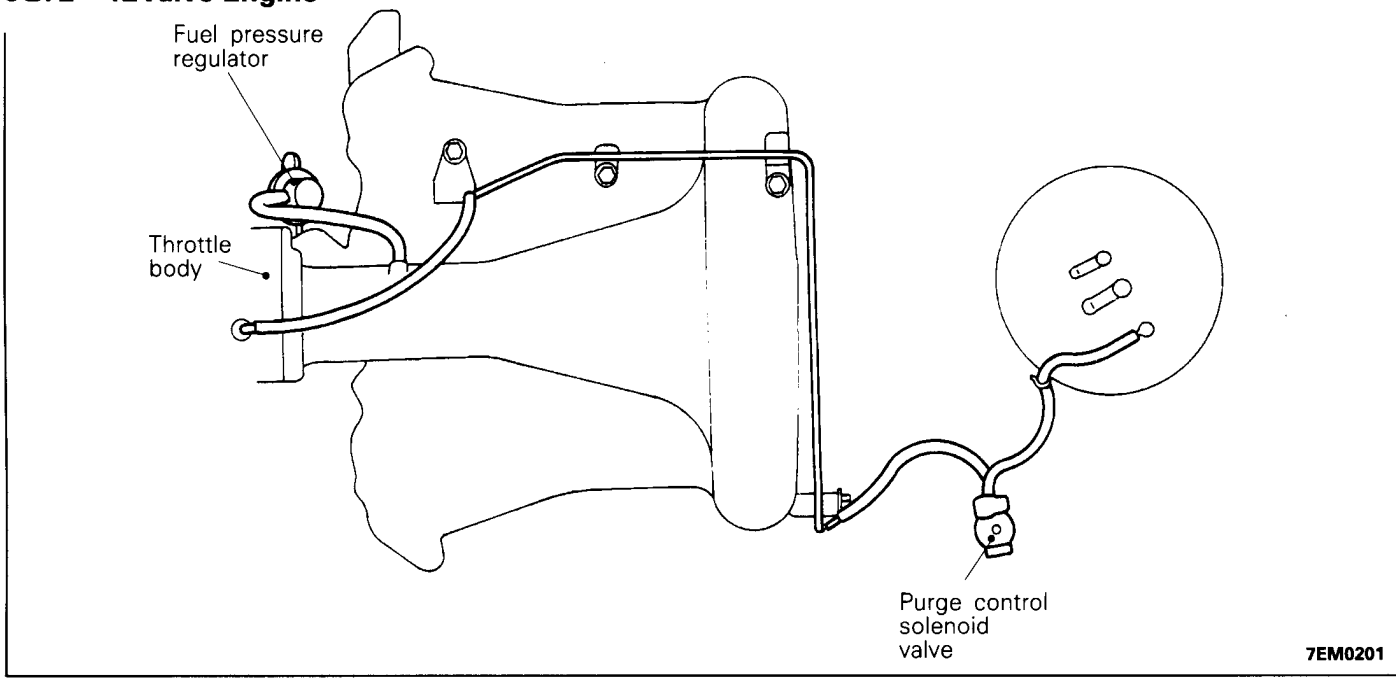
PCV: Positive Crankcase Ventilation
ISC: Idle Speed Control

6FU1695

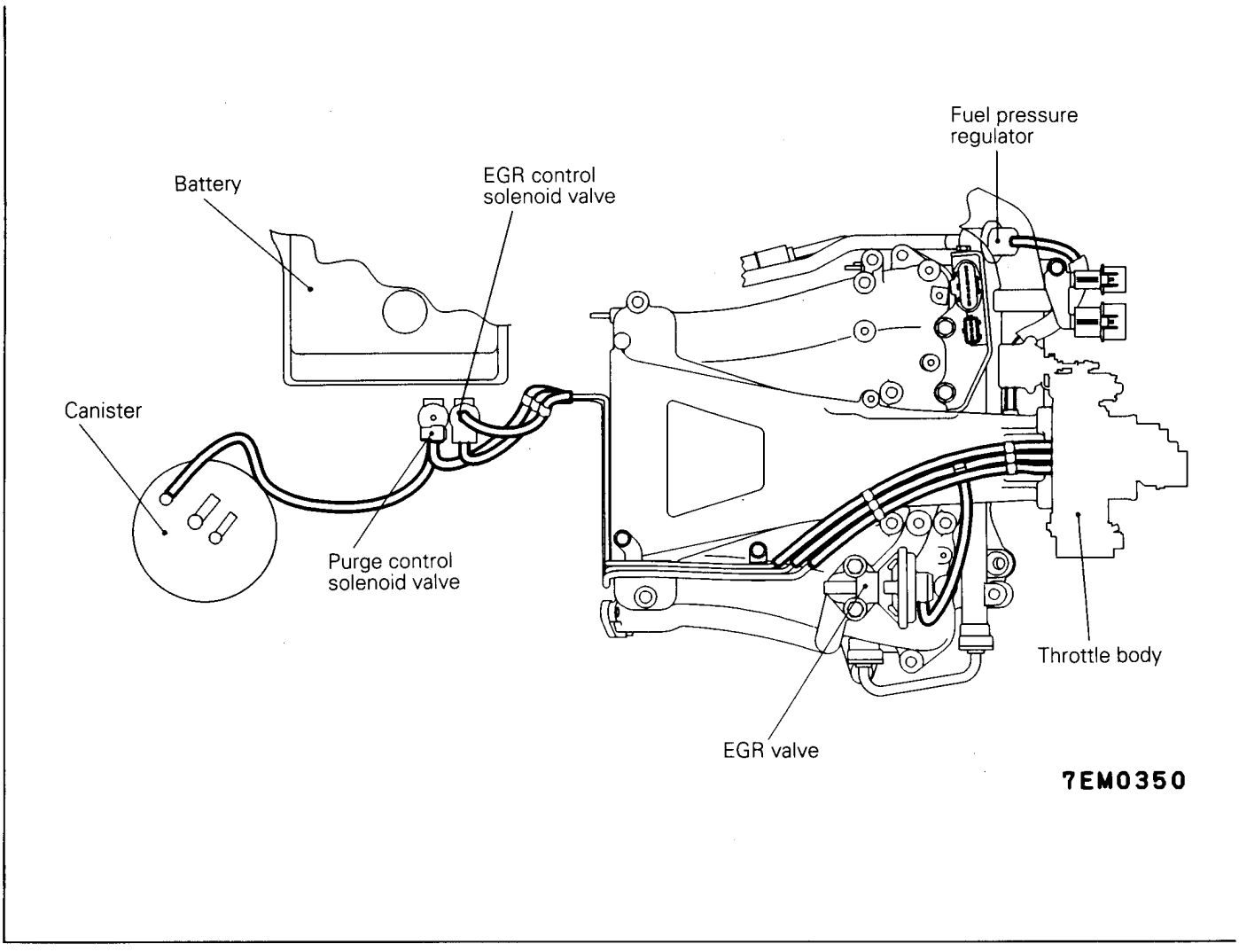
NOTES

VACUUM HOSE LAYOUT

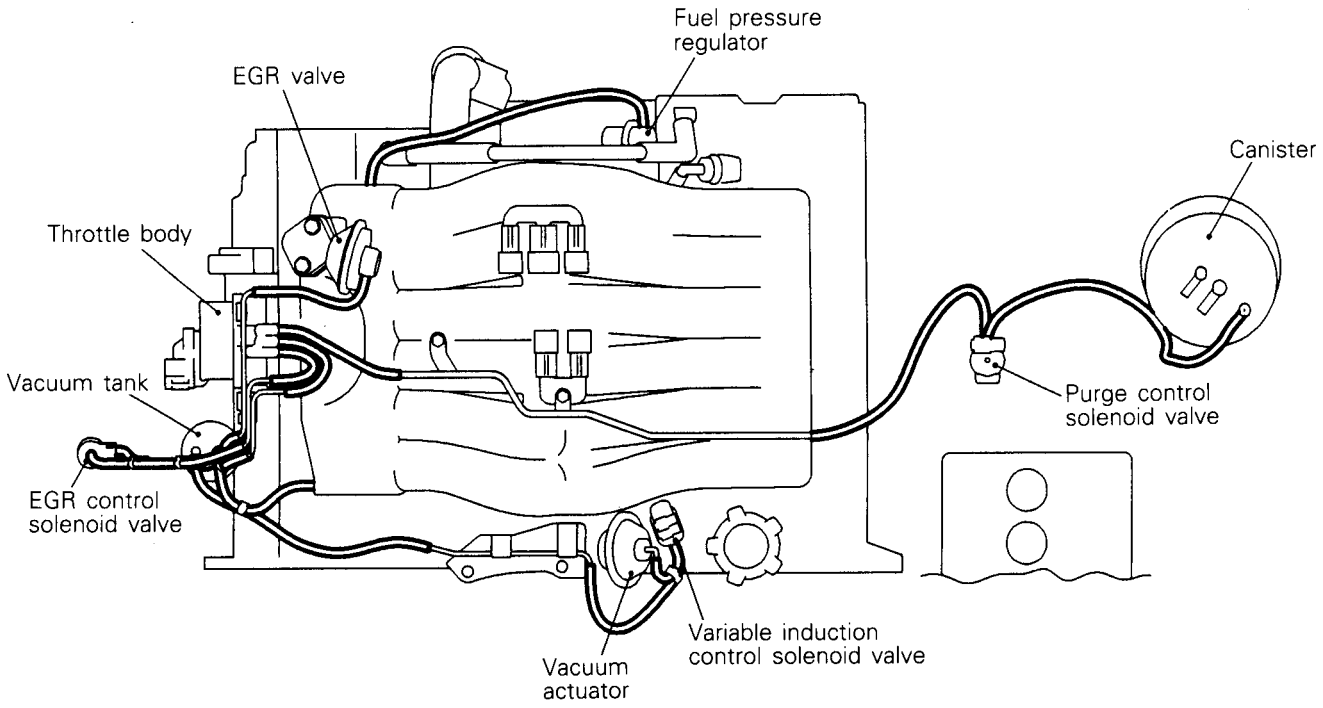
6G72 – 12Valve Engine



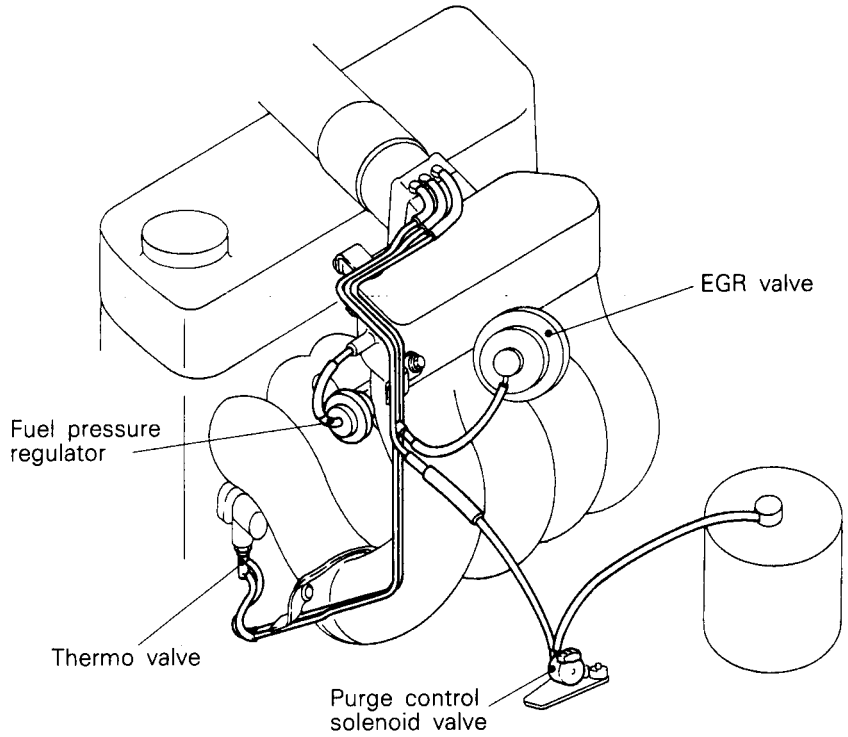
6G72 – 24Valve Engine



6G74 Engine



4G64 Engine



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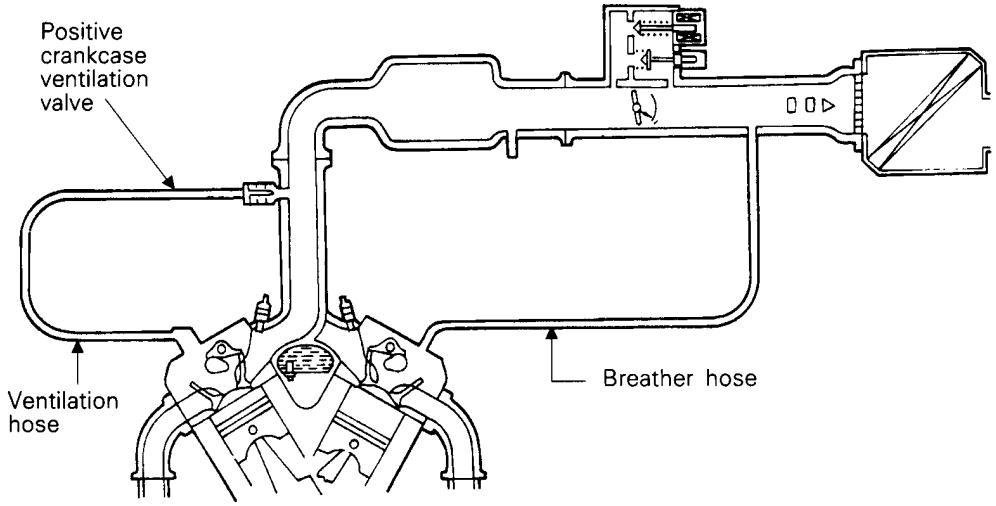
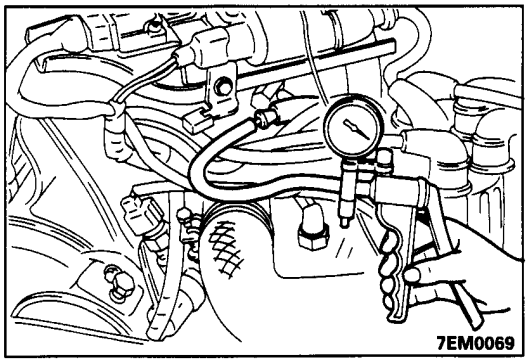
CAUTIONS ON INSPECTION E17FFAE2

1. Inspect the various devices only after completing engine adjustment.
2. Inspect the hoses to make sure there are no disconnections, connection erros or damage.
3. Make sure there is no hose, pipe or port clogging, or cracks or damage in the hoses and pipes.
4. When replacing device hoses, always mount the replacement hose in the same position (direction) as the original.
5. When finished, check the connections as described in the service manual or service label.

CRANKCASE EMISSION CONTROL SYSTEM <6G72 Engine> E17FAAN1



7EM0202

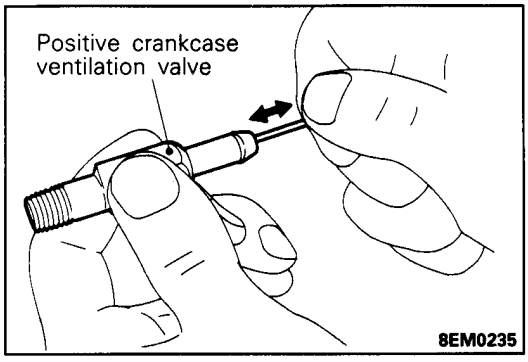


7EM0069

POSITIVE CRANKCASE VENTILATION SYSTEM <12Valve Engine>

System Inspection

(1) Disconnect the ventilation hose from the air-intake plenum, and connect a hand vacuum pump to the ventilation hose.
(2) At this time, make sure that there is leakage when vacuum is applied. If there is no leakage when vacuum is applied, either clean the positive crankcase ventilation valve or replace it.



8EM0235

Positive Crankcase Ventilation (PCV) Valve Inspection

(1) Insert a thin rod from the nipple side of the positive crankcase ventilation valve, and move it back and forth to check that the plunger moves.
(2) If the plunger does not move, there is a blockage inside the positive crankcase ventilation valve, so clean the valve or replace it.

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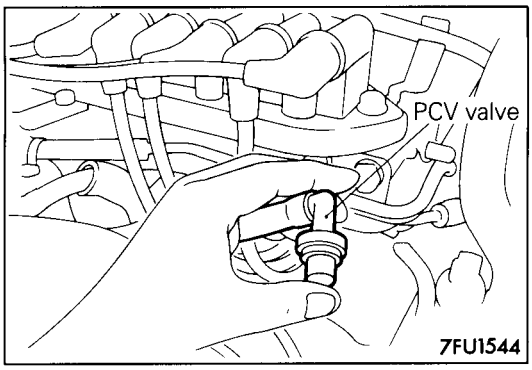


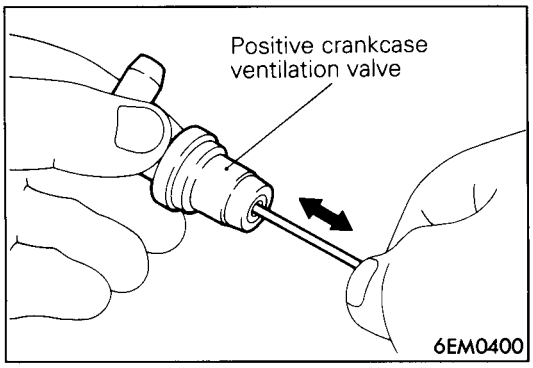
POSITIVE CRANKCASE VENTILATION SYSTEM <24Valve Engine>

System Inspection

(1) Disconnect the ventilation hose from the positive crankcase ventilation (PCV) valve.
(2) Remove the PCV valve from the rocker cover.
(3) Install the PCV valve to the ventilation valve again.
(4) Start the engine and let it run at idle.
(5) Plug the PCV valve by your finger and check that intake manifold vacuum can be felt.

NOTE
The plunger in the PCV valve moves back and forth at this time.

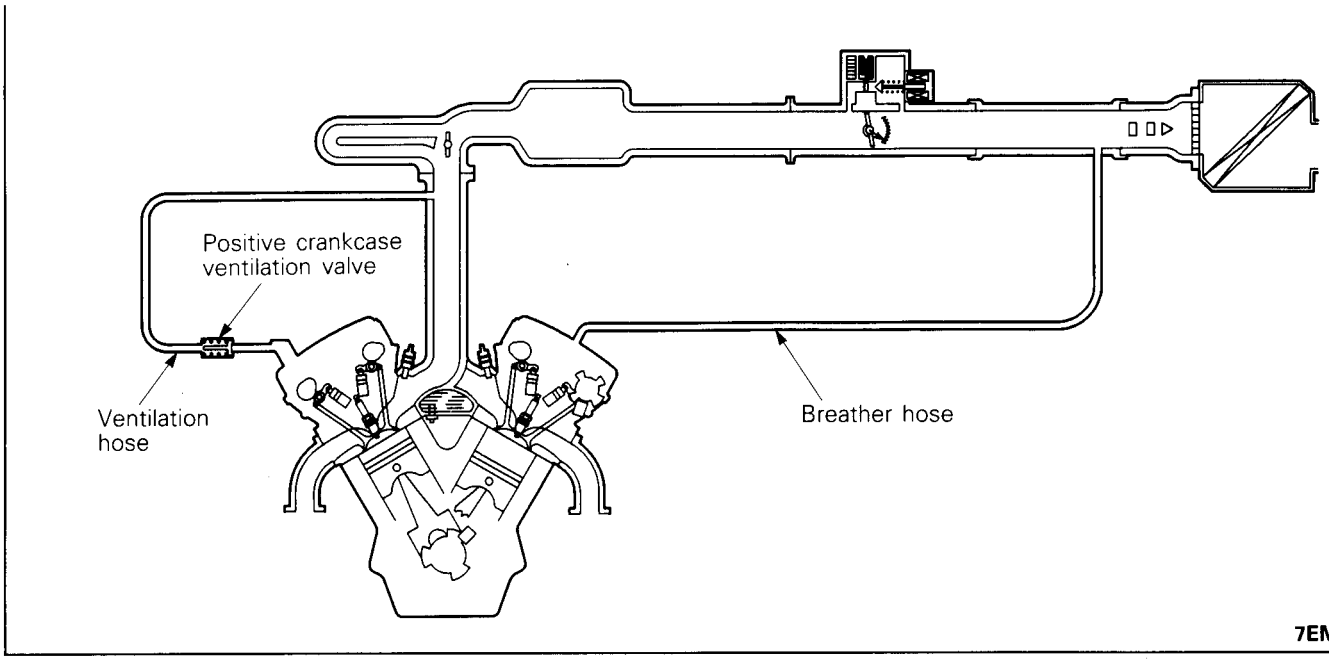
(6) If vacuum can not be felt, clean or replace the PCV valve.

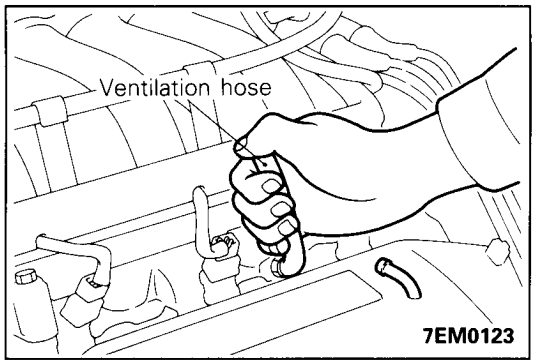


Positive Crankcase Ventilation (PCV) Valve Inspection

(1) Remove the air intake plenum.
(2) Remove the positive crankcase ventilation valve from the rocker cover.
(3) Insert a thin rod from the threaded side of the positive crankcase ventilation valve, and move it back and forth to check that the plunger moves.
(4) If the plunger does not move, there is a blockage inside the positive crankcase ventilation valve, so clean the valve or replace it.

CRANKCASE EMISSION CONTROL SYSTEM <6G74 Engine>





POSITIVE CRANKCASE VENTILATION SYSTEM

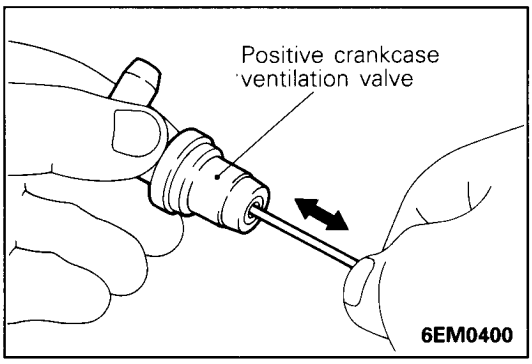
System Inspection

(1) Disconnect the ventilation hose from the rocker cover.
(2) Start the engine and run it at idle.
(3) Put a finger to the ventilation hose to make sure that intake manifold vacuum is felt on the finger.

NOTE
At this time, the plunger inside the positive crankcase ventilation valve moves back and forth.

(4) If vacuum is not felt on finger, clean the positive crankcase ventilation valve in cleaning solvent or replace if necessary.
(5) Tighten the positive crankcase ventilation valve to the specified torque.

Tightening torque: 9.8 Nm (1.0 kgm, 7ft.lbs.)

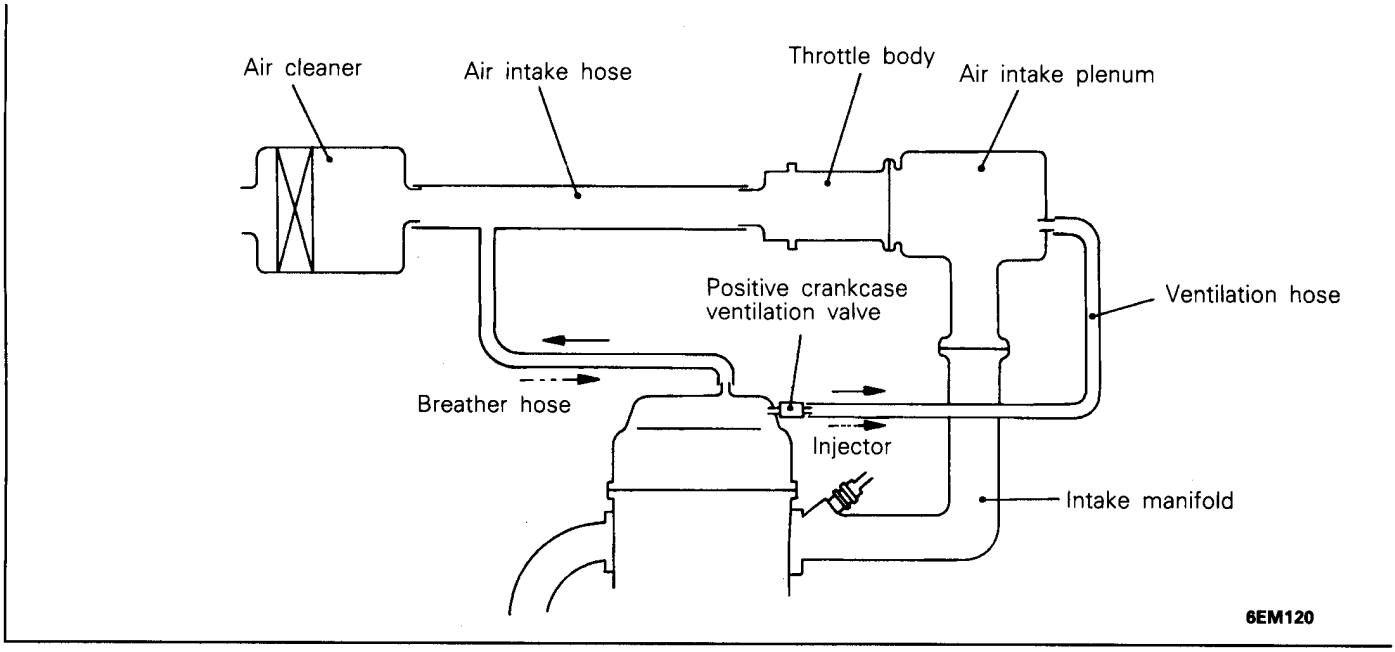


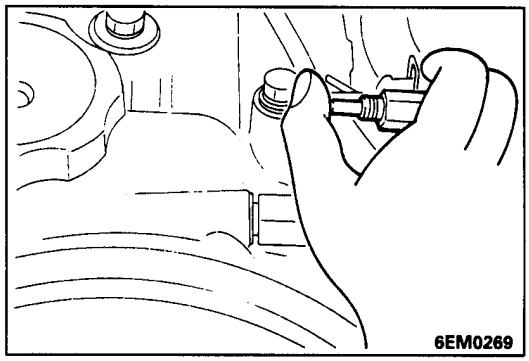
Positive Crankcase Ventilation (PCV) Valve Inspection

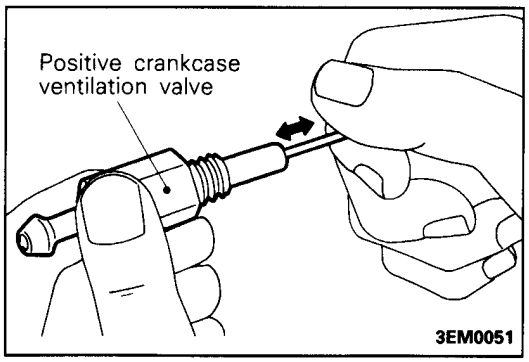
(1) Remove the air intake plenum.
(2) Remove the positive crankcase ventilation valve from the rocker cover.
(3) Insert a thin rod from the threaded side of the positive crankcase ventilation valve, and move it back and forth to check that the plunger moves.
(4) If the plunger does not move, there is a blockage inside the positive crankcase ventilation valve, so clean the valve or replace it.

CRANKCASE EMISSION CONTROL SYSTEM <4G64 Engine>

E17FAAN2







POSITIVE CRANKCASE VENTILATION SYSTEM

System Inspection

(1) Disconnect the ventilation hose from the positive crankcase ventilation valve. Then, remove the positive crankcase ventilation valve from the rocker cover and reconnect it to the ventilation hose.
(2) Idle the engine and put a finger to the open end of positive crankcase ventilation valve to make sure that intake manifold vacuum is felt on the finger.

NOTE
At this time, the plunger inside the positive crankcase ventilation valve moves back and forth.

(3) If vacuum is not felt on finger, clean the positive crankcase ventilation valve and ventilation hose in cleaning solvent or replace if necessary.

Positive Crankcase Ventilation (PCV) Valve Inspection

(1) Insert a thin stick into the positive crankcase ventilation valve from the threaded side to check that the plunger moves.
(2) If the plunger does not move, the positive crankcase ventilation valve is clogged. Clean it or replace.

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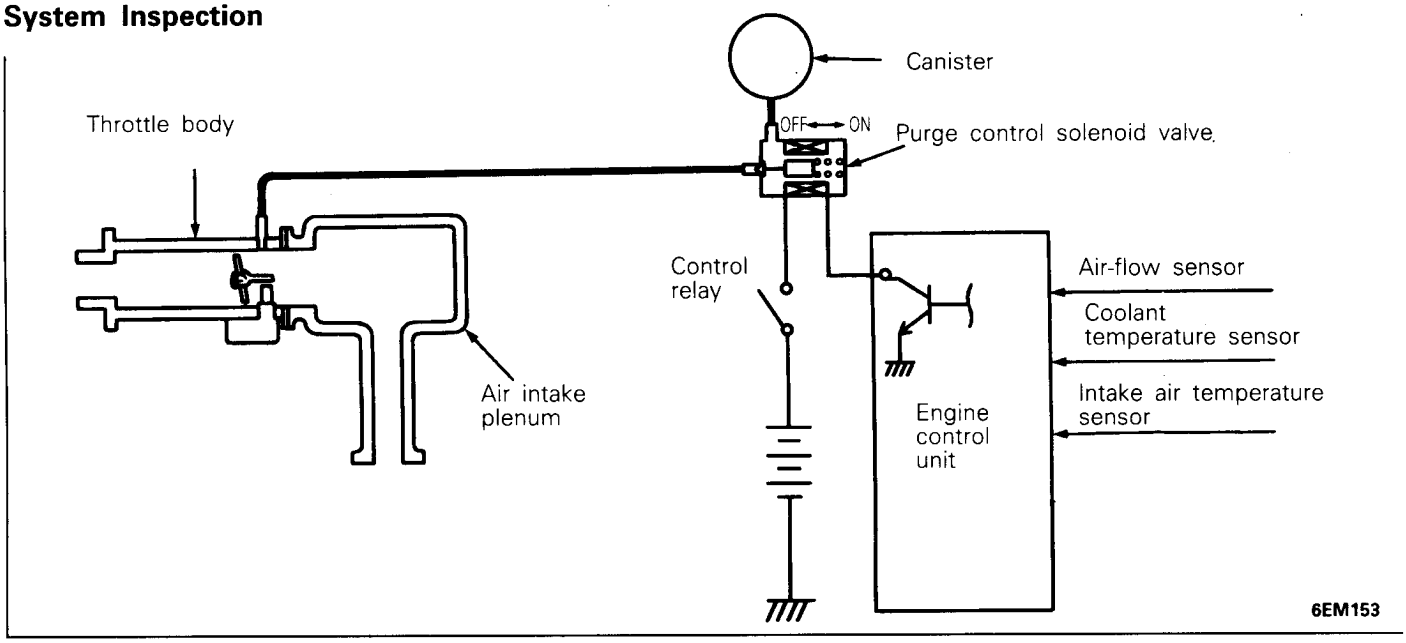
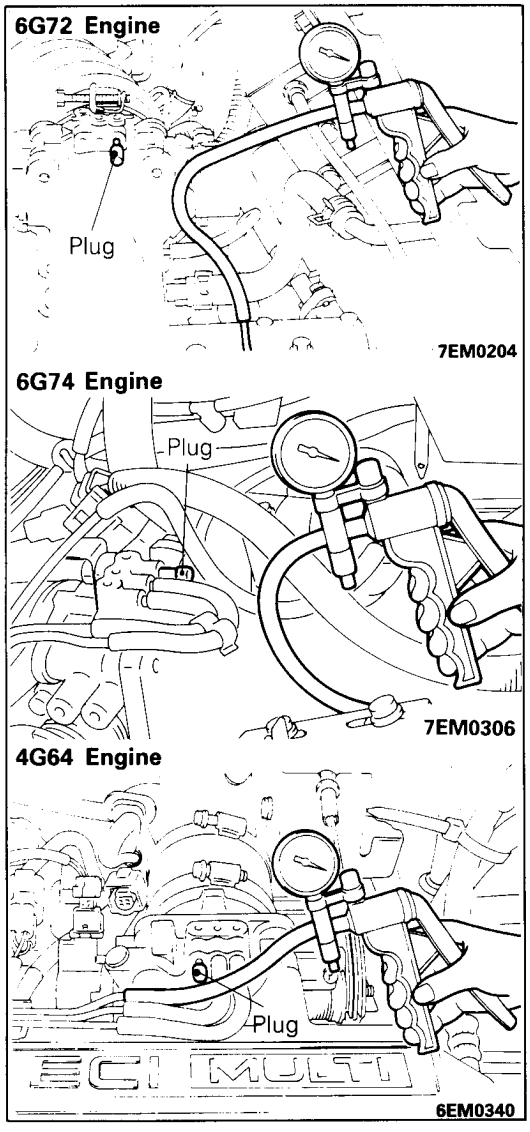
EVAPORATIVE EMISSION CONTROL SYSTEM

E17FBBA

PURGE CONTROL SYSTEM

System Inspection





INSPECTION

(1) Disconnect the vacuum hose (red stripes) from the throttle body and connect it to a hand vacuum pump.
(2) Plug the nipple from which the vacuum hose was removed.
(3) Check the following points when the engine is cold [coolant temperature at 40°C (104°F) or below] and when it is warm [coolant temperature at 80°C (176°F) or higher].

When engine is cold

Engine operating condition	Applying vacuum	Result
Idling	400 mmHg (15.7 in.Hg.)	Vacuum is maintained
3,000 r/min.		

When engine is warm

Engine operating condition	Applying vacuum	Result
Idling	400 mmHg (15.7 in.Hg.)	Vacuum is maintained
Within 3 minutes after engine start 3,000 r/min.	Try applying vacuum	Vacuum leaks
After 3 minutes have passed after engine start 3,000 r/min.	400 mmHg (15.7 in.Hg.)	Vacuum will be maintained momentarily, after which it will leak. NOTE The vacuum will leak continuously if the altitude is 2,200 m (7,200 ft.) or higher, or the intake air temperature is 50°C (122°F) or higher.

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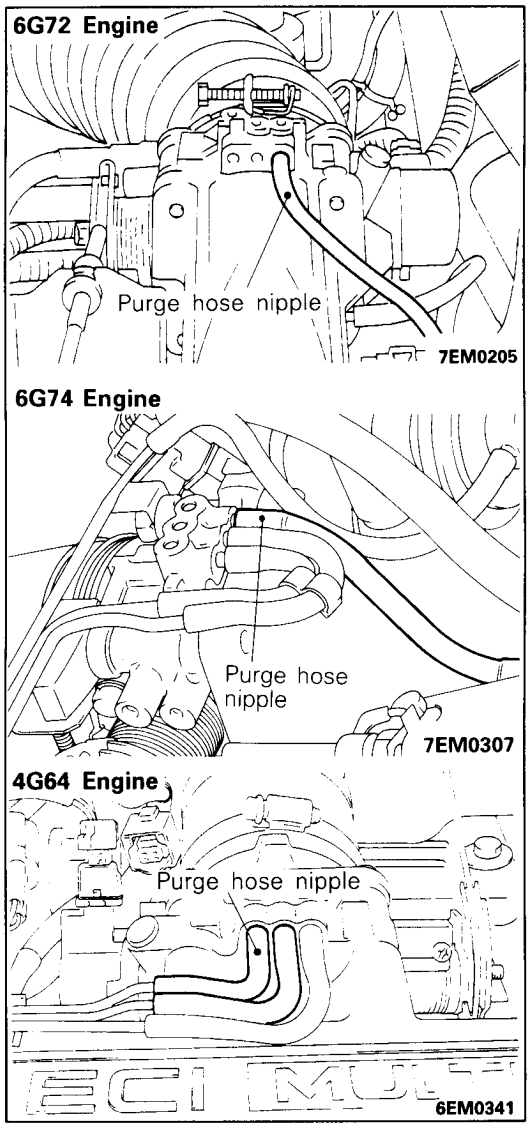
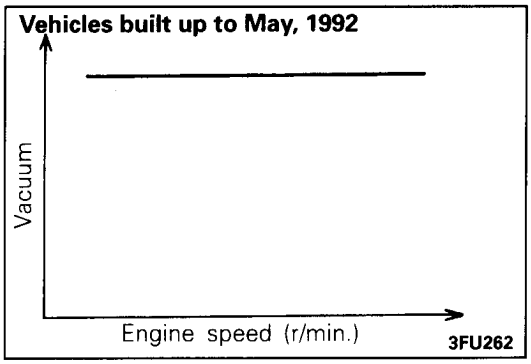


Purge Port Vacuum Inspection

Check Condition

Engine coolant temperature: 80–95°C (176–205°F)

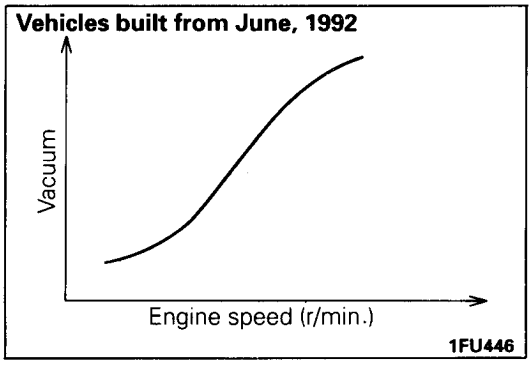
(1) Disconnect the vacuum hose (red) from the throttle body purge hose nipple and connect a hand vacuum pump to the nipple.



(2) Vehicles built up to May, 1992

Start the engine and check to see that, after raising the engine speed by racing the engine, vacuum remains fairly constant.

NOTE
If there is no vacuum created, it is possible that the throttle body port may be clogged and require cleaning.



Vehicles built from June, 1992

Start the engine and check to see that, after raising the engine speed by racing the engine, vacuum raises proportionately with the rise in engine speed.

NOTE
If there is a problem with the change in vacuum, it is possible that the throttle body port may be clogged and require cleaning.

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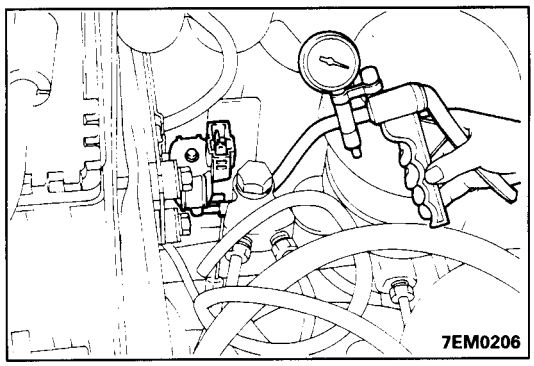
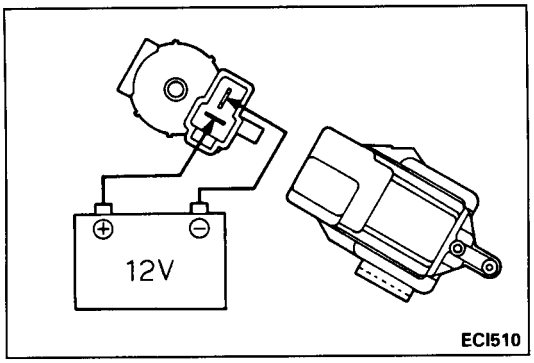
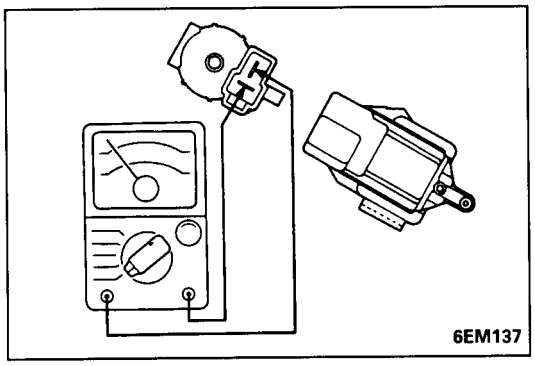
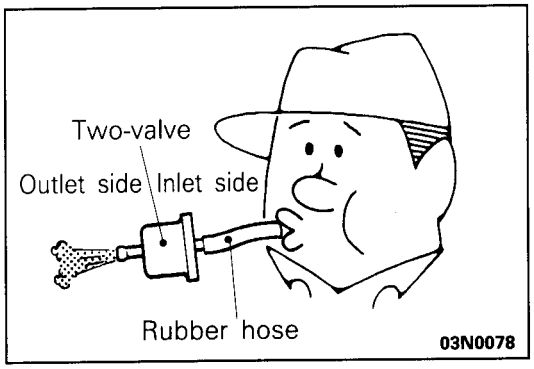

7EM0206



ECI510


6EM137



03N0078

Purge Control Solenoid Valve Inspection

NOTE
When disconnecting the vacuum hose, make an identification mark on it so that it can be reconnected to the original position.

(1) Disconnect the vacuum hose (black with red stripe) from the solenoid valve.
(2) Disconnect the harness connector.
(3) Connect a hand vacuum pump to the nipple to which the red-striped vacuum hose was connected.

(4) Apply a vacuum and check for air-tightness when voltage is applied directly to the purge-control solenoid valve and when the voltage is discontinued.

Battery voltage	Normal condition
When applied	Vacuum leaks
When discontinued	Vacuum is maintained

(5) Measure the resistance between the terminals of the solenoid valve.
Standard value: 36–44 Ω [at 20°C (68°F)]

SIMPLE CHECKING OF THE TWO-WAY VALVE

Attach a clean hose and check the operation of the two-way valve.

Inspection procedure	Normal condition
Lightly blow from inlet side (fuel tank side).	Air passes through with a slight feeling of resistance.
Lightly blow from outlet side (canister side).	Air passes through.

AIR FLOW SENSOR, ENGINE COOLANT TEMPERATURE SENSOR AND INTAKE AIR TEMPERATURE SENSOR INSPECTION

Refer to GROUP 13.

CANISTER INSPECTION

Refer to GROUP 13.

EXHAUST EMISSION CONTROL SYSTEM E17FCBL

AIR FUEL RATIO CONTROL SYSTEM

- To inspect the air-fuel ratio control system, refer to GROUP 13.
- For detailed information concerning the illumination pattern of the malfunction-indicator light and other aspects of the self-diagnosis function, refer to GROUP 13

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CATALYTIC CONVERTER E17YA--

REMOVAL AND INSTALLATION

For removal and installation procedures, refer to GROUP 15.

INSPECTION E17YCAC

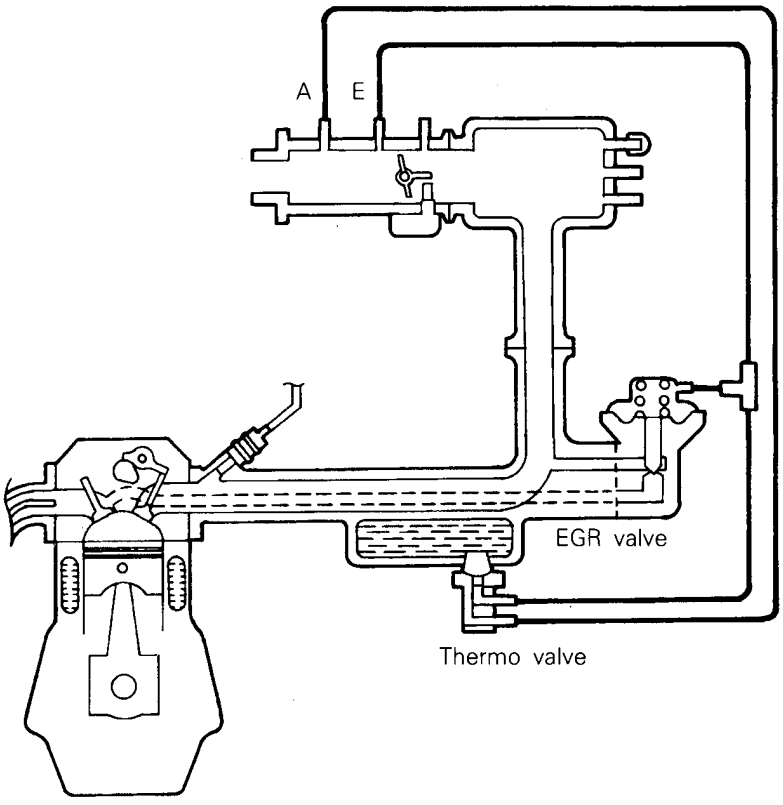
Check for damage, cracks or fusion and replace if faulty.

Caution

1. **Operation of any type, including idling, should be avoided if engine misfiring occurs. Under this condition the exhaust system will operate at abnormally high temperature, which may cause damage to the catalytic converter or under-body parts of the vehicle.**
2. **Alteration or deterioration of ignition or fuel system, or any type of operating condition which result in engine misfiring must be corrected to avoid overheating the catalytic converters.**
3. **Proper maintenance and tune-up according to manufacturer's specifications should be made to correct the conditions as soon as possible.**

EXHAUST GAS RECIRCULATION (EGR) SYSTEM <4G64 Engine> E17QAAD

System Inspection



6EM0159

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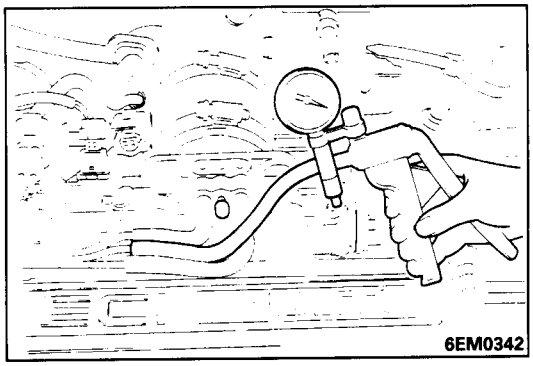

6EM0342

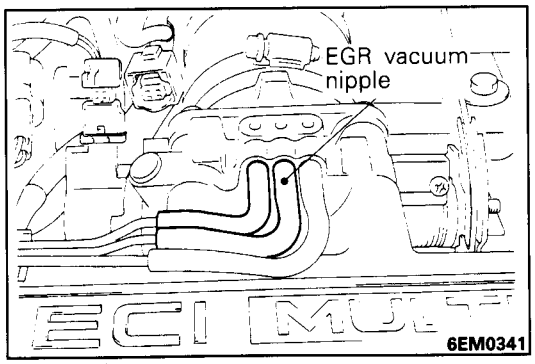
(1) Disconnect the vacuum hose (green stripe) from the throttle body, and connect a hand vacuum pump to the vacuum hose.
(2) Under the engine conditions described below, provide a vacuum by using the hand vacuum pump, and then check.

When Engine is Cold–
Coolant temperature at 40°C (104°F) or below

Engine operating condition	Applying vacuum	Result
Idling	Try applying vacuum	Vacuum leaks

When Engine is Hot–
Coolant temperature at 80°C (176°F) or higher

Engine operating condition	Applying vacuum	Result
Idling	30 mmHg (1.2 in.Hg.)	Vacuum is maintained
Changes from idling to slightly unstable	195 mmHg (7.7 in.Hg.)	Vacuum is maintained



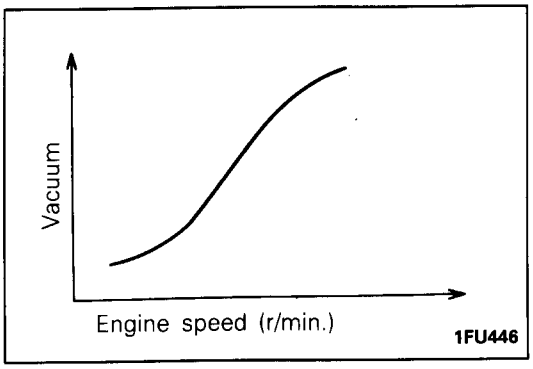
6EM0341

EGR Valve Control Vacuum Inspection

Check Condition

Engine coolant temperature: 80–95°C (176–205°F)

(1) Disconnect the vacuum hose (green) from the throttle body EGR vacuum nipple and connect a hand vacuum pump to the nipple.



1FU446

(2) Start the engine and check to see that, after raising the engine speed by racing the engine, the vacuum raises proportionately with the rise in engine speed.

NOTE
If there is a problem with the change in vacuum, it is possible that the throttle body vacuum port may be clogged and require cleaning.

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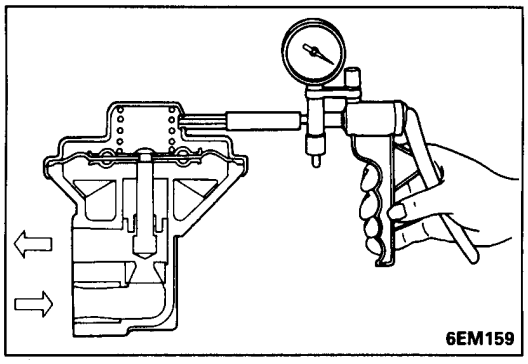


EGR Valve Inspection

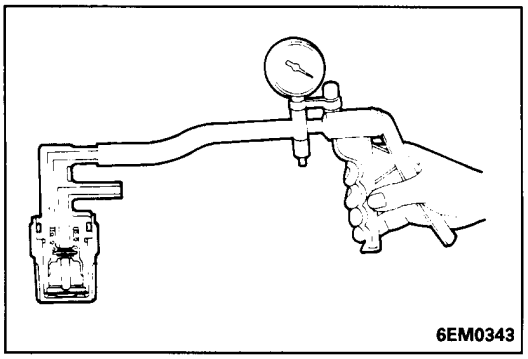
(1) Remove the EGR valve and check it for sticking, deposit of carbon, etc.
If such condition exists, clean with adequate solvent to ensure tight valve seat contact.
(2) Connect a hand vacuum pump to the EGR valve.
(3) Apply a vacuum of 500 mmHg (19.6 in.Hg.) and check air tightness.
(4) Blow in air from one passage of the EGR to check condition as follows.

Applying vacuum	Result
30 mmHg (1.2 in.Hg.)	Air does not blow through
195 mmHg (7.7 in.Hg.)	Air blows through

INSTALLATION

(1) Install a new gasket and EGR valve, tighten bolts to specified torque.

Specified tightening torque: 22 Nm (2.2 kgm, 16 ft.lbs.)



Thermo Valve Inspection

(1) Disconnect the vacuum hoses from the thermo valve, and connect a hand vacuum pump to nipple of the thermo valve.
(2) Apply a vacuum and check the air passage through the thermo valve.

Engine coolant temperature	Result
50°C (122°F) or less	Vacuum leaks.
80°C (176°F) or more	Vacuum is maintained.

REMOVAL

(1) When removing the thermo valve, do not use wrenches or other tools on the resin part.
(2) When disconnecting the vacuum hose, put a mark on the hose so that it may be reconnected at original position.

INSTALLATION

(1) Apply specified sealant to the threads of thermo valve and tighten to the specified torque. When installing the thermo valve, do not use wrenches or other tools on the resin part.

Specified sealant:
3M NUT Locking No. 4171 or equivalent
Specified torque: 30 Nm (3.0 kgm, 22 ft.lbs.)

(2) Reconnect the vacuum, hose as it was before.

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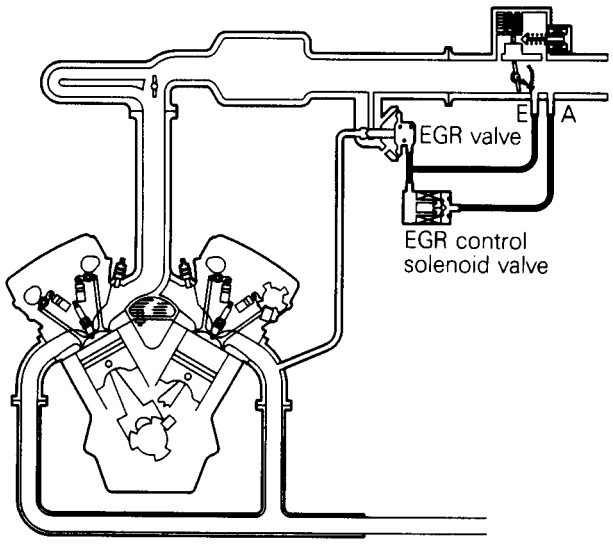
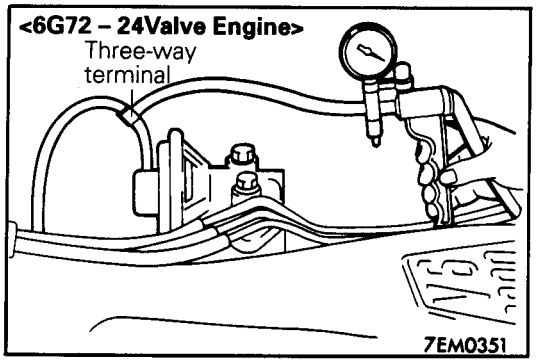
EXHAUST GAS RECIRCULATION (EGR) SYSTEM

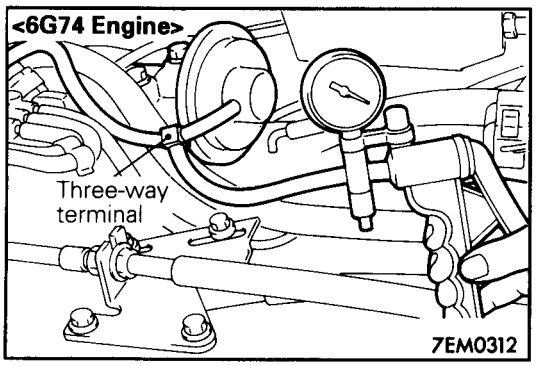
<6G72 – 24Valve Engine, 6G74 Engine>

System Inspection



7EM0327





(1) Disconnect the vacuum hose (green stripe) from the exhaust gas recirculation (EGR) valve, and then connect a hand vacuum pump via the three-way terminal.

(2) Check the following points when the engine is cold [engine coolant temperature is 40°C (104°F) or below] and when the engine is warm [engine coolant temperature is 80°C (176°F) or higher].

When engine is cold

Engine condition	Normal condition
Press the accelerator pedal suddenly and race the engine.	Vacuum: no change (atmospheric pressure)

When engine is warm

Engine condition	Normal condition
Press the accelerator pedal suddenly and race the engine.	Vacuum rises temporarily to 100 mmHg (3.9 in. Hg)

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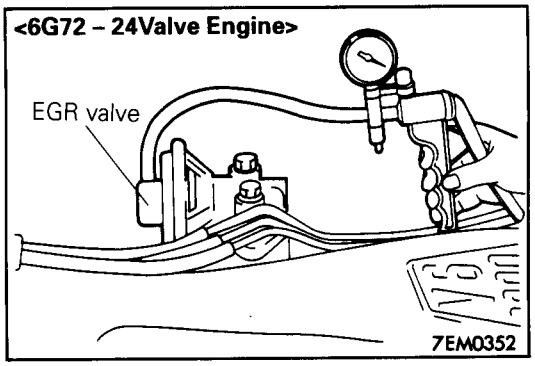
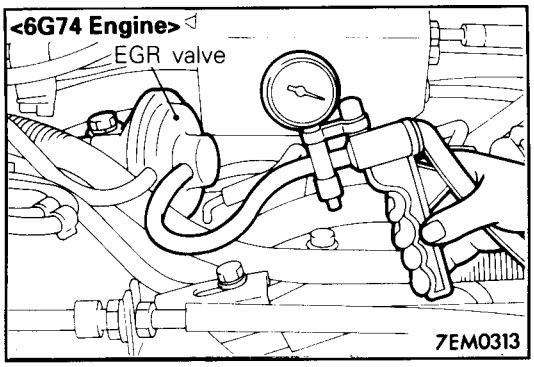
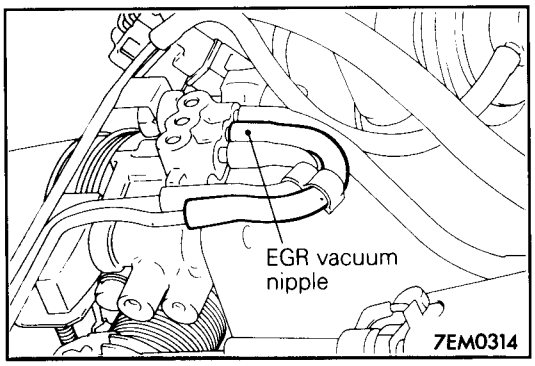




(3) Disconnect the three-way terminal and connect the hand vacuum pump directly to the EGR valve.
(4) Check whether or not the engine stalls or shows idling instability when a negative pressure (vacuum) of 230 mmHg (9.1 in. Hg) or higher is applied during idling.

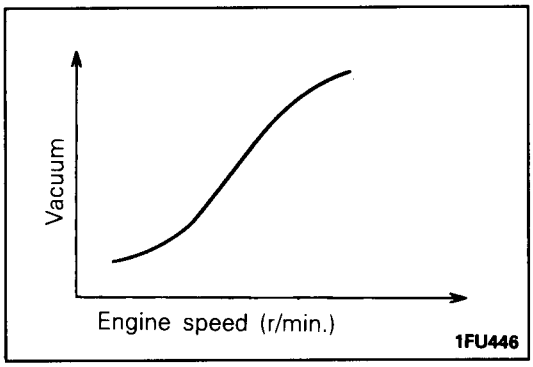


EGR Valve Control Vacuum Inspection

Check Condition

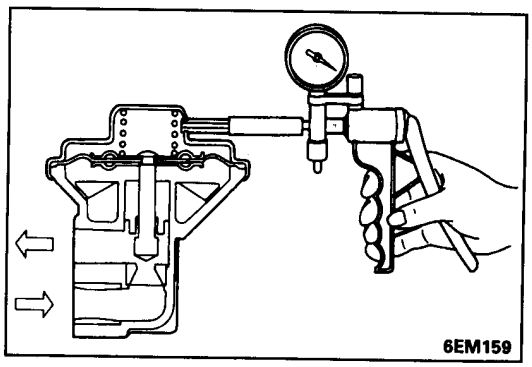
Engine coolant temperature: 80–95°C (176–205°F)

(1) Disconnect the vacuum hose (green) from the throttle body EGR vacuum nipple and connect a hand vacuum pump to the nipple.



(2) Start the engine and check to see that, after raising the engine speed by racing the engine, the vacuum raises proportionately with the rise in engine speed.

NOTE
If there is a problem with the change in vacuum, it is possible that the throttle body vacuum port may be clogged and require cleaning.



EGR Valve Inspection

(1) Remove the EGR valve and check if for sticking, deposit of carbon, etc.
If such condition exists, clean with adequate solvent to ensure tight valve seat contact.
(2) Connect a hand vacuum pump to the EGR valve.
(3) Apply a vacuum of 500 mmHg (19.7 in. Hg) and check air tightness.
(4) Blow in air from one passage of the EGR to check condition as follows:

Applying vacuum	Result
30 mmHg (1.2 in. Hg) or less	Air does not blow through
230 mmHg (9.1 in. Hg) or more	Air blows through

INSTALLATION

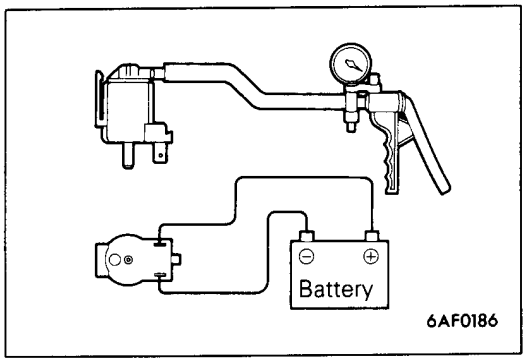
(1) Install a new gasket and EGR valve, tighten bolts to specified torque.

Specified tightening torque:
22 Nm (2.2 kgm, 16ft.lbs.)

EGR Control Solenoid Valve Inspection

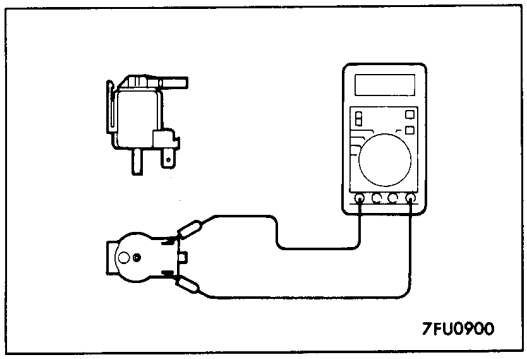
NOTE
When disconnecting the vacuum hose, always make a mark so that it can be reconnected at original position.

1. Disconnect the vacuum hose (yellow stripe, green stripe) from the solenoid valve.
2. Disconnect the harness connector.



3. Connect a hand vacuum pump to the nipple to which the green-striped vacuum hose was connected.
4. Check airtightness by applying a vacuum with voltage applied directly from the battery to the EGR control solenoid valve and without applying voltage.

Battery voltage	Normal condition
Not applied	Vacuum leaks
Applied	Vacuum maintained



5. Measure the resistance between the terminals of the solenoid valve.

Standard value: 36–44Ω (at 20°C)

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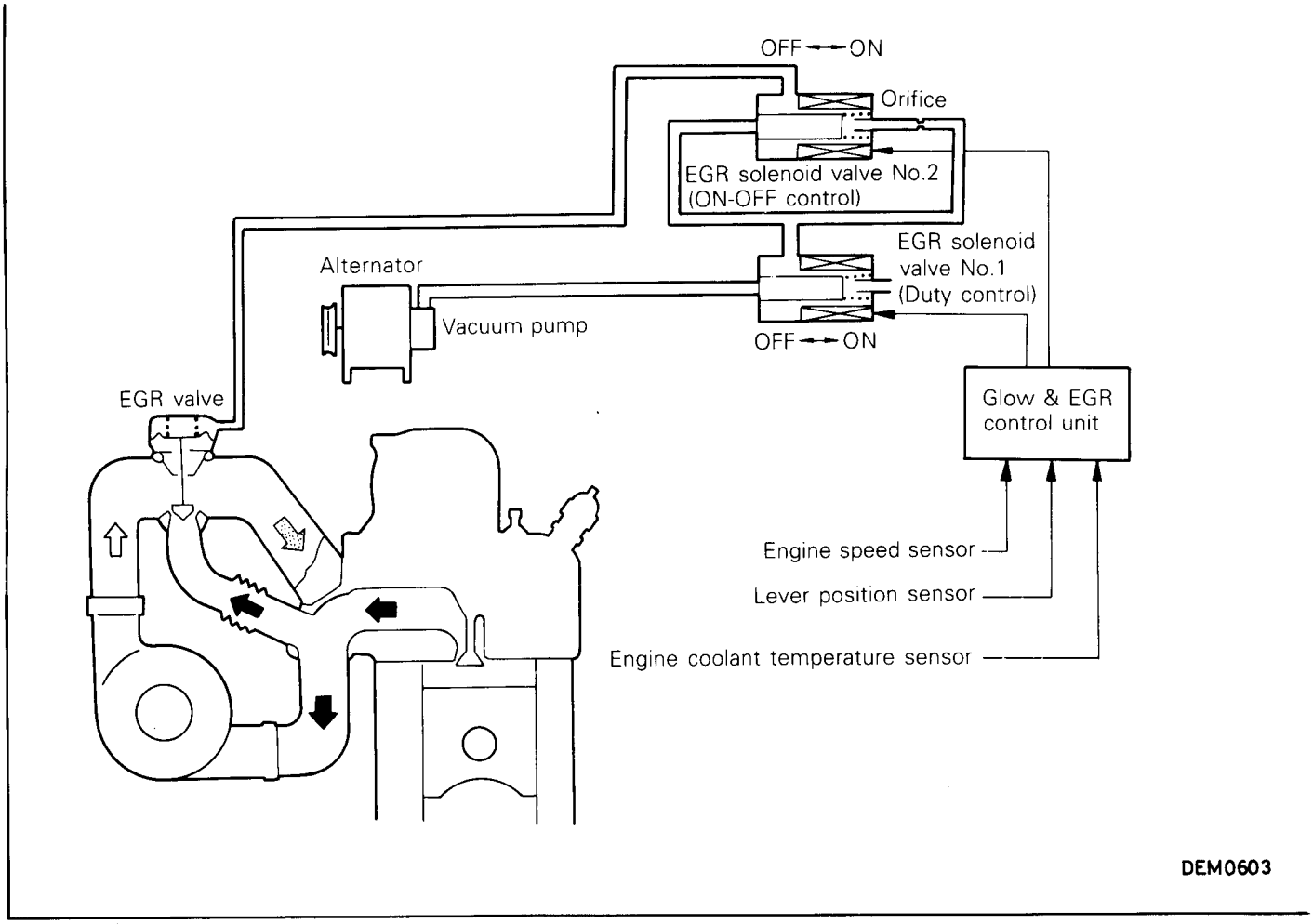
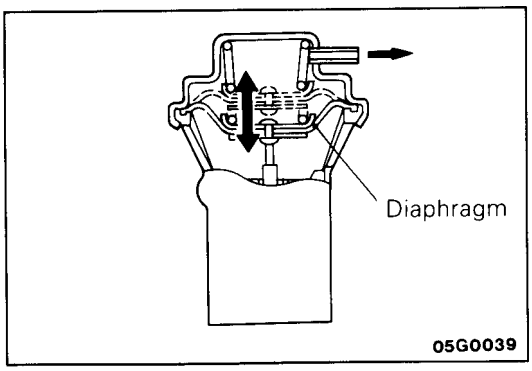
NOTES

EXHAUST GAS RECIRCULATION (EGR) SYSTEM <4D56 Engine>

System Inspection



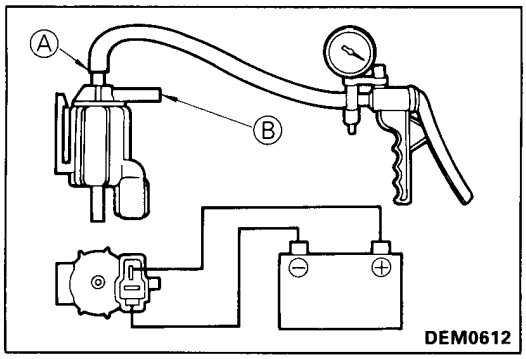


FUNCTION INSPECTION

(1) Start the engine and let it warm up until the engine coolant temperature is 65°C (149°F) or above.
(2) When the engine is raced by suddenly depressing the accelerator pedal, check to be sure that the diaphragm of the EGR valve lifts.

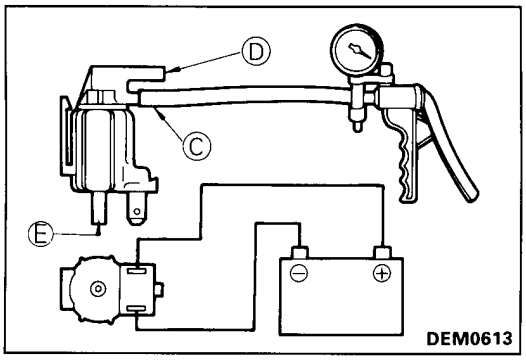
EGR SOLENOID VALVE NO.1/NO.2 OPERATION INSPECTION

(1) Remove the EGR solenoid valve No.1/No.2 connectors and vacuum hoses.
(2) Attach a vacuum pump to each nipple of the EGR solenoid valve No.1/No.2 and apply a vacuum. Check that the valves are airtight both when voltage is applied to each terminal of the EGR solenoid valves and when it is not applied.



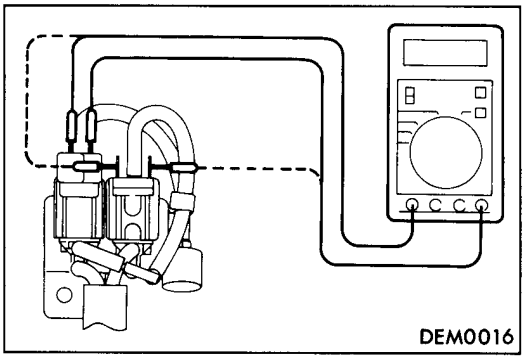
EGR SOLENOID VALVE No.1

Battery voltage	Normal condition
When current is flowing	Vacuum leaks (Vacuum is maintained when nipple Ⓑ is covered)
When current is not flowing	Vacuum is maintained



EGR SOLENOID VALVE No.2

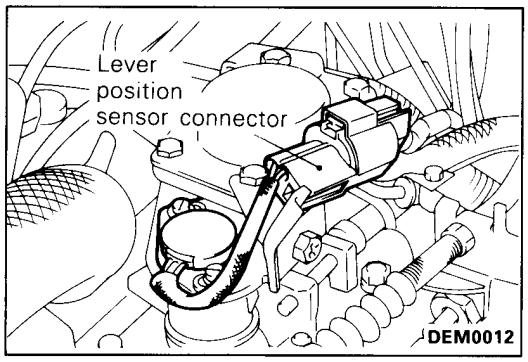
Battery voltage	Normal condition
When current is flowing	Vacuum leaks (Vacuum is maintained when nipple Ⓓ is covered)
When current is not flowing	Vacuum leaks (Vacuum is maintained when nipple Ⓔ is covered)



EGR SOLENOID VALVE NO.1/NO.2 RESISTANCE INSPECTION

Measure the coil resistances of the EGR solenoid valve No.1 and No.2 with a circuit tester.

Standard value [At 20°C (68°F)]: 36–44Ω



LEVER POSITION SENSOR (LPS) ADJUSTMENT [Condition before adjustment]

- Engine coolant temperature 80–95°C (176–203°F)

(1) Loosen the accelerator cable tension sufficiently.
(2) Connect the special tool (MD998478) to the lever position sensor connector as shown in the illustration.
(3) Connect a digital-type voltmeter between the red clip (output) and blue clip (earth) of the connected special tool.

(4) Turn the ignition switch to ON. (Do not start the engine.)
(5) Measure the output voltage of the lever position sensor.

Standard value:

Lever condition	Voltage V
Idle position	0.3 – 1.5
Fully open	3.7 – 4.9

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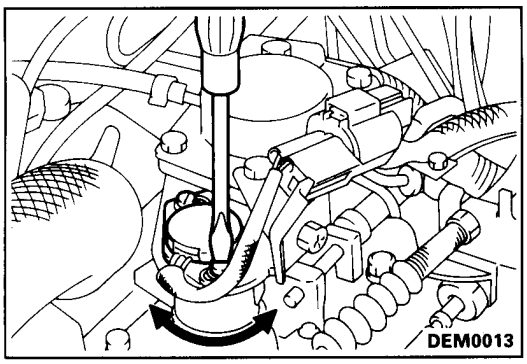
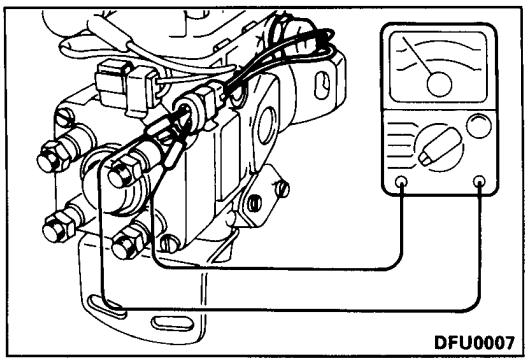


(6) If the voltage is outside the standard value, adjust by loosening the lever position sensor mounting screw and turning the lever position sensor body. After adjusting, securely tighten the screw.

NOTE
The output voltage will increase if the lever position sensor body is turned in an anti–clockwise direction.

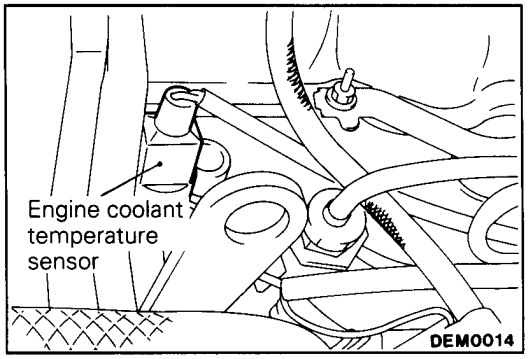
(7) Turn the ignition switch to "OFF".
(8) Adjust the accelerator cable play.



ENGINE SPEED SENSOR INSPECTION

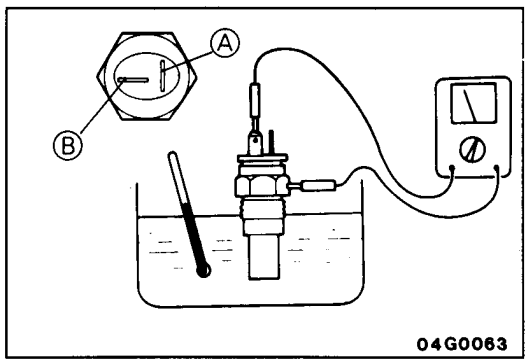
(1) Disconnect the engine speed sensor connectors.
(2) Measure the resistance between the engine speed sensor terminals.

Standard value: 1.3 - 1.9 kΩ



ENGINE COOLANT TEMPERATURE SENSOR INSPECTION

(1) Remove the engine coolant temperature sensor.



(2) While the sensor section of the engine coolant temperature sensor is submerged, measure the resistance between (B) terminal and the body.

Standard value:

Temperature [°C (°F)]	Resistance value (k Ω)
0 (32)	8.6
20 (68)	3.3
40 (104)	1.5
80 (176)	0.3

If the resistance differs largely from the standard value, replace the engine coolant temperature sensor.

(3) After applying specified sealant to the thread, tighten to the specified torque.

Specified sealant: 3M Nut Locking Part No. 4171 or equivalent
Tightening torque: 10–12 Nm (1.0–1.2 kgm, 7–9 ft.lbs.)

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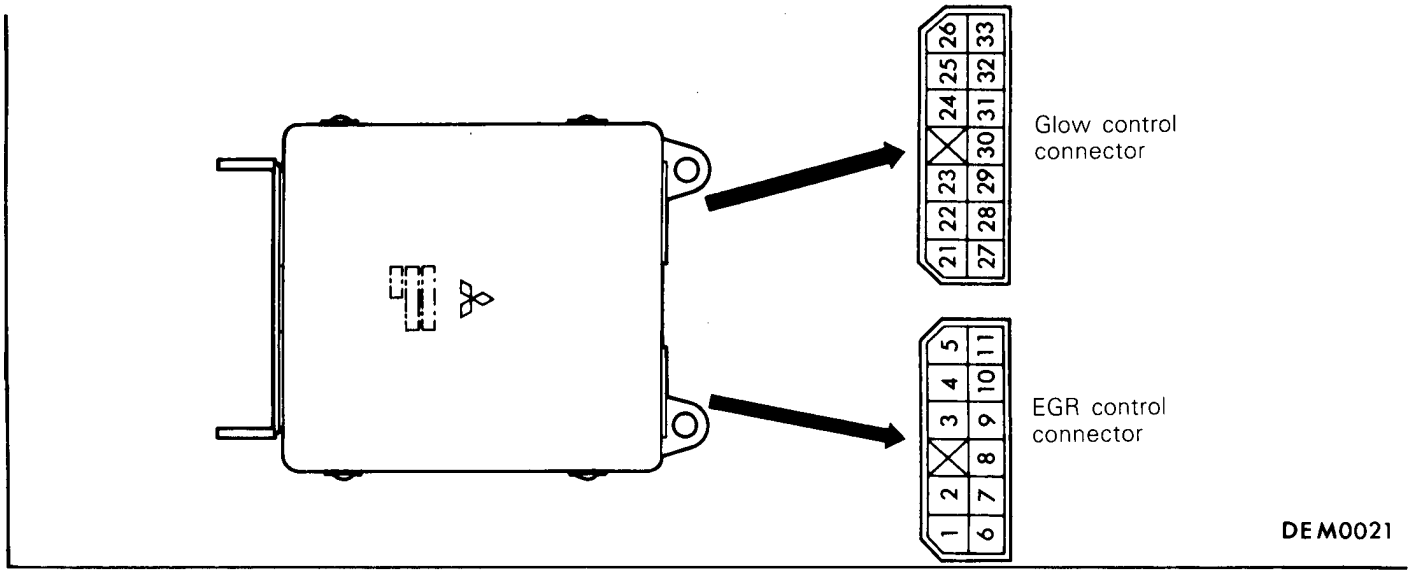
GLOW AND EGR CONTROL UNIT <SUPER QUICK GLOW SYSTEM>



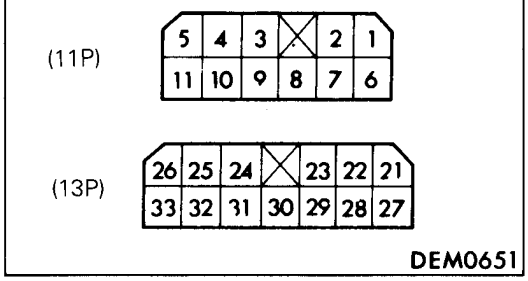
TERMINAL VOLTAGE MEASUREMENT

NOTE
(1) Inspect with the glow & EGR control unit connectors still connected.
(2) When measuring the voltage, the earth will be the glow & EGR unit terminal no. 30.

Terminal Voltage Reference Table

Glow & EGR control unit inspection terminal	Inspection item	Inspection conditions		Standard value
2	EGR solenoid valve No.1	Ignition switch: OFF → ON		11 – 13V
		While engine is idling after having warmed up, suddenly race the engine.		Momentarily increases
3	Lever position sensor	Ignition switch: OFF → ON	Throttle lever idle position	0.3 – 1.5V
			Throttle lever fully open position	3.7 – 4.9V
5	Sensor power supply <M/T only>	Ignition switch: OFF → ON		4.5 – 5.5V
8	EGR solenoid valve No.2	Ignition switch: OFF → ON		11 – 13V
		While engine is idling after having warmed up, suddenly race the engine.		Momentarily decreases

Glow & EGR control unit harness-side connector seen from the terminal side



HARNESS CONTINUITY INSPECTION

(1) Disconnect the glow & EGR control unit connector.
(2) Check to be sure that there is continuity (1.3 – 1.9 kΩ) between the harness-side connector terminals 10 – 11.

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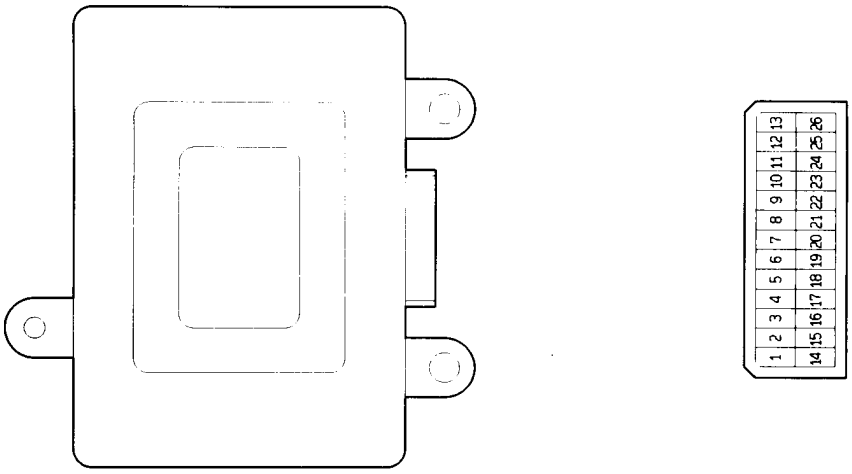
GLOW AND EGR CONTROL UNIT <SELF-REGULATING GLOW SYSTEM>

<From 1994 models>



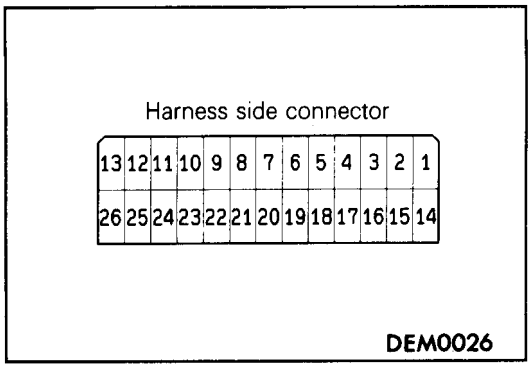
DEM0025

TERMINAL VOLTAGE MEASUREMENT

NOTE
(1) Inspect with the glow and EGR control unit connectors still connected.
(2) Connect the earth to terminal No. 26 of the glow and EGR control terminal when measuring the voltage.

Terminal Voltage Table

Glow and EGR control unit inspection terminal	nspection item	Inspection condition		Standard value
3	EGR solenoid valve No.1	Ignition switch: OFF → ON		11 – 13V
		While engine is idling after having warmed up, suddenly depress the accelerator pedal.		Momentarily increases
6	Lever position sensor	Ignition switch OFF → ON	Throttle lever idle position	0.3 – 1.5V
			Throttle lever fully open position	3.7 – 4.9V
7	Sensor power supply	Ignition switch: OFF → ON		4.5 – 5.5V
16	EGR solenoid valve No. 2	Ignition switch: OFF → ON		11 – 13V
		While engine is idling after having warmed up, suddenly depress the accelerator pedal.		Momentarily decreases



HARNESS CONTINUITY INSPECTION

(1) Disconnect the glow and EGR control unit connectors.
(2) Check to be sure that there is continuity (1.3 – 1.9Ω) between the harness side connector terminals (11) – (24).

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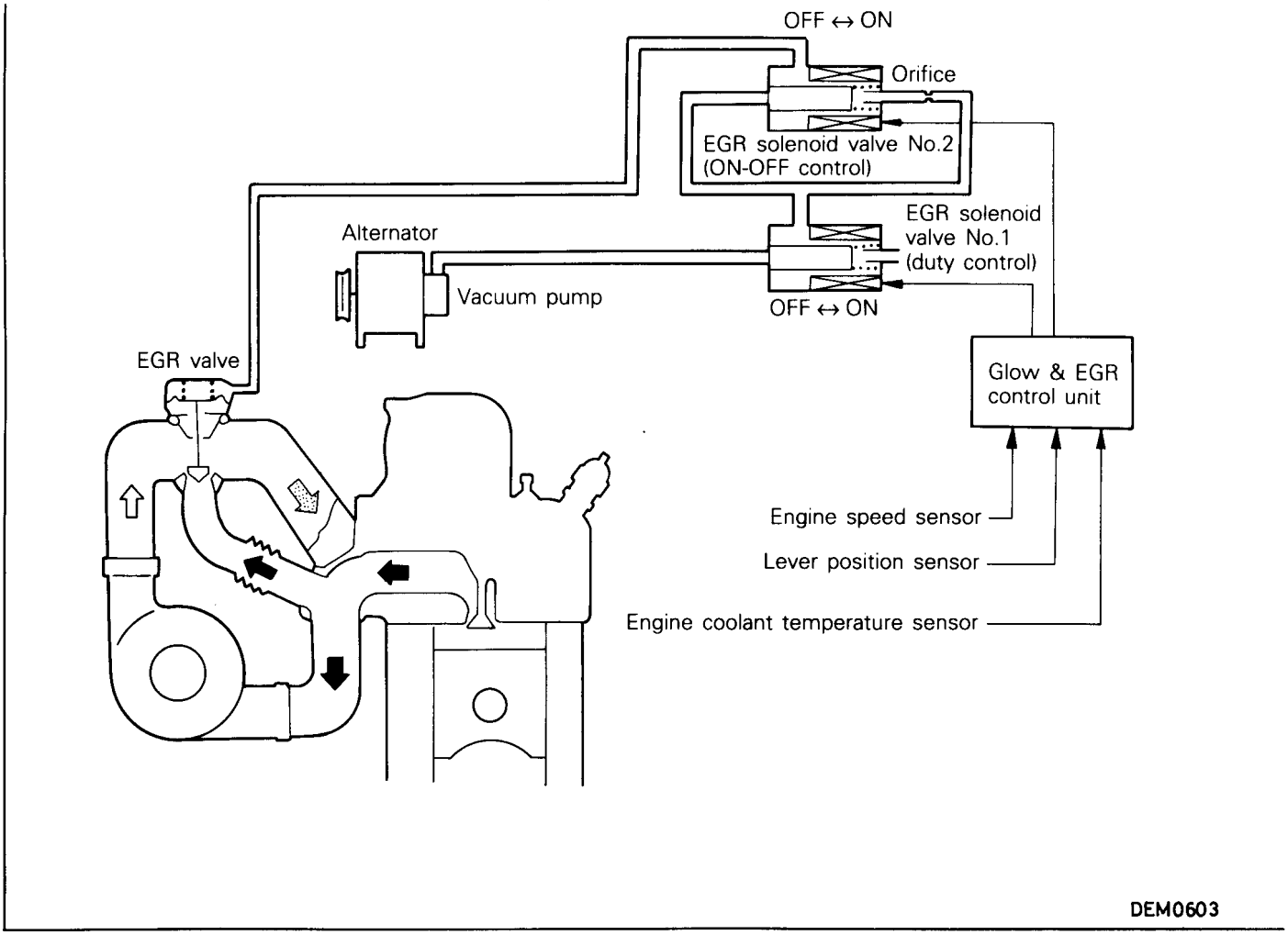
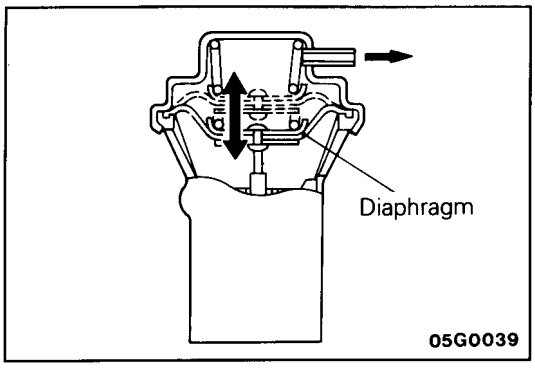
EXHAUST GAS RECIRCULATION (EGR) SYSTEM <4M40 Engine>

System Inspection



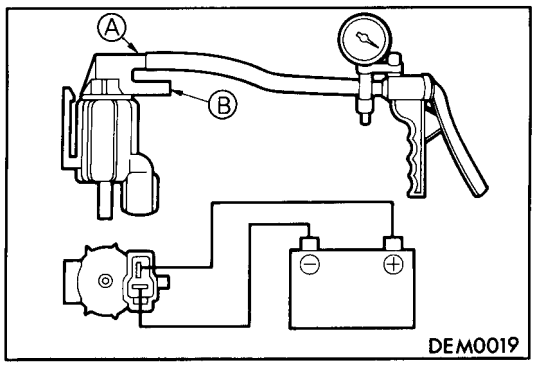


FUNCTION INSPECTION

(1) Start the engine and let it warm up until the engine coolant temperature is 65°C (149°F) or above.
(2) When the engine is raced by suddenly depressing the accelerator pedal, check to be sure that the diaphragm of the EGR valve lifts.

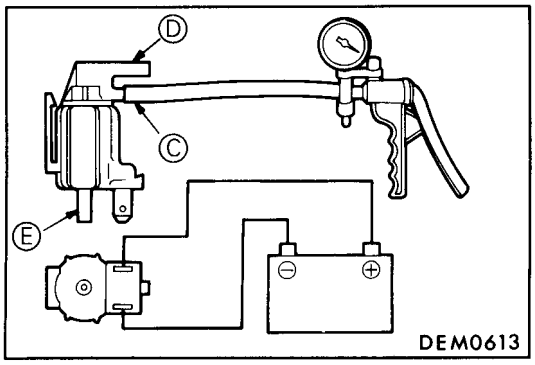
EGR SOLENOID VALVE NO. 1/NO. 2 OPERATION INSPECTION

(1) Remove the EGR solenoid valve No.1/No.2 connectors and vacuum hoses.
(2) Attach a vacuum pump to each nipple of the EGR solenoid valve No. 1/No. 2 and apply a vacuum. Check that the valves are airtight both when voltage is applied to each terminal of the EGR solenoid valves and when it is not applied.



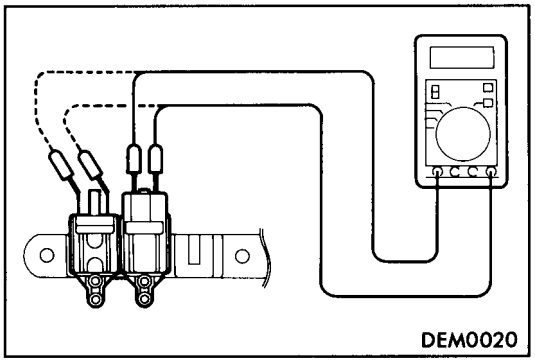
EGR SOLENOID VALVE NO. 1

Battery voltage	Normal condition
When current is flowing	Vacuum leaks (Vacuum is maintained when nipple B is covered)
When current is not flowing	Vacuum is maintained



EGR SOLENOID VALVE NO. 2

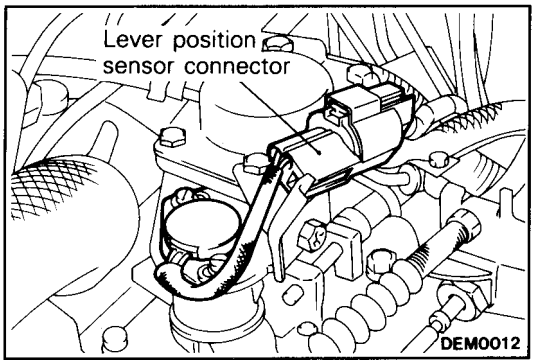
Battery voltage	Normal condition
When current is flowing	Vacuum leaks (Vacuum is maintained when nipple D is covered)
When current is not flowing	Vacuum leaks (Vacuum is maintained when nipple E is covered)



EGR SOLENOID VALVE NO. 1/NO. 2 RESISTANCE INSPECTION

(1) Measure the coil resistances of the EGR solenoid valve No.1/No. 2 with a circuit tester.

	Solenoid valve No.1/No.2 resistance
Standard value [At 20°C (68°F)]	36–44Ω



LEVER POSITION SENSOR (LPS) ADJUSTMENT

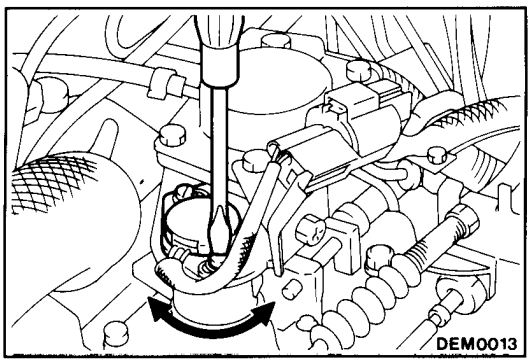
[Condition before adjustment]

- Engine coolant temperature 80–95°C (176–203°F)

(1) Loosen the accelerator cable tension sufficiently.
(2) Connect the special tool (MD998478) to the lever position sensor connector shown in the illustration.
(3) Connect a digital-type voltmeter between the red clip (output) and blue clip (earth) to which the special tool has been connected.
(4) Turn the ignition switch to ON. (Do not start the engine.)
(5) Measure the output voltage of the lever position sensor.

Standard value:

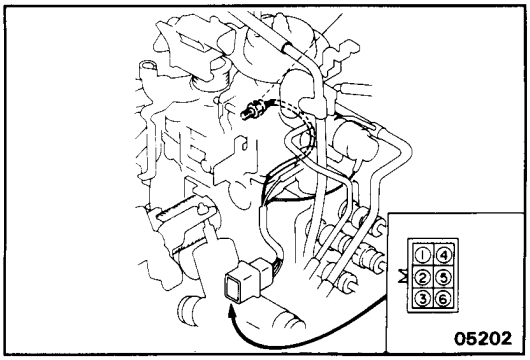
Lever condition	Voltage V
Idle position	0.3–1.5
Fully open	3.7–4.9



(6) If the voltage is outside the standard value, adjust by loosening the lever position sensor mounting screw and turning the lever position sensor. After adjustment, securely tighten the screw.

NOTE
If the lever position sensor is turned clockwise, the output voltage will be increased.

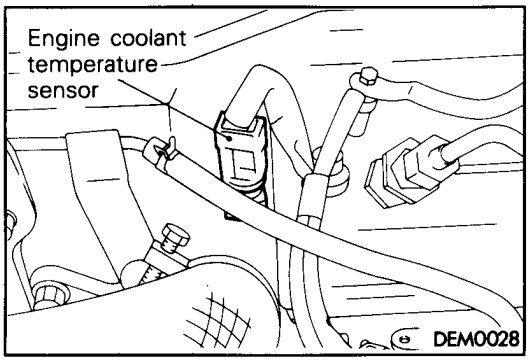
(7) Turn the ignition switch to OFF.
(8) Adjust the accelerator cable play.



ENGINE SPEED SENSOR INSPECTION

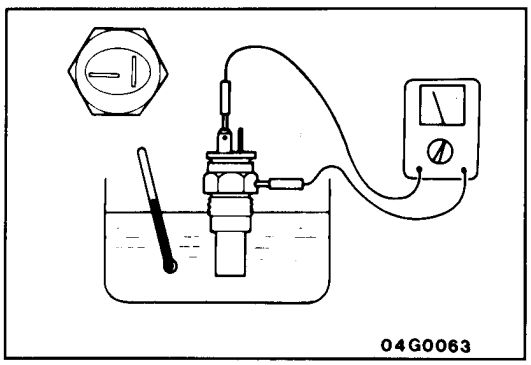
(1) Disconnect the engine speed sensor connectors.
(2) Measure the resistance between the engine speed sensor terminals ③ – ⑥.

Standard value: 1.3–1.9 kΩ



ENGINE COOLANT TEMPERATURE SENSOR INSPECTION

(1) Remove the engine coolant temperature sensor.



(2) Dip the sensing section of the engine coolant temperature sensor in oil and measure the resistance value.

Standard value:

Temperature [°C (°F)]	Resistance value (kΩ)
0 (32)	8.6
20 (68)	3.3
40 (104)	1.5
80 (176)	0.3

If the resistance differs largely from the standard value, replace the engine coolant temperature sensor.

GLOW AND EGR CONTROL UNIT

TERMINAL VOLTAGE MEASUREMENT

Refer to P.17-23

HARNESS CONTINUITY INSPECTION

Refer to P.17-24

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CLUTCH

CONTENTS

E21AA--

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General Specifications 2
Service Specifications 2
Lubricants 2

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CLUTCH CONTROL **7**

CLUTCH MASTER CYLINDER **10**

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SPECIFICATIONS

GENERAL SPECIFICATIONS

E21CA--

Items	2400, 2500D	3000	3500, 2800D
Clutch operating method	Hydraulic type		
Clutch disc O.D. × I.D. mm (in.)	225 × 150 (8.9 × 5.9)	240 × 160 (9.4 × 6.3)	250 × 160 (9.8 × 6.3)
Clutch release cylinder I.D. mm (in.)	19.05 (3/4)		23.81 (15/16)
Clutch master cylinder I.D. mm (in.)	15.87 (5/8)		19.05 (3/4)

SERVICE SPECIFICATIONS

E21CB--

Items		Specifications
Standard value		
Clutch pedal height	mm (in.)	185.5–190.5 (7.30–7.50)
Clutch pedal clevis pin play	mm (in.)	1–3 (0.04–0.12)
Clutch pedal free play	mm (in.)	6–13 (0.24–0.51)
Distance between the clutch pedal and the toeboard when the clutch is disengaged	mm (in.)	35 (1.4 in.) or more

LUBRICANTS

E21CD--

Items	Specified lubricants	Quantity
Clutch fluid	Brake fluid DOT3 or DOT4	As required
Inner surface of clutch master cylinder and outer circumference of piston assembly		
End of clutch release cylinder push rod	MITSUBISHI genuine grease Part No. 0101011	

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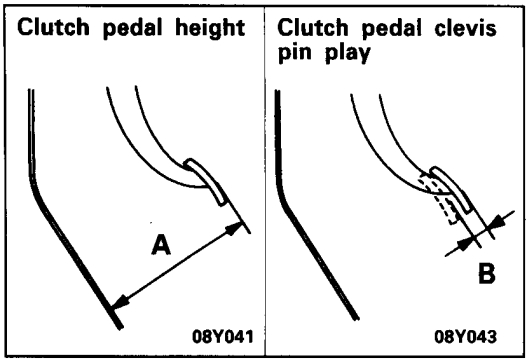

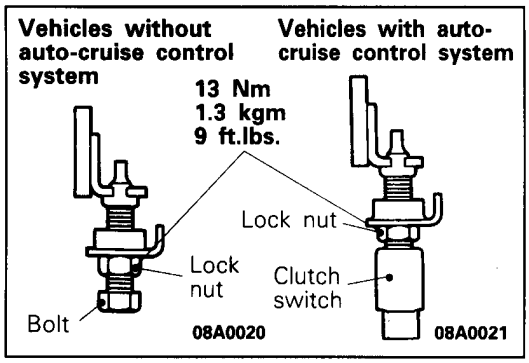

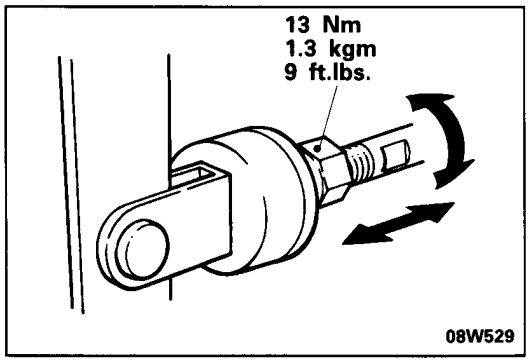

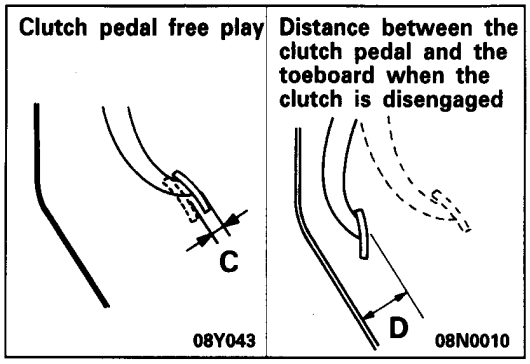

SERVICE ADJUSTMENT PROCEDURES

CLUTCH PEDAL INSPECTION AND ADJUSTMENT

E21FAAL

1. Measure the clutch pedal height (A) from the toeboard and the clutch pedal clevis pin play (B) at the face of the pedal pad.

   Standard value (A): 185.5–190.5 mm (7.30–7.50 in.)
   Standard value (B): 1–3 mm (0.04–0.12 in.)

2. If either the clutch pedal height or the clutch pedal clevis pin play are not within the standard value range, adjust as follows:
   (1) For vehicles without auto-cruise control system, turn and adjust the bolt so that the pedal height is the standard value, and then secure by tightening the lock nut. For vehicles with auto-cruise control system, disconnect the clutch switch connector and turn the switch for standard clutch pedal height. Then lock with the lock nut.

   NOTE
   When the pedal height is lower than the standard value, loosen the bolt, and then turn the push rod to make the adjustment. After the adjustment, tighten the bolt until it reaches the pedal stopper, and then lock with the lock nut.

   (2) Turn the push rod to adjust the clutch pedal clevis pin play to agree with the standard value and then secure the push rod with the lock nut.

   Caution
   When adjusting the clutch pedal clevis pin play, be careful not to push the push rod toward the master cylinder.

(3) After completing the adjustments, confirm that the clutch pedal free play (measured at the face of the pedal pad) and the distance between the clutch pedal (the face of the pedal pad) and the toeboard when the clutch is disengaged are within the standard value ranges.

   Standard value (C): 6–13 mm (0.24–0.51 in.)
   Standard value (D): 35 mm (1.4 in.) or more

4. If the clutch pedal free play (C) and the distance (D) between the clutch pedal and the toeboard when the clutch is disengaged do not agree with the standard values, it is probably the result of either air in the hydraulic system or a faulty master cylinder or clutch. Bleed the air, or disassemble and inspect the master cylinder or clutch.

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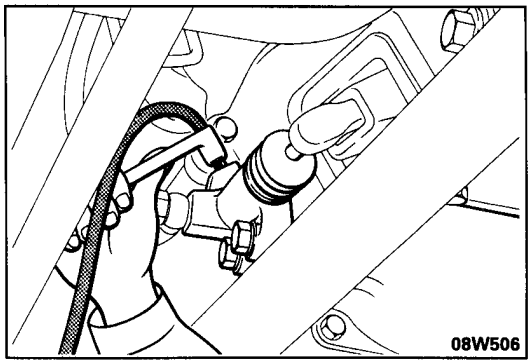

BLEEDING E21FEAD

Whenever the clutch pipe, the clutch hose, and/or the clutch master cylinder have been removed, or if air is suspected in the clutch lines, bleed the system.

Specified fluid: DOT3 or DOT4

Caution
Use the specified fluid. Avoid using a mixture of the specified fluid and other fluid.

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CLUTCH PEDAL

REMOVAL AND INSTALLATION

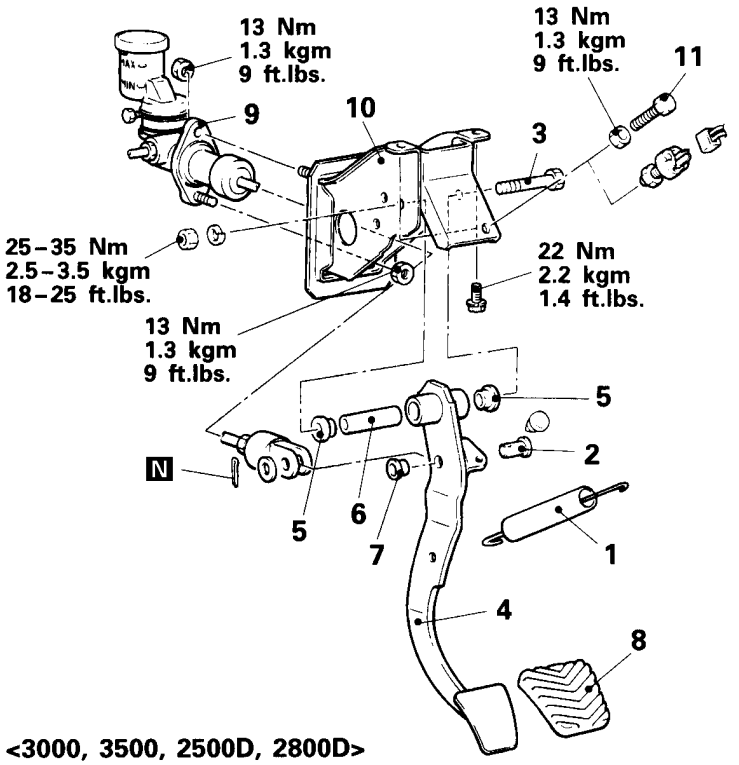
E21PA–

L.H. drive vehicles

<2400>

Pre-removal Operation
- Removal of the Foot Shower Duct (LH) and the Lap Cooler Duct A (Refer to GROUP 55 – Ventilators.)

Post-installation Operation
- Installation of the Foot Shower Duct (L.H.) and the Lap Cooler Duct A (Refer to GROUP 55 – Ventilators.)
- Adjustment of Clutch Pedal (Refer to P.21-3.)



08E0021

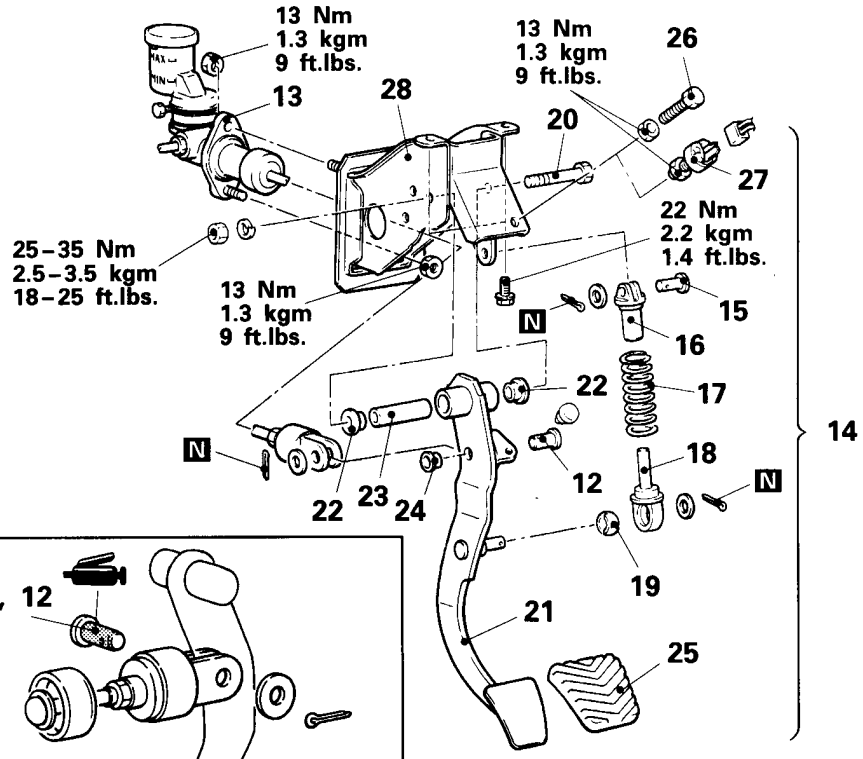
Removal steps <2400>

1. Return spring
2. Clevis pin
3. Pedal shaft
4. Clutch pedal
5. Bushings
6. Spacer
7. Bushing
8. Pedal pad
9. Connection for clutch master cylinder
10. Stopper bolt
11. Clutch pedal bracket

Removal steps <3000, 3500, 2500D, 2800D>

12. Clevis pin
13. Connection for clutch master cylinder
14. Clutch pedal assembly
15. Clevis pin
16. Rod A
17. Turnover spring
18. Rod B
19. Bushing
20. Pedal shaft
21. Clutch pedal
22. Bushings
23. Spacer
24. Bushing
25. Pedal pad
26. Stopper bolt <Vehicles without auto-cruise control system>
27. Clutch switch <Vehicles with auto-cruise control system>
28. Clutch pedal bracket

<3000, 3500, 2500D, 2800D>



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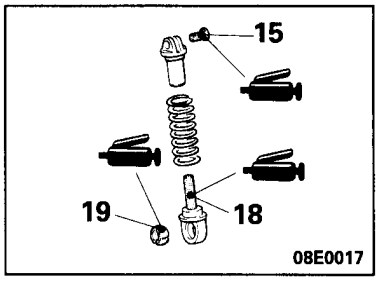
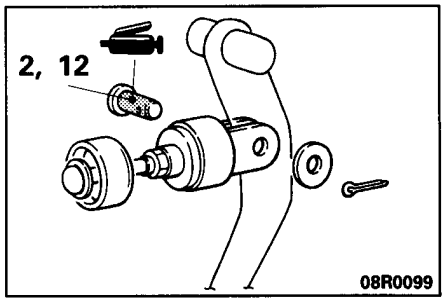


08E0017



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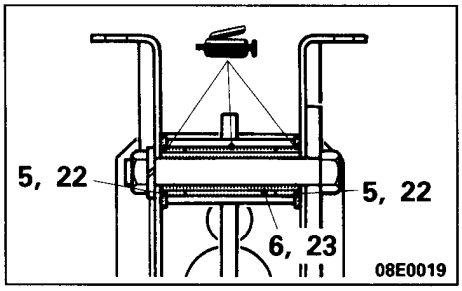
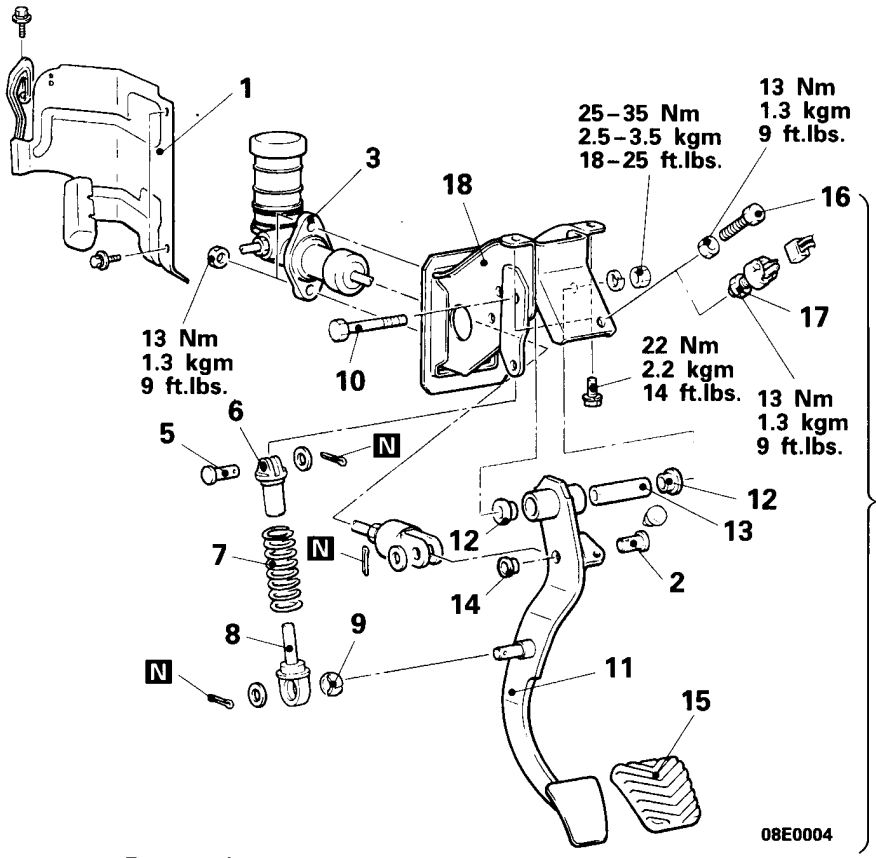


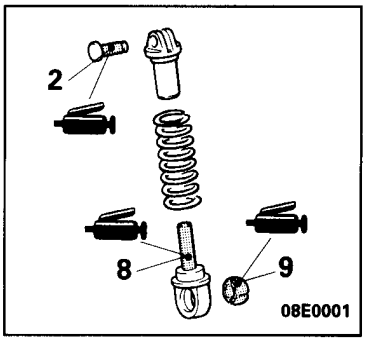
08E0019

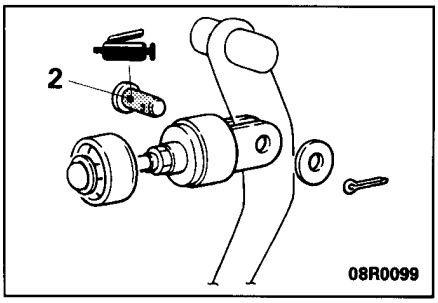
R.H. drive vehicles

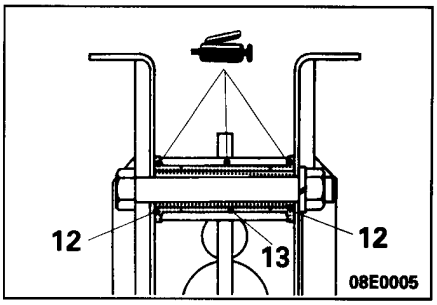
Post-installation Operation
- Installation of Foot Shower Duct (R.H.) and Lap Cooler Duct A (Refer to GROUP 55 – Ventilators).
- Adjustment of Clutch Pedal (Refer to P.21-3.)

Pre-removal Operation
- Removal of Foot Shower Duct (R.H.) and Lap Cooler Duct A (Refer to GROUP 55 – Ventilators)









Removal steps
1. Heat protector <2500D, 2800D>
2. Clevis pin
3. Connection for clutch master cylinder
4. Clutch pedal assembly
5. Clevis pin
6. Rod A
7. Turnover spring
8. Rod B
9. Bushing
10. Pedal shaft
11. Clutch pedal
12. Bushings
13. Spacer
14. Bushing
15. Pedal pad
16. Stopper bolt <vehicles without auto-cruise control system>
17. Clutch switch <vehicles with auto-cruise control system>
18. Clutch pedal bracket

INSPECTION

E21FCAF

- Check the pedal shaft and bushing for wear.
- Check the clutch pedal for bend or torsion.
- Check the return spring for damage or deterioration. <2400>
- Check the turnover spring for damage or deterioration. <3000, 3500, 2500D, 2800D>
- Check the pedal pad for damage or wear.

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CLUTCH CONTROL

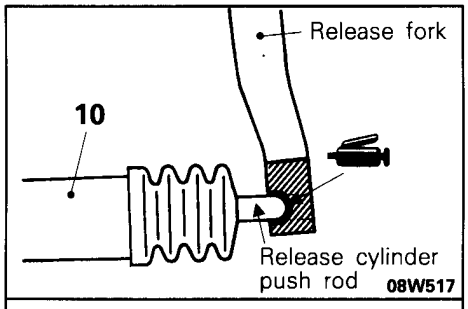
REMOVAL AND INSTALLATION

E21JA--

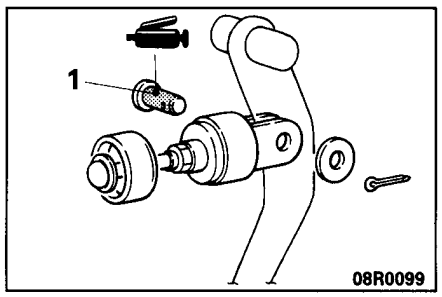
L.H. drive vehicles <2400, 3000, 2500D>

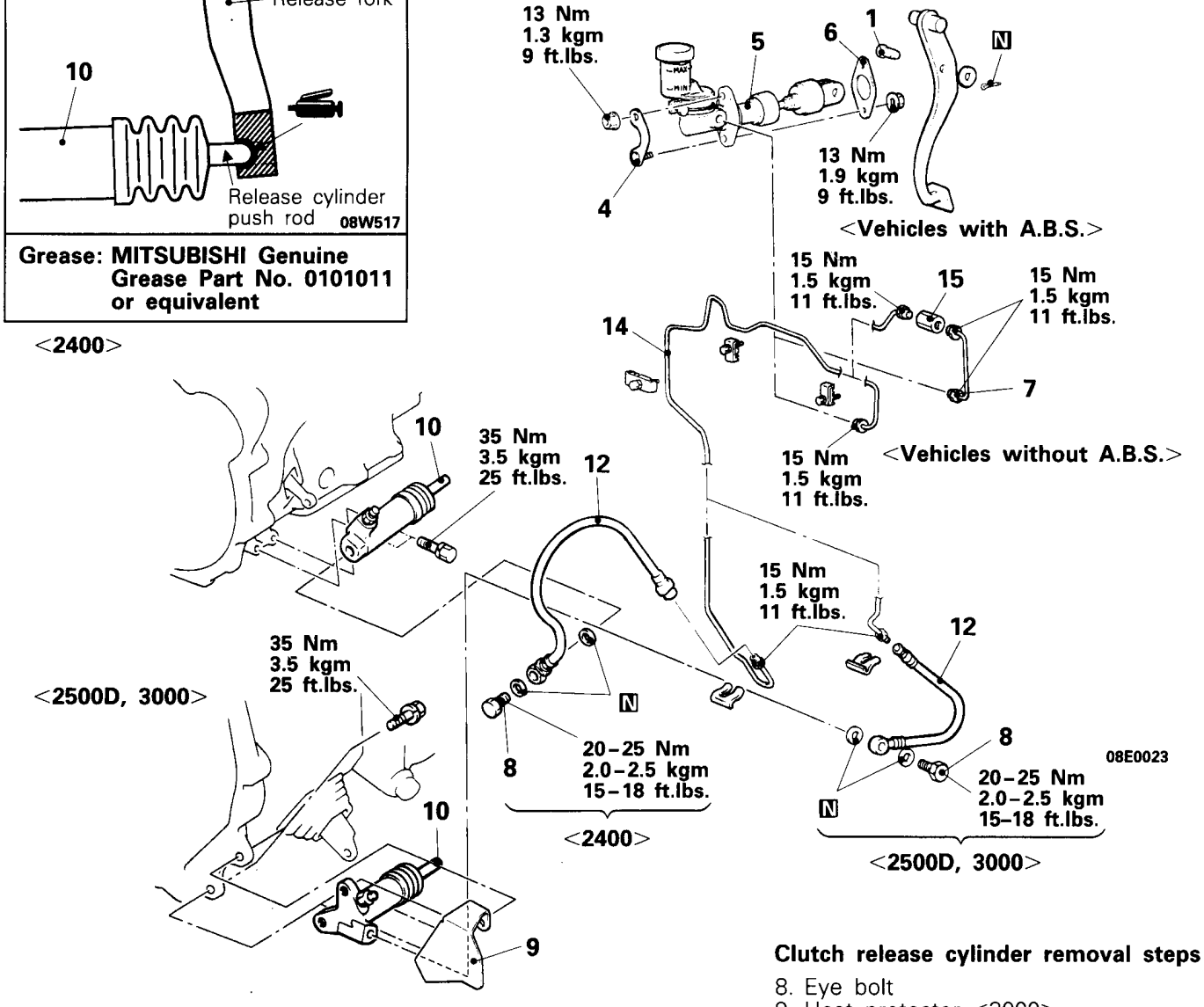
Pre-removal Operation
- Draining of Clutch Fluid

Post-installation Operation
- Supplying Clutch Fluid
- Bleeding
  (Refer to P.21-4.)



Grease: MITSUBISHI Genuine Grease Part No. 0101011 or equivalent





Clutch master cylinder removal steps
- **Adjustment of Clutch Pedal (Refer to P.21-3.)**

1. Clevis pin
4. Plate
5. Clutch master cylinder ◆◆
6. Sealer
7. Clutch pipe A <Vehicles with A.B.S.>

NOTE
A.B.S.: Anti-skid Brake System

Clutch release cylinder removal steps

8. Eye bolt
9. Heat protector <3000>
10. Clutch release cylinder

Clutch pipe B and connector removal steps

14. Clutch pipe B ◆◆
15. Connector <Vehicles with A.B.S.>

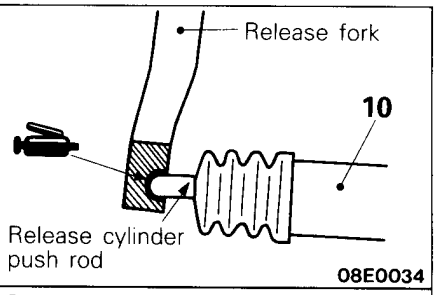
Clutch hose removal steps

8. Eye bolt
12. Clutch hose ◆◆

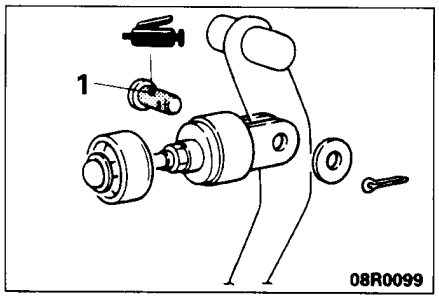
L.H. drive vehicles <3500, 2800D>

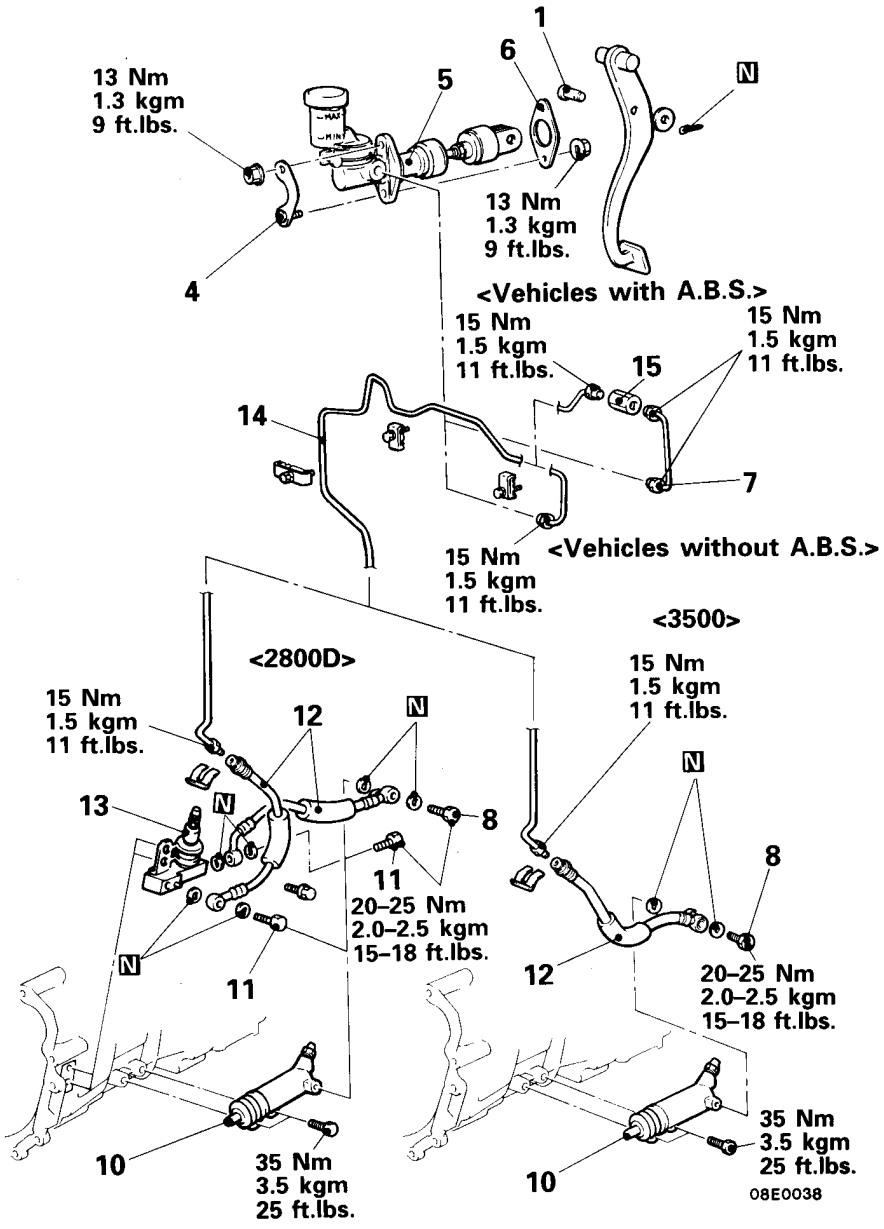
Pre-removal Operation
- Draining of Clutch Fluid

Post-installation Operation
- Supplying Clutch Fluid
- Bleeding
(Refer to P.21-4.)



Grease: MITSUBISHI Genuine Grease Part No. 0101011 or equivalent





Clutch master cylinder removal steps
- **Adjustment of Clutch Pedal (Refer to P.21-3.)**
1. Clevis pin
4. Plate
5. Clutch master cylinder
6. Sealer
7. Clutch pipe A <Vehicles with A.B.S.>

Clutch release cylinder removal steps
8. Eye bolt
10. Clutch release cylinder

Clutch pipe B and connector removal steps
14. Clutch pipe B
15. Connector <Vehicles with A.B.S.>

Clutch hose removal steps
8. Eye bolt
11. Eye bolt
12. Clutch hose

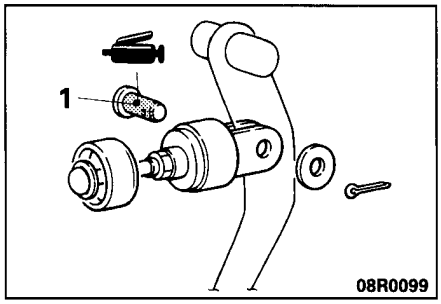
Clutch fluid chamber removal steps
11. Eye bolt
13. Clutch fluid chamber

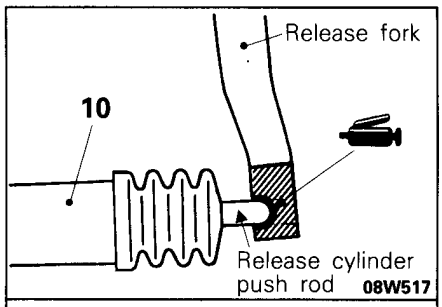
NOTE:
A.B.S.: Anti-skid Brake System

R.H. drive vehicles <3000, 2500D>

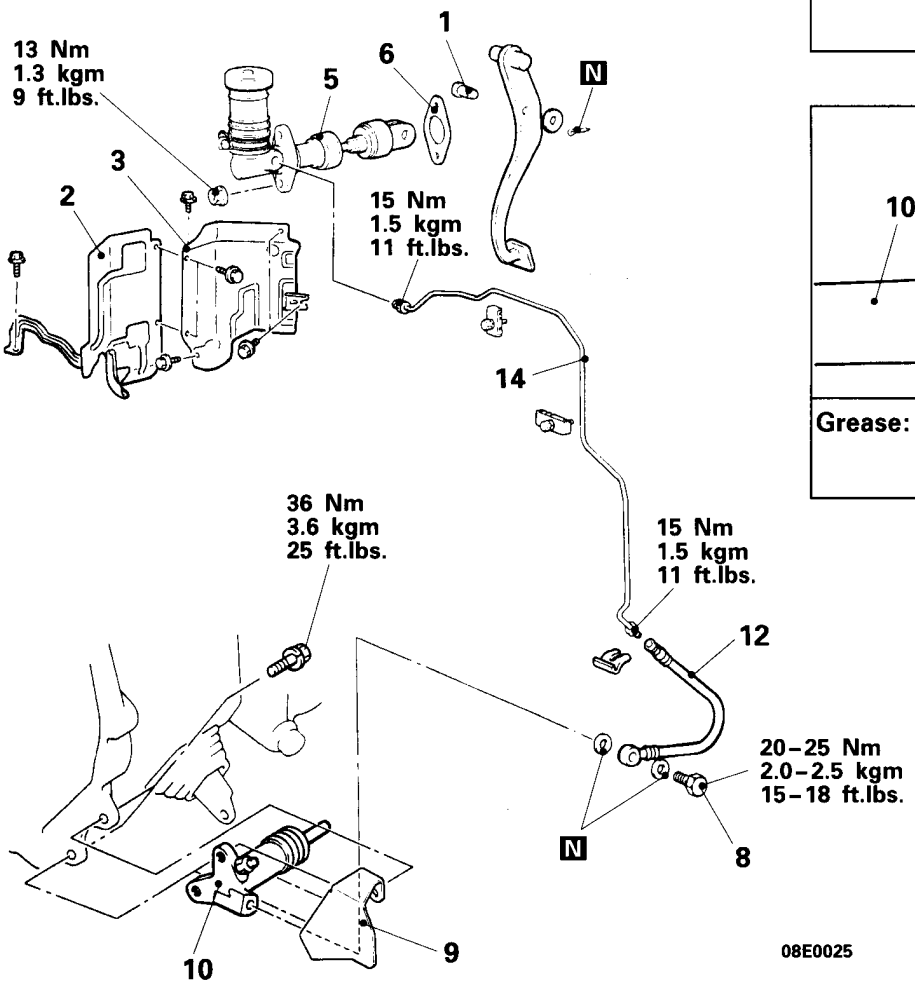
Pre-removal Operation
- Draining of Clutch Fluid

Post-installation Operation
- Supplying Clutch Fluid
- Bleeding
  (Refer to P.21-4.)





Grease: MITSUBISHI Genuine Grease Part No. 0101011 or equivalent



Clutch master cylinder removal steps

- **Adjustment of Clutch Pedal (Refer to P.21-3.)**

1. Clevis pin
2. Heat protector <2500D>
3. Dash panel heat protector <2500D>
5. Clutch master cylinder ◆◆
6. Sealer

Clutch release cylinder removal steps

8. Eye bolt
9. Heat protector <3000>
10. Clutch release cylinder

Clutch pipe B removal steps

2. Heat protector <2500D>
3. Dash panel heat protector <2500D>
14. Clutch pipe B ◆◆

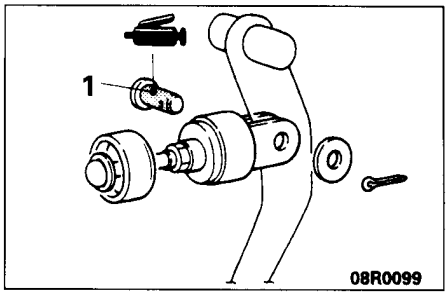
Clutch hose removal steps

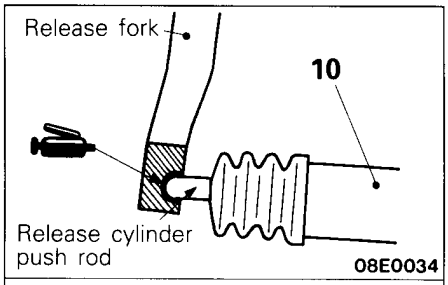
8. Eye bolt
12. Clutch hose ◆◆

R.H. drive vehicles <3500, 2800D>

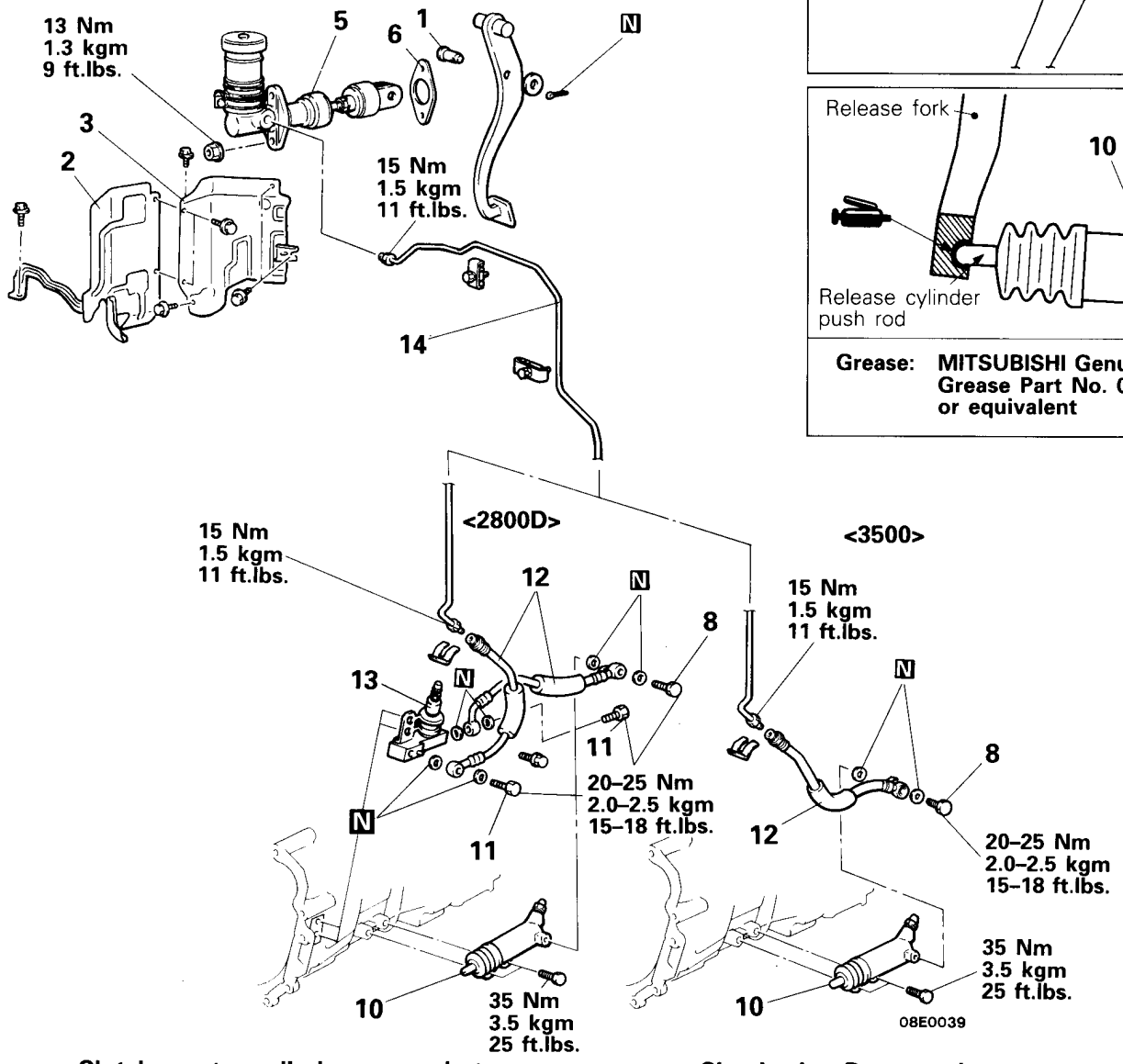
Pre-removal Operation
- Draining of Clutch Fluid

Post-installation Operation
- Supplying Clutch Fluid
- Bleeding
(Refer to P.21-4.)





Grease: **MITSUBISHI Genuine Grease Part No. 0101011 or equivalent**



Clutch master cylinder removal steps
- **Adjustment of Clutch Pedal (Refer to P.21-3.)**
1. Clevis pin
2. Heat protector <2800D>
3. Dash panel heat protector <2800D>
5. Clutch master cylinder
6. Sealer

Clutch release cylinder removal steps
8. Eye bolt
10. Clutch release cylinder

Clutch pipe B removal steps
2. Heat protector <2800D>
3. Dash panel heat protector <2800D>
14. Clutch pipe B

Clutch hose removal steps
8. Eye bolt
11. Eye bolt
12. Clutch hose

Clutch fluid chamber removal steps
11. Eye bolt
13. Clutch fluid chamber

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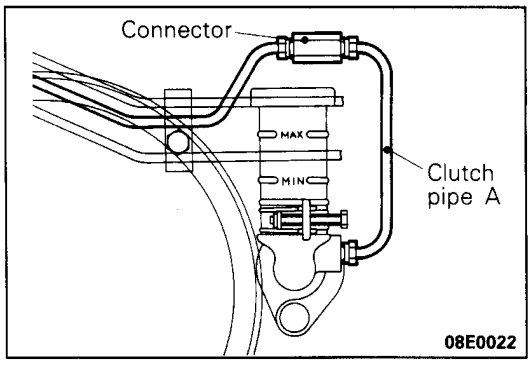
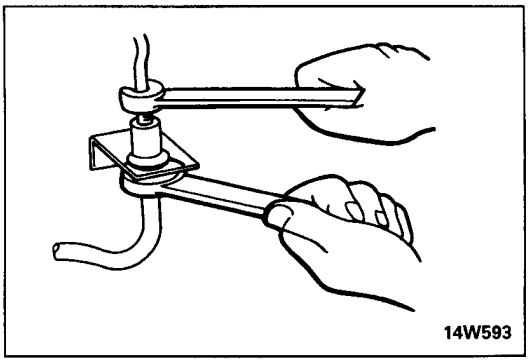




SERVICE POINTS OF REMOVAL E21JBBE

5. REMOVAL OF CLUTCH MASTER CYLINDER <L.H. drive Vehicles>

For vehicles with A.B.S., remove the connector and the clutch pipe A assembly, and remove the clutch master cylinder from the vehicle with the clutch pipe still attached.

12. REMOVAL OF CLUTCH HOSE

Holding the nut at the clutch hose side, loosen the flare nut of the clutch pipe.

14. REMOVAL OF CLUTCH PIPE B

(1) For L.H. drive vehicles, remove the brake booster, intercooler <2500D, 2800D> and link assembly <vehicles with cruise control>, and for RH drive vehicles, remove the intercooler <2500D, 2800D> and link assembly <vehicles with cruise control>. (Refer to GROUP 35 – Brake Booster, GROUP 15 – Intercooler, and GROUP 13 – Cruise Control.)

(2) Holding the nut at the clutch hose side, loosen the flare nut of the clutch pipe.

INSPECTION E21JCBB

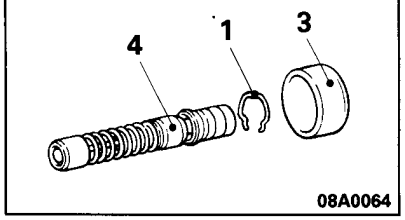
- Check the master cylinder or clutch hose for fluid leakage.
- Check the clutch hose or pipe for cracks or clogging.

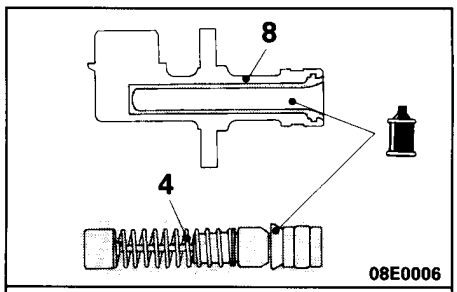
CLUTCH MASTER CYLNDER

DISASSEMBLY AND REASSEMBLY

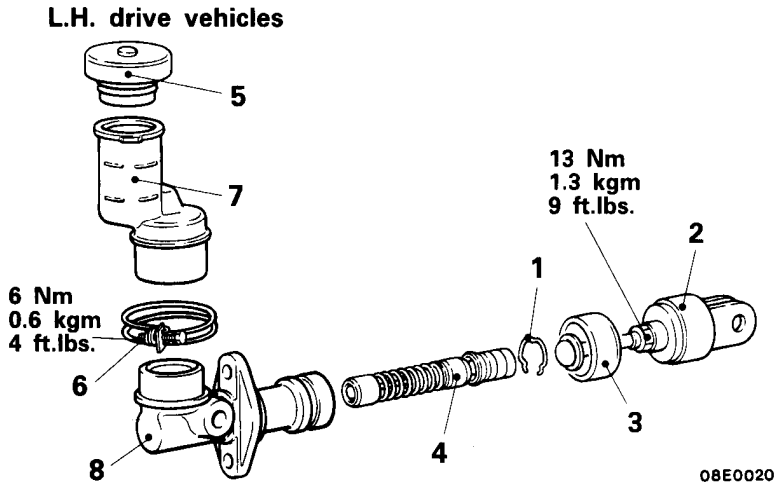
E21SE--

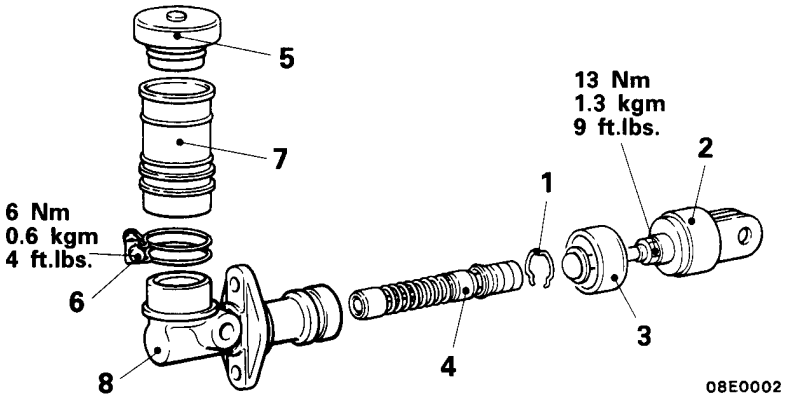
Piston repair kit





Clutch fluid: Brake fluid DOT3 or DOT4





Disassembly steps

1. Piston stop ring
2. Damper and push rod
3. Boot
4. ◆◆ Piston assembly
5. Reservoir cap
6. Reservoir band
7. Reservoir
8. Master cylinder body

SERVICE POINTS OF DISASSEMBLY

E21SFAE

4. REMOVAL OF PISTON ASSEMBLY

Caution

1. Do not damage the master cylinder body and piston assembly.

2. Do not disassemble piston assembly.

INSPECTION

E21SGAC

- Check the inside cylinder body for rust or scars.
- Check the piston cup for wear or deformation.
- Check the piston for rust or scars.
- Check the clutch tube connection part for clogging.

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MANUAL TRANSMISSION

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E22AA--

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SPECIFICATIONS

GENERAL SPECIFICATIONS

E22CA--

Items	2400	3000, 2500D	3500	2800D
Transmission models	V5M21	V5MT1	V5M31	V5M31
Type	5-speed floor shift	5-speed floor shift	5-speed floor shift	5-speed floor shift
Gear ratio				
1st	3.967	3.918	3.952	3.952
2nd	2.136	2.261	2.238	2.238
3rd	1.360	1.395	1.398	1.398
4th	1.000	1.000	1.000	1.000
5th	0.856	0.829	0.819	0.761
Reverse	3.578	3.295	3.553	3.553
Transfer				
Type	2-speed floor shift	2-speed floor shift	2-speed floor shift	2-speed floor shift
Gear ratio				
High	1.000	1.000	1.000	1.000
Low	1.925	1.925	1.900	1.900

LUBRICANTS

Items	Specified lubricant	Quantity dm^3 (U.S. qts., Imp. qts.)
Manual transmission oil	Hypoid gear oil API GL-4, SAE 75W-90 or 75W-85W	2.2 (2.3, 1.9) <V5M21> 2.2 (2.6, 2.2) <V5MT1> 3.7 (3.9, 3.3) <V5M31>
Transfer oil	Hypoid gear oil API GL-4, SAE 75W-90 or 75W-85W	V5M21, V5MT1 2.3 (2.4, 2.0) <Vehicles without P.T.O.> 2.7 (2.9, 2.4) <Vehicles with P.T.O.> V5M31 2.5 (2.6, 2.2) <Vehicles without P.T.O.> 2.9 (3.1, 2.6) <Vehicles with P.T.O.>
Transfer oil seal lip	Hypoid gear oil API GL-4, SAE 75W-90 or 75W-85W	As required

NOTE
P.T.O.: Power Take Off

SEALANTS AND ADHESIVES

E22CE--

Items	Specified sealant	Remarks
Oil drain plug	3M ATD Part No. 8660 or equivalent	Semi-drying sealant
Oil filter plug	3M ATD Part No. 8660 or equivalent	Semi-drying sealant
Outer circumference of speedometer cable grommet	3M ATD Part No. 8001, 8011 or equivalent	Drying adhesive
Control lever assembly		
Control lever gasket	3M ATD Part No. 8661 or equivalent	Semi-drying sealant
Control lever assembly mounting bolt	3M Stud Locking No. 4170 or equivalent	Anaerobic sealant
Transmission and transfer assembly		
Control housing gasket	3M ATD Part No. 8661 or equivalent	Semi-drying sealant
Control housing mounting bolt	3M Stud Locking No. 4170 or equivalent	Anaerobic sealant

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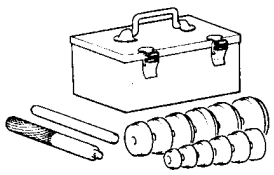
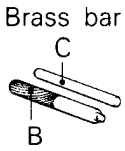
SPECIAL TOOLS

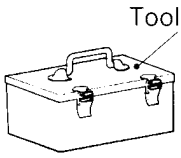
E22DA--

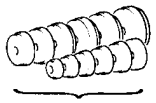
Tool	Number	Name	Use
	MB990925	Bearing and oil seal installer set	Installation of oil seal (MB990928, MB990938)

MB990925



Bar (snap-in type)





Installer adaptor

	Contents of new tool (MB990925)	Current tools	O.D. mm (in.)		Contents of new tool (MB990925)	Current tools	O.D. mm (in.)
A	MB990926	MB990272 MB990658 MB990659	39 (1.54)	A	MB990933	MB990307 MB990724	63.5 (2.50)
	MB990927	MB990264 MB990680	45 (1.77)		MB990934	MB990766 MB990807	67.5 (2.66)
	MB990928	MB990271 MB990808	49.5 (1.95)		MB990935	MB990133 MB990308 MB990762	71.5 (2.81)
	MB990929	MB990306	51 (2.01)		MB990936	MB990718	75.5 (2.97)
	MB990930	MB990283	54 (2.13)		MB990937	MB990309	79 (3.11)
	MB990931	MB990681 MB990764	57 (2.24)	B	MB990938	MB990124	-
	MB990932	MB990263	61 (2.40)	C	MB990939	-	-

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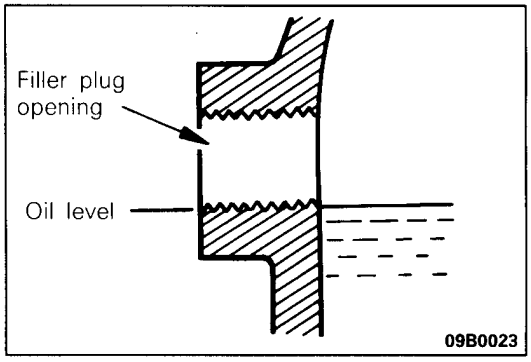

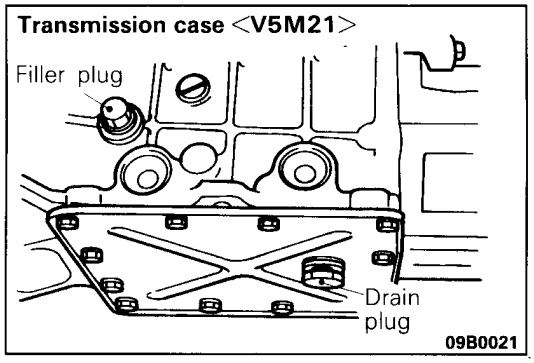

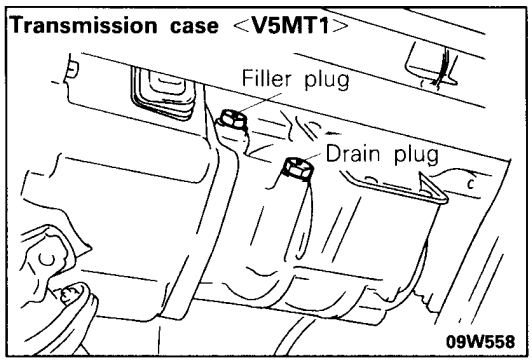

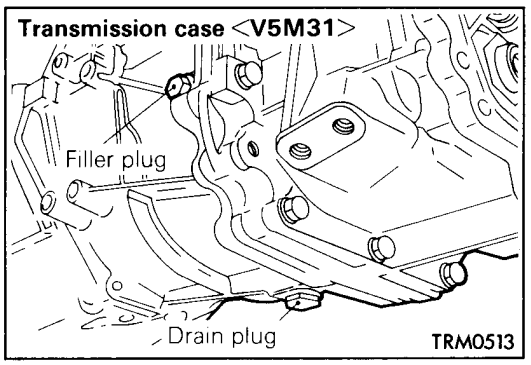

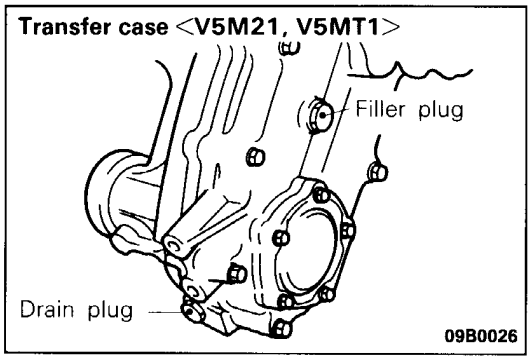

SERVICE ADJUSTMENT PROCEDURES

OIL LEVEL CHECK E22FDAG

Inspect each component for evidence of leakage, and check the oil level by removing the filler plug. If the oil is contaminated, it is necessary to replace it with new oil.

1. Oil level should be at the lower portion of the filler plug hole.
2. Check that the transmission oil is not noticeably dirty, and that it has a suitable viscosity.
3. When installing the V5MT1 transmission's filler plug, coat the threaded part with the drying sealant.

OIL REPLACEMENT E22FDAP

1. Remove oil filler plug and oil drain plug.
2. Drain oil.
3. Tighten the oil drain plug to the specified torque.

Specified torque:

<V5M21>	**59 Nm (6 kgm, 4.3 ft.lbs.)**
<V5M31>	**33 Nm (3.4 kgm, 24.6 ft.lbs.)**
<Transfer>	**33 Nm (3.4 kgm, 24.6 ft.lbs.)**

4. When installing the V5MT1 transmission's drain plug, coat the threaded part with the drying sealant.

Specified sealant: 3M ATD Part No. 8660 or equivalent

5. Fill with specified oil till the level comes to the lower portion of oil filler plug hole.

Specified transmission oil: Hypoid gear oil SAE 75W-90 or 75W-85W conforming API GL-4 or higher

Quantity:

Transmission

<V5M21> 2.2 dm³(2.3 U.S. qts., 1.9 Imp. qts.)
<V5MT1> 2.5 dm³(2.6 U.S. qts., 2.2 Imp. qts.)
<V5M31> 3.7 dm³(3.9 U.S. qts., 3.3 Imp. qts.)

Transfer

<V5M21, V5MT1–Vehicles without P.T.O.>
2.3 dm³ (2.4 U.S. qts., 2.0 Imp. qts.)

<V5M21, V5MT1–Vehicles with P.T.O.>
2.7 dm³ (2.9 U.S. qts., 2.4 Imp. qts.)

<V5M31–Vehicles without P.T.O.>
2.5 dm³ (2.6 U.S. qts., 2.2 Imp. qts.)

<V5M31–Vehicles with P.T.O.>
2.9 dm³ (3.1 U.S. qts., 2.6 Imp. qts.)

6. Tighten the oil filler plug to the specified torque.

Specified torque:

<V5M21>	**59 Nm (6 kgm, 4.3 ft.lbs.)**
<V5M31>	**33 Nm (3.4 kgm, 24.6 ft.lbs.)**
<Transfer>	**33 Nm (3.4 kgm, 24.6 ft.lbs.)**

7. When installing the V5MT1 transmission's filler plug, coat the threaded part with the drying sealant.

Specified sealant: 3M ATD Part No. 8660 or equivalent

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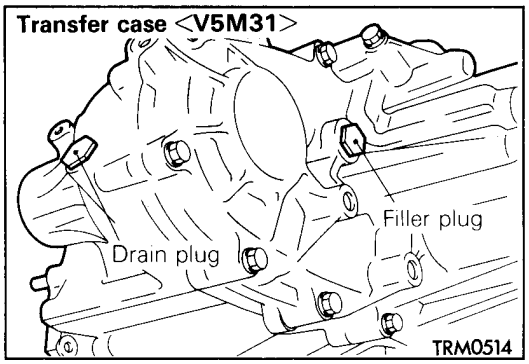
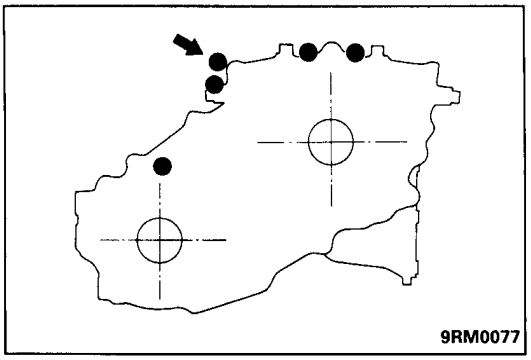


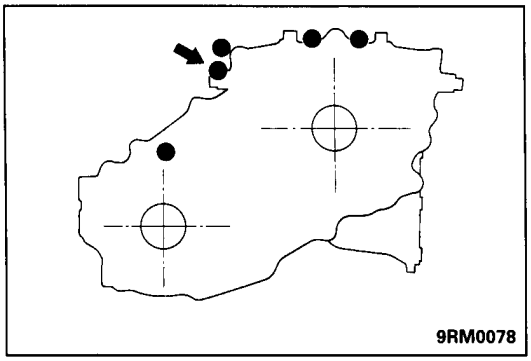


CENTRE DIFFERENTIAL LOCK DETECTION SWITCH CHECK

E22FFAA

Check the continuity between the brown connector terminal on the side of the transfer case and the transfer case.

Transfer control lever position	Continuity
4H	No continuity
4HLc	Continuity

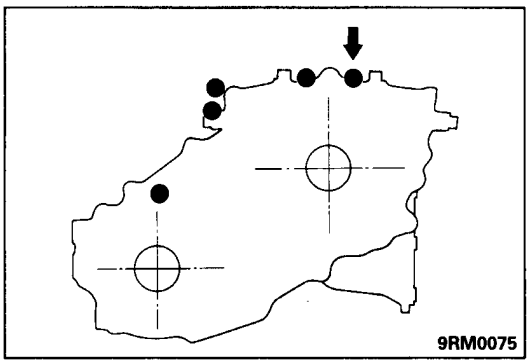


2WD/4WD DETECTION SWITCH CHECK

E22FGAA

Check the continuity between the black connector terminal on the side of the transfer case and the transfer case.

Transfer control lever position	Continuity
2H	Continuity
4H	No continuity

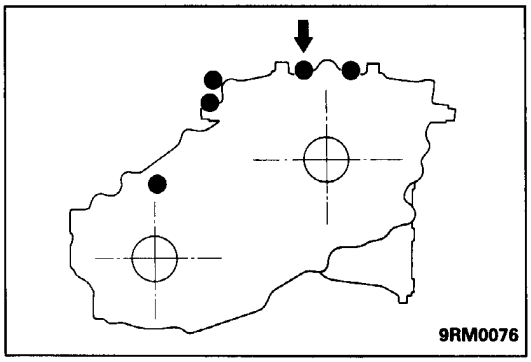


CENTRE DIFFERENTIAL LOCK OPERATION DETECTION SWITCH CHECK

E22FHAA

Check the continuity between the brown connector terminal on the top of the transfer case and the transfer case.

Transfer control lever position	Continuity
4H	No continuity
4HLc	Continuity

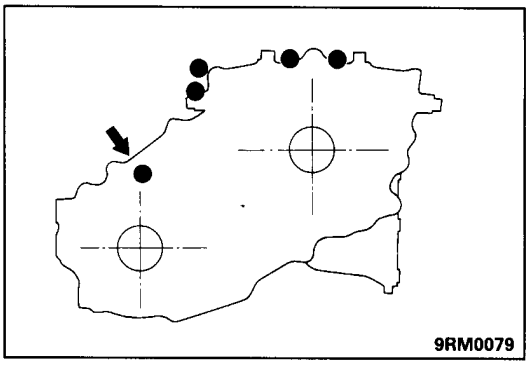


4WD OPERATION DETECTION SWITCH CHECK

E22FIAA

Check the continuity between the black connector terminal on the top of the transfer case and the transfer case.

Transfer control lever position	Continuity
2H	No continuity
4H	Continuity



HI/LO DETECTION SWITCH CHECK E22KJAA

Check the continuity between the white connector terminal on the side of the transfer case and the transfer case.

Transfer control lever position	Continuity
4HLc	Continuity
N (between 4HLc and 4LLc)	No continuity
4LLc	Continuity

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NOTES

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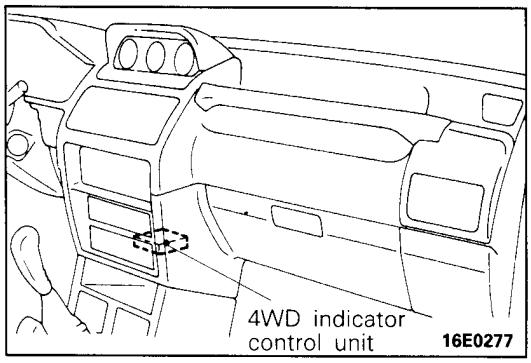

4WD INDICATOR CONTROL UNIT INSPECTION

1. Remove the radio or CD player. (Refer to GROUP 54 – Radio and Stereo.)
2. Remove the 4WD indicator control unit.
3. Measure the voltage at the terminals under each condition.
4. Carry out the voltage measurements with the harness disconnected from the control unit. Insert the probe from the rear of the connector and take the measurement between terminal ⑧ (earth terminal) and the respective terminals.

16E0277a

(Control unit side)

Terminal No.	Inspection item		Inspection condition			Terminal voltage
3	Ignition switch (IG²)		Ignition switch (IG2)		OFF	0 V
					ON	System voltage*
4	Combination meter (4WD indicator lamp)	Center differential lock indicator lamp	Ignition switch: ON	Transfer lever position	4H	System voltage*
					4HLc	Less than 1.5V
10		Front wheel lamp	Ignition switch: ON		In 2WD	0 V
					In 4WD	System voltage*
9		Rear wheel lamp	Ignition switch: ON	Transfer lever position	N	0 V
					4HLc, 4LLc	System voltage*
6	Free-wheel engage switch		Ignition switch: ON		In 2WD	system voltage*
					In 4WD	0 V
1	HI/LOW detection switch		Ignition switch: ON	Transfer lever position	N	System voltage*
					4HLc, 4LLc	0 V
2	4WD operation detection switch		Ignition switch: ON	Transfer lever position	2H	System voltage*
					4H	0 V
5	Centre differential lock detection switch		Ignition switch: ON	Transfer lever position	4H	System voltage*
					4HLc	0 V
7	Centre differential lock operation detection switch		Ignition switch: ON	Transfer lever position	4H	System voltage*
					4HLc	0 V

NOTE
System voltage marked with (*) is 1–2V lower than actual battery voltage.

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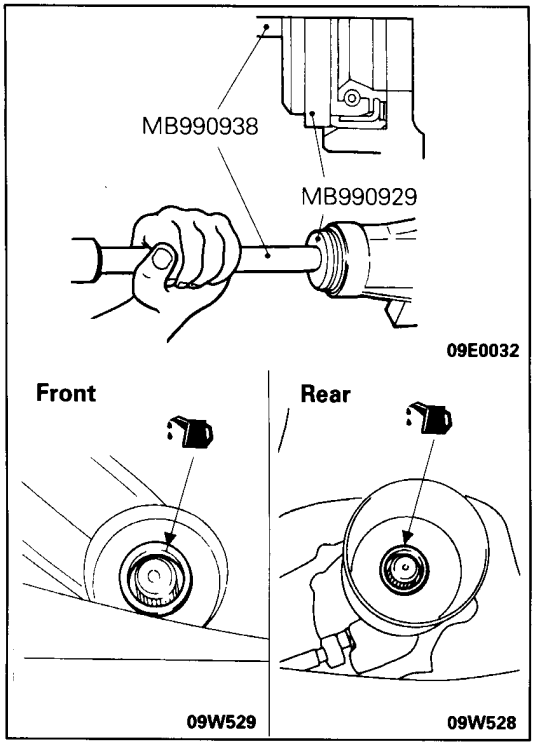
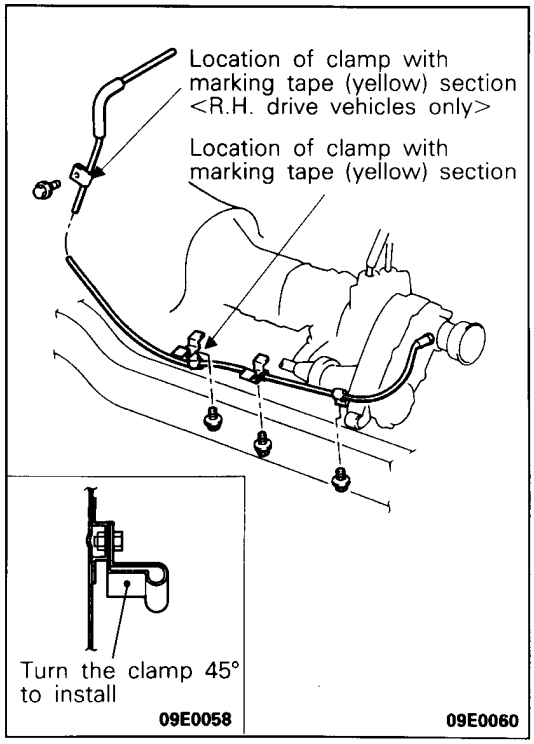


TRANSFER OIL SEALS REPLACEMENT E22FAAF

1. Disconnect the propeller shaft from the transfer. (Refer to GROUP 25 – Propeller Shaft.)
2. Using a flat-tip (–) screwdriver, remove the oil seal.
3. Using the special tool, tap the transfer oil seal into the transfer.
   Note in illustration the direction of installation of transfer oil seal.
4. Apply a coating of the transmission oil to the lip of the oil seal.

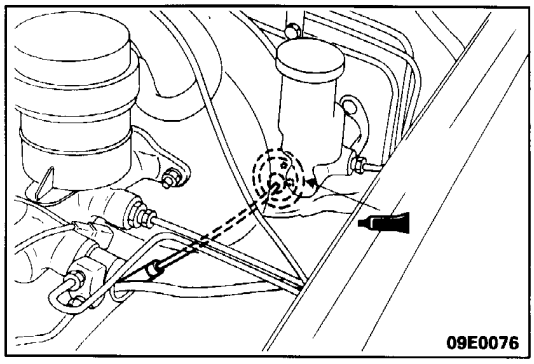
Specified transmission oil: Hypoid gear oil API GL-4, SAE 75W-90 or 75W-85W



SPEEDOMETER CABLE REPLACEMENT E22FCBI

1. Replace the cable assembly if there is a malfunction.
2. Connect the speedometer cable to the transmission and connect the wiring by the following procedure.
   (1) Wire the speedometer cable so that the minimum bend radius is 150mm (5.91 in.) or more.
   (2) Wire the clamps that have a section with marking tape (yellow) in the locations shown in the ilustration.

Caution
Wire the speedometer cable so that it does not interfere with the brake tube.



3. After installing the speedometer cable grommet to the towboard, apply specified sealant to the outside of the grommet.

Specified sealant: 3M ATD Part No. 8001, 8011 or equivalent

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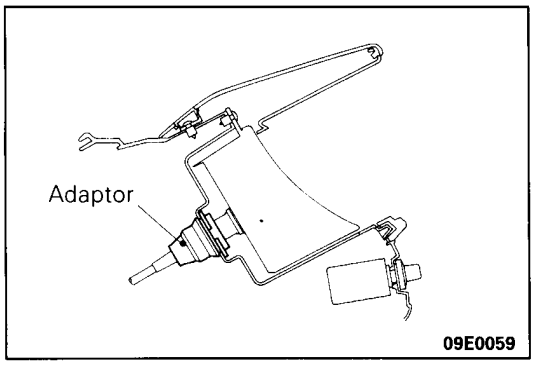

4. Install the adaptor to the speedometer cable, and install the speedometer.

   Caution
   If the cable connections are not made securely to the speedometer side and to the transmission side, the speedometer indications will not be accurate, and an abnormal noise will develop, so be sure to make the connections securely.

5. After connecting to the speedometer, pull the speedometer cable out from the engine compartment until the cable marking is fully withdrawn from the grommet, to remove all bends from the cable inside the instrument panel.

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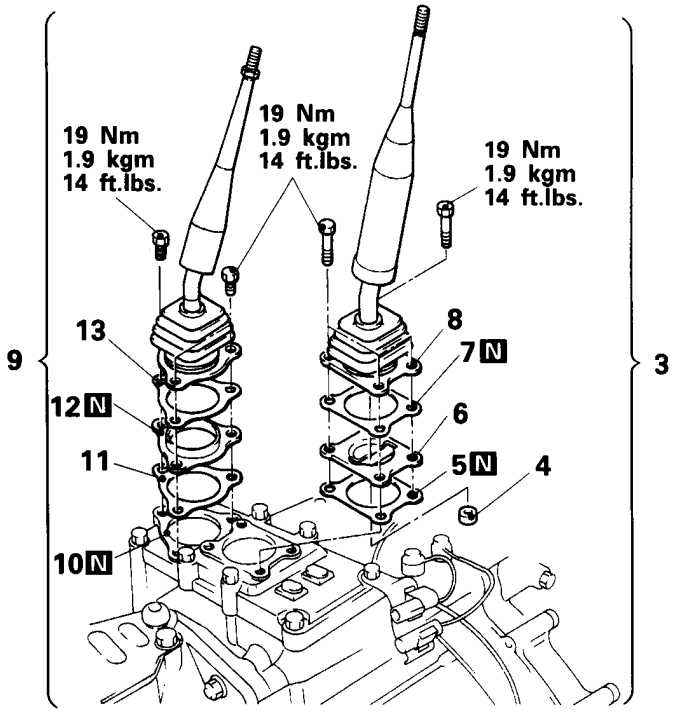
GEARSHIFT LEVER ASSEMBLY

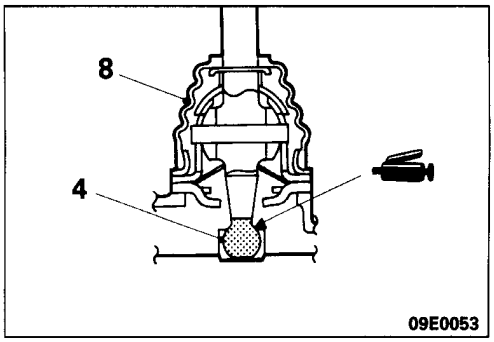
E22GA--

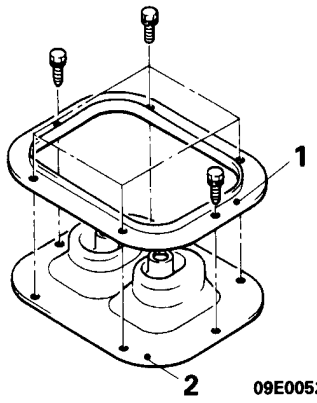
REMOVAL AND INSTALLATION

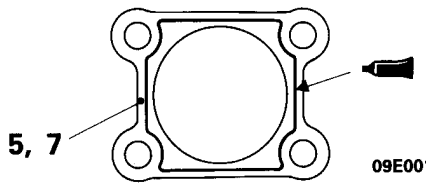
Pre-removal Operation
- Removal of Front Console Assembly (Refer to GROUP 52 – Floor Console.)
- Move the Transmission and Transfer Control Levers to the Following Positions.
  Transmission Control Lever: Neutral Position
  Transfer Control Lever: 4H (4 wheel drive–high range) Position

Post-installation Operation
- Installation of Front Floor Console Assembly (Refer to GROUP 52 – Floor Console.)
- Check the Operation of the Transmission and Transfer Control Levers and the Movement in each Lever Position.

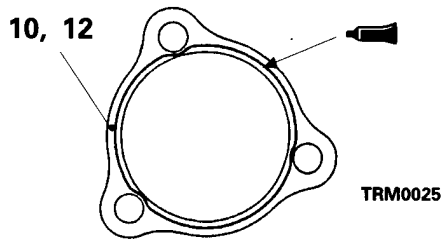








Apply the sealant to both sides of the gasket (No. 5 and 7).



Apply the sealant to both sides of the gasket (No. 10 and 12).

Sealant: 3M ATD Part No. 8661 or equivalent

Transmission control lever assembly removal steps
1. Retainer
2. Control lever boot
3. Transmission control lever assembly
4. Control lever bushing
5. Gasket
6. Stopper plate
7. Gasket
8. Transmission control lever

Transfer control lever assembly removal steps
1. Retainer
2. Control lever boot
9. Transfer control lever assembly
10. Gasket
11. Stopper plate
12. Gasket
13. Transfer control lever

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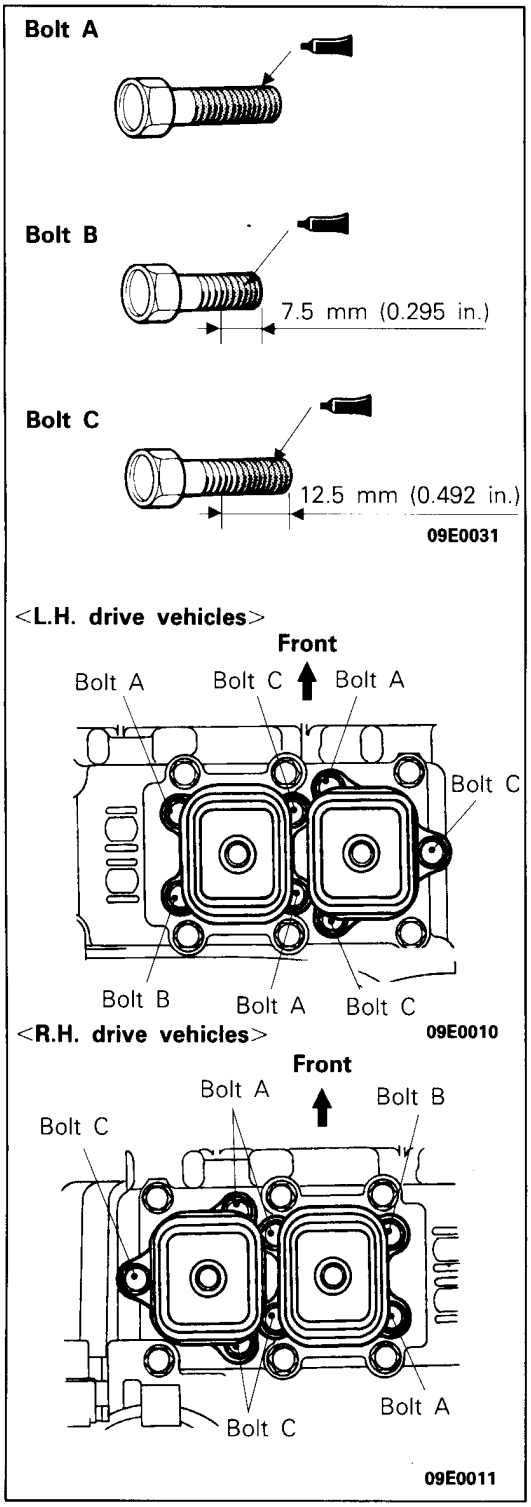
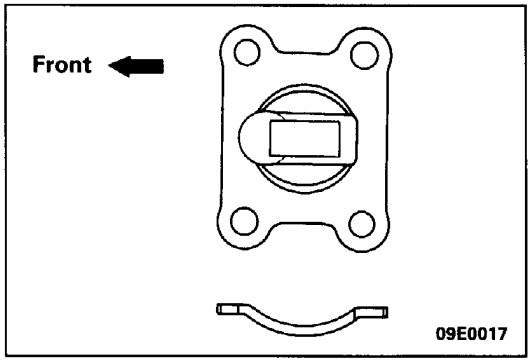




SERVICE POINTS OF INSTALLATION E22GDBC

9. INSTALLATION OF TRANSFER CONTROL LEVER ASSEMBLY/3. TRANSMISSION CONTROL LEVER ASSEMBLY

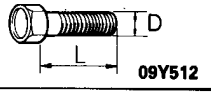
(1) Remove the adhesive sticking to the lever assembly mounting bolts.
(2) Use a tap (M8x1.25) to remove the adhesive sticking to the screw holes in the control housing, and clean it by blowing in air.

(3) Apply specified adhesive to the threads of the lever assembly mounting bolts.
Apply adhesive to the whole thread for bolt A, and to the areas shown in the illustration for bolts B and C.

Specified adhesive: 3M Stud Locking No. 4710 or equivalent

(4) The dimensions of the mounting bolts vary according to their mounting locations, so do not confuse them when installing.

Bolt	O.D. × Length mm(in.)	Bolt identification
A	④ 8×22 (0.3×0.9)	④ D × L
B	④ 8×18 (0.3×0.7)	
C	④ 8×23 (0.3×0.9)	



6. INSTALLATION OF STOPPER PLATE

Install the stopper plate to the transmission control lever in the direction shown in the illustration.

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TRANSMISSION AND TRANSFER ASSEMBLY

REMOVAL AND INSTALLATION

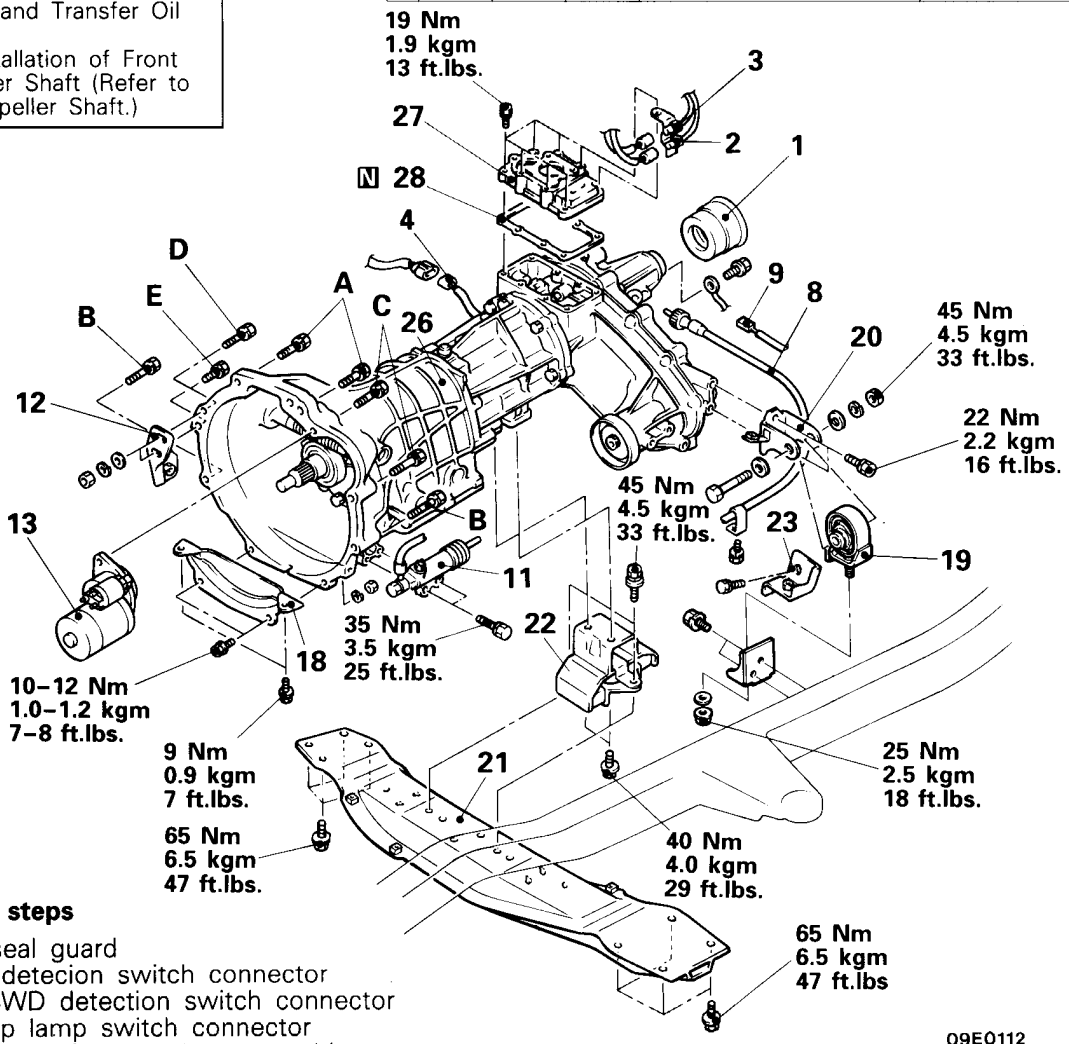
E22JA--

<2400>

Pre-removal and Post-installation Operation
- Removal and Installation of Transmission and Transfer Control Lever Assembly (Refer to P.22-9.)
- Removal and Installation of Transfer Case Protector
- Removal and Installation of Front Exhaust Pipe
- Draining and Supplying of Transmission Oil and Transfer Oil (Refer to P.22-4.)
- Removal and Installation of Front and Rear Propeller Shaft (Refer to GROUP 25 – Propeller Shaft.)

	Nm	kgm	ft.lbs.	O.D. × Length mm (in.)	Bolt identification
A	50	5.0	35	10×40 (0.4×1.6)	D × L
B	50	5.0	35	10×65 (0.4×2.6)	
C	31	3.1	22	10×60 (0.4×2.4)	
D	24	2.4	17	8×55 (0.3×2.2)	
E	24	2.4	17	8×25 (0.3×1.0)	

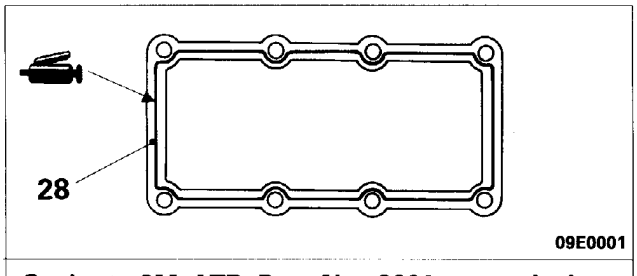
09Y512



09E0112

Removal steps

1. Dust seal guard
2. HI/LO detecion switch connector
3. 2WD/4WD detection switch connector
4. Back-up lamp switch connector
8. Connection for speedometer cable <Vehicles built up to October, 1993>
9. Speed sensor connector <Vehicles built from November, 1993>
11. Connection for clutch release cylinder
12. Exhaust pipe mounting bracket
13. Starter motor
18. Bell housing cover
19. Transfer roll stopper
20. Transfer mounting bracket
21. No. 2 crossmember
22. Engine mounting rear insulator
23. Transfer case protector bracket
26. Transmission and transfer assembly
27. Control housing
28. Gasket



09E0001

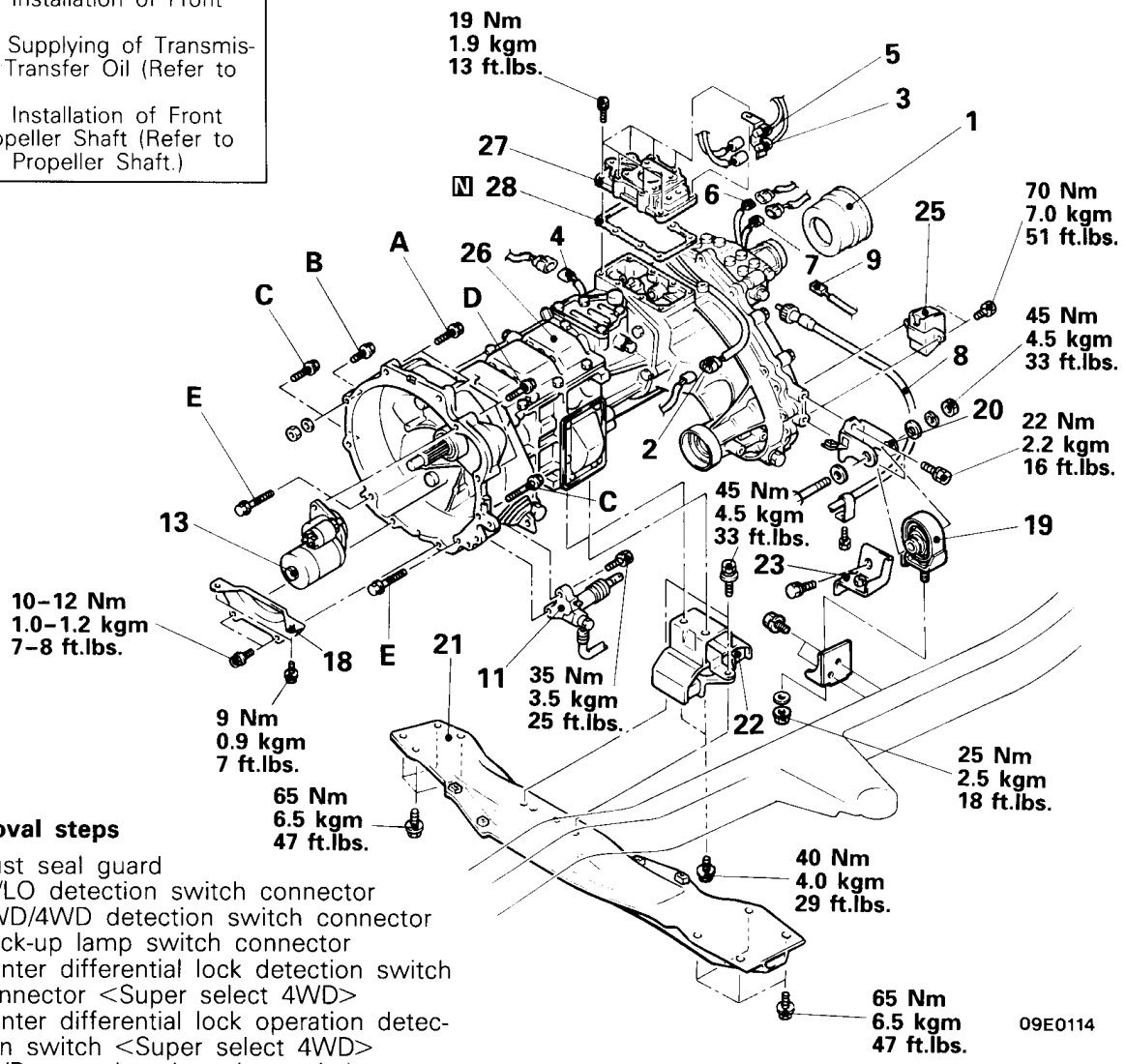
Sealant: 3M ATD Part No. 8661 or equivalent

<2500D>

Pre-removal and Post-installation Operation
- Removal and Installation of Transmission and Transfer Control Lever Assembly (Refer to P.22-9.)
- Removal and Installation of Transfer Case Protector
- Removal and Installation of P.T.O. (Refer to GROUP 51 – P.T.O..)
- Removal and Installation of Front Exhaust Pipe
- Draining and Supplying of Transmission Oil and Transfer Oil (Refer to P.22-4.)
- Removal and Installation of Front and Rear Propeller Shaft (Refer to GROUP 25 – Propeller Shaft.)

	Nm	kgm	ft.lbs.	O.D. × Length mm (in.)	Bolt identification
A	50	5.0	35	⑦ 10×45 (0.4×1.8)	⑦ D × L
B	24	2.4	17	⑦ 8×30 (0.3×1.2)	
C	50	5.0	35	⑦ 10×80 (0.4×3.2)	
D	31	3.1	22	⑦ 10×60 (0.4×2.4)	
E	36	3.6	26	⑦ 10×25 (0.4×1.0)	

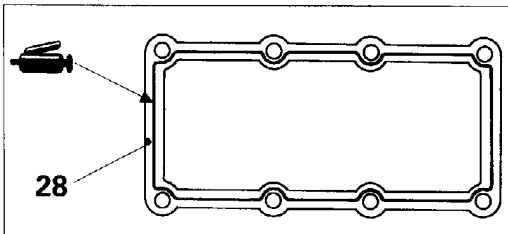
09Y512



09E0114

Removal steps

1. Dust seal guard
2. HI/LO detection switch connector
3. 2WD/4WD detection switch connector
4. Back-up lamp switch connector
5. Center differential lock detection switch connector <Super select 4WD>
6. Center differential lock operation detection switch <Super select 4WD>
7. 4WD operation detection switch connector <Super select 4WD>
8. Connection for speedometer cable <Vehicles built up to October, 1993>
9. Speed sensor connector <Vehicles built from November, 1993>
11. Connection for clutch master cylinder
13. Starter motor
18. Bell housing cover
19. Transfer roll stopper
20. Transfer mounting bracket
21. No. 2 crossmember
22. Engine mounting rear insulator
23. Transfer case protector bracket
25. Mass damper
26. Transmission and transfer assembly
27. Control housing
28. Gasket



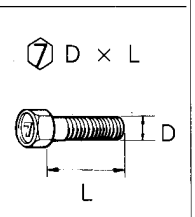
09E0001

Sealant: 3M ATD Part No. 8661 or equivalent

<3000>

Pre-removal and Post-installation Operation
- Removal and Installation of Transmission and Transfer Control Lever Assembly (Refer to P.22-9.)
- Removal and Installation of Transfer Case Protector
- Removal and Installation of Front Exhaust Pipe
- Draining and Supplying of Transmission Oil and Transfer Oil (Refer to P.22-4.)
- Removal and Installation of Front and Rear Propeller Shaft (Refer to GROUP 25 – Propeller Shaft.)

	Nm	kgm	ft.lbs.	O.D. × Length mm (in.)	Bolt identification
A	75	7.5	54	12×40 (0.5×1.6)	
B	90	9.0	65	12×55 (0.5×2.2)	
C	31	3.1	22	10×55 (0.4×2.2)	
D	36	3.6	26	10×40 (0.4×1.6)	
E	75	7.5	54	12×35 (0.5×1.4)	
F	42	4.2	30	10×30 (0.4×1.2)	
G	75	7.5	34	12×50 (0.5×2.0)	



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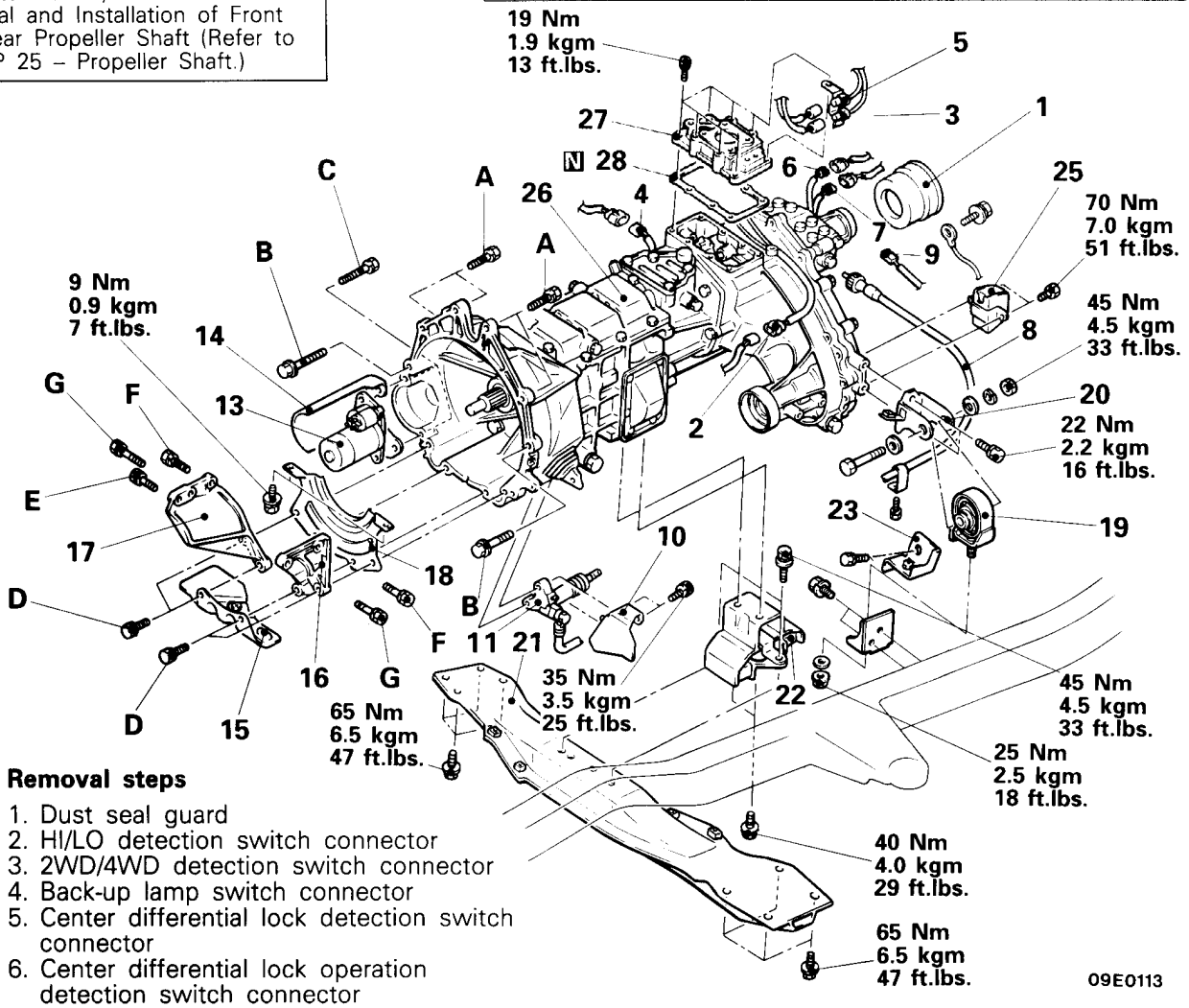
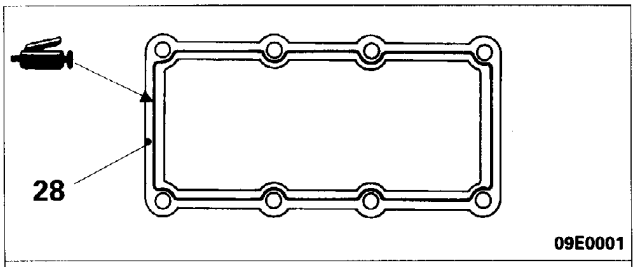


09E0113

Removal steps
1. Dust seal guard
2. HI/LO detection switch connector
3. 2WD/4WD detection switch connector
4. Back-up lamp switch connector
5. Center differential lock detection switch connector
6. Center differential lock operation detection switch connector
7. 4WD operation detection switch
8. Connection for speedometer cable <Vehicles built up to October, 1993>
9. Speed sensor connector <Vehicles built from November, 1993>
10. Heat protector
11. Connection for clutch master cylinder
13. Starter motor
14. Starter cover
15. Heat protector
16. Transmission stay
17. Transmission stay
18. Bell housing cover
19. Transfer roll stopper
20. Transfer mounting bracket
21. No. 2 crossmember
22. Engine mounting rear insulator
23. Transfer case protector bracket



09E0001

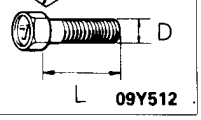
Sealant: 3M ATD Part No. 8661 or equivalent

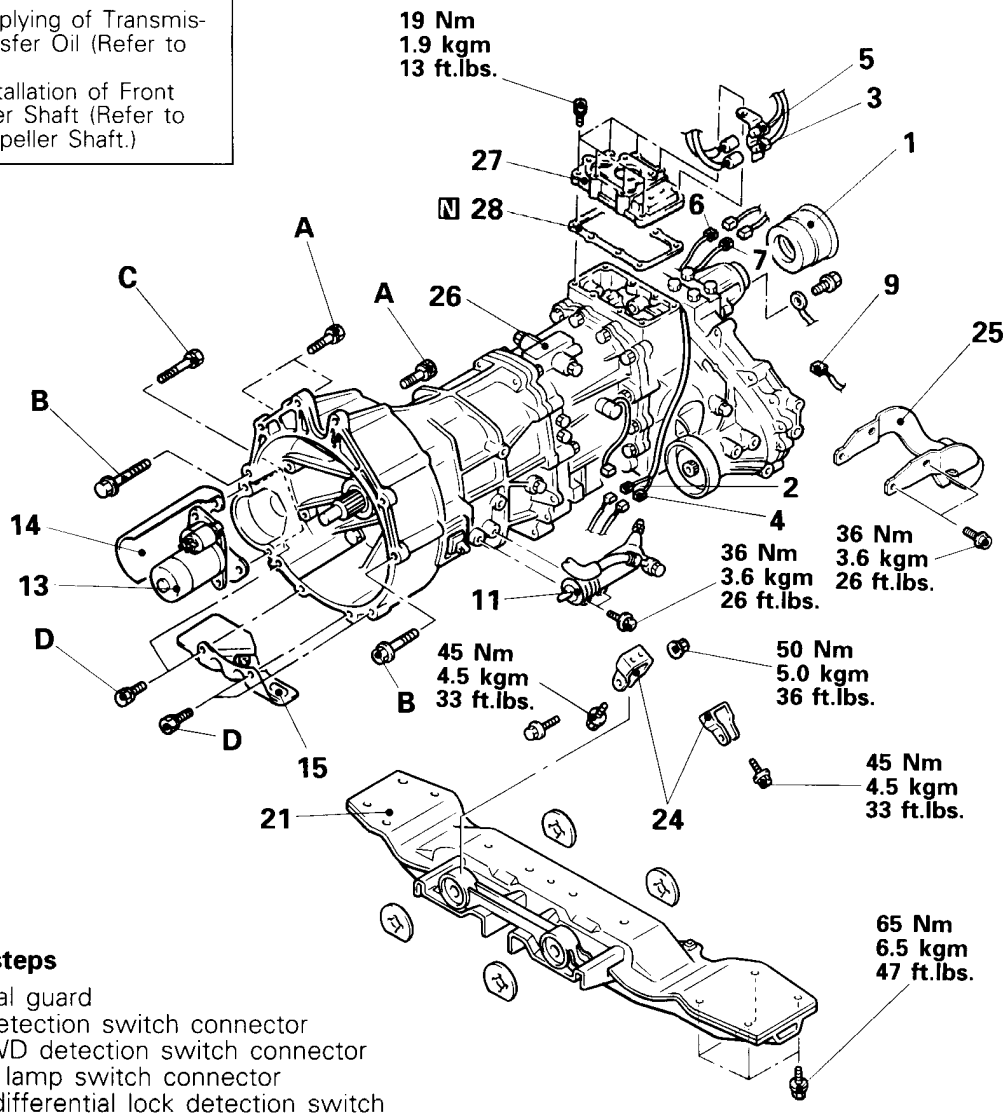
25. Mass damper
26. Transmission and transfer assembly
27. Control housing
28. Gasket

<3500>

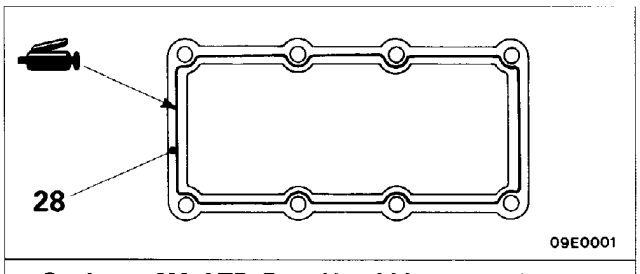
Pre-removal and Post-installation Operation
- Removal and Installation of Transmission and Transfer Control Lever Assembly (Refer to P.22-9.)
- Removal and Installation of Transfer Case Protector
- Removal and Installation of Front Exhaust Pipe
- Draining and Supplying of Transmission Oil and Transfer Oil (Refer to P.22-4.)
- Removal and Installation of Front and Rear Propeller Shaft (Refer to GROUP 25 – Propeller Shaft.)

	Nm	kgm	ft.lbs.	O.D. × Length mm (in.)	Bolt identification
A	75	7.5	54	7 12 × 40 (0.5 × 1.6)	7 D × L
B	90	9.0	65	7 12 × 55 (0.5 × 2.2)	
C	31	3.1	22	7 10 × 55 (0.4 × 2.2)	
D	36	3.6	26	7 10 × 40 (0.4 × 1.6)	





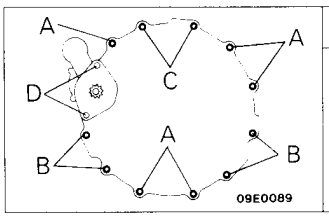
Removal steps
1. Dust seal guard
2. HI/LO detection switch connector
3. 2WD/4WD detection switch connector
4. Back-up lamp switch connector
5. Center differential lock detection switch connector
6. Center differential lock operation detection switch connector
7. 4WD operation detection switch
9. Speed sensor connector
- ◆◆ 11. Connection for clutch master cylinder
13. Starter motor
14. Starter cover
15. Heat protector
21. No. 2 crossmember
- ◆◆ 24. Engine mounting rear bracket
25. Mass damper
- ◆◆ ● Disconnection of clutch release bearing
- ◆◆ ◆◆ 26. Transmission and transfer assembly
- ◆◆ 27. Control housing
28. Gasket



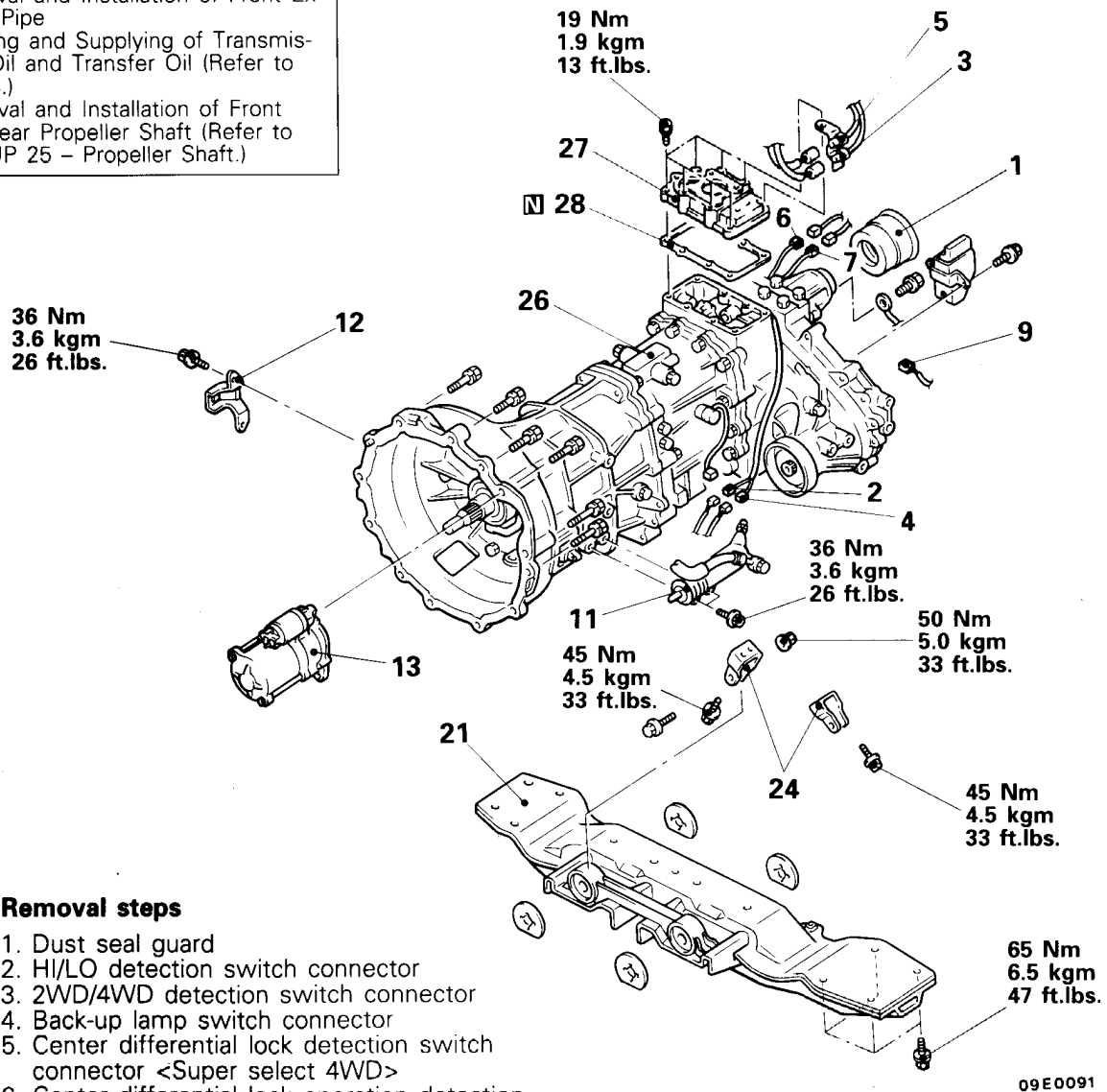
Sealant: 3M ATD Part No. 8661 or equivalent

<2800D>

Pre-removal and Post-installation Operation
- Removal and Installation of Transmission and Transfer Control Lever Assembly (Refer to P.22-9.)
- Removal and Installation of Transfer Case Protector
- Removal and Installation of P.T.O. (Refer to GROUP 51 – P.T.O..)
- Removal and Installation of Front Exhaust Pipe
- Draining and Supplying of Transmission Oil and Transfer Oil (Refer to P.22-4.)
- Removal and Installation of Front and Rear Propeller Shaft (Refer to GROUP 25 – Propeller Shaft.)

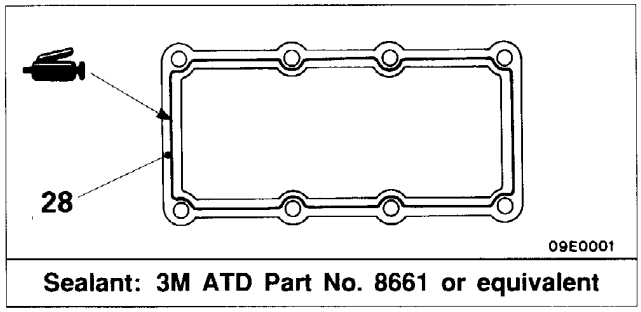


	O.D. × Length mm (in.)	Bolt identification
A	10 × 25 (0.4 × 1.0)	D × L
B	10 × 45 (0.4 × 1.8)	
C	10 × 50 (0.4 × 2.0)	
D	10 × 90 (0.4 × 3.6)	09Y512



Removal steps

1. Dust seal guard
2. HI/LO detection switch connector
3. 2WD/4WD detection switch connector
4. Back-up lamp switch connector
5. Center differential lock detection switch connector <Super select 4WD>
6. Center differential lock operation detection switch <Super select 4WD>
7. 4WD operation detection switch connector <Super select 4WD>
9. Speed sensor connector
- ◆◆ 11. Connection for clutch master cylinder
12. Exhaust pipe mounting bracket
13. Starter motor
21. No. 2 crossmember
- ◆◆ 24. Engine mounting rear bracket
- ◆◆ ● Disconnection of clutch release bearing
- ◆◆ ◆◆ 26. Transmission and transfer assembly
- ◆◆ 27. Control housing
28. Gasket



Sealant: 3M ATD Part No. 8661 or equivalent

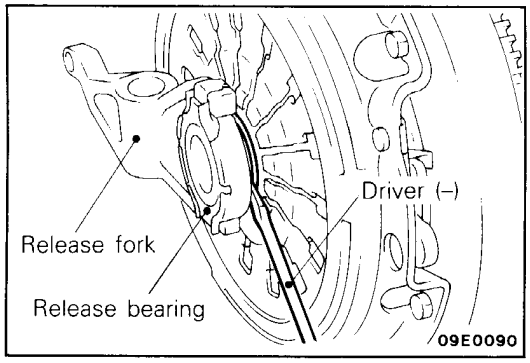
SERVICE POINTS OF REMOVAL E22JBAG

11. REMOVAL OF CLUTCH RELEASE CYLINDER

Remove the clutch release cylinder (with the clutch hose connected to it) from the transmission, and suspend it from the body by using a piece of wire or a similar method.

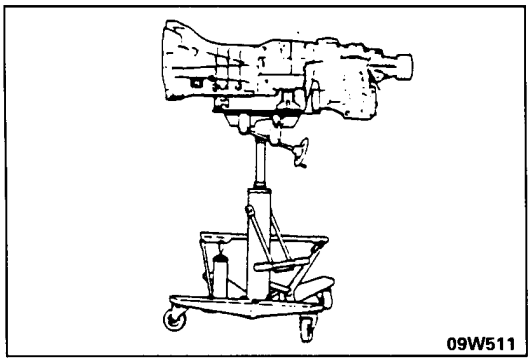
19. REMOVAL OF TRANSFER ROLL STOPPER

Before removing the transfer roll stopper, use a transmission jack to hold the transmission and transfer assembly.



- **DISCONNECTION OF CLUTCH RELEASE BEARING**

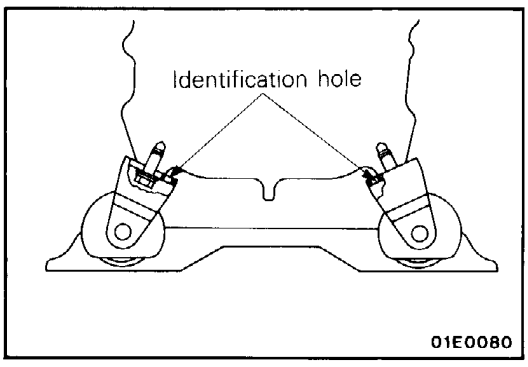
(1) Remove the service hole cover on the clutch housing.
(2) Operate the release fork to push the release bearing over to the clutch side.
(3) Insert a flat-tipped screwdriver as shown in the illustration to disconnect the release bearing.



26. REMOVAL OF TRANSMISSION AND TRANSFER ASSEMBLY

Caution
When removing the transmission and transfer assembly from the engine, care must be taken not to shake or rock with force, because to do so might cause damage to the end of the main drive gear, the pilot bearing, or the clutch disc, etc.

(1) Disconnect the transmission and transfer assembly from the engine by pulling it slowly toward the rear of the vehicle.
(2) When the transmission and transfer assembly are lowered, tilt the front of the transmission downward and slowly lower forward, while using care to make sure that the rear of the transmission does not interfere with the No. 4 crossmember.



24. INSTALLATION OF ENGINE REAR MOUNT BRACKET

Install the engine rear mount bracket so that the identification hole of the bracket is facing towards the inside of the vehicle.

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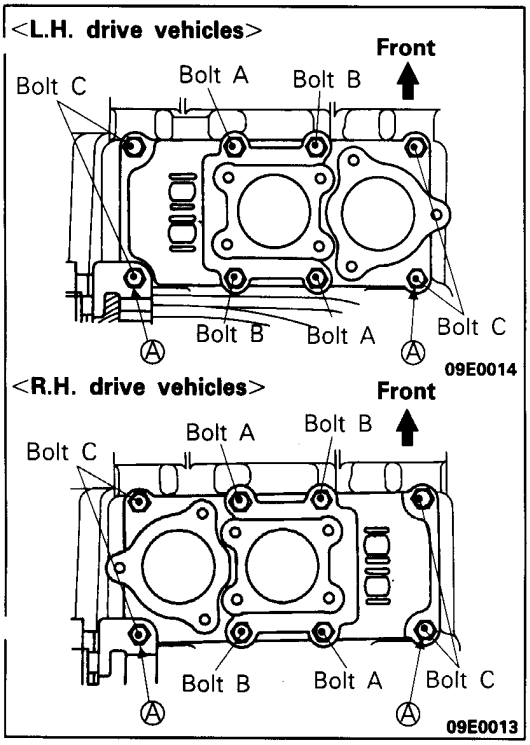
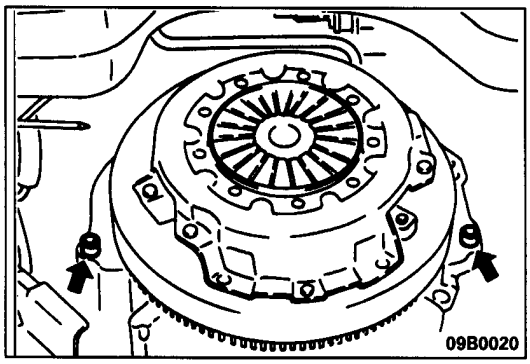




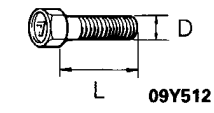
SERVICE POINTS OF INSTALLATION E22JDCD

27. INSTALLATION OF CONTROL HOUSING

(1) Remove the adhesive sticking to the control housing mounting bolts at (A) section.
(2) Use a tap (M8×1.25) to remove the adhesive sticking to the screw holes at (A) section.
(3) Apply specified adhesive to the mounting bolt threads at (A) section.

Specified adhesive: 3M Stud Locking No. 4170 or equivalent

(4) The dimensions of the mounting bolts vary according to their mounting locations, so do not confuse them when installing.

Bolt	O.D. × Length mm (in.)	Bolt identification
A	⑦ 8 × 40 (0.3 × 1.6)	⑦ D × L
B	⑦ 8 × 40 (0.3 × 1.6) (Reemer bolt)	
C	⑦ 8 × 25 (0.3 × 1.0)	

24. INSTALLATION OF TRANSMISSION AND TRANSFER ASSEMBLY

On the engine side, there are two centering locations. Make sure that the transmission mounting bolt holes are aligned with them before mounting the transmission and transfer assembly to the engine.

AUTOMATIC TRANSMISSION

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E23AA--

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NOTES

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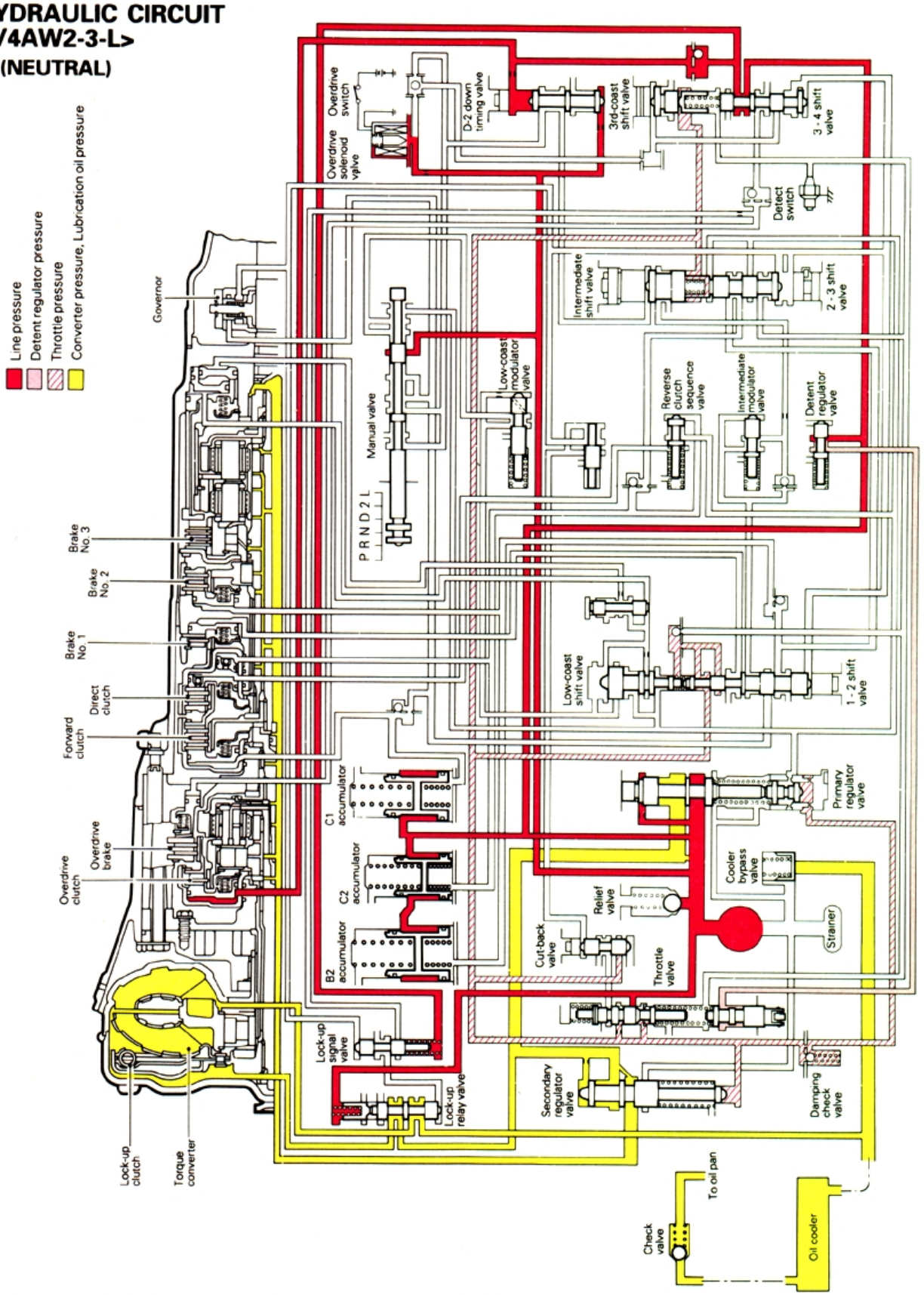
GENERAL INFORMATION

E23BAAL

TRA0238

HYDRAULIC CIRCUIT <V4AW2-3-L>

N (NEUTRAL)



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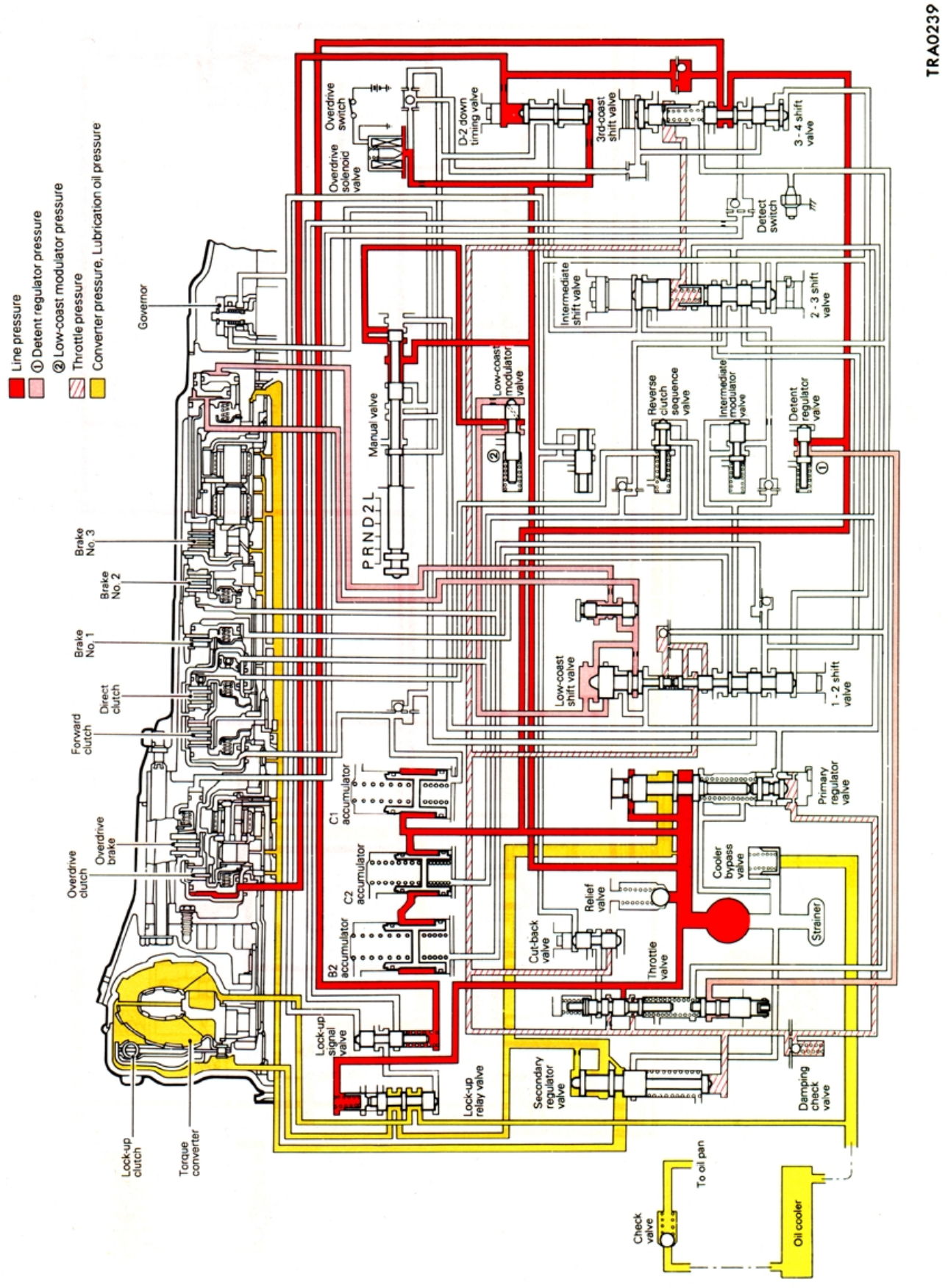

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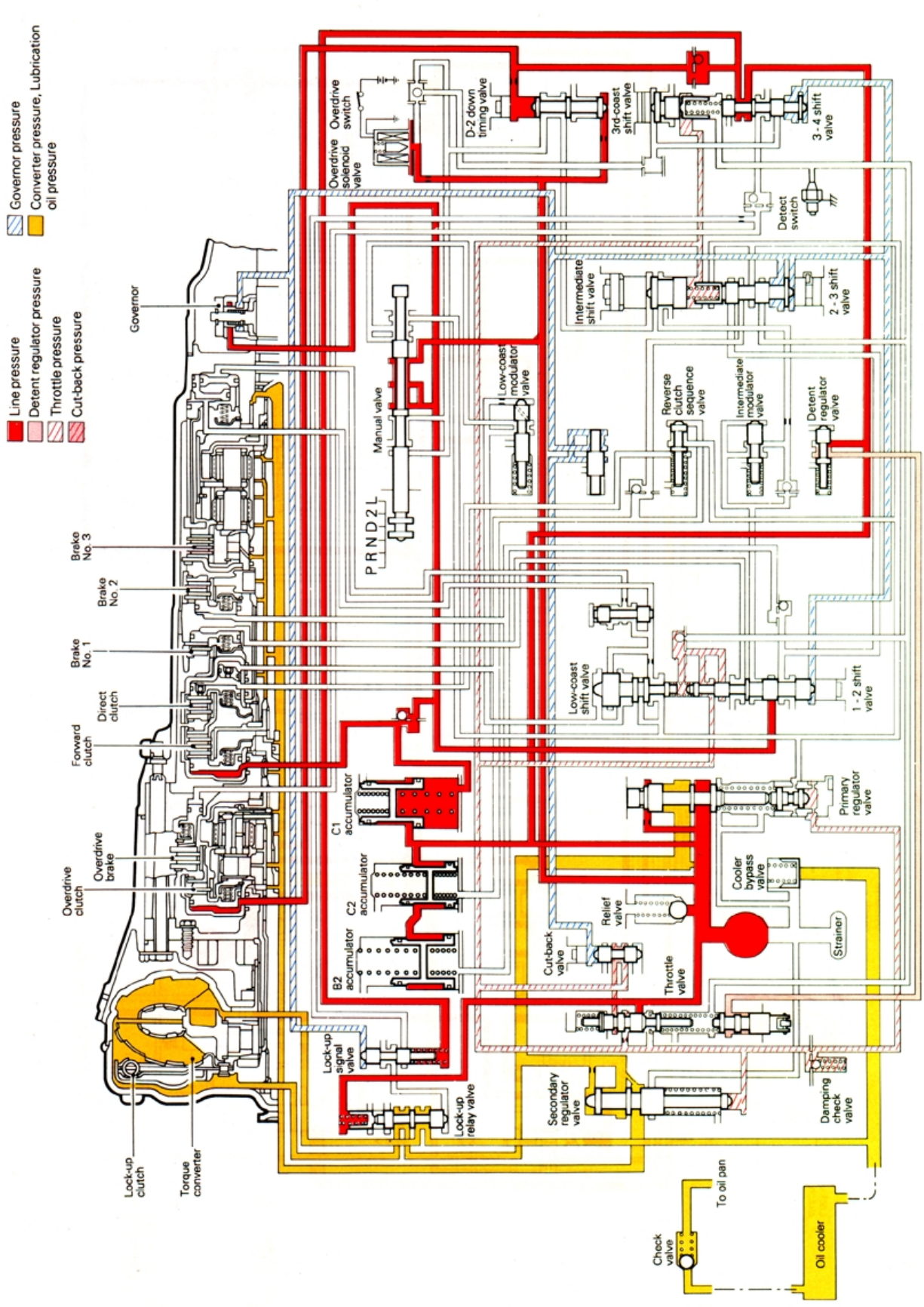
D-1 (DRIVE 1ST)



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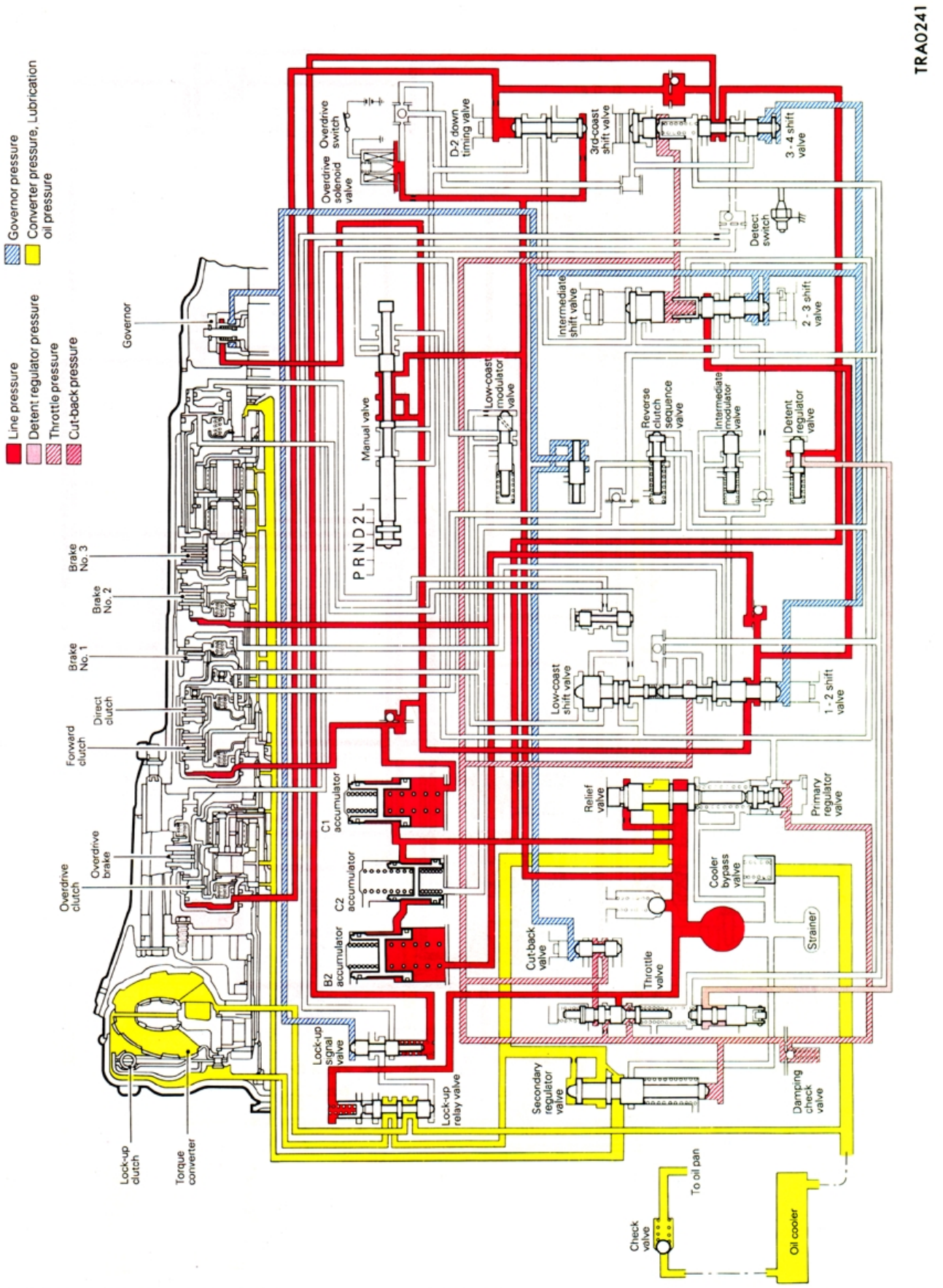
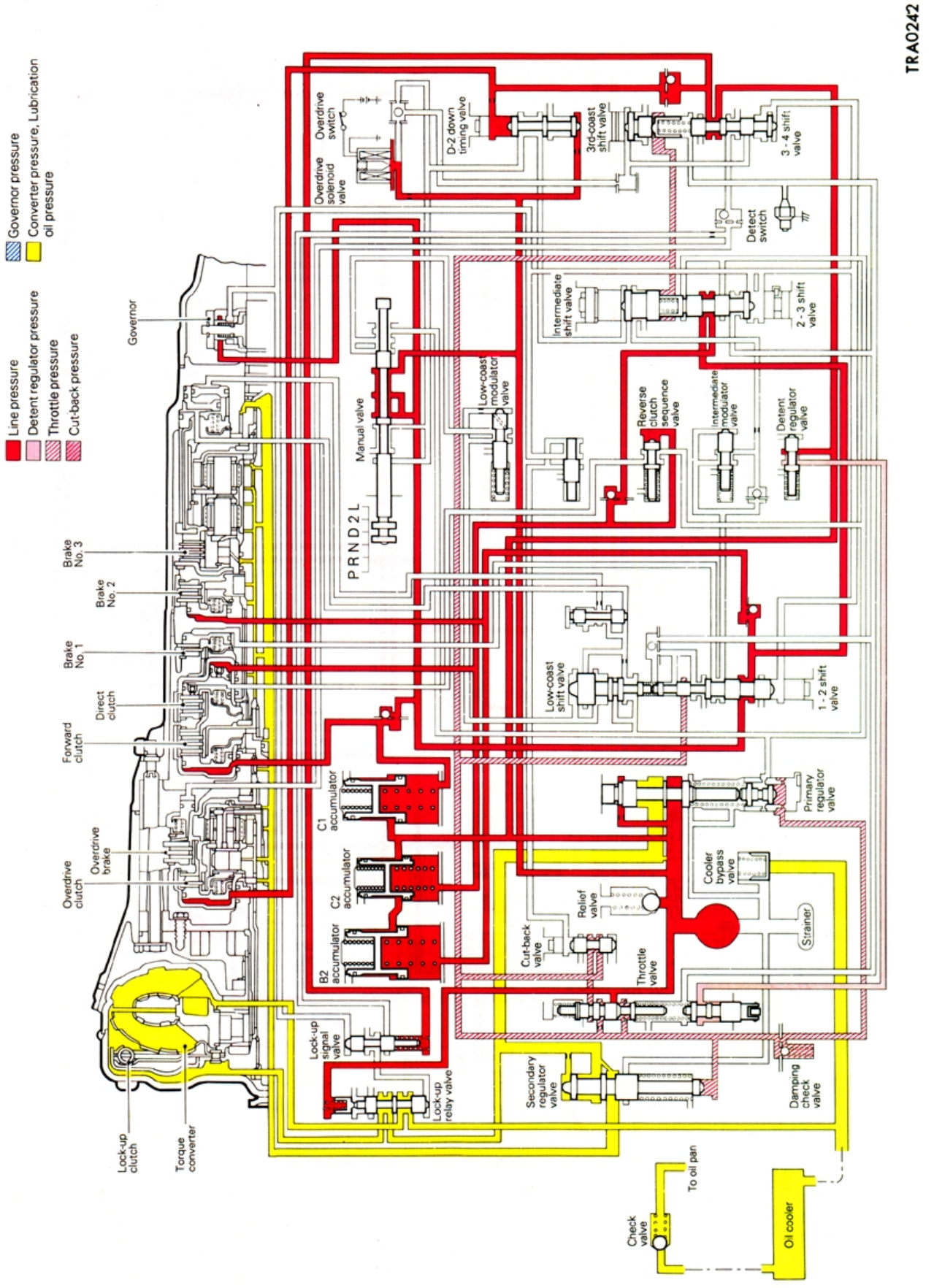
D-2 (DRIVE 2ND)


TRA0241
Governor pressure
Converter pressure, Lubrication oil pressure
Line pressure
Detent regulator pressure
Throttle pressure
Cut-back pressure
Governor
Overdrive switch
Overdrive solenoid valve
D-2 down timing valve
3rd-coast shift valve
3 - 4 shift valve
Detect switch
Intermediate shift valve
2 - 3 shift valve
Manual valve
Low-coast modulator valve
Reverse clutch sequence valve
Intermediate modulator valve
Detent regulator valve
P R N D 2 L
Brake No. 3
Brake No. 2
Brake No. 1
Direct clutch
Forward clutch
Overdrive brake
Overdrive clutch
Low-coast shift valve
1 - 2 shift valve
C1 accumulator
C2 accumulator
B2 accumulator
Relief valve
Primary regulator valve
Cooler bypass valve
Strainer
Cut-back valve
Throttle valve
Lock-up signal valve
Lock-up relay valve
Secondary regulator valve
Damping check valve
Lock-up clutch
Torque converter
To oil pan
Check valve
Oil cooler

D-3 (DRIVE 3RD)



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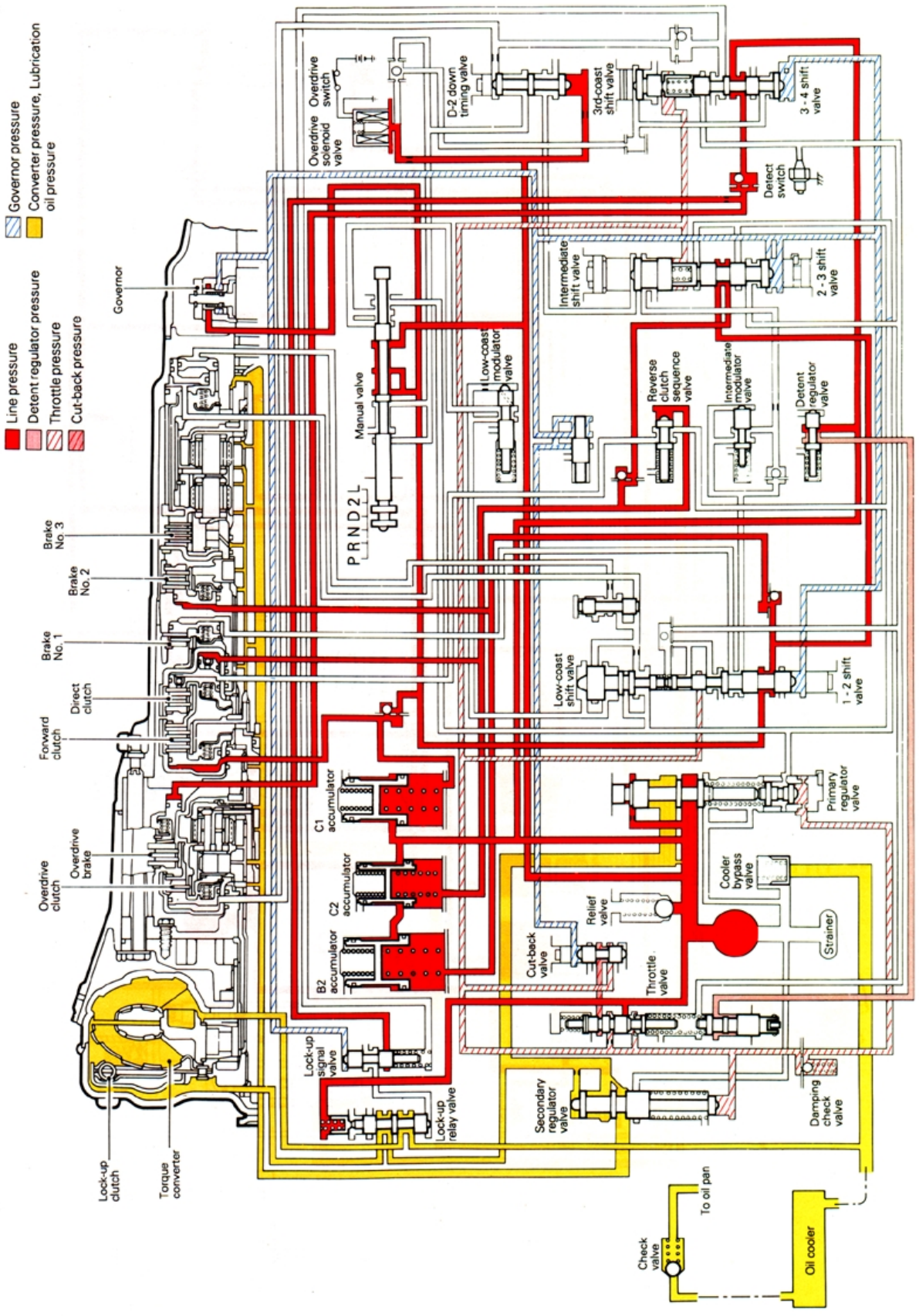
D-4 (DRIVE 4TH)
LOCK-UP CLUTCH : OFF

TRA0243



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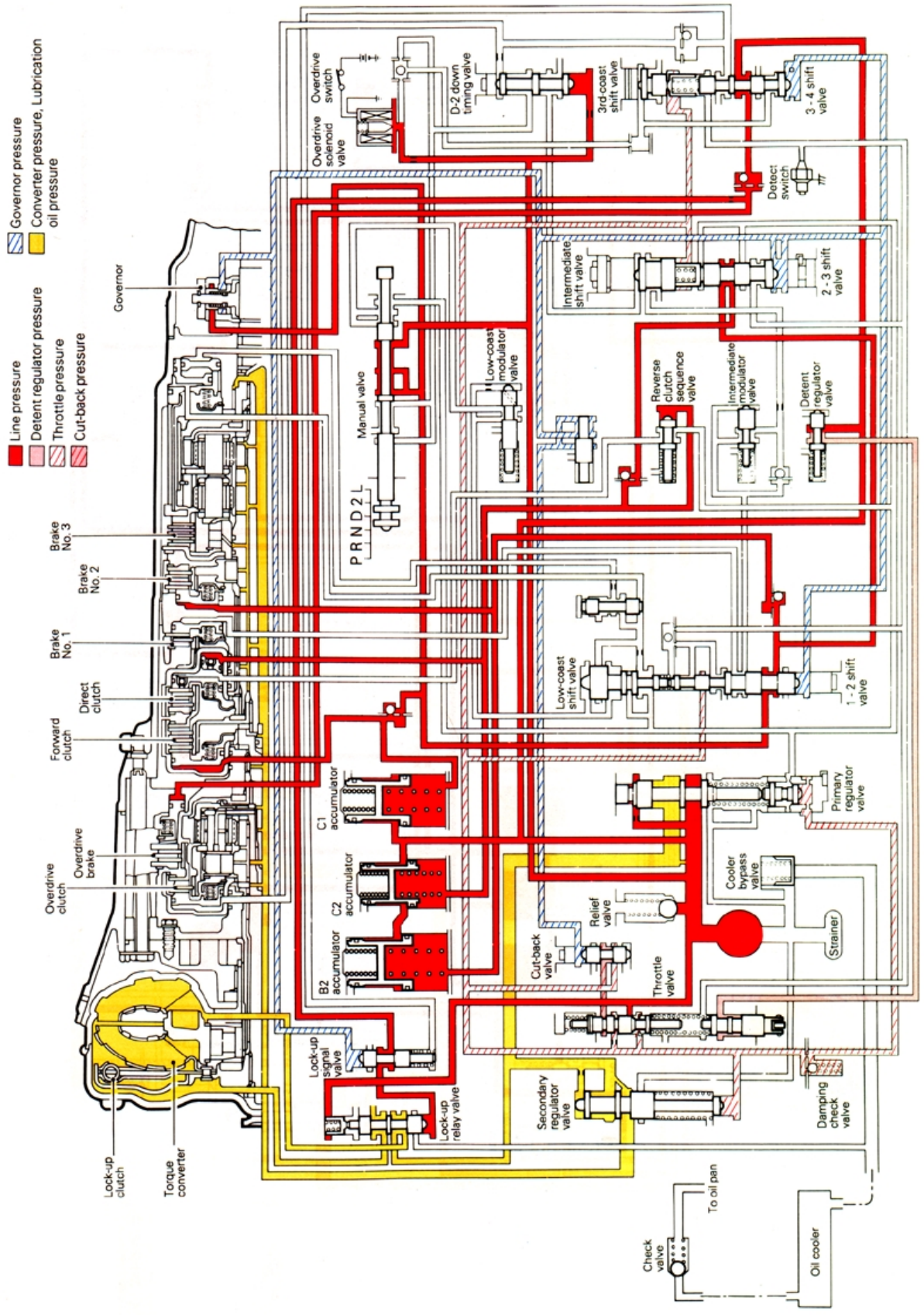
D-4 (DRIVE 4TH)
LOCK-UP CLUTCH : ON



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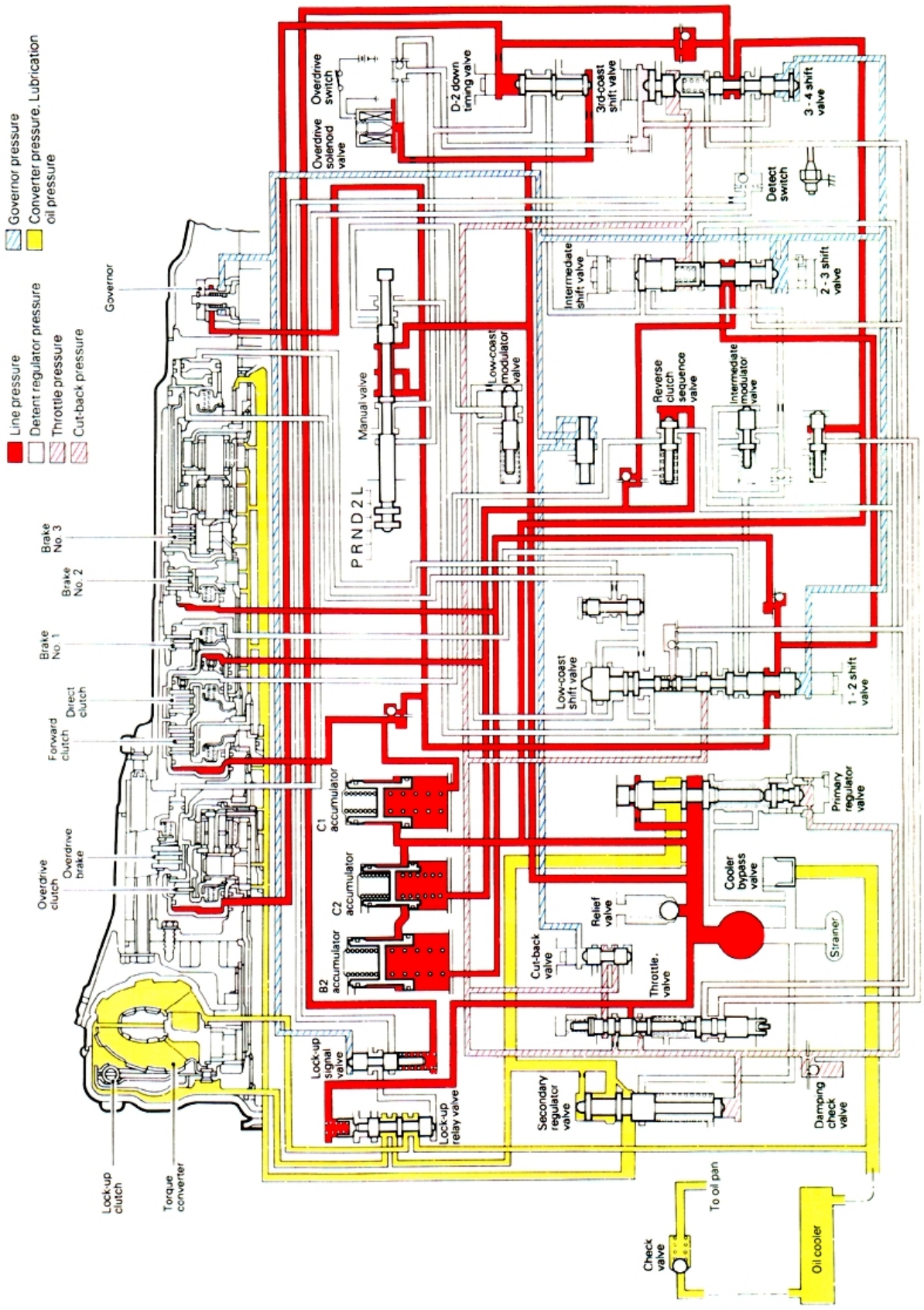
D-K/D (DRIVE KICK DOWN)

4TH ➡ 3RD

TRA0245



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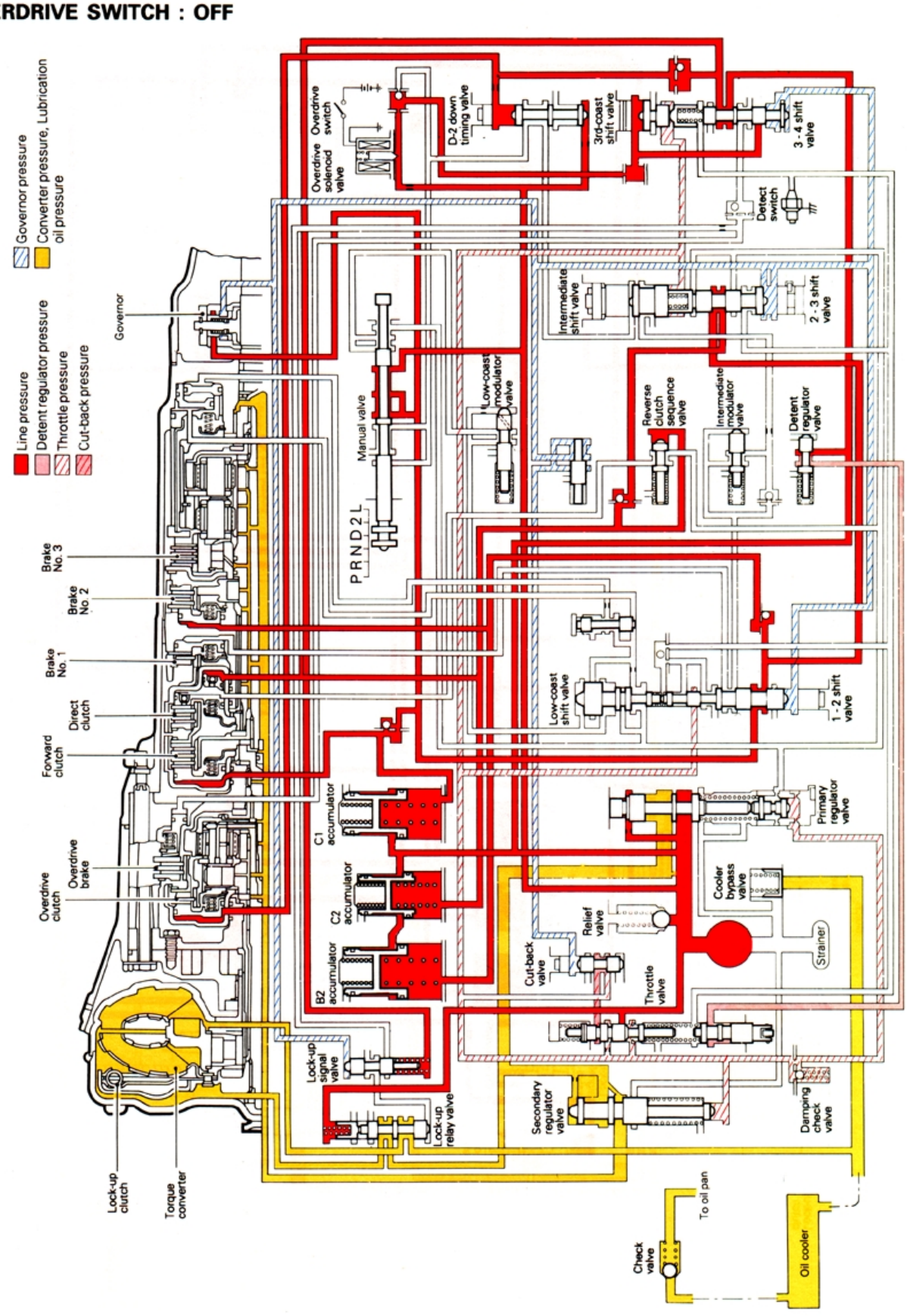
D-3 (DRIVE 3RD)

OVERDRIVE SWITCH : OFF



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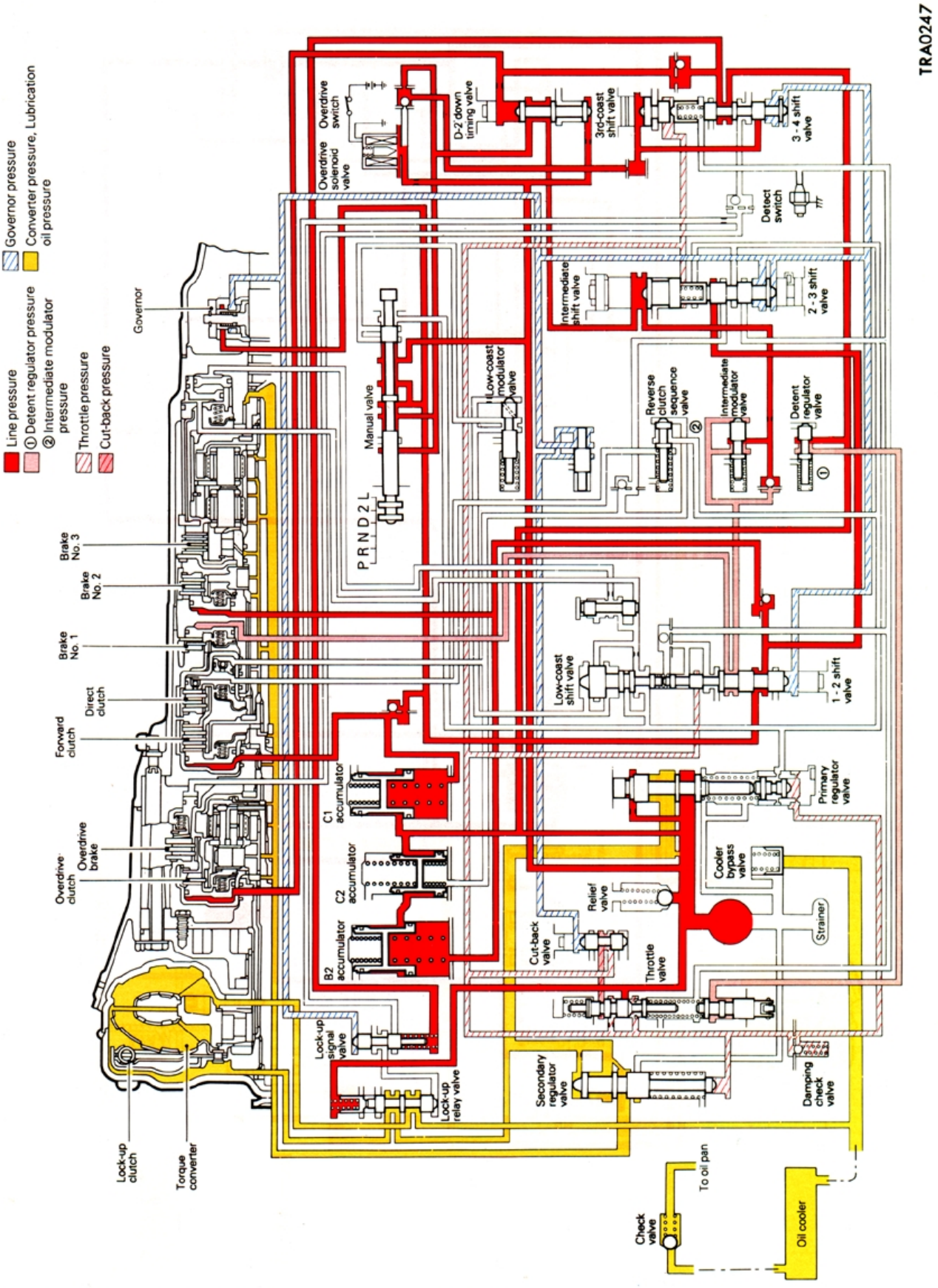
2-2 (SECOND 2ND)



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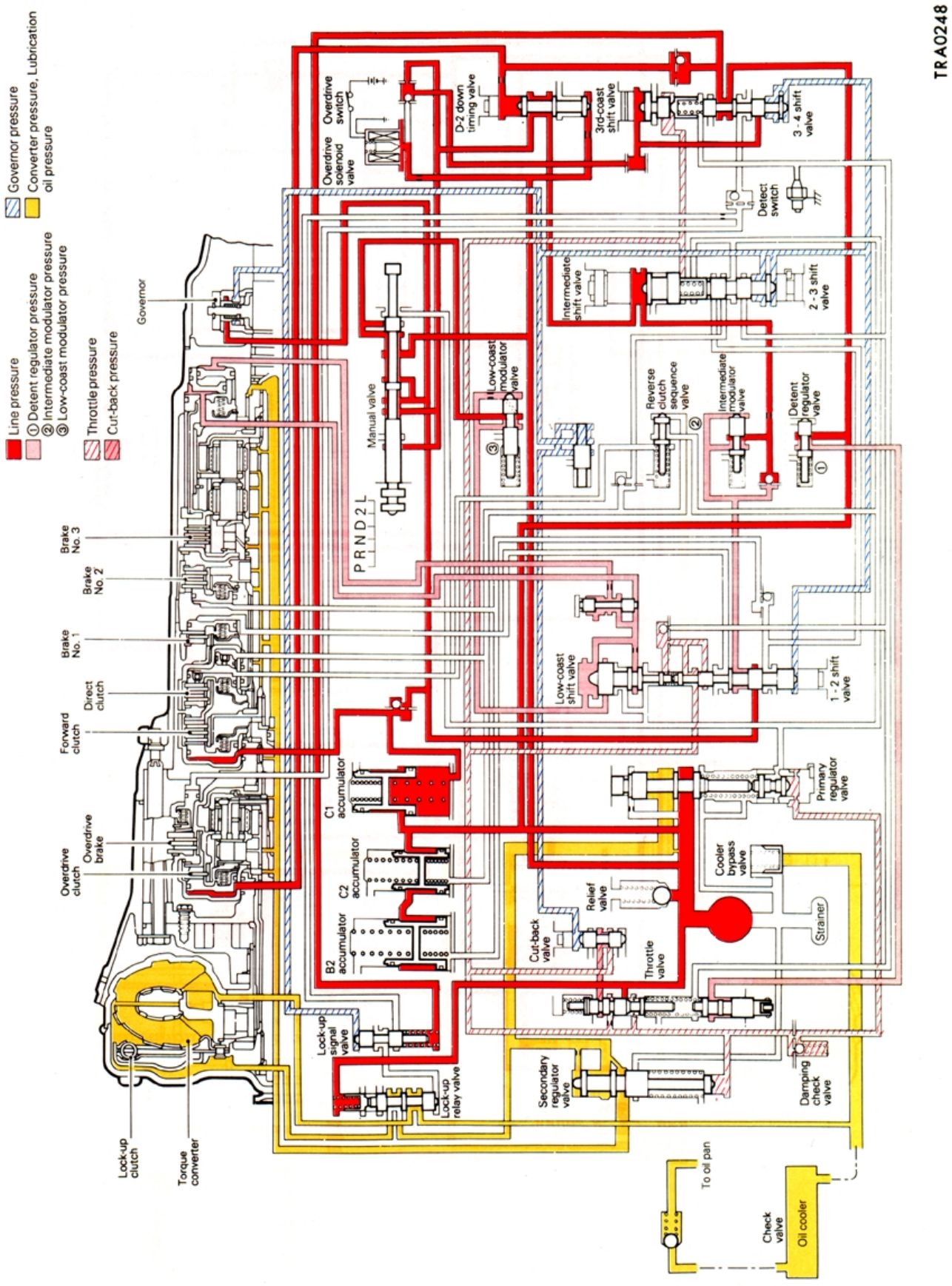
L (LOCK UP)



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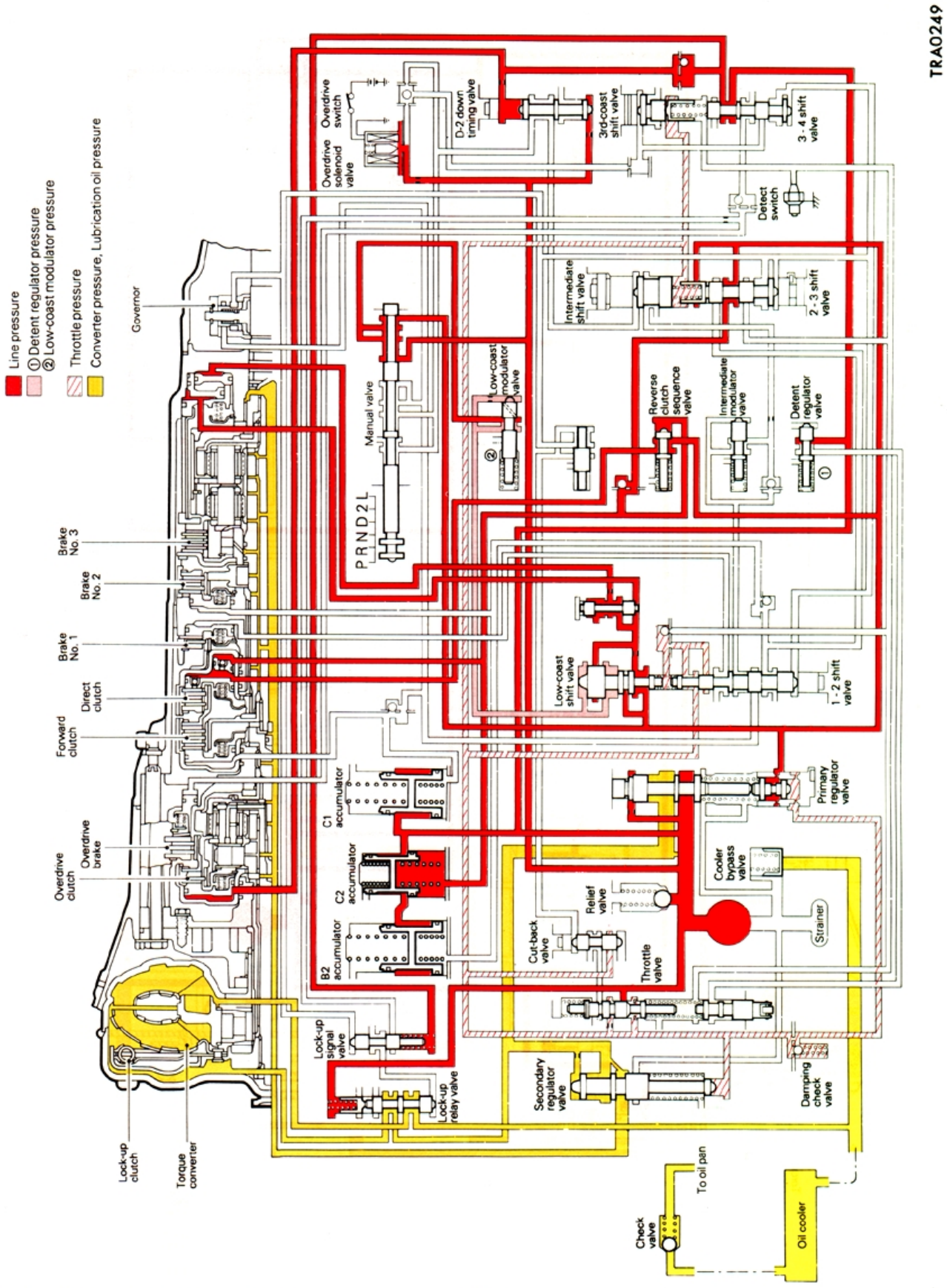
R (REVERSE)



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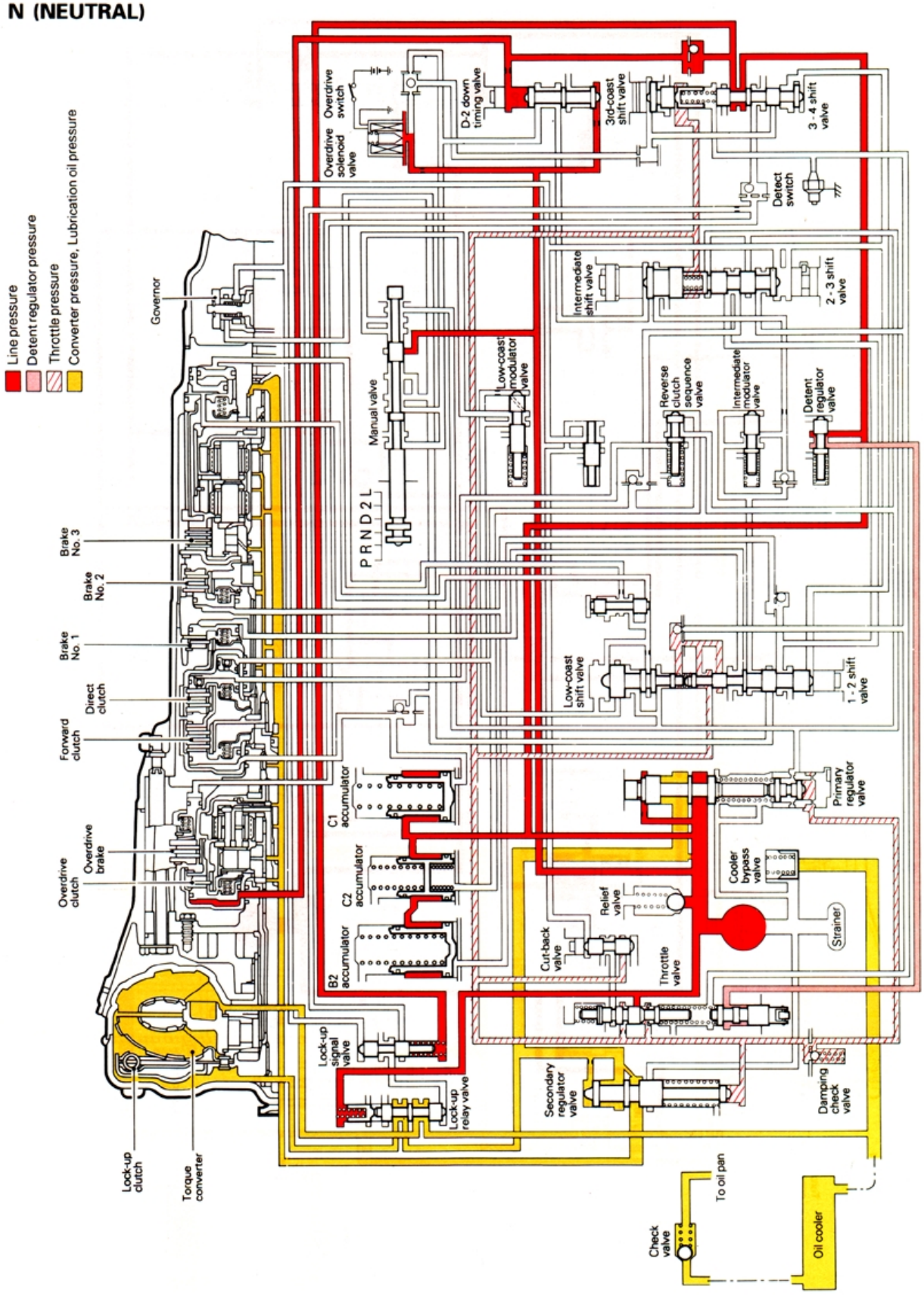
HYDRAULIC CIRCUIT <V4AW2-3-Q>

N (NEUTRAL)

TRA0250



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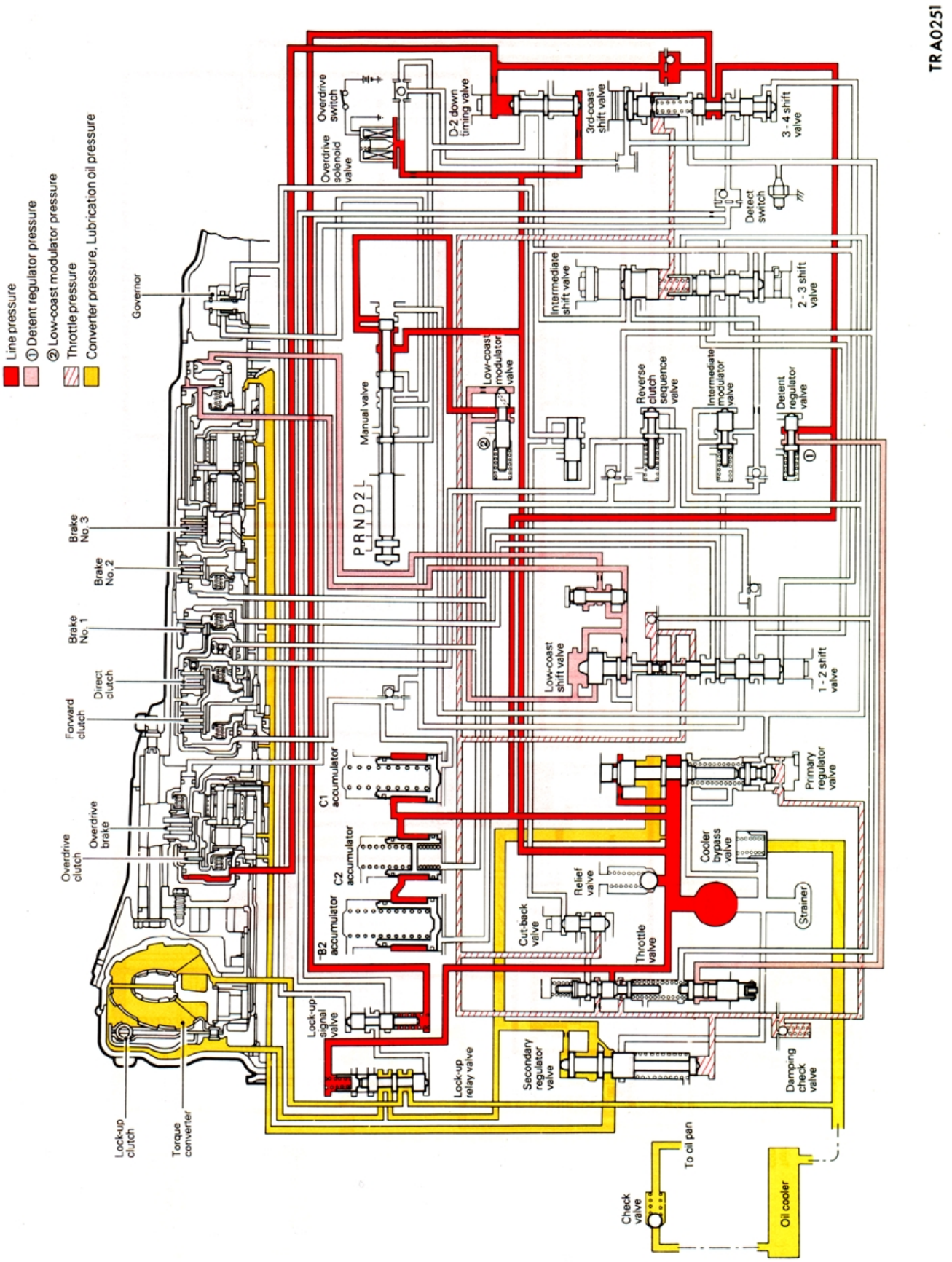

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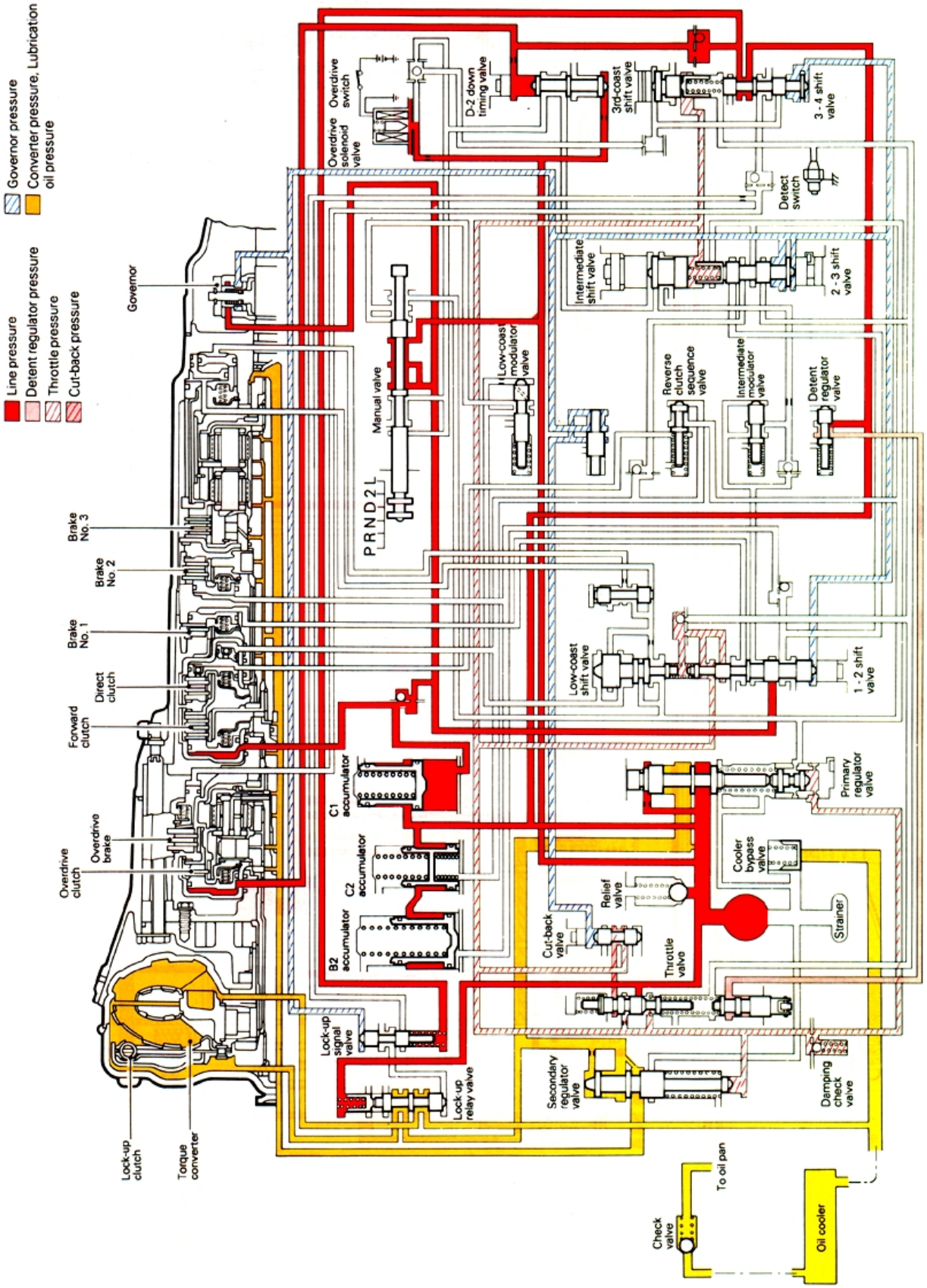
D-1 (DRIVE 1ST)



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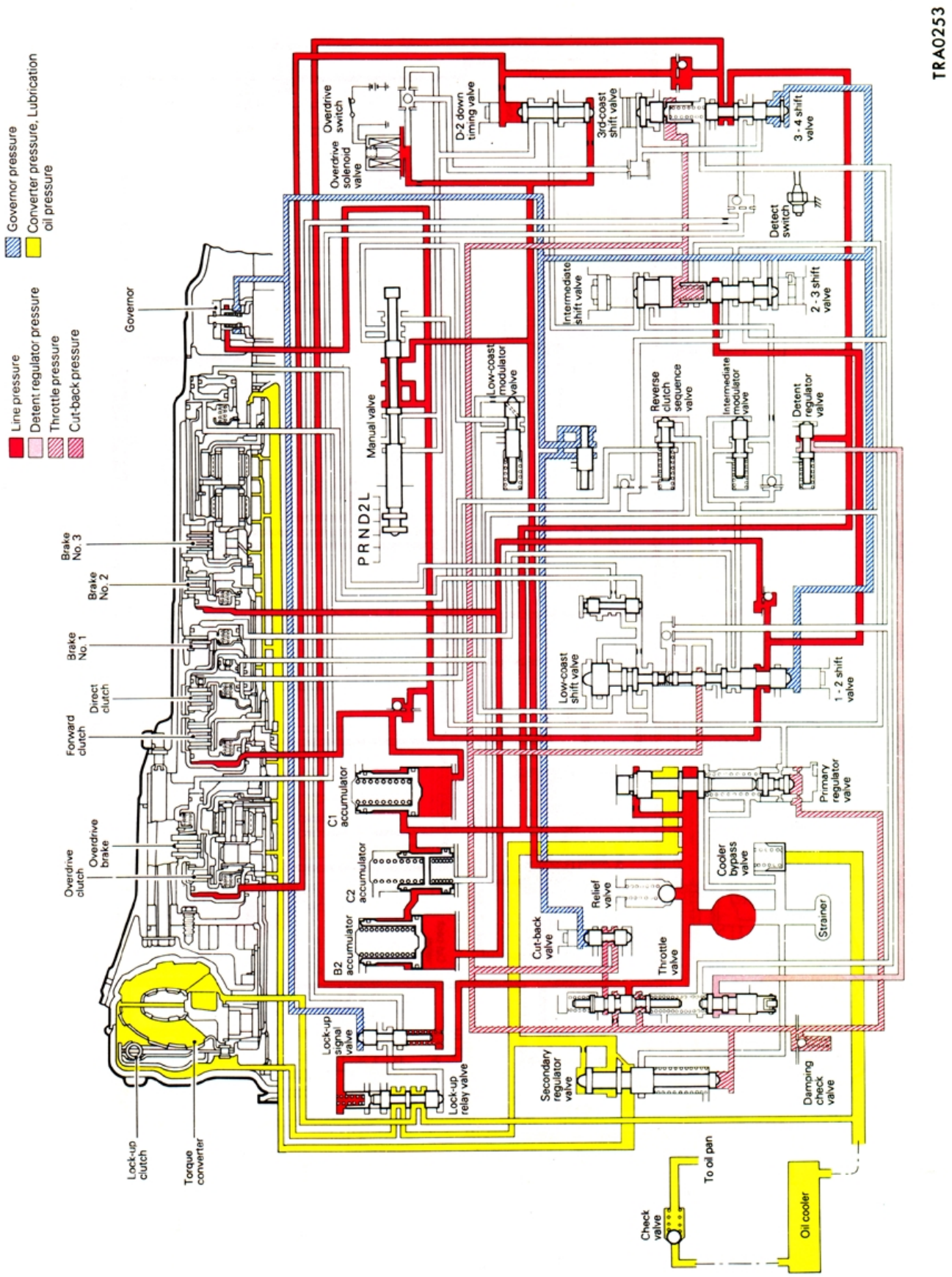
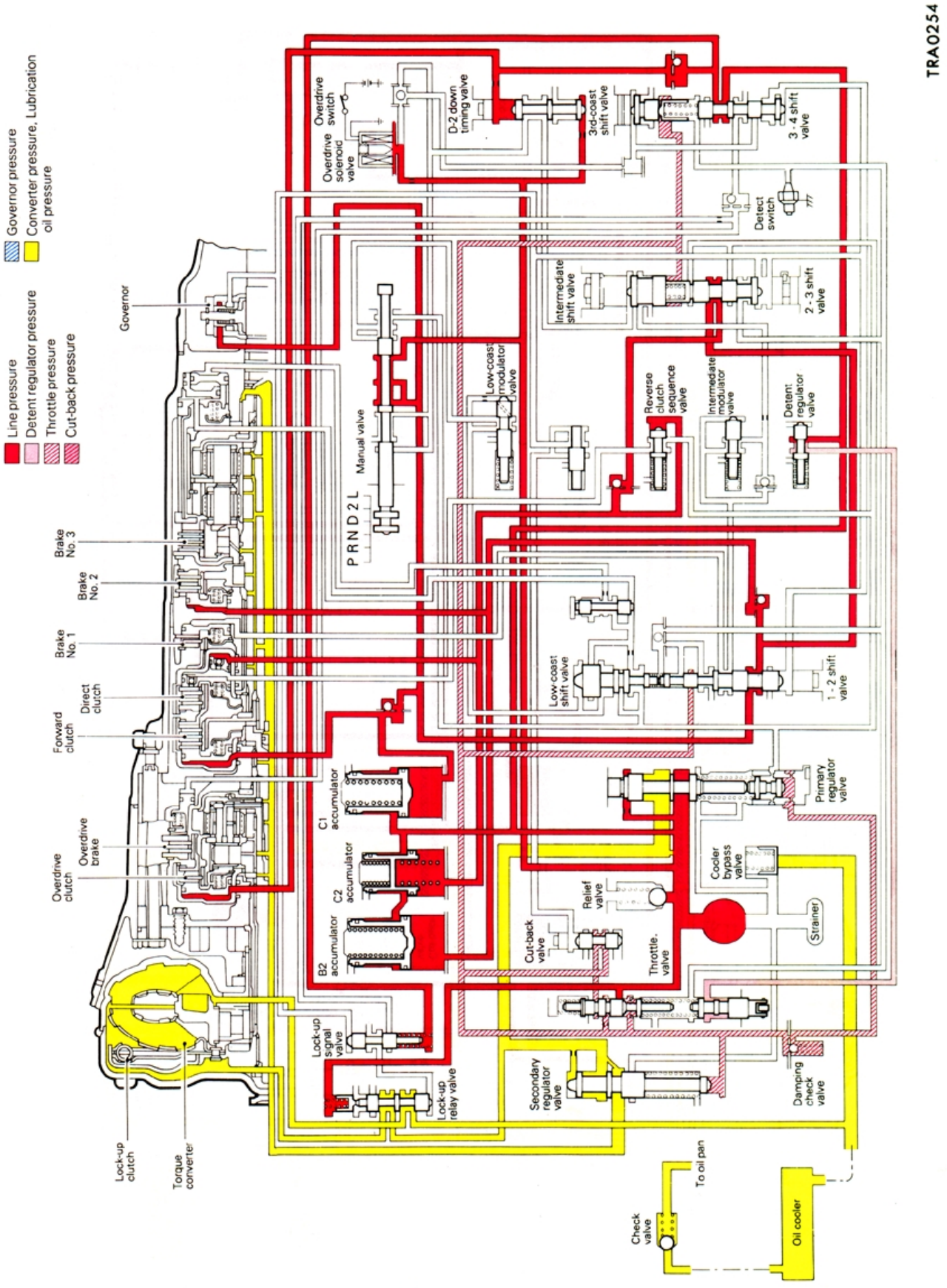
D-2 (DRIVE 2ND)


TRA0253
Governor pressure
Converter pressure, Lubrication oil pressure
Line pressure
Detent regulator pressure
Throttle pressure
Cut-back pressure
Governor
Overdrive switch
Overdrive solenoid valve
D-2 down timing valve
3rd-coast shift valve
3 - 4 shift valve
Detect switch
Intermediate shift valve
2 - 3 shift valve
Low-coast modulator valve
Manual valve
P R N D 2 L
Reverse clutch sequence valve
Intermediate modulator valve
Detent regulator valve
Brake No. 3
Brake No. 2
Brake No. 1
Direct clutch
Forward clutch
Low-coast shift valve
1 - 2 shift valve
Overdrive brake
Overdrive clutch
C1 accumulator
C2 accumulator
B2 accumulator
Primary regulator valve
Cooler bypass valve
Relief valve
Strainer
Cut-back valve
Throttle valve
Lock-up signal valve
Lock-up relay valve
Secondary regulator valve
Damping check valve
Lock-up clutch
Torque converter
To oil pan
Check valve
Oil cooler

D-3 (DRIVE 3RD)



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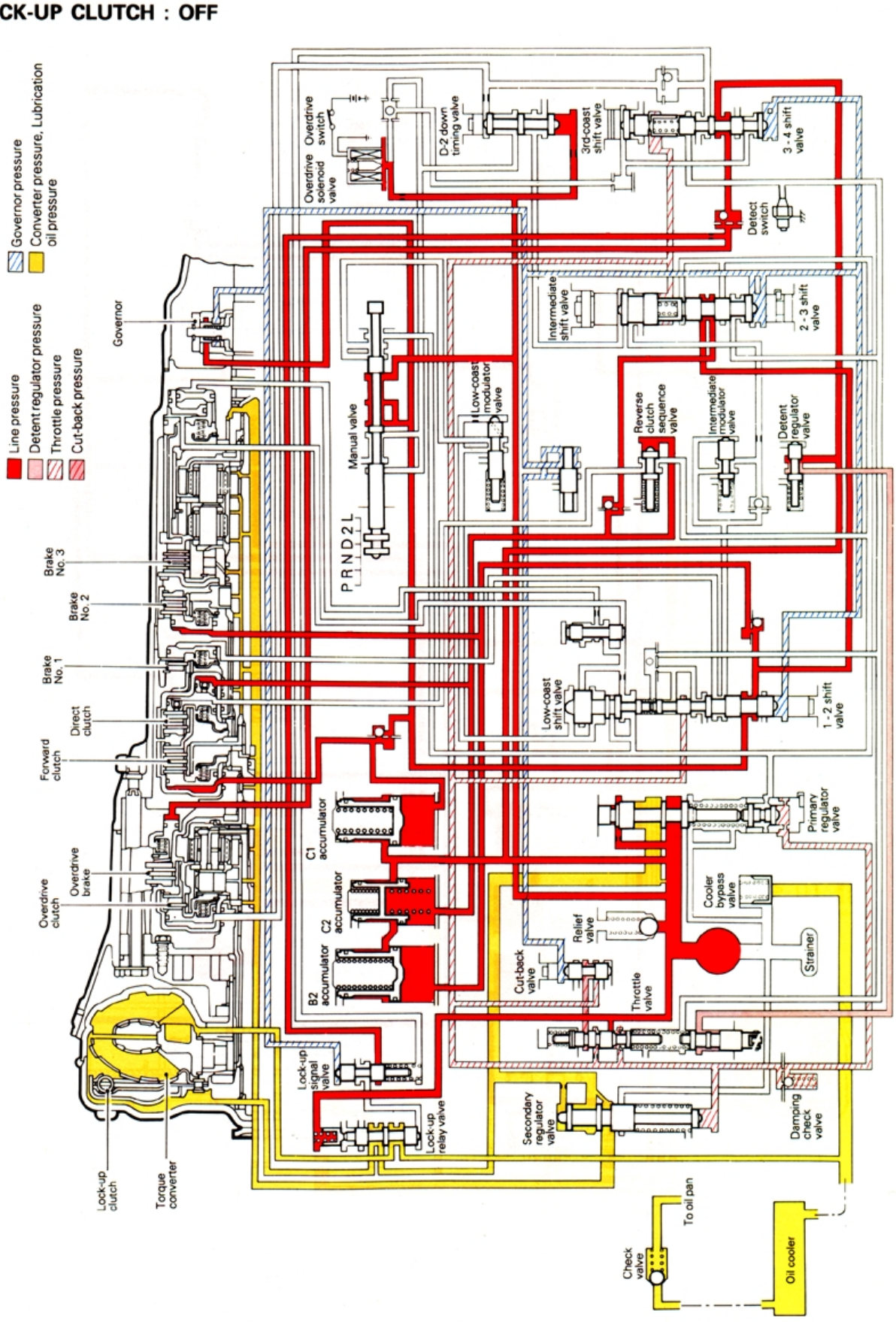
D-4 (DRIVE 4TH)

LOCK-UP CLUTCH : OFF



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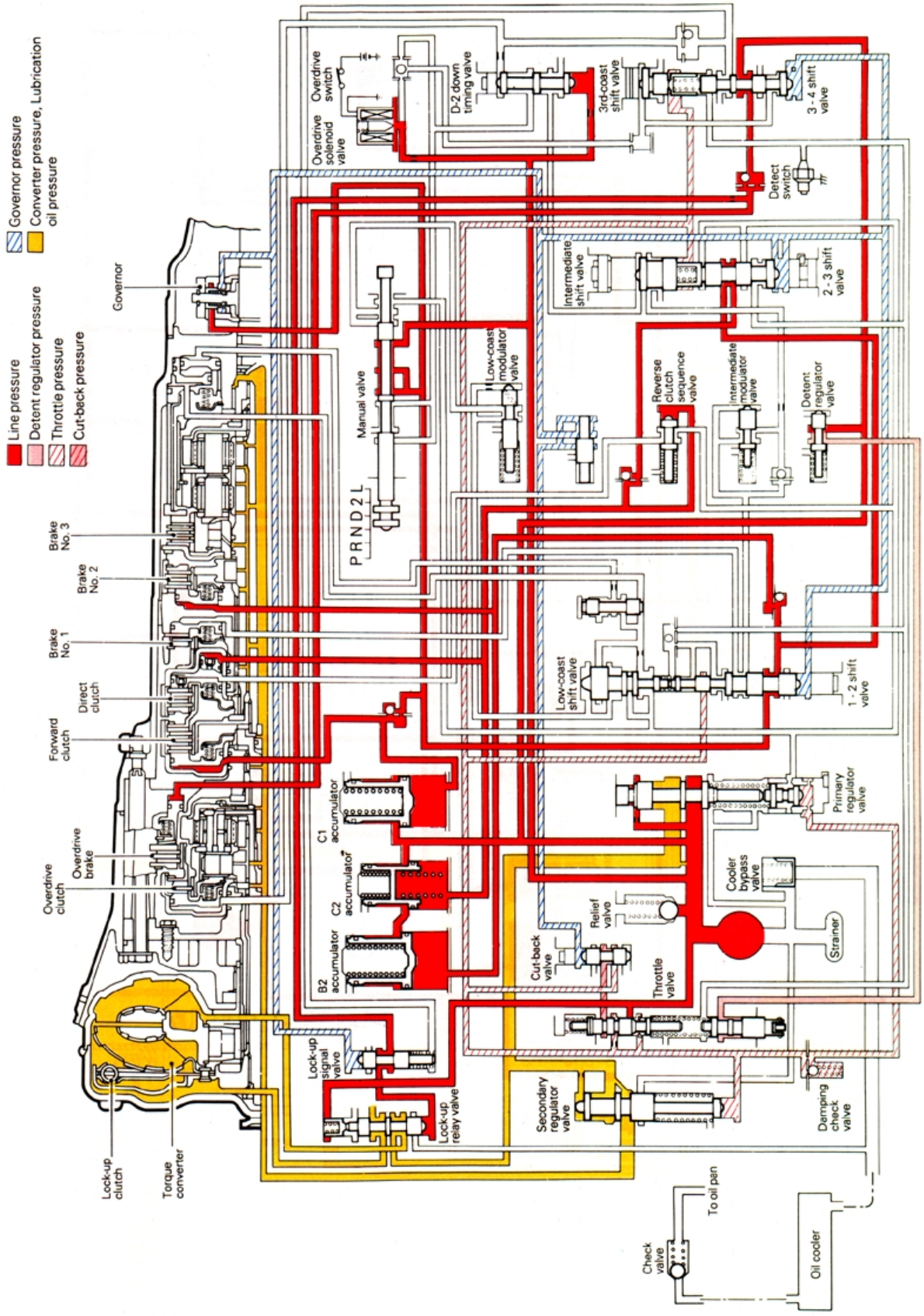
D-4 (DRIVE 4TH)
LOCK-UP CLUTCH : ON



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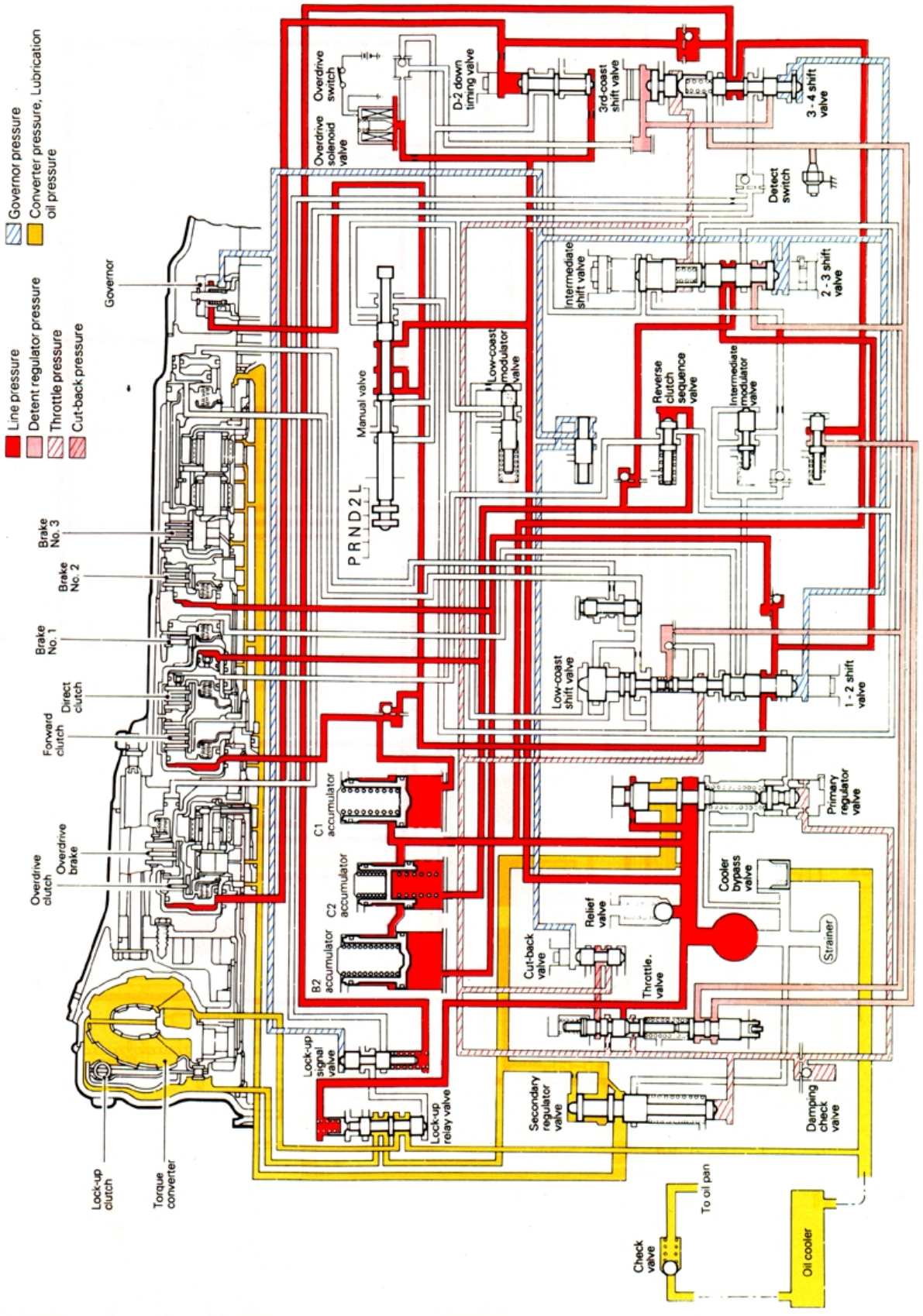
D-K/D (DRIVE KICK DOWN)

4TH ➡ 3RD

TRA0257



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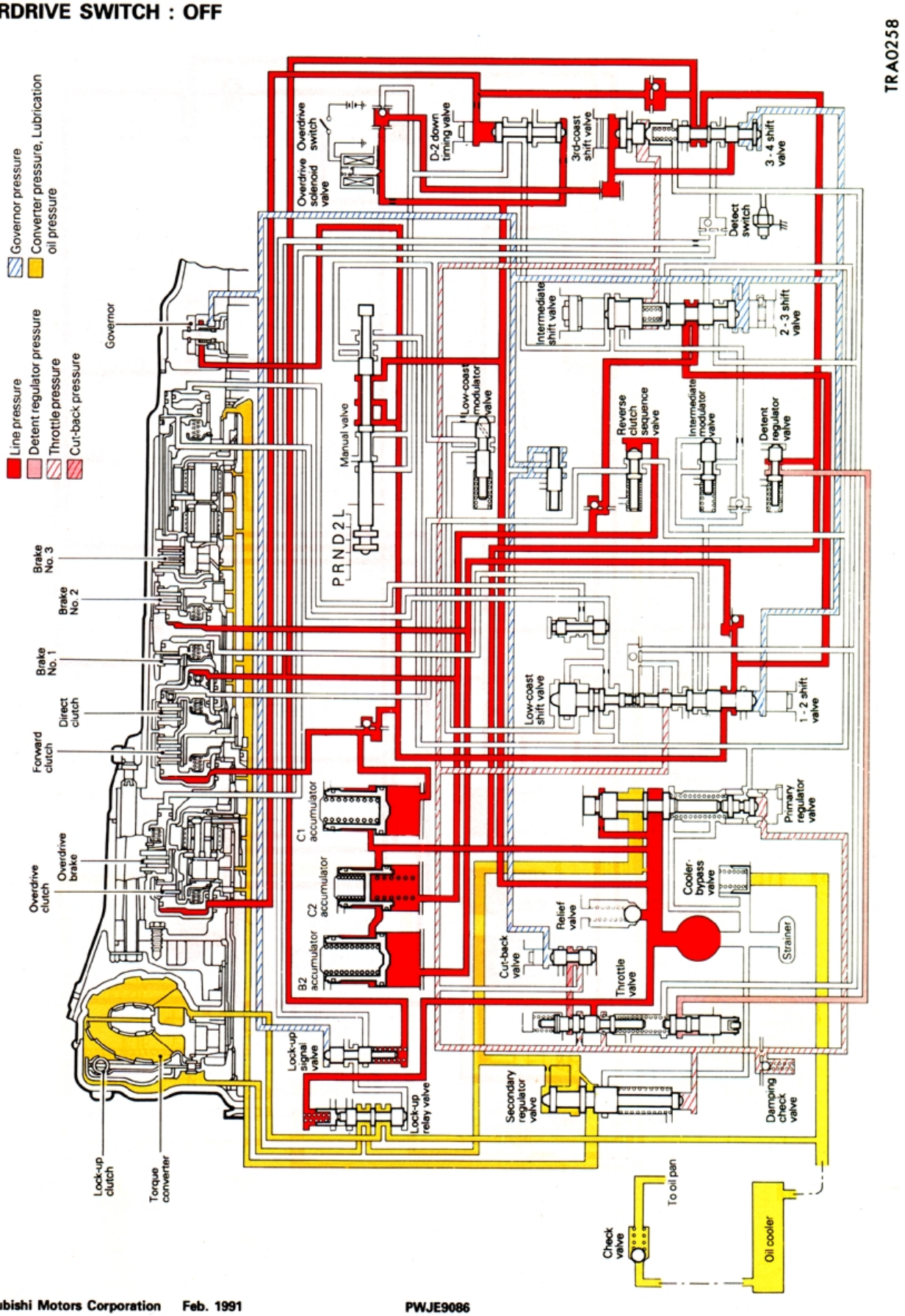
D-3 (DRIVE 3RD)

OVERDRIVE SWITCH : OFF



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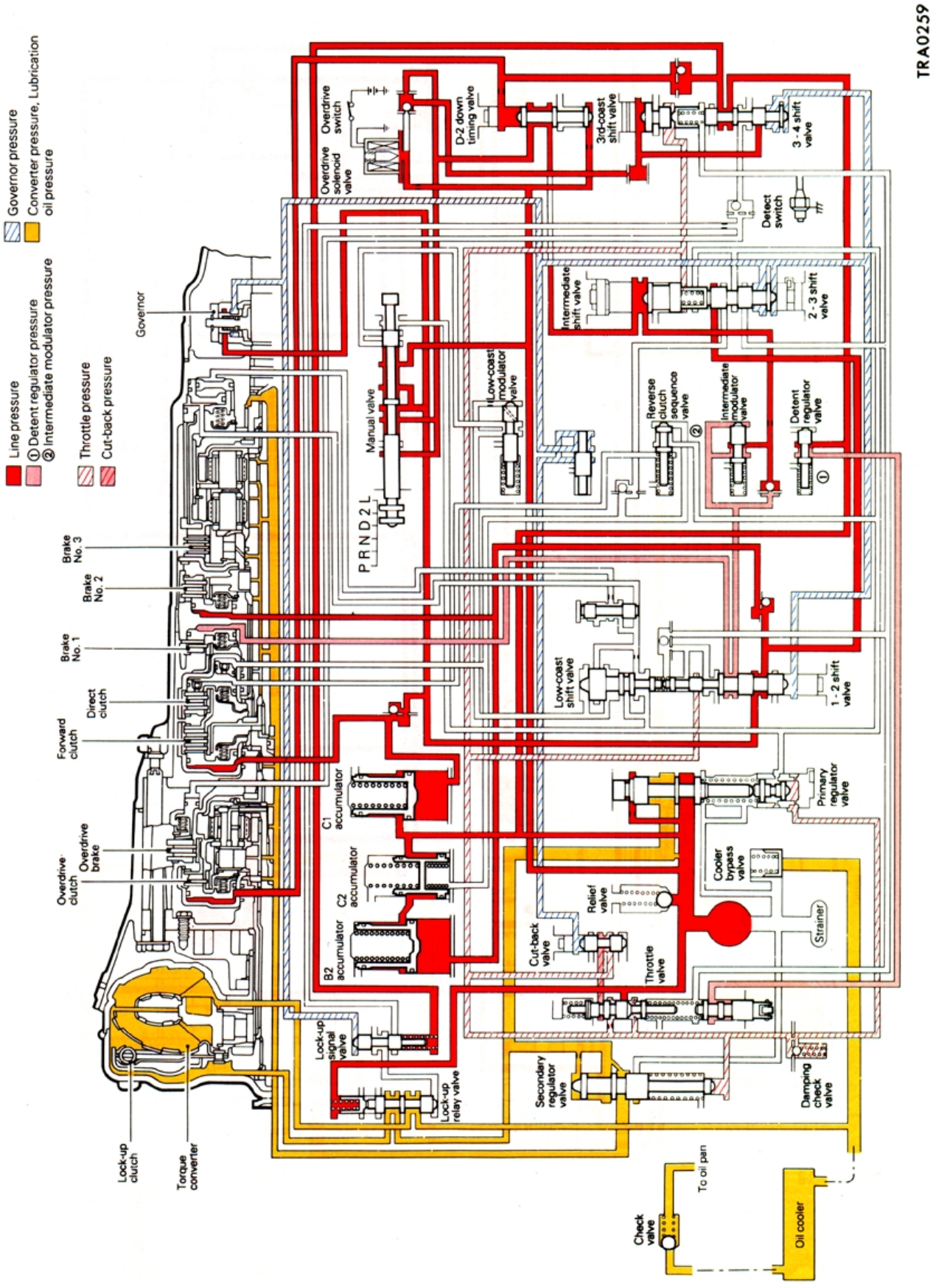
2-2 (SECOND 2ND)



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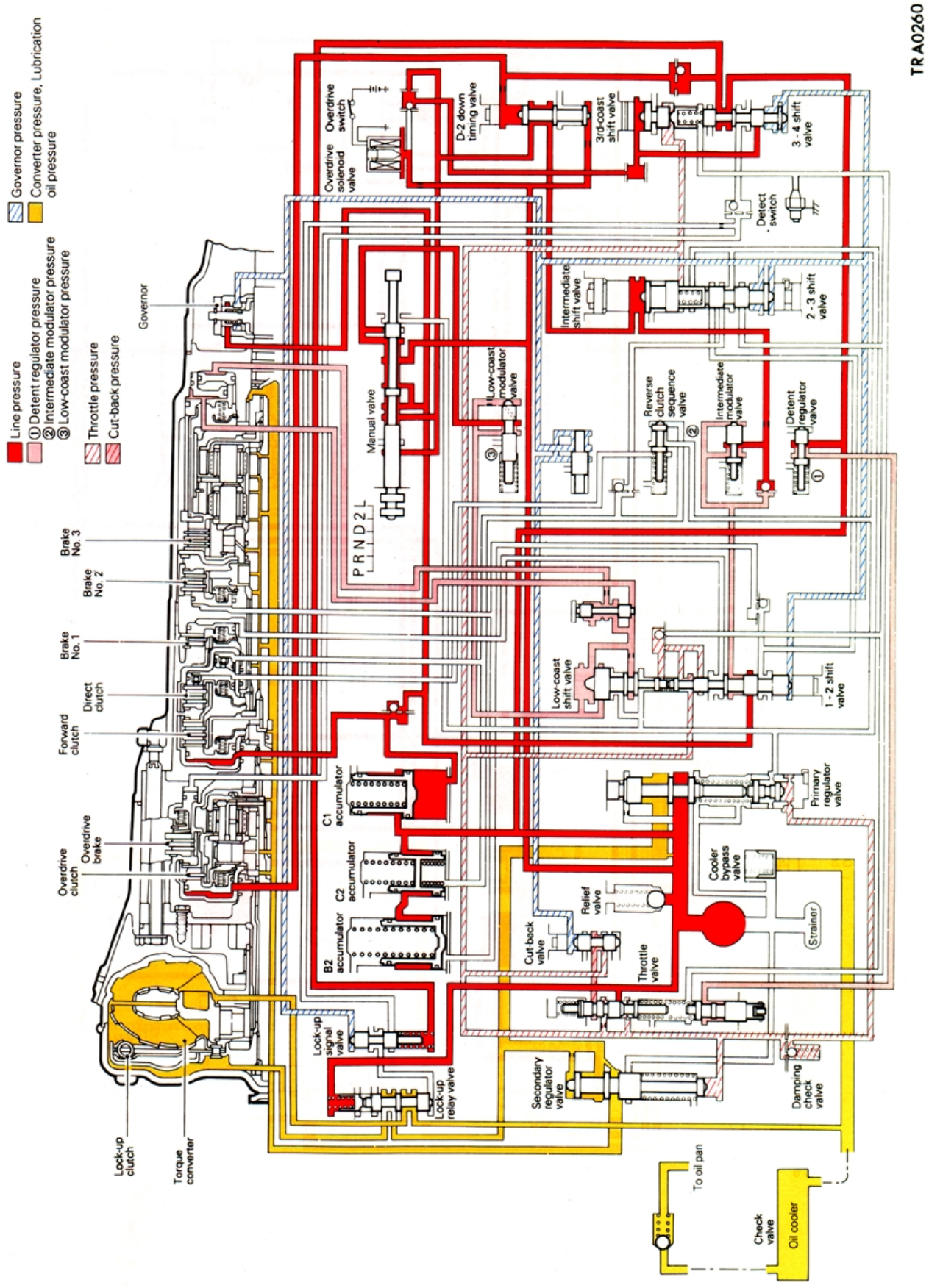
L (LOCK UP)



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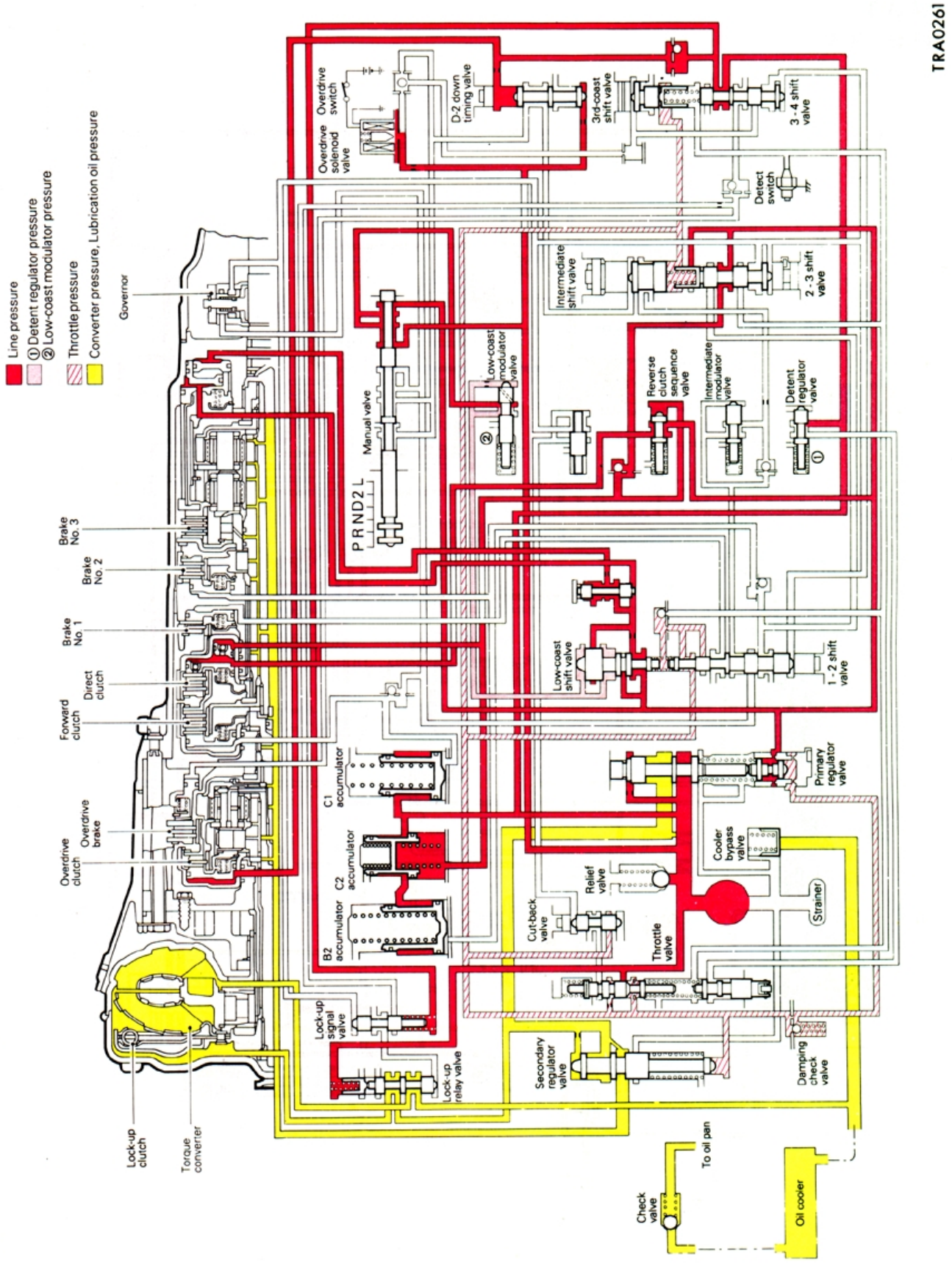
R (REVERSE)



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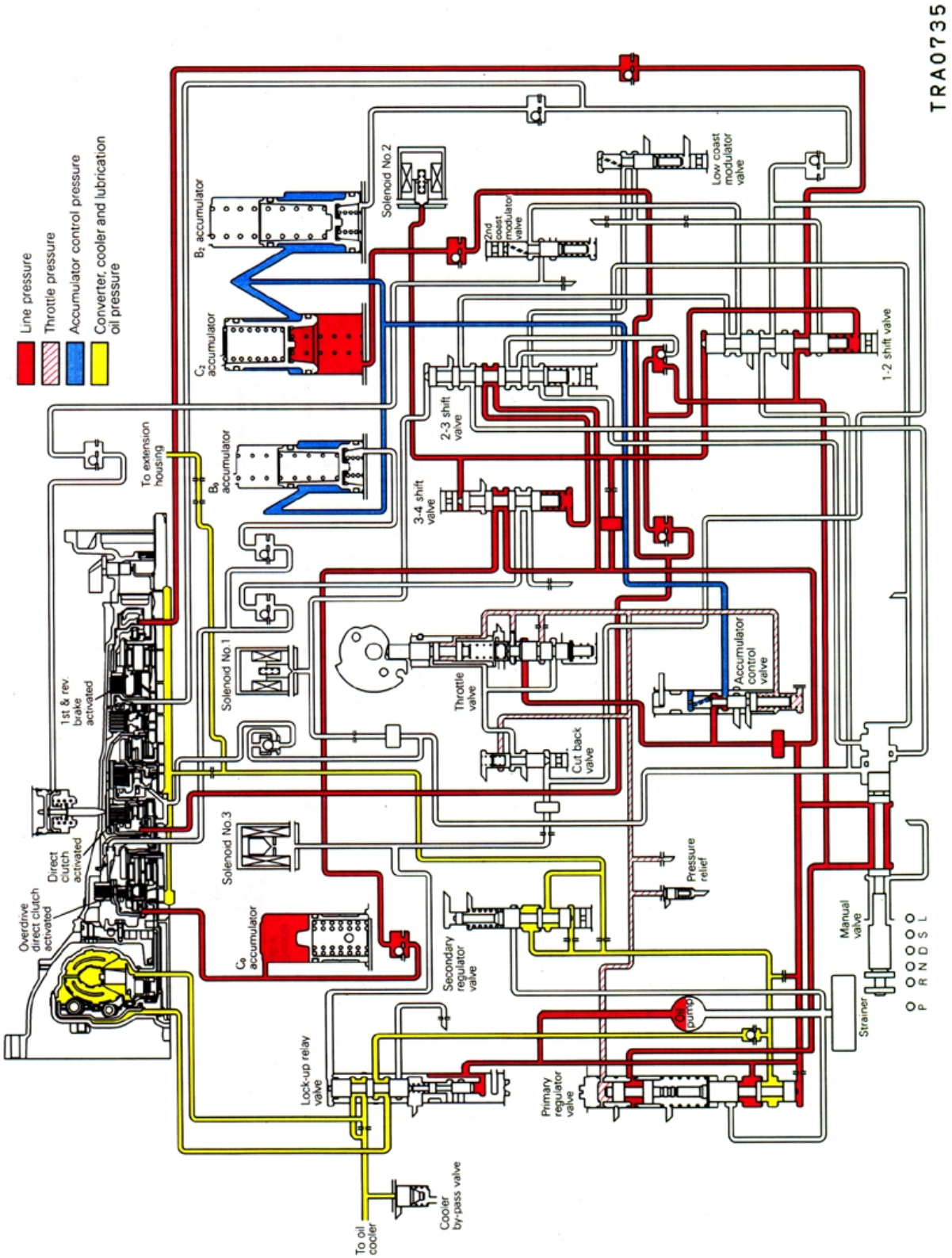
HYDRAULIC CIRCUIT <V4AW3>

(1) R (REVERSE)



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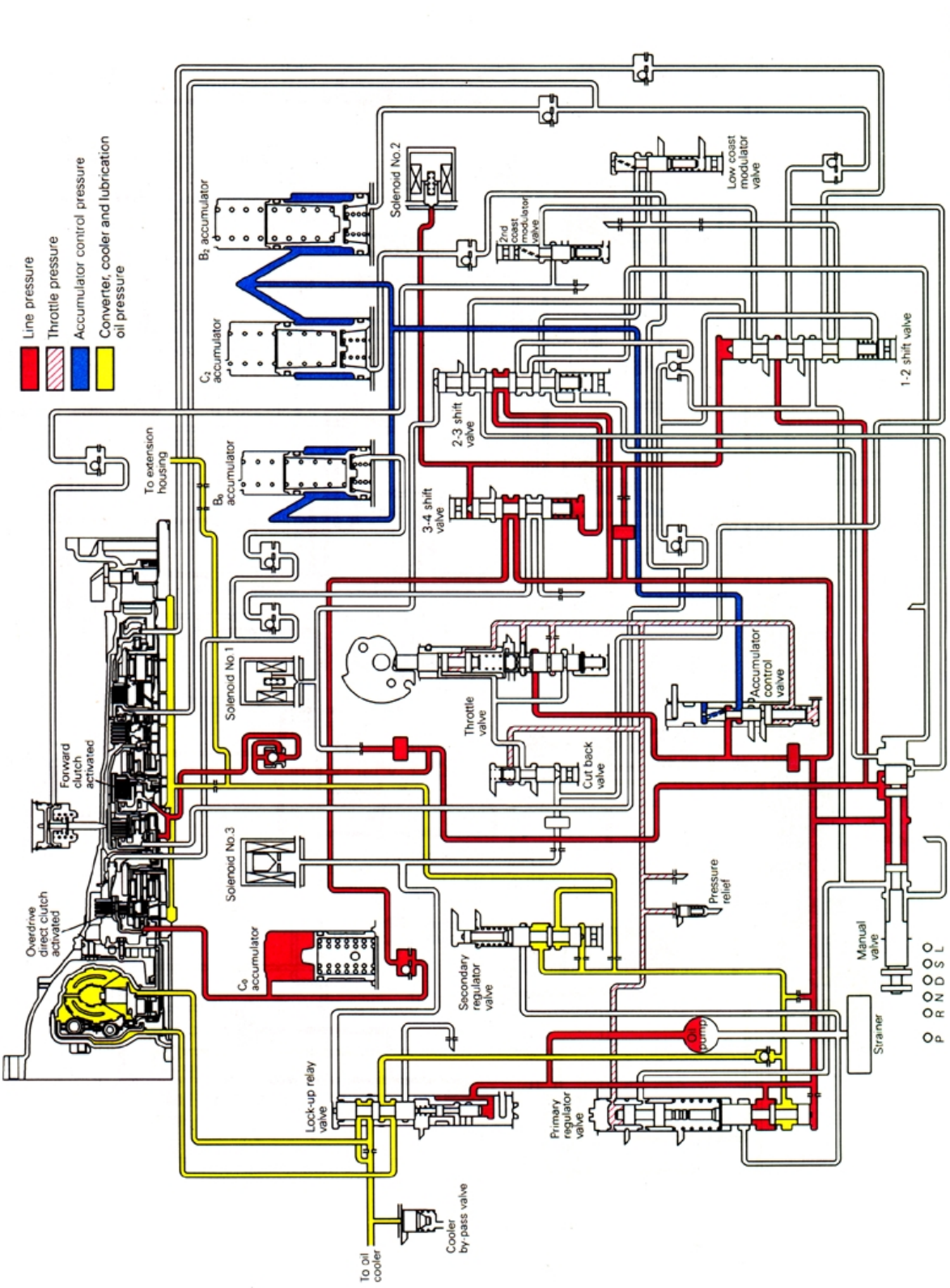

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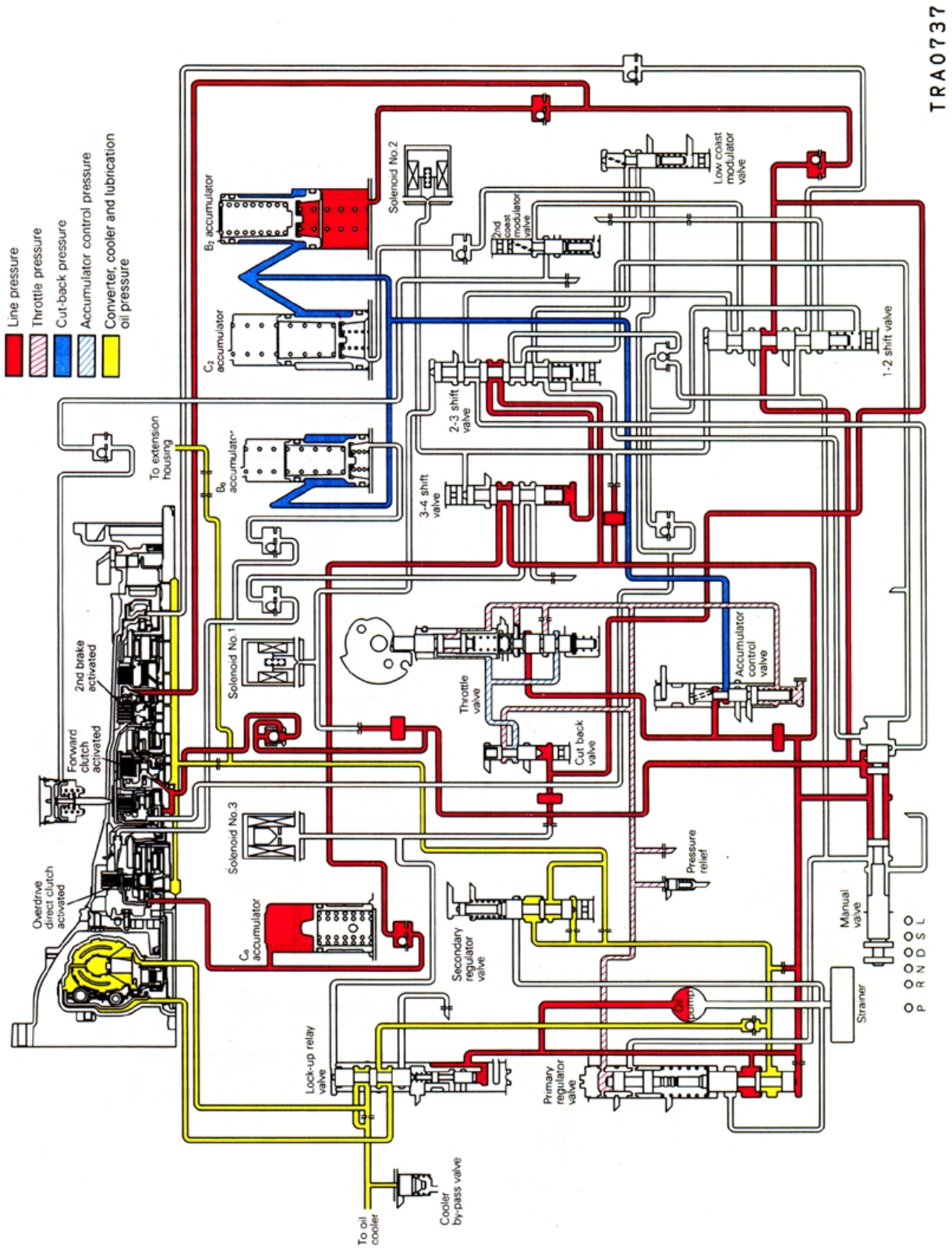
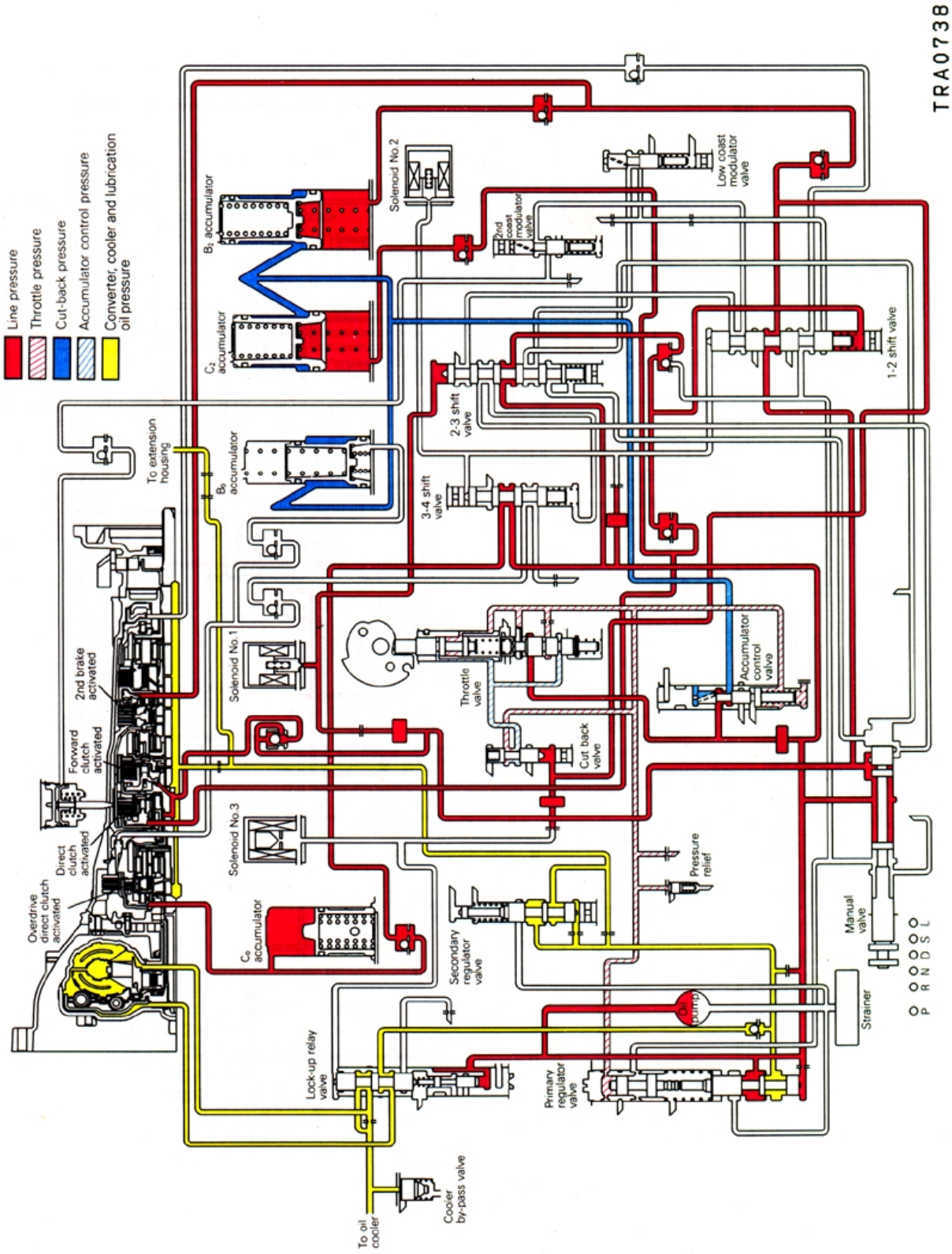
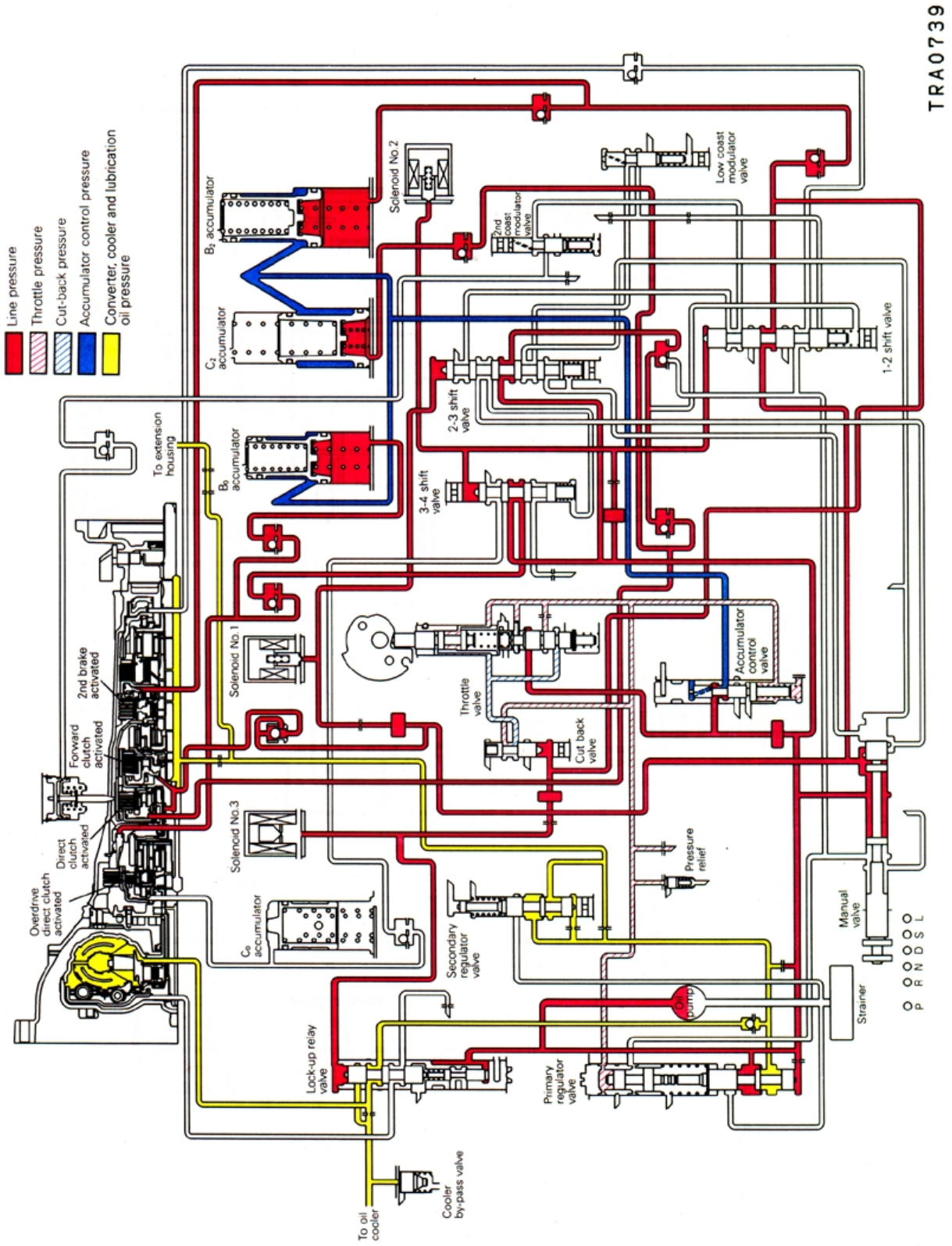


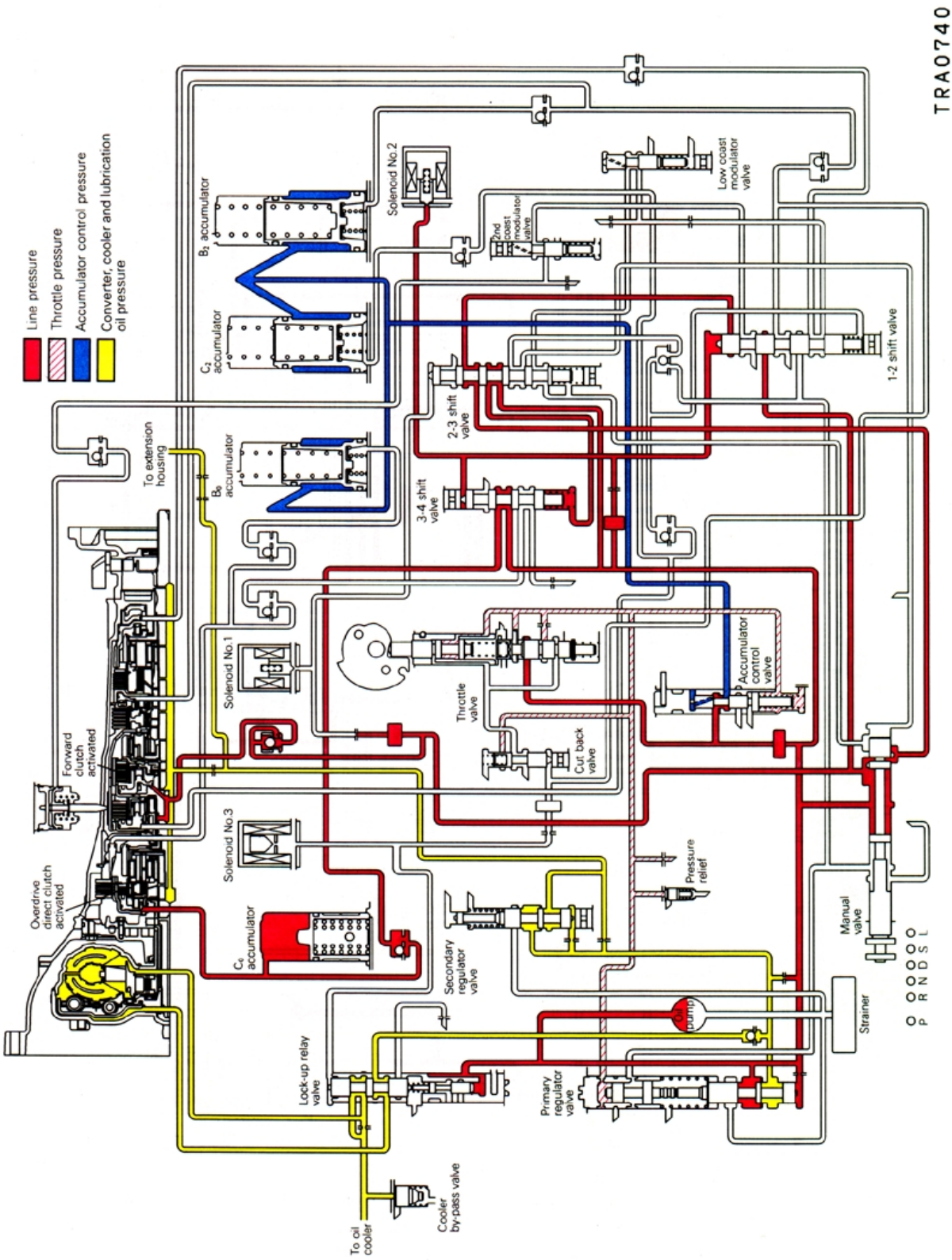
(4) D-3 (DRIVE 3RD)



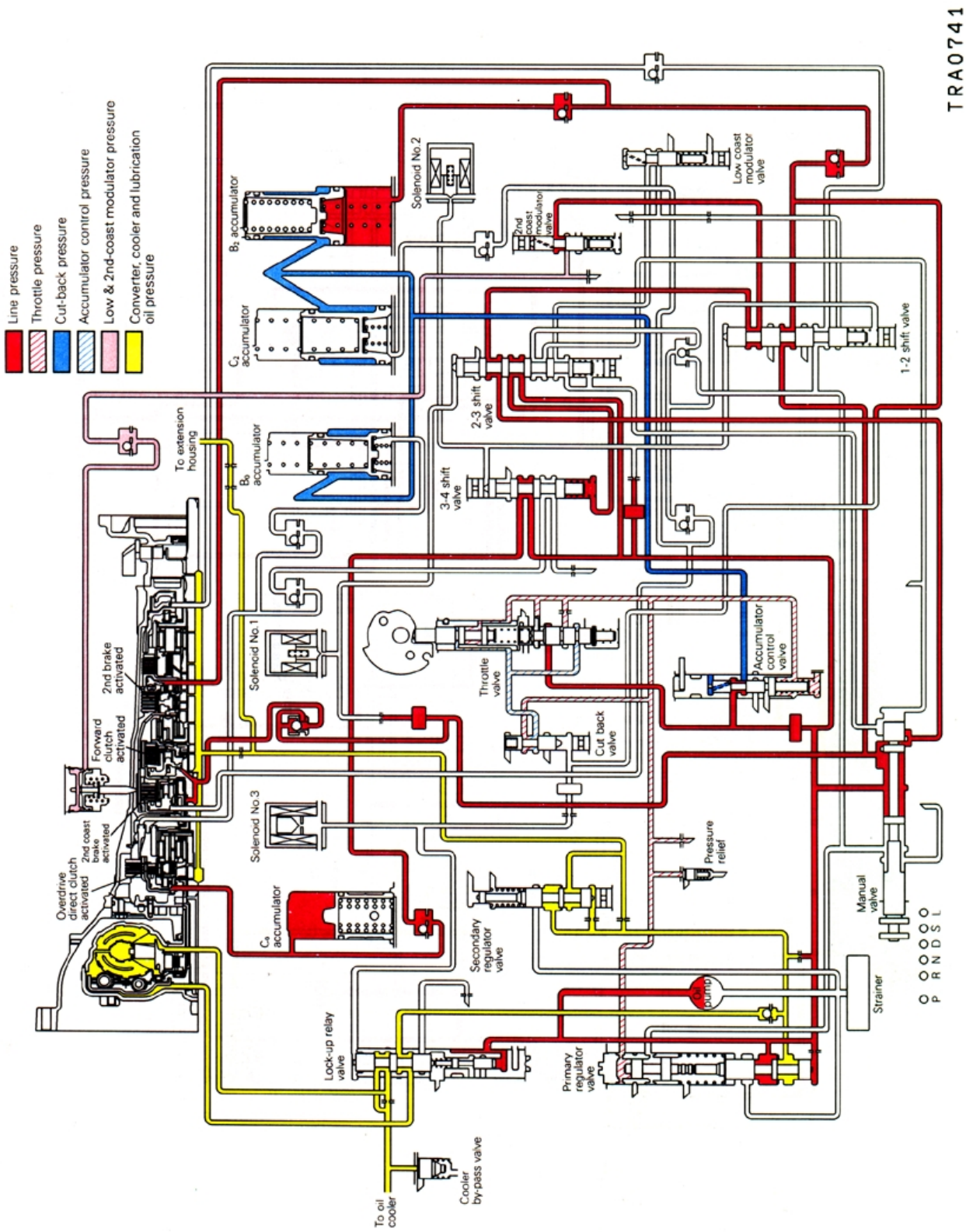
(5) D-4 (DRIVE 4TH) LOCK UP



(6) 2-1 (SECOND 1ST)



(7) 2-2 (SECOND 2ND)



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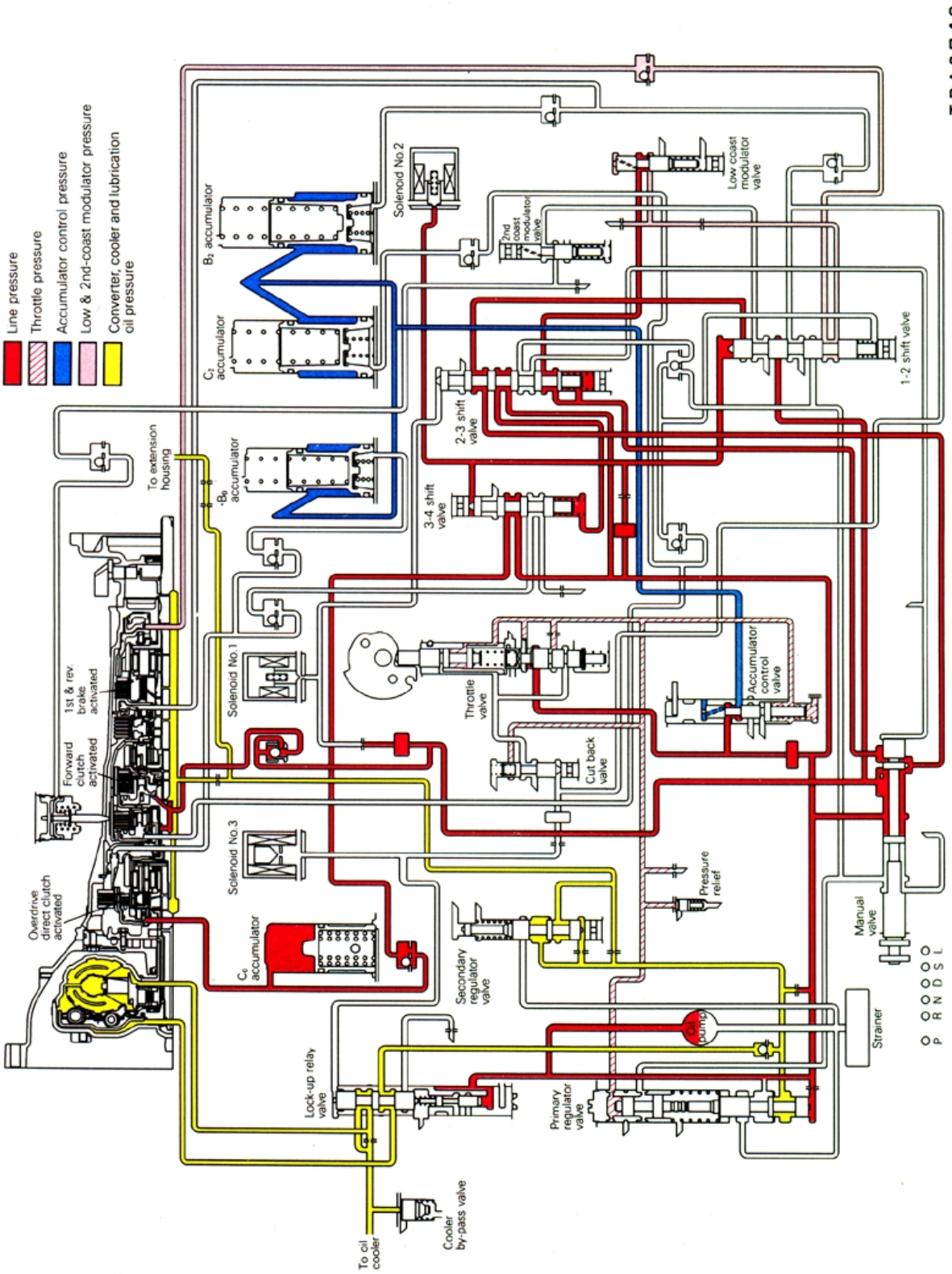

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NOTES

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NOTES

SPECIFICATIONS

TRANSMISSION MODEL TABLE

E23CF--

Transmission model	Gear ratio	Speedometer gear ratio	Vehicle model	Engine model (Engine displacement)
V4AW2-3-LFP	B	26/8	V23W, V43W	6G72–12 valve (3000–12V)
V4AW2-3-LFPL	B	26/8	V23C, V23W, V43W	6G72–12 valve (3000–12V)
V4AW2-3-QGP	A	27/8	V44W	4D56 (2500D)
V4AW2-3-QGPL	A	27/8	V44W	4D56 (2500D)
V4AW2-3-QHP	A	28/8	V44W	4D56 (2500D)
V4AW2-3-QHPL	A	28/8	V44W	4D56 (2500D)
V4AW2-7-LFP	B	26/8	V23W, V43W	6G72–12 valve (3000–12V)
V4AW2-7-LFPL	B	26/8	V23C, V23W, V43W	6G72–12 valve (3000–12V)
V4AW3-7-LI	C	29/8	V23W, V43W	6G72–24 valve (3000–24V)
V4AW3-7-LIL	C	29/8	V23C, V23W, V43W	6G72–24 valve (3000–24V)
V4AW3-7-MH	C	28/9	V25W, V45W	6G74 (3500)
V4AW3-7-MHL	C	28/9	V25W, V45W	6G74 (3500)
V4AW3-7-UI	D	29/9	V46W	4M40 (2800D)
V4AW3-7-UIL	D	29/9	V46W	4M40 (2800D)
V4AW3-7-UJ	D	30/9	V46W	4M40 (2800D)
V4AW3-7-UJL	D	30/9	V46W	4M40 (2800D)

GEAR RATIO TABLE

E23CG--

	A	B	C	D
1st	2.826	2.826	2.804	2.804
2nd	1.493	1.493	1.531	1.531
3rd	1.000	1.000	1.000	1.000
4th	0.688	0.730	0.754	0.705
Reverse	2.703	2.703	2.393	2.393

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GENERAL SPECIFICATIONS

E23CA--

Items	V4AW2-3	V4AW3-7
Torque converter		
Type	3 elements, 1-step 2-phase system with lock-up clutch	3 elements, 1-step 2-phase system with lock-up clutch
One-way clutch	Sprag type	Sprag type
Transmission		
Type	4 speed full automatic	Electronically controlled 4 speed full automatic
Control elements		
Clutch	Multiple disc type 3 pairs	Multiple disc type 3 pairs
Brake	Multiple disc type 4 pairs	Multiple disc type 3 pairs
One-way clutch	Sprag type 3 pairs	Sprag type 3 pairs
Shift control method	Floor shift type	Floor shift type
Select pattern	P-R-N-D-2-L and overdrive switch	P-R-N-D-2-L and overdrive switch
Oil pump		
Type	Gear type	Gear type
Drive system	Directly coupled to engine via torque converter	Directly coupled to engine via torque converter
Hydraulic control system	Throttle opening and vehicle speed detection	Electronically controlled
Oil-cooling system	Air-cooled and water-cooled type	Air-cooled and water-cooled type
Transfer		
Type	2 speed	2 speed
Shift control method	Floor-shift type	Floor-shift type
Gear ratios		
LOW	1.925	1.925
HIGH	1.000	1.000

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NOTES

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SERVICE SPECIFICATIONS

E23CB--

Items	3000–12V	2500D
Stall speed (r/min)	2,100–2,400	2,100–2,400
Governor pressure kPa (kg/cm^2, psi)		
1000 r/min	140–170 (1.4–1.7, 19.9–24.2)	110–140 (1.1–1.4, 15.6–19.9)
2000 r/min	250–290 (2.5–2.9, 35.6–41.2)	220–240 (2.2–2.4, 31.3–34.1)
3200 r/min	410–470 (4.1–4.7, 58.3–66.8)	410–470 (4.1–4.7, 58.3–66.8)
Line pressure kPa (kg/cm^2, psi)		
"D" range		
When idling	520–600 (5.2–6.0, 74–85)	450–510 (4.5–5.1, 64–72.5)
During stall	1100–1300 (11–13, 156–185)	1,120–1,320 (11.2–13.2, 159.3–187.7)
"R" range		
When idling	790–910 (7.9–9.1, 112–129)	620–700 (6.2–7.0, 88.2–99.5)
During stall	1600–2000 (16–20, 228–284)	1,500–1,900 (15–19, 213.3–270.2)
Dimensions of inner cable stopper and dust cover end mm (in.)	0–1 (0–0.04)	—
Dimensions of inner cable stopper and outer cable end mm (in.)	—	34–35 (1.34–1.38)
Clearance between sleeve and selector lever end mm (in.)	18.2–18.9 (0.717–0.744)	18.2–18.9 (0.717–0.744)

Items	3000–24V, 3500	2800D
Stall speed (r/min)	2,100–2,600	2,100–2,600
Governor pressure kPa (kg/cm^2, psi)		
1000 r/min	—	—
2000 r/min	—	—
3200 r/min	—	—
Line pressure kPa (kg/cm^2, psi)		
"D" range		
When idling	430–490 (4.3–4.9, 61–70)	430–490 (4.3–4.9, 61–70)
During stall	1,140–1,390 (11.4–13.9, 162–198)	1,350–1,600 (13.5–16.0, 192–228)
"R" range		
When idling	520–620 (5.2–6.2, 74–88)	530–630 (5.3–6.3, 75–90)
During stall	1,400–1,750 (14.0–17.5, 199–249)	1,670–2,020 (16.7–20.2, 238–287)
Dimensions of inner cable stopper and dust cover end mm (in.)	0–1 (0–0.0394)	—
Dimensions of inner cable stopper and outer cable end mm (in.)	—	34–35 (1.3386–1.3780)
Clearance between sleeve and selector lever end mm (in.)	—	—

LUBRICANTS

E23CD--

Items	Specified lubricants	Quantity dm³ (U.S.qts., Imp.qts.)
Automatic transmission fluid	Dia Queen ATF SP, ATF DEXRON II or equivalent	Approx. 7.2 (7.6, 6.3): V4AW2 Approx. 8.5 (9.0, 7.5): V4AW3
Transfer oil	Hypoid gear oil API GL-4, SAE 75W-90 or 75W-85W	Approx. 2.3 (2.4, 2.0): V4AW2 Approx. 2.5 (2.6, 2.2): V4AW3
Transfer oil seal lip	Hypoid gear oil API GL-4, SAE 75W-90 or 75W-85W	As required
O-ring for oil filler pipe	Dia Queen ATF SP, ATF DEXRON II or equivalent	As required

SEALANTS AND ADHESIVES

E23CE--

Items	Specified sealant and adhesive	Remarks
TRANSMISSION CONTROL		
Transfer control lever assembly gasket	3M ATD Part No. 8661 or equivalent	Semi-drying sealant
Stopper plate gasket	3M ATD Part No. 8661 or equivalent	Semi-drying sealant
Transfer control lever assembly mounting bolt	3M Stud Locking No. 4170 or equivalent	Anaerobic sealant
TRANSISSION AND TRANSFER ASSEMBLY		
Control housing gasket	3M ATD Part No. 8661 or equivalent	Semi-drying sealant
Control housing mounting bolt	3M Stud Locking No. 4170 or equivalent	Anaerobic sealant

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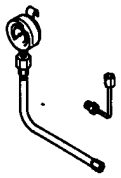
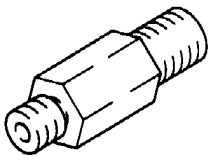
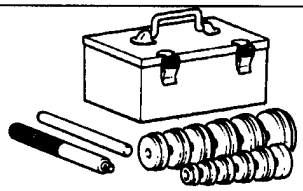
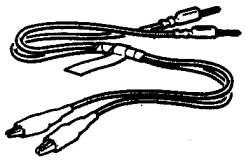
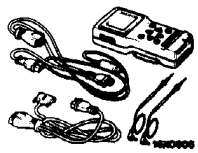
SPECIAL TOOLS

E23DA--

Tool	Number	Name	Use
	MD998330 (includes MD9983331)	Oil pressure gauge (3,000 kPa, 30 kg/cm^2, 427 psi)	Measurement of oil pressure
	MD999563 (includes MD998331)	Oil pressure gauge (1,000 kPa, 10 kg/cm^2, 142 psi)	
	MD998920	Adapter	Connection of oil pressure gauge
	MB990925	Bearing and oil seal installer set	Installation of oil seal MB990938, MB990928 (Refer to GROUP 22–Special Tools.)
	MB991529	Diagnostic trouble code check terminal	Reading diagnostic trouble code
	MB991502	MUT-II	• Reading diagnostic trouble code • ELC-4A/T system inspection
		ROM pack	

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NOTES

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TROUBLESHOOTING <V4AW2>

E23EAAK

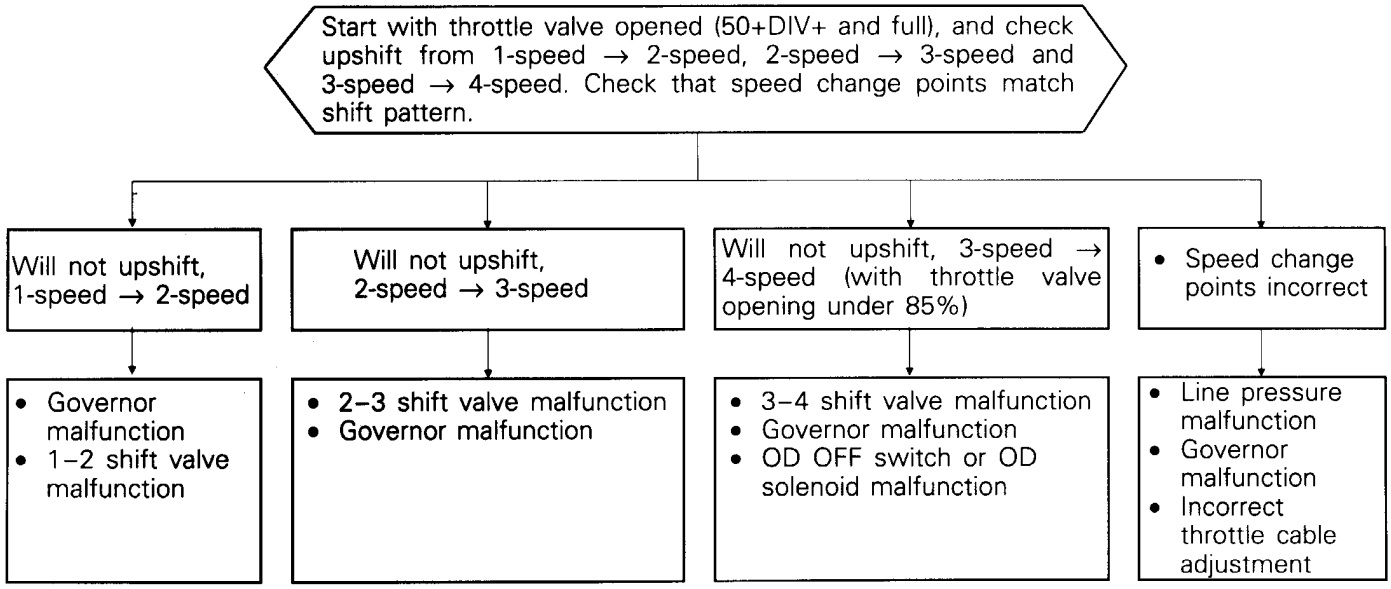
Automatic transmission malfunctions may be caused by the following conditions:
(1) Improper maintenance and adjustment
(2) Mechanical malfunctions
(3) Hydraulic malfunctions
(4) Poor engine performance

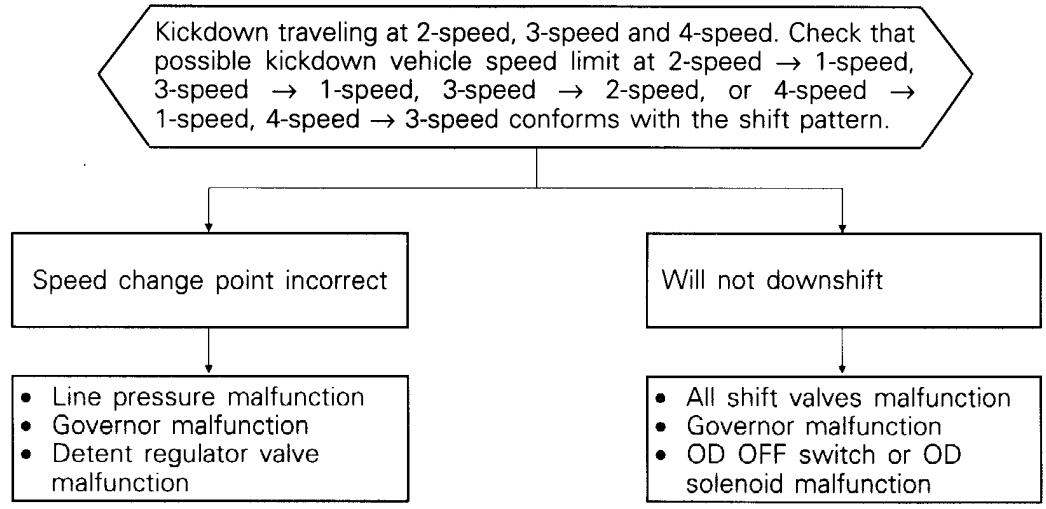
Troubleshooting in the event of any such malfunctions should begin by checking fluid level, ATF condition, manual linkage adjustment, throttle control cable adjustment and other conditions whose deviation from standards can be readily known. Then, road test shall be performed to determine whether or not the problem has been corrected or more diagnosis is necessary. If the problem still persists after these tests and corrections, hydraulic tests should be performed for further troubleshooting.

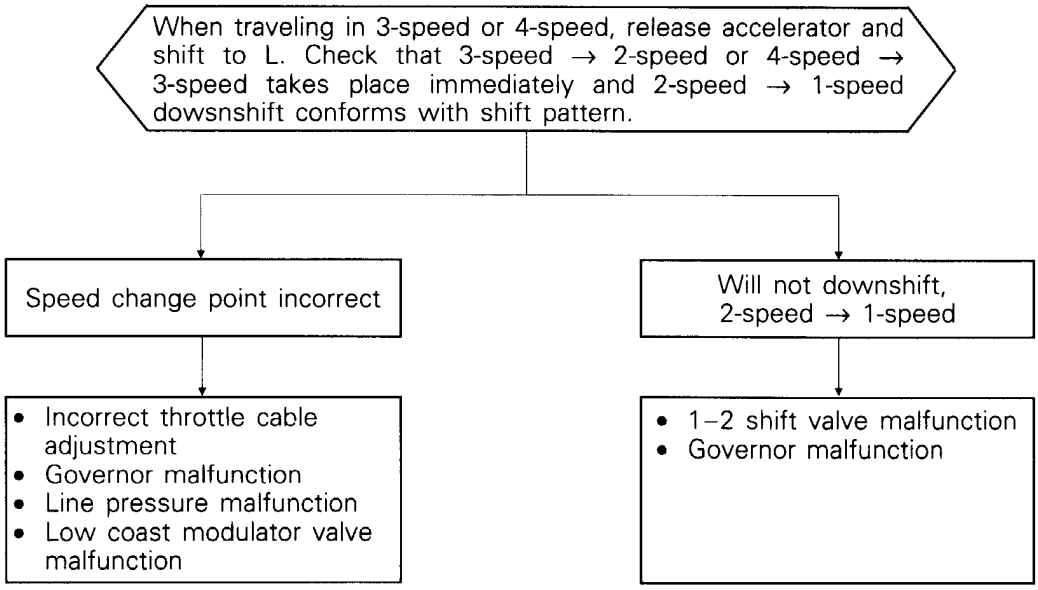
ROAD TEST

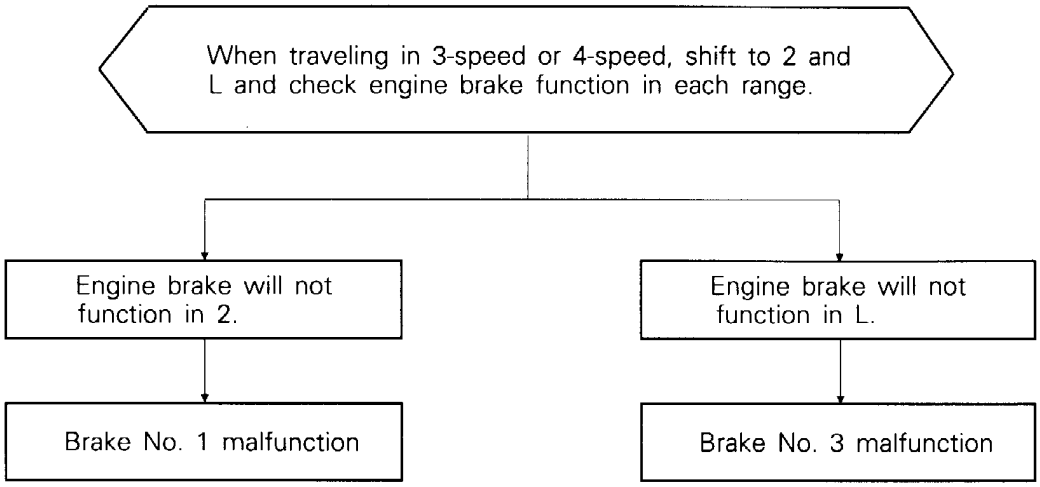
Prior to performing road test, be sure to make basic checks including check and adjustment of fluid level and condition and adjustment of the throttle cable. For road test, the transfer must be placed in the 2H (2WD-high) position. In road test, various changes such as slips in transmission and shifting conditions are checked and hence the transmission operation at each shift position must have been checked.

D RANGE TEST









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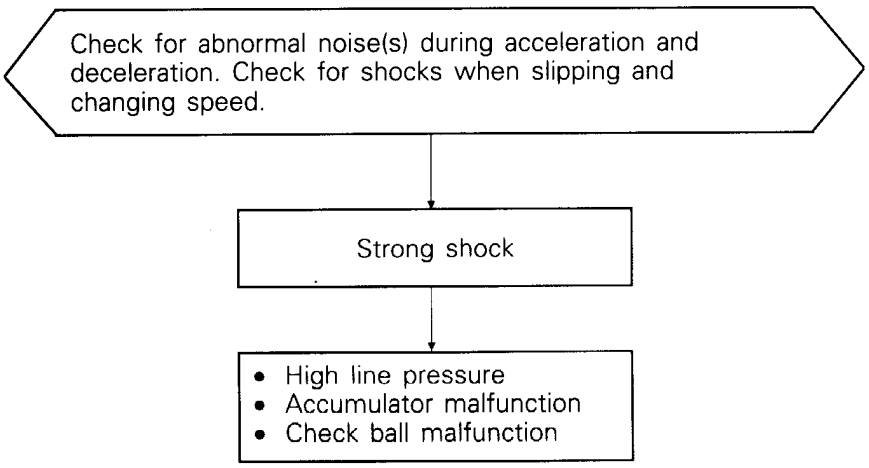
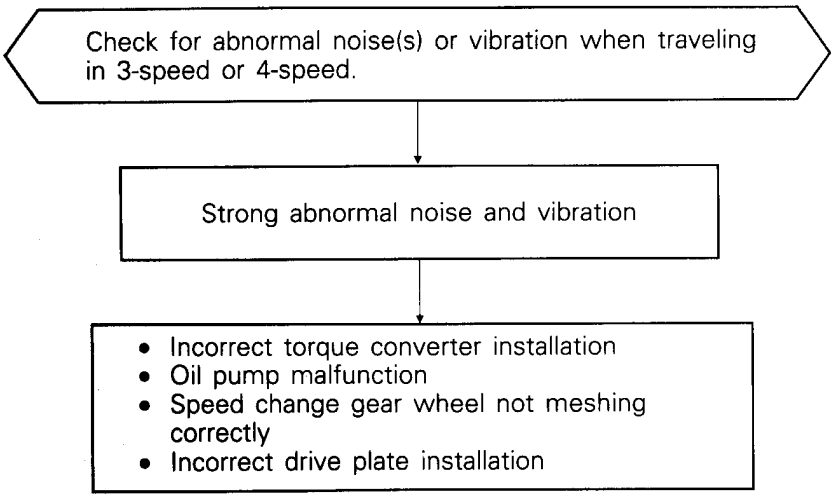
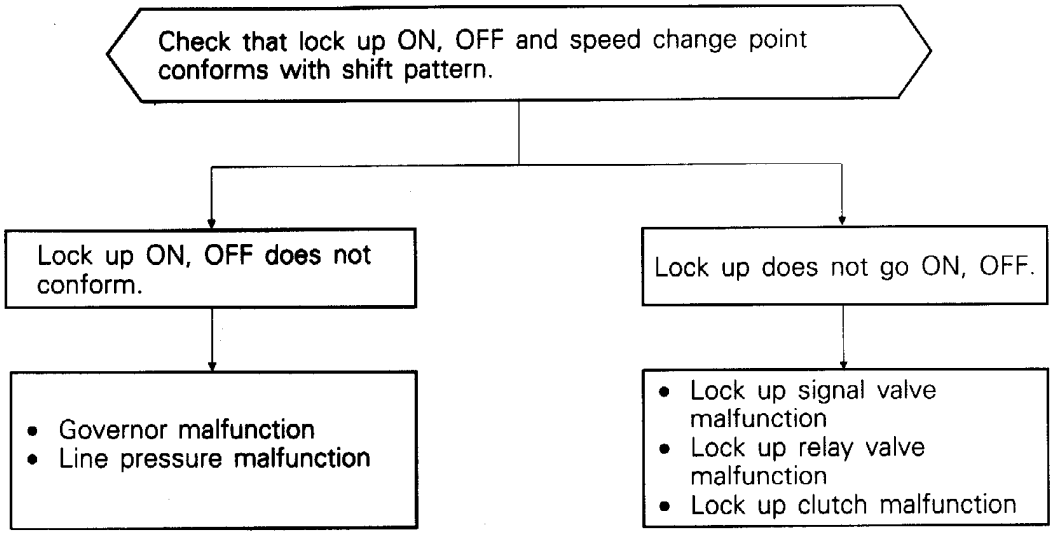




NOTE
Abnormal noises and vibrations are often caused by an unbalanced propeller shaft, differential, tyre, torque converter, engine etc. Extremely thorough inspection is therefore required.



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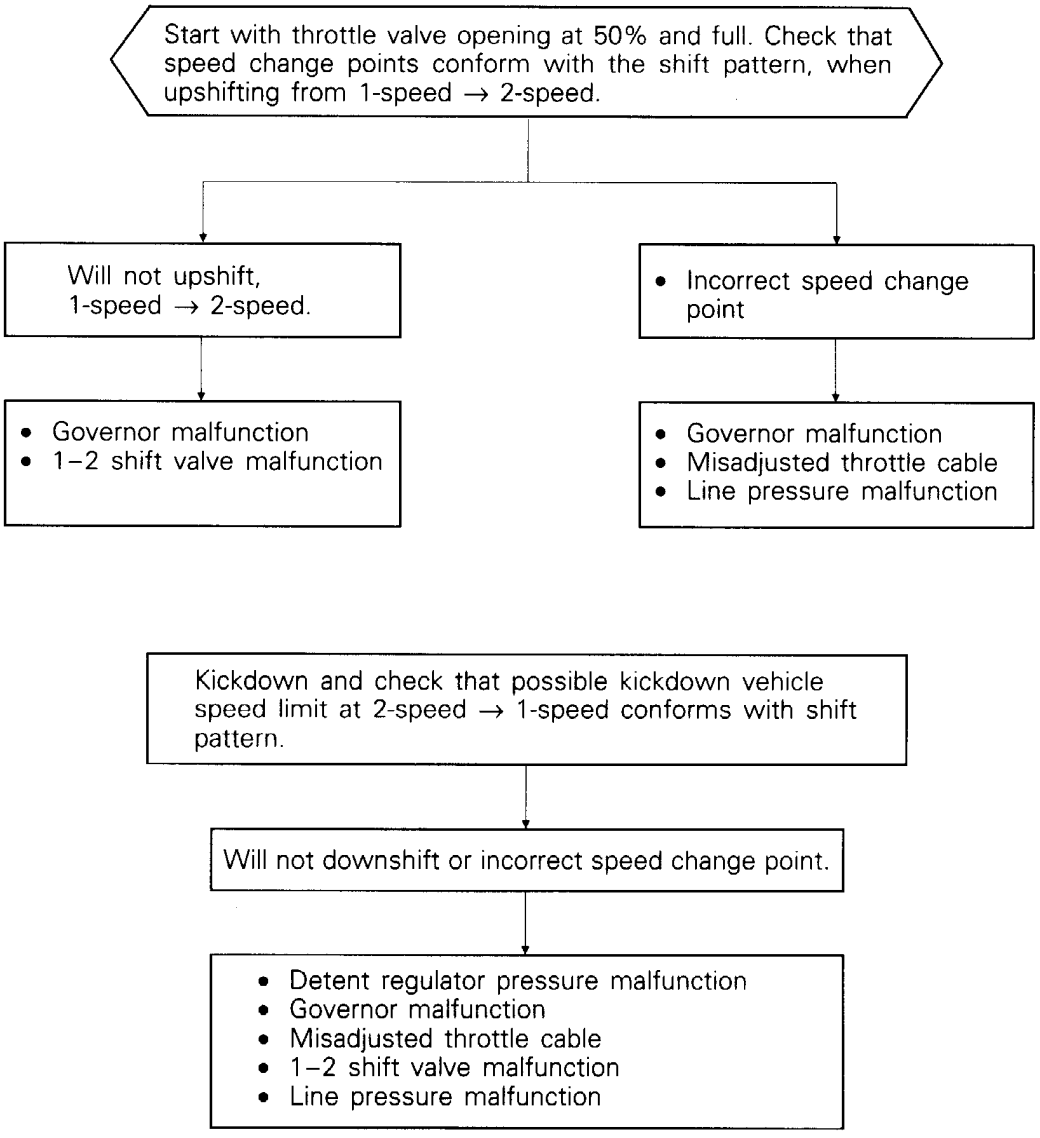
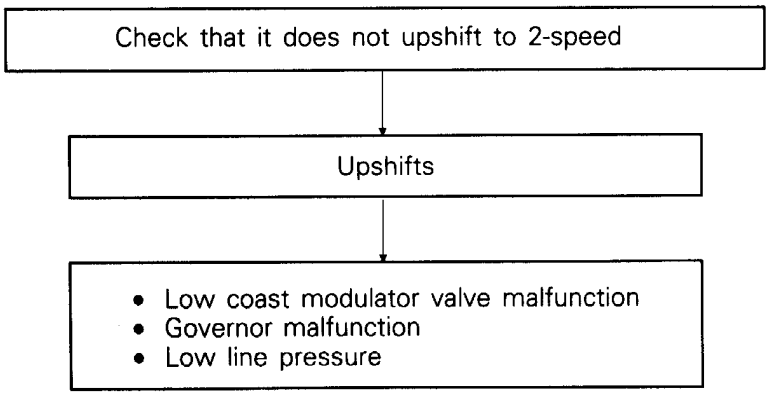
NOTE
(1) Determine the moment when lock up turns ON by decreased engine r/min or by a slight shock back and forth.
(2) Determine the moment when lock up turns OFF by increased engine r/min.
(3) Check lock up condition by pumping the accelerator slightly. If engine r/min rises in accordance with throttle valve opening size, determine that the lock up is OFF, if not, determine it ON.
(When lock up is OFF, drive power is transferred through the fluid in the torque converter and therefore, when the accelerator pedal is depressed, slipping occurs inside the torque converter with a resulting large increase in engine r/min.)

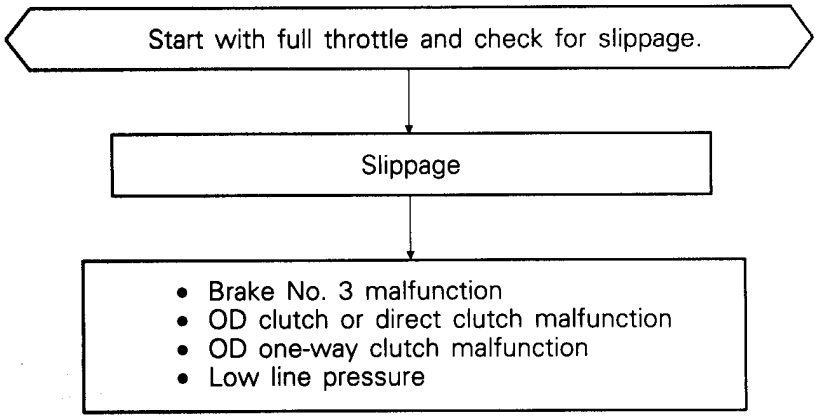
2 RANGE TEST



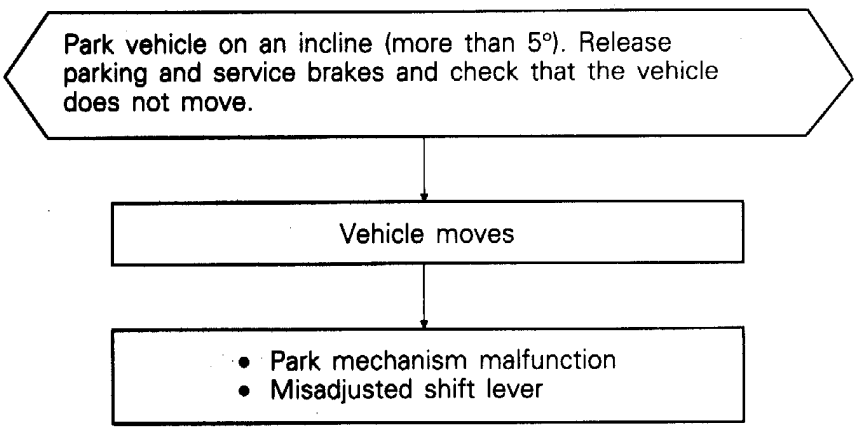
L RANGE TEST



R RANGE TEST

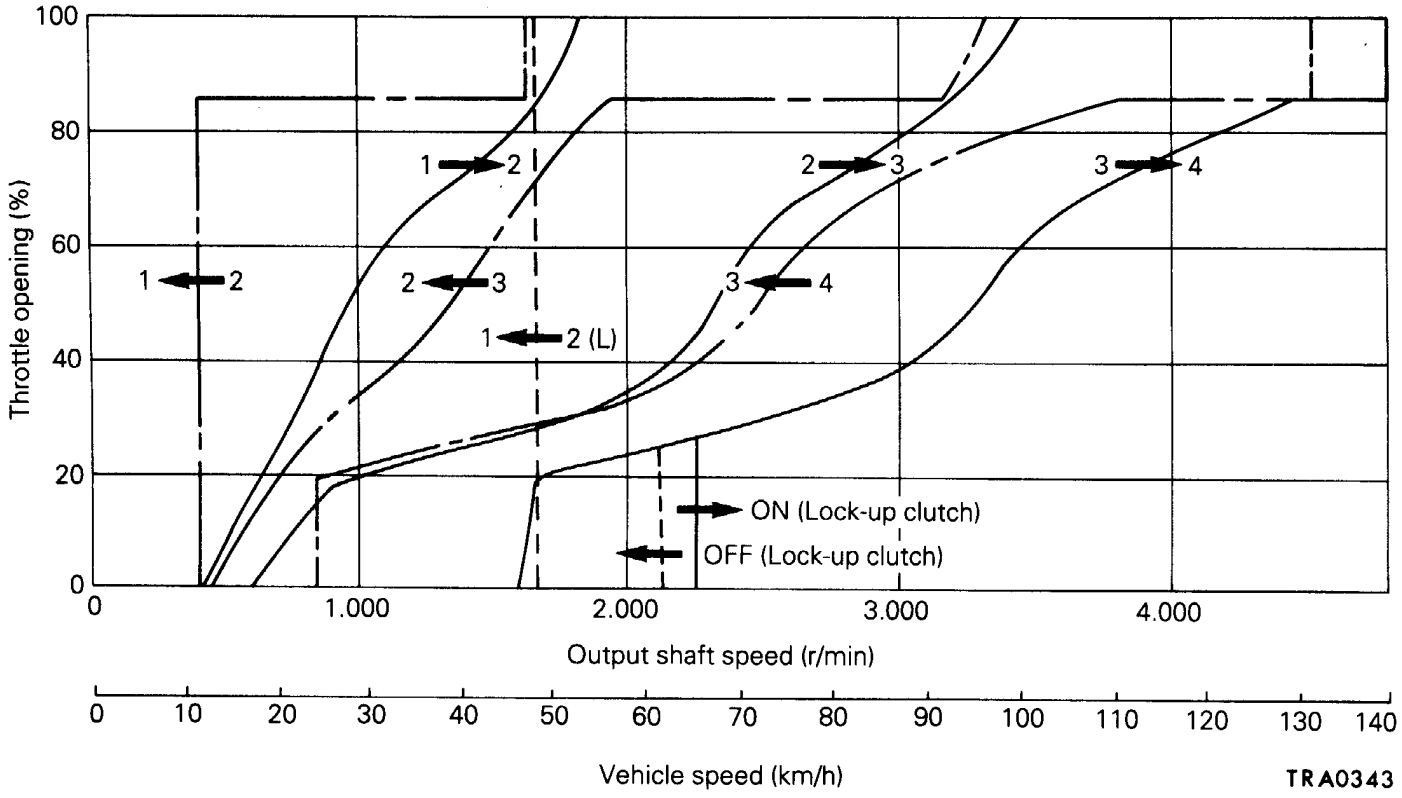


P RANGE TEST



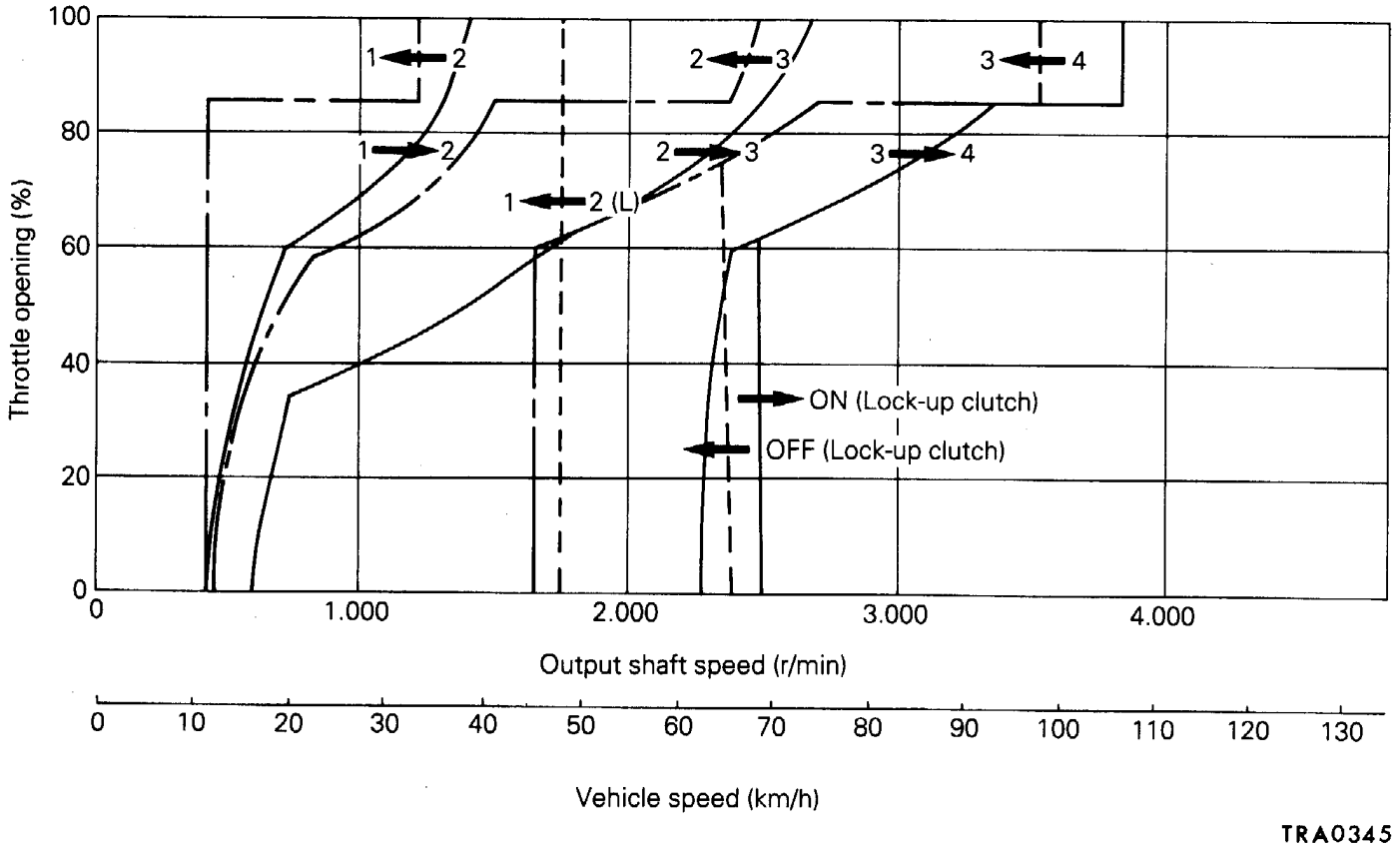
SHIFT PATTERN

3000–12V <V4AW2-3-LFP, LFPL>



TRA0343

2500D <V4AW2-3-QGP, QGPL>



TRA0345

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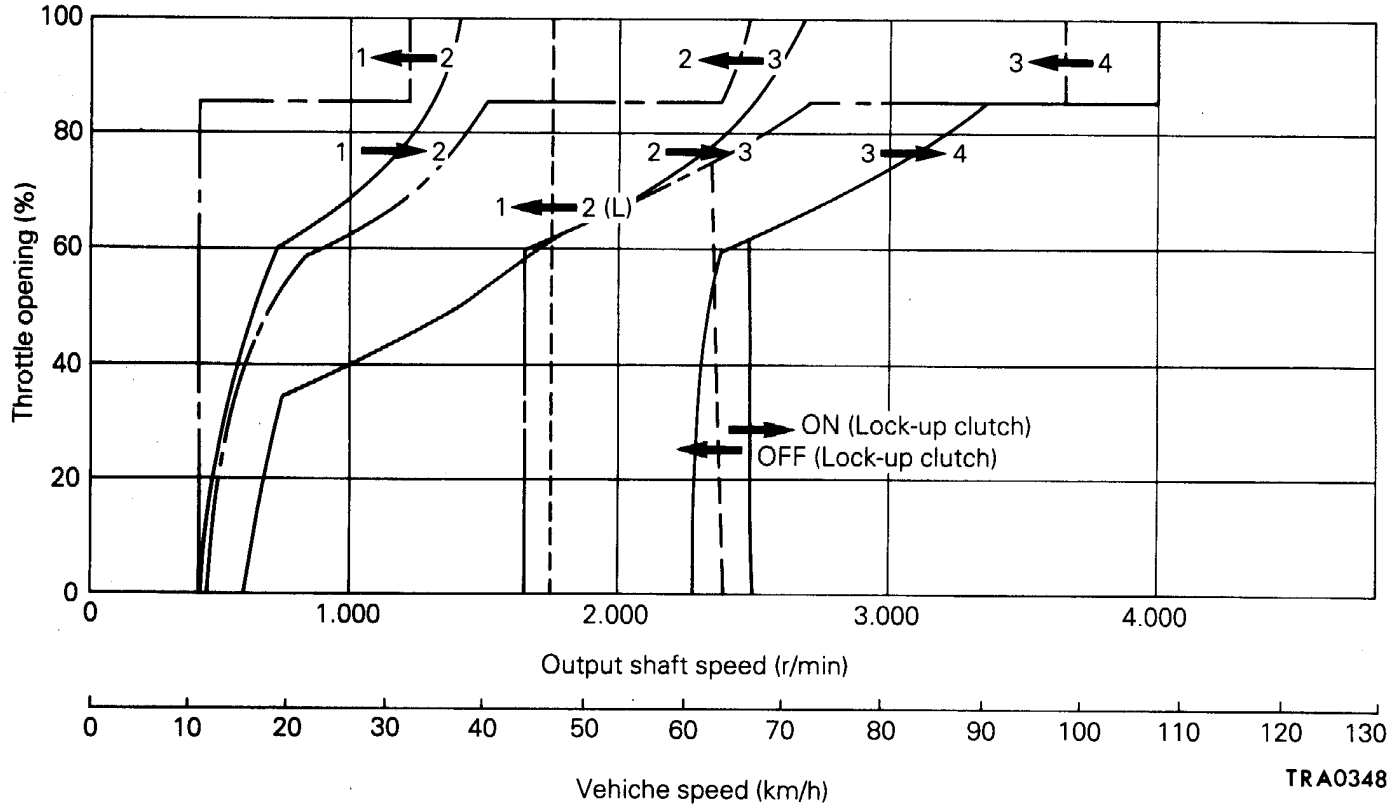
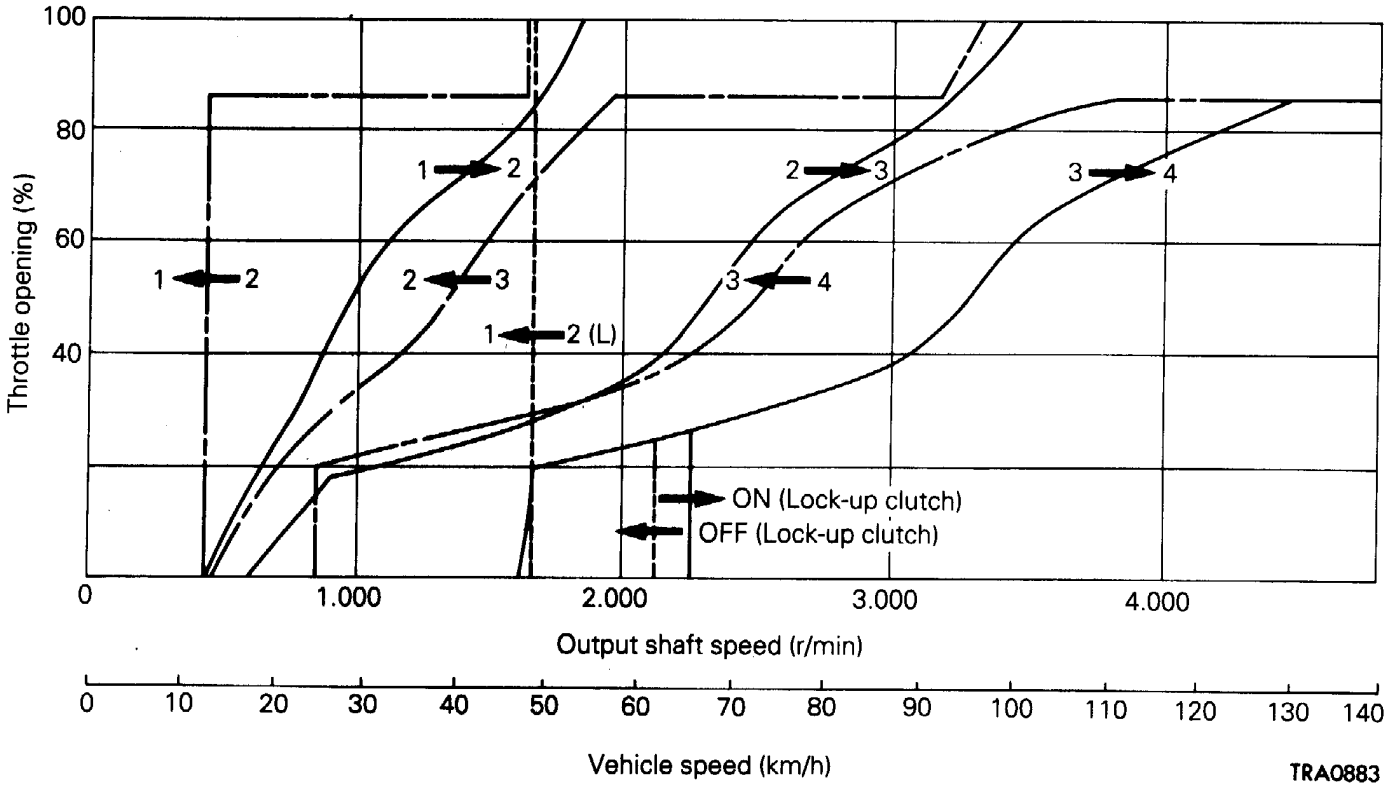
2500D <V4AW2-3-QHP, QHPL>



TRA0348

3000–12V <V4AW2-7-LFP, LFPL>

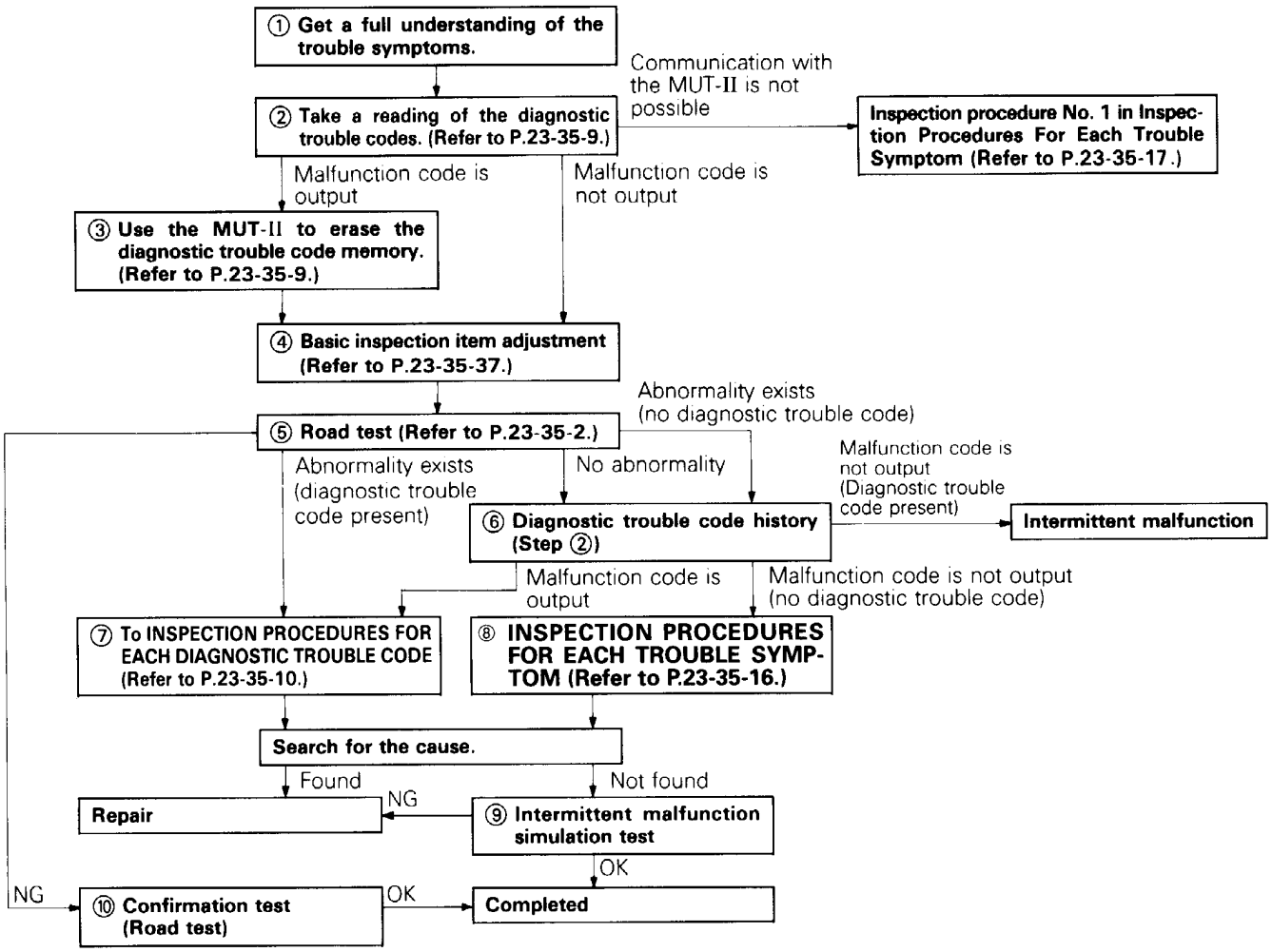


TRA0883

TROUBLESHOOTING <V4AW3>

STANDARD FLOW OF DIAGNOSTIC TROUBLESHOOTING

Malfunctions of the 4 A/T system can be caused by malfunctions or incorrect adjustments of the electronic control system, hydraulic control system or A/T system or a combination of these.
Carry out troubleshooting by the following procedure in order to make effective diagnoses.



① Gain a full understanding of the conditions under which the trouble symptoms that the customer is complaining about occur, including frequency of occurrence.
② Use the MUT-II to read and make a note of the diagnostic trouble codes (including fail-safe codes). (Refer to P.23-35-9.)
③ Erase the diagnostic trouble codes in order to carry out a road test. (Refer to P.23-35-9.)
④ Carry out adjustment of the basic inspection items (ATF, TPS, inhibitor switch, manual control cable, etc.) (Refer to P.23-35-37.)
⑤ Carry out a road test. (Refer to P.23-35-2.)
Be sure to check that the basic inspection items and all diagnostic trouble codes and conditions of reoccurrence are covered during this test.
⑥ Check that the diagnostic trouble codes which were read before the road test (in step (2) above) are present.
⑦ Determine the probable cause from the Inspection Procedures For Each Diagnostic Trouble Code. (Refer to P.23-35-10.)
⑧ Determine the probable cause from the Inspection Procedures For Each Trouble Symptom. (Refer to P.23-35-16.)

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⑨ Carry out a intermittent malfunction simulation test.
⑩ After repairs are completed, carry out a road test to check that the malfunction has been repaired.

ROAD TEST

(Transfer Lever position: 4H Range)

★ : MUT-II used

Procedure	Conditions	Operation	Judgement value	Inspection item	Inspection procedure page
1	Ignition switch: ON Engine: Stopped	Overdrive switch (1) ON (2) OFF	★ Data List No. 35 (1) OD (2) OD-OFF	Overdrive switch	Overdrive switch system (P.23-35-29)
		Pattern select switch (1) Power (2) Hold	★ Data List No. 36 (1) Power (2) Hold	Pattern select switch	Pattern select switch system (P.23-35-28)
		Selector lever position (1) P (2) R (3) N (4) D (5) 2 (6) L	★ Data List No. 37 (1) P, R,D (2) P, R, D (3) N (4) P, R, D (5) 2 (6) L	Inhibitor switch	Inhibitor switch system (P.23-35-27)
		Brake pedal (1) Depressed (2) Released	★ Data List No. 28 (1) OD (2) OFF	Stop lamp switch	Stop lamp switch system (P.23-35-29)
2	Ignition switch: ST Engine: Stopped	Engine starting test in P and N positions	Starting should be possible	Starting	Does not move (P.23-35-18.)
					Lockup malfunction (P.23-35-26)
3	Warming up	(1) When engine is cold	★ Data List No. 29 (1) OFF (2) ON	Engine coolant temperature switch	Engine coolant temperature switch system (P.23-35-30)
		(2) Drive for 15 minutes or more so that the ATF temperature becomes 70–90°C (158–194°F)	★ Data List No. 15 (2) 70–90°C (158–149°F)	Oil temperature sensor	Oil temperature sensor system (P. 23-35-31)

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Procedure	Conditions	Operation	Judgement value	Inspection item	Inspection procedure page
4	Engine: Idle Selector lever position: N	Accelerator pedal (1) Fully closed (2) Depressed (3) Fully open (up to 2 seconds)	★ Data List No. 11 (1) 0–5% <Petrol engine> 0–20% <Diesel engine> (2) Gradually rises (1) (3) 85–100% <Petrol engine> 90–100% <Diesel engine>	TPS <Petrol engine>	Code No. 11 – TPS system (P.23-35-11)
				LPS <Diesel engine>	Code No. 11 – LPS system (P.23-35-11)
			★ Data List No. 21 (1) OFF (3) ON	Wide open throttle switch (W.O.T. switch)	Code No. 22 – W.O.T. switch system (P.23-35-12)
		Selector lever operation (1) N → D shift (2) N → R shift	Should be no abnormal shifting shocks Time lag should be within 2 seconds	Does not move	Does not move forward or reverse (P.23-35-18)
					Does not move forward only (P.23-35-19)
					Does not reverse only (P.23-35-19)
				Shock	Large shocks (P.23-35-24)
5	Engine: Idle (Vehicle stopped) Selector lever position: D Mode selection: Normal	Accelerator pedal (1) Fully closed	★ Data List No. 27 (1) 1st	Shift solenoid No. 1	Code Nos. 41, 42 – Shift control solenoid valve No. 1 system (P.23-35-14)
				Shift solenoid No. 2	Code Nos. 43, 44 – Shift control solenoid valve No. 2 system (P.23-35-15)

Procedure	Conditions	Operation	Judgement value	Inspection item	Inspection procedure page
6	Selector lever position: D Mode selection: Normal Overdrive: OFF	Engine (1) Idle (Vehicle stopped) (2) Driving at 10 km/h (3) Driving at constant speed of 50 km/h (20 seconds or more) (4) Driving at constant speed of 40 km/h with selector lever in 2 range	★ Data List No. 27 (1) 1st (2) 1st (3) 3rd (4) 2nd	Shift solenoid No. 1	Code Nos. 41, 42 – Shift solenoid No. 1 system (P.23-35-14)
				Shift solenoid No. 2	Code Nos. 43, 44 – Shift solenoid No. 2 system (P.23-35-15)
			★ Data List No. 32 (1) 0 km/h (2) 7 – 13 km/h (3) 42 – 58 km/h (4) 33 – 47 km/h	A/T speed sensor	A/T speed sensor system (P.23-35-13)
			★ Data List No. 41 (2) OFF (3) OFF (4) ON	Shift solenoid No. 1	Code Nos. 41, 42 – Shift control solenoid valve No. 1 system (P.23-35-14)
			★ Data List No. 43 (2) OFF (3) ON (4) ON	Shift solenoid No. 2	Code Nos. 43, 44 – Shift control solenoid valve No. 2 system (P.23-35-15)
			★ Data List No. 47 (2) OFF (3) ON (3) Acceleration should be smooth with no abnormal vibration.	Lock-up solenoid Malfunction when shifting	Code Nos. 47, 48 – Lock-up solenoid (P.23-35-15) Shifting point abnormality (P.23-35-22)
					Slippage (vibration) (P.23-35-25)

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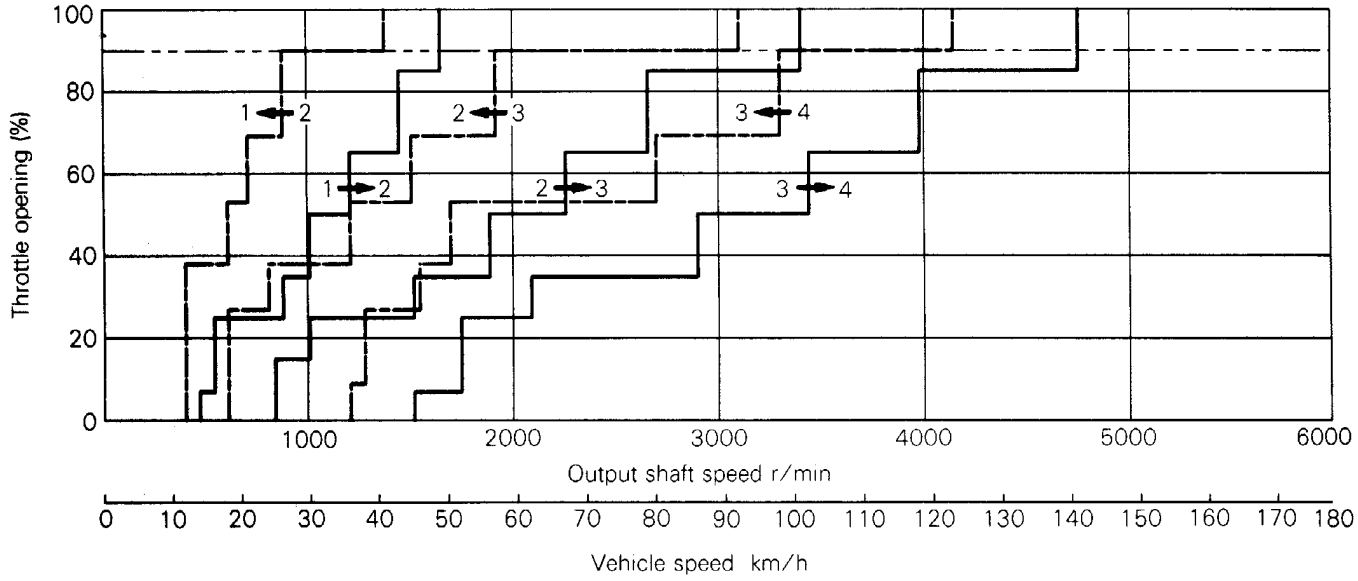
Procedure	Conditions	Operation	Judgement value	Inspection item	Inspection procedure page
7	Selector lever position: D Mode selection: Normal Overdrive: ON	Engine (1) Driving at constant speed of 50 km/h (20 seconds or more)	★ Data List No. 27 (1) 4	Shift control solenoid valve No. 1	Code Nos. 41, 42 – Shift control solenoid valve No. 1 system (P.23-35-14)
				Shift control solenoid valve No. 2	Code Nos. 43, 44 – Shift control solenoid valve No. 2 system (P.23-35-15)
			★ Data List No. 41 (1) OFF	Shift control solenoid valve No. 1	Code Nos. 41, 42 – Shift control solenoid valve No. 1 system (P.23-35-14)
			★ Data List No. 43 (1) OFF	Shift control solenoid valve No. 2	Code Nos. 43, 44 – Shift control solenoid valve No. 2 system (P.23-35-15)
8	Selector lever position: D Mode selection: Normal Overdrive: ON • Carry out the same test with the mode selection at POWER and HOLD also.	Monitor MUT-II data list Nos. 11, 27 and 32. (1) TPS Accelerate to 4 range at opening angle of 30%. (2) Slowly decelerate to a standstill. (3) TPS Accelerate to 4 range at opening angle of 50%. (4) At 50 km/h in 4 range, turn overdrive OFF. (5) At 50 km/h in 3 range, move selector lever to 2 range. (6) At 20 km/h in 2 range, move selector lever to L range.	(1), (2) and (3) should match the specified output shaft speed (vehicle speed), and there should be no abnormal shocks. For (4), (5) and (6), downshifting should occur immediately after moving the lever.	Malfunction when shifting	Upshifting does not occur (P.23-35-20)
					Downshifting does not occur (P.23-35-21)
					Shifting point abnormality (P.23-35-22)
					Upshifting occurs spontaneously (P.23-35-22)
					Incorrect drive gear position (P.23-35-23)
				Malfunction while driving	Large shocks (P.23-35-24)
					Slippage (vibration) (P.23-35-25)
					Lockup malfunction (P.23-35-26)
					Poor engine braking (P.23-35-26)

SHIFT PATTERN

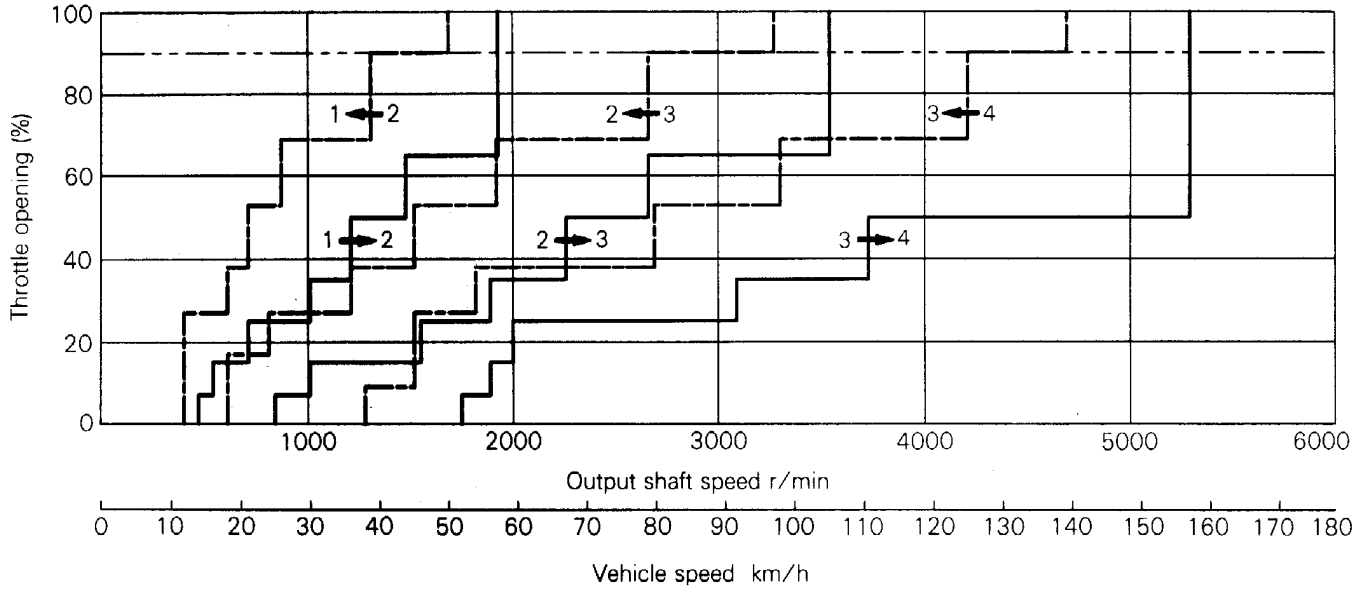
<3500>

Normal pattern



TRA0729

Power pattern



TRA0730

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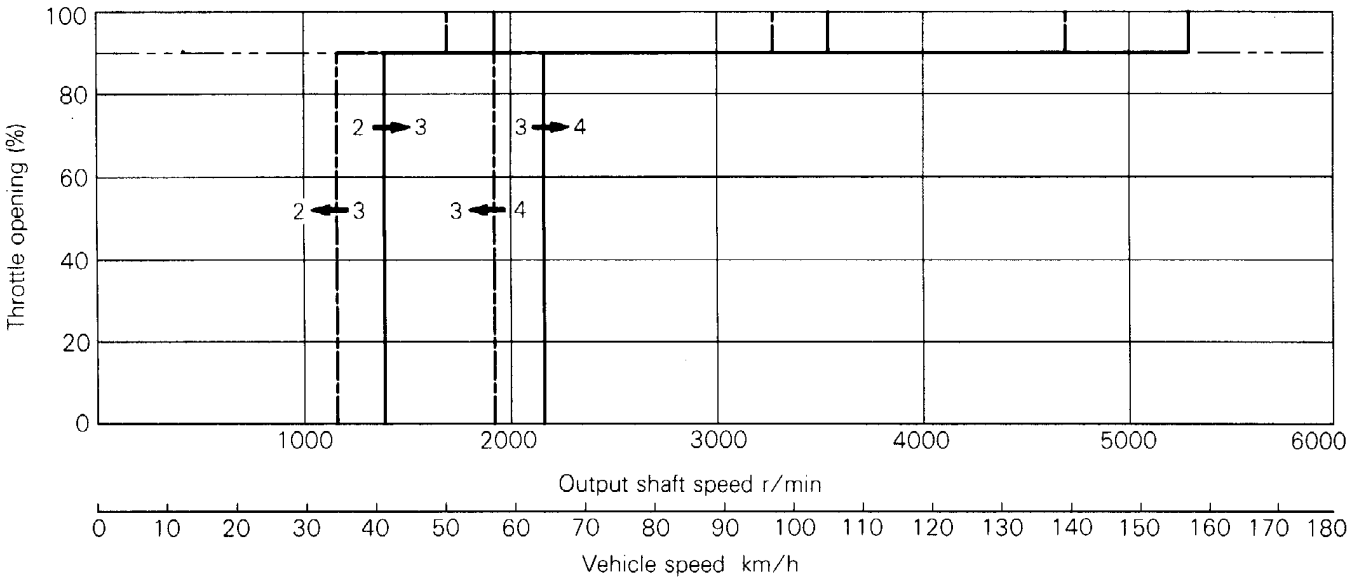
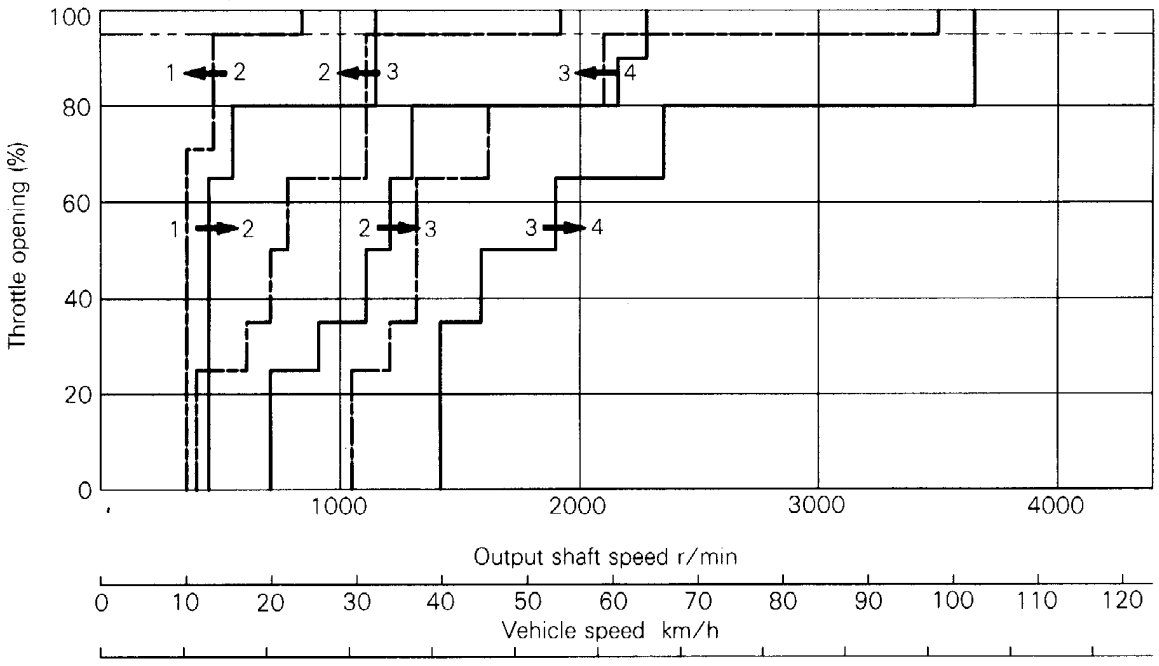
Hold Pattern



TRA0731

<2800D>
Normal pattern



TRA0732

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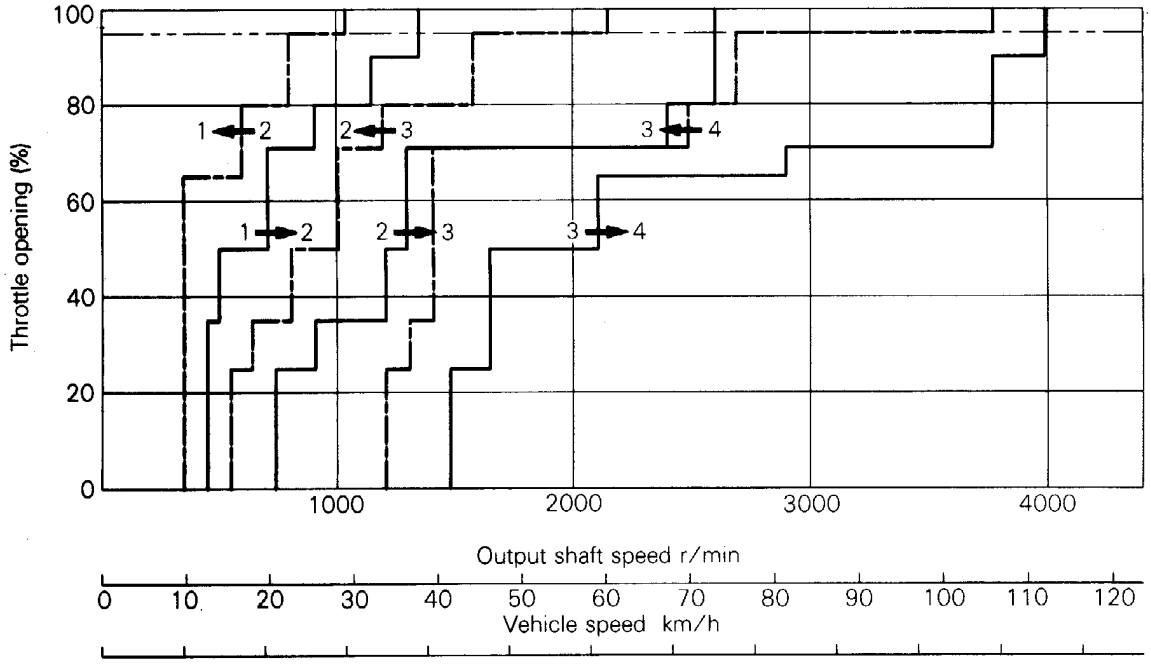
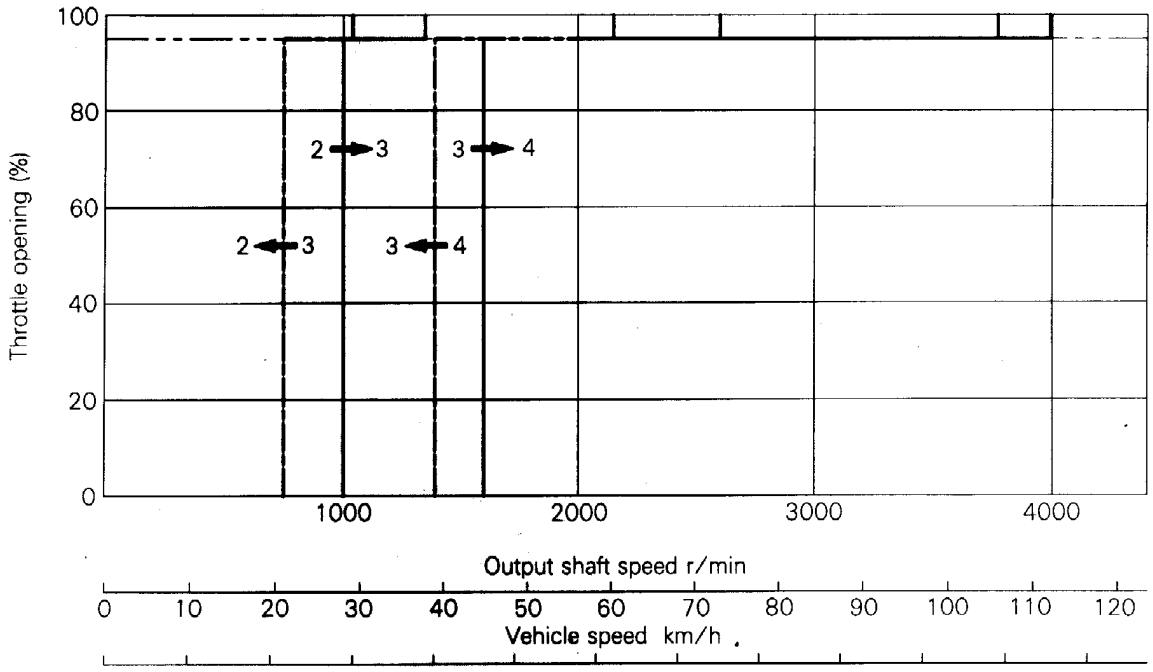
<3000–24V>

Power pattern



TRA0733

Hold pattern



TRA0734

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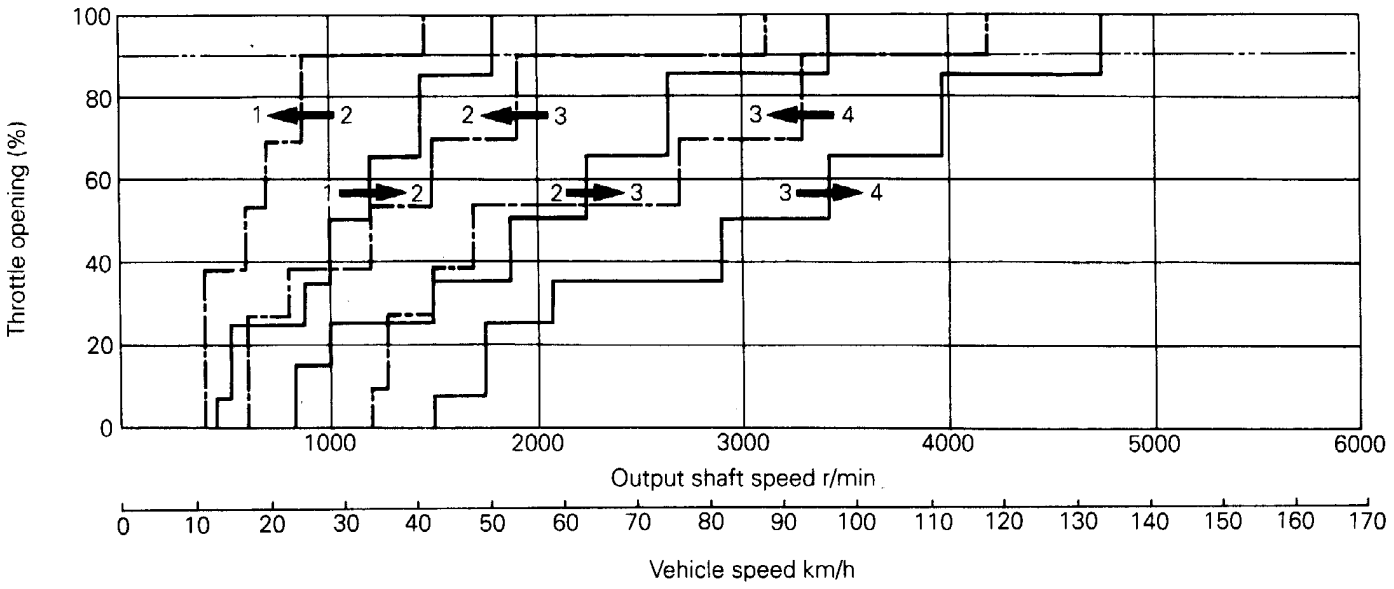
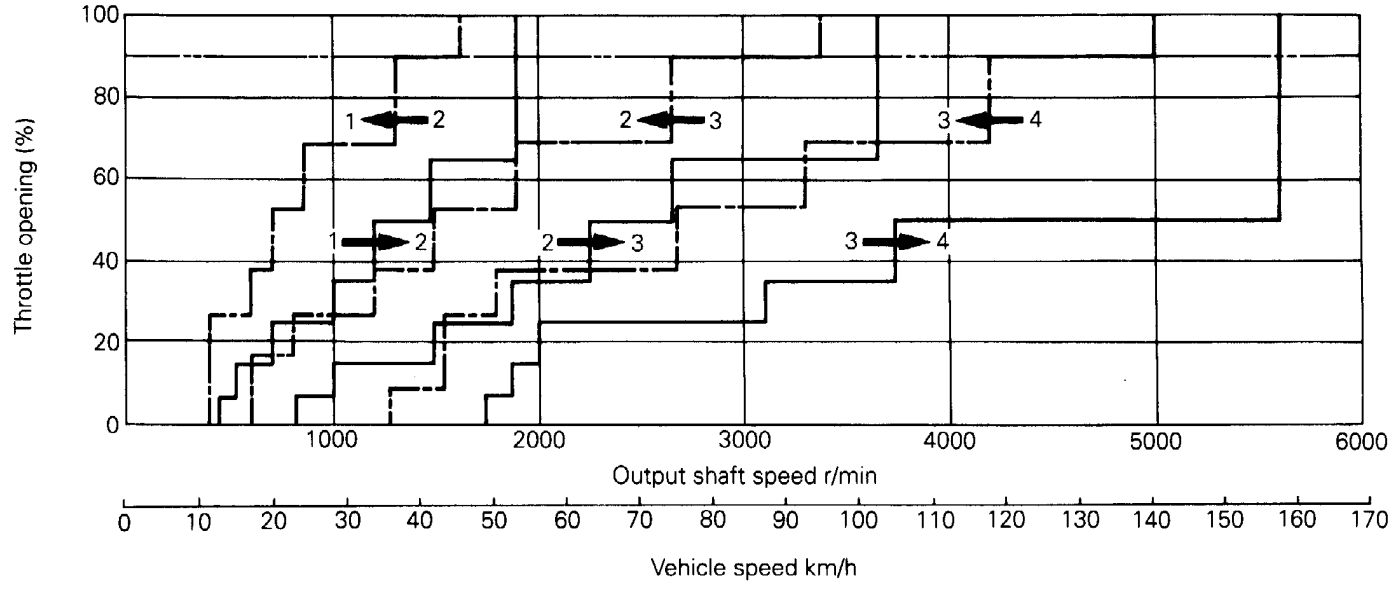
<3000–24 V>

Normal pattern



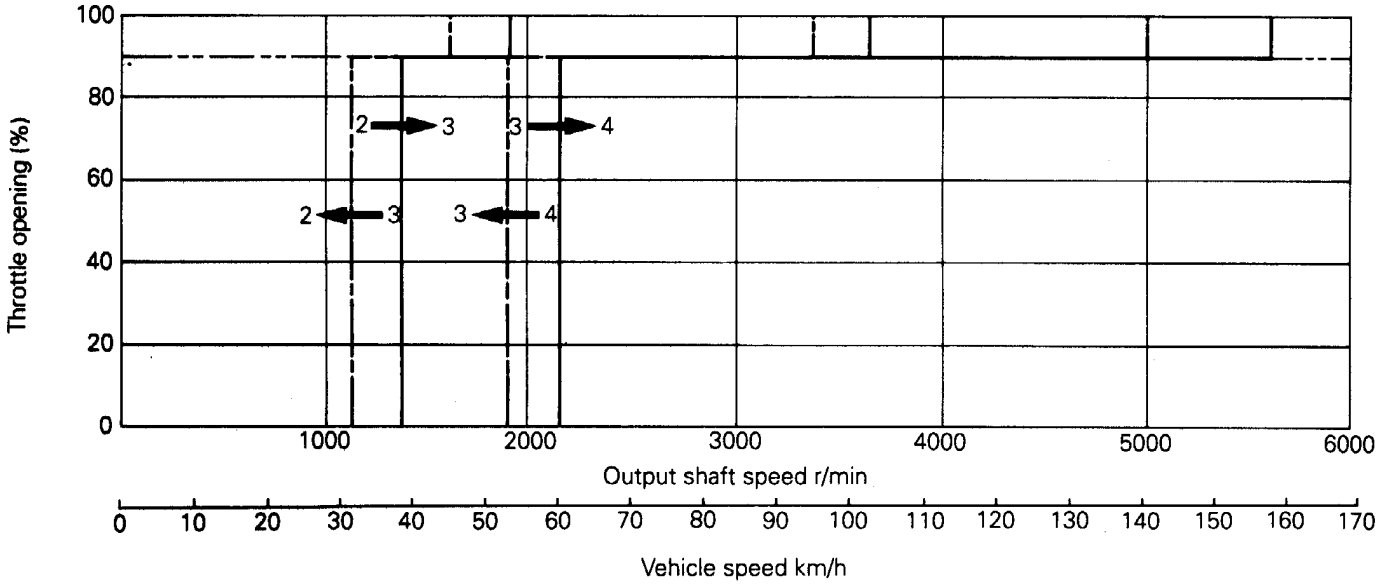
TRA0880

Power pattern



TRA0881

Hold pattern

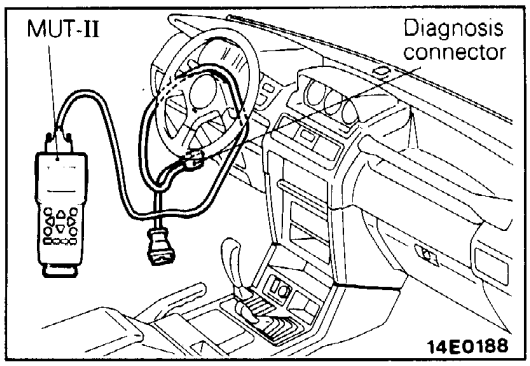


TRA0882

DIAGNOSTIC FUNCTIONS

PRECAUTIONS BEFORE SERVICE

(1) If battery voltage is low, diagnostic trouble codes will not be output. Accordingly, check the battery before carrying out inspection.
(2) If the battery is disconnected or if the engine control unit connector is disconnected, the diagnostic trouble code memory will be erased.
Accordingly, the battery should not be disconnected until reading of the diagnostic trouble codes has been completed.

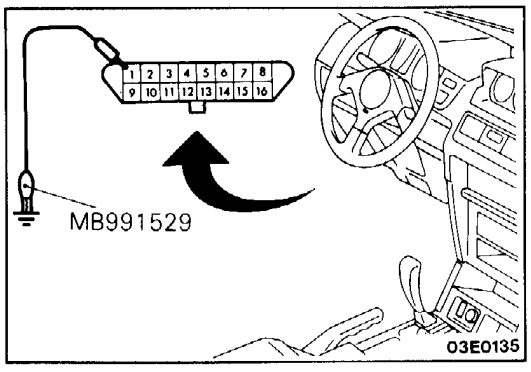


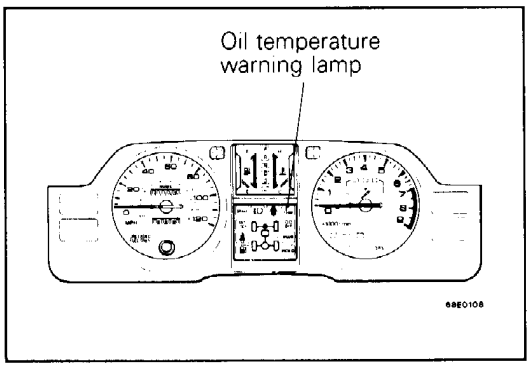
READING THE DIAGNOSTIC TROUBLE CODES

<When using the MUT-II>

Caution
Connection and disconnection of the MUT-II should always be carried out with the ignition switch in the OFF position.

(1) Connect the MUT-II to the diagnosis connector.
(2) Turn the ignition switch to ON.
(3) Take a reading of the diagnostic code output.
(4) Repair the malfunction location while referring to the Inspection Procedures For Each Diagnostic Trouble Code.
(5) Turn the ignition switch to OFF and then back to ON again.
(6) Erase the diagnostic trouble codes.
(7) Check that the diagnostic code output is normal.





<When using the oil temperature warning lamp>

(1) Use the special tool (diagnostic trouble code check harness) to earth terminal ① of the self-diagnosis connector.
(2) Take a reading of the diagnostic trouble codes from the flashing of the oil temperature warning lamp.
(3) Repair the malfunction location while referring to the Chart Classified by Diagnostic Trouble Codes.
(4) Erase the diagnostic trouble codes by the following procedure.
   ① Turn the ignition switch to OFF.
   ② After disconnecting the battery cable from the negative battery terminal for 10 seconds or more, re-connect the cable.
   ③ Turn the ignition switch to ON, take a reading of the diagnostic code output and check that a normal code is output.
   ④ After the engine has warmed up, run it at idle for about 10 minutes.

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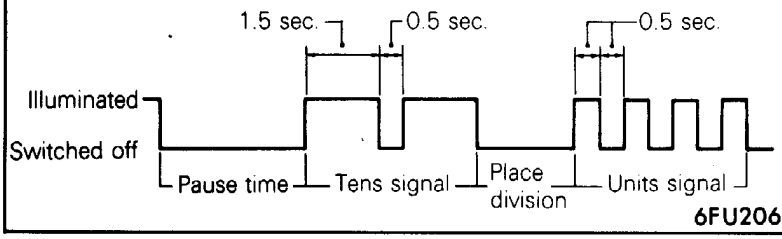
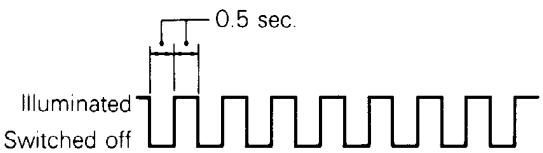
UNDERSTANDING DIAGNOSIS RESULT BY THE OIL TEMPERATURE WARNING LAMP FLASHING

Example of flashing when a diagnostic trouble code is output	Flashing when normal
For diagnostic trouble code No. 24  6FU2060	 6FU2061

NOTE
Other diagnostic trouble codes also are output by the flashing of the check warning lamp corresponding to the same code numbers as when using the MUT-II.

INSPECTION CHART CLASSIFIED BY DIAGNOSTIC TROUBLE CODES

Code	Diagnostic item		Reference page
11	Throttle position sensor system <Petrol engine> Lever position sensor system <Diesel engine>	Malfunction of sensor Open circuit, short circuit	P.23-35-11
22	Wide open throttle switch system	Short circuit	P.23-35-12
32	A/T speed sensor system	Open circuit	P.23-35-13
38	Vehicle speed sensor system	Open circuit	P.23-35-14
41	Shift control solenoid valve No. 1 system	Open circuit	P.23-35-14
42	Shift control solenoid valve No. 1 system	Short circuit	P.23-35-14
43	Shift control solenoid valve No. 2 system	Open circuit	P.23-35-15
44	Shift control solenoid valve No. 2 system	Short circuit	P.23-35-15
47	Lock-up solenoid system	Open circuit	P.23-35-15
48	Lock-up solenoid system	Short circuit	P.23-35-15

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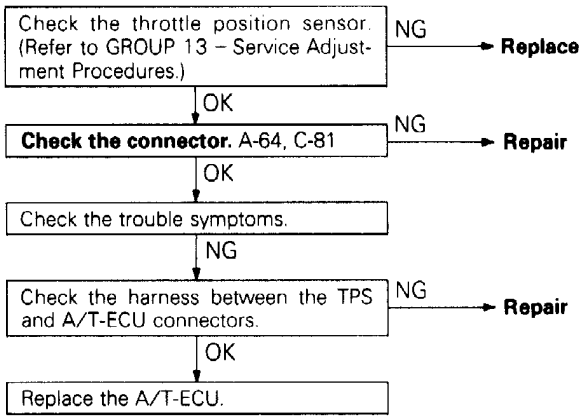
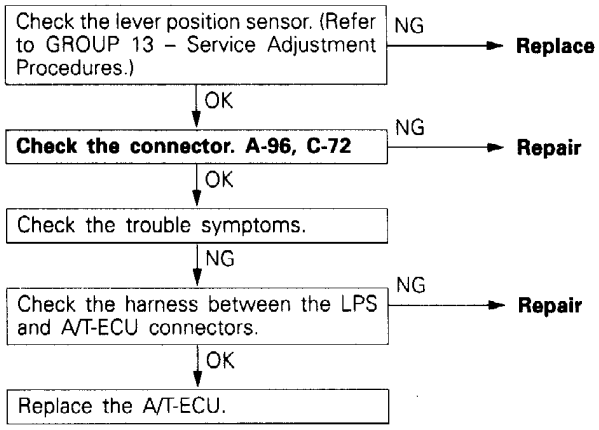
INSPECTION PROCEDURES FOR EACH DIAGNOSTIC TROUBLE CODE

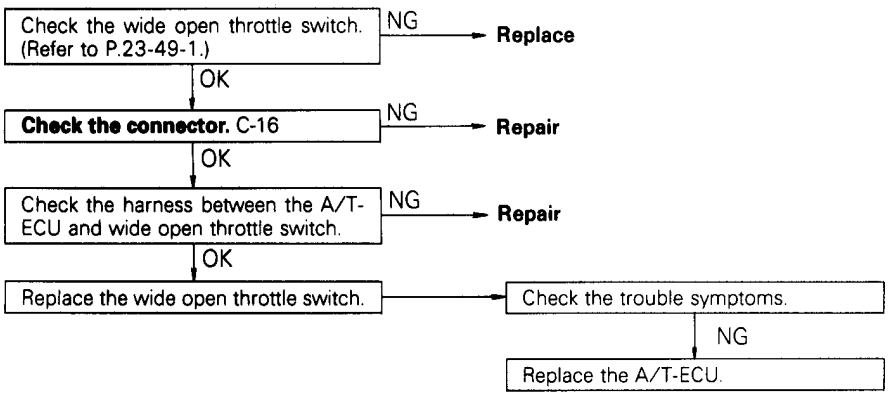
Code No. 11	Throttle position sensor system	Probable cause
[Comment]	If the TPS output becomes 4.95 V or more, TPS output is excessive, and if the TPS output becomes 0.09 V or less, TPS output is insufficient. In both cases, diagnostic trouble code No. 11 is output.	• Malfunction of throttle position sensor • Malfunction of connector • Malfunction of A/T-ECU



Code No. 11	Lever position sensor system	Probable cause
[Comment]	If the LPS output becomes 4.95 V or more, LPS output is excessive, and if the LPS output becomes 0.09 V or less, LPS output is insufficient. In both cases, diagnostic trouble code No. 11 is output.	• Malfunction of lever position sensor • Malfunction of connector • Malfunction of A/T-ECU

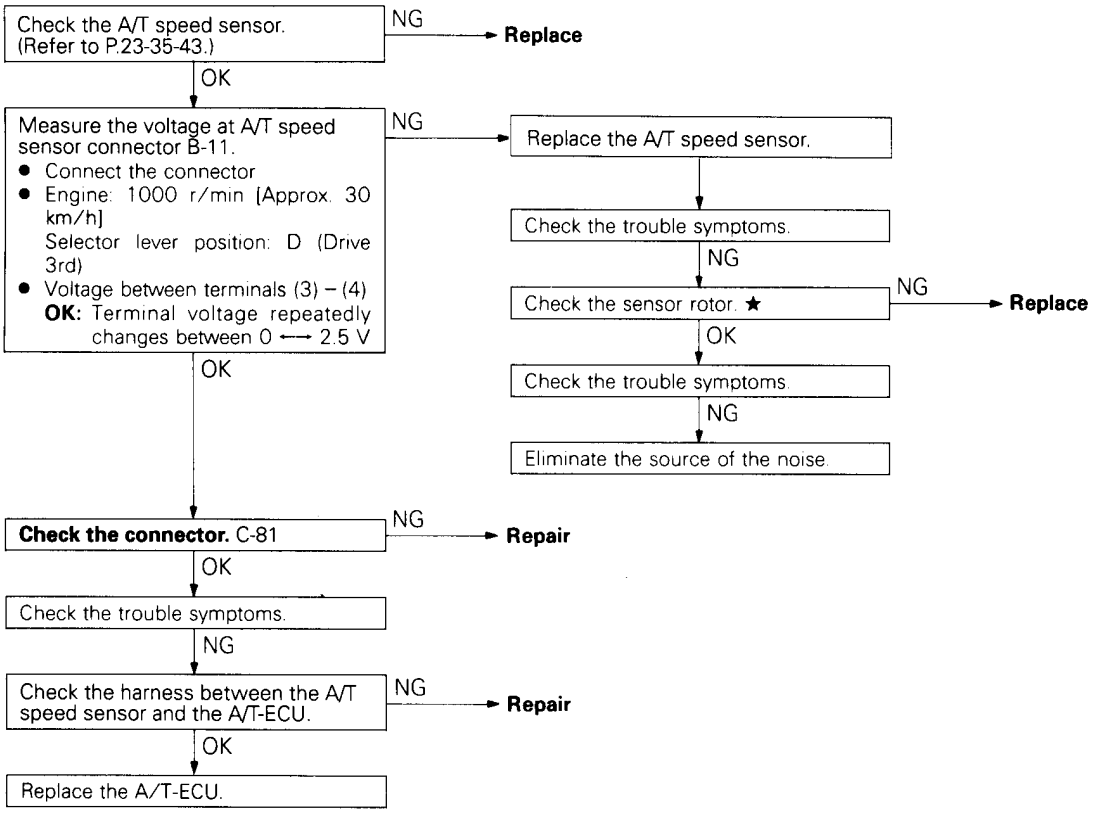


Code No. 22	Wide open throttle switch system	Probable cause
[Comment]	When the wide open throttle switch is ON despite less than 85% opening of the throttle, Code No. 22 is output.	• Malfunction of wide open throttle switch • Malfunction of connector • Malfunction of A/T-ECU

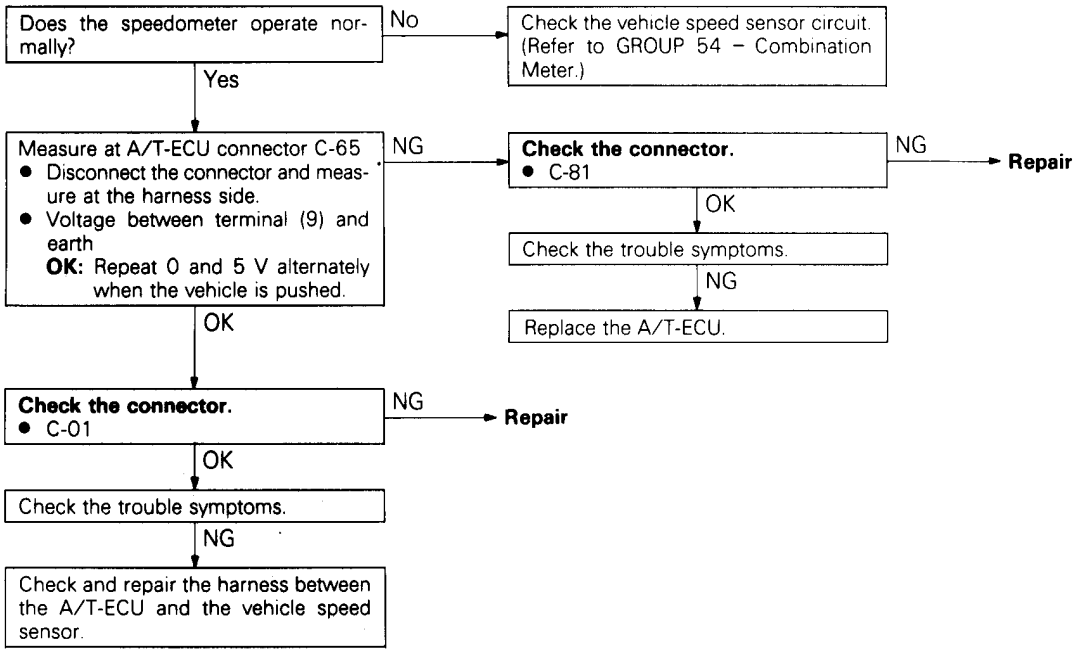


Code No. 32	A/T speed sensor system	Probable cause
[Comment]	If the vehicle moves 800 m or more while there is no output from the A/T speed sensor during the time that four pulses are input from the vehicle speed sensor, then there is judged to be an open circuit in the A/T speed sensor, and diagnostic trouble code No. 32 is output.	• Malfunction of A/T speed sensor • Malfunction of connector • Malfunction of sensor rotor • Malfunction of A/T-ECU • Noise generated

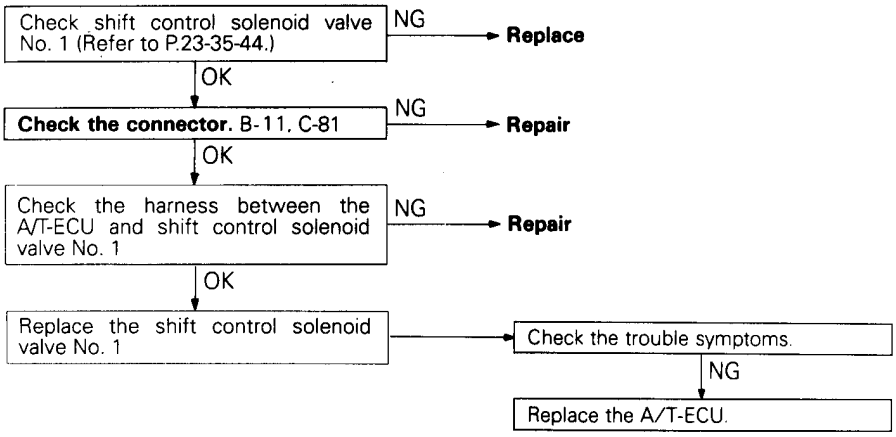
★ : Refer to the Transmission Workshop Manual.



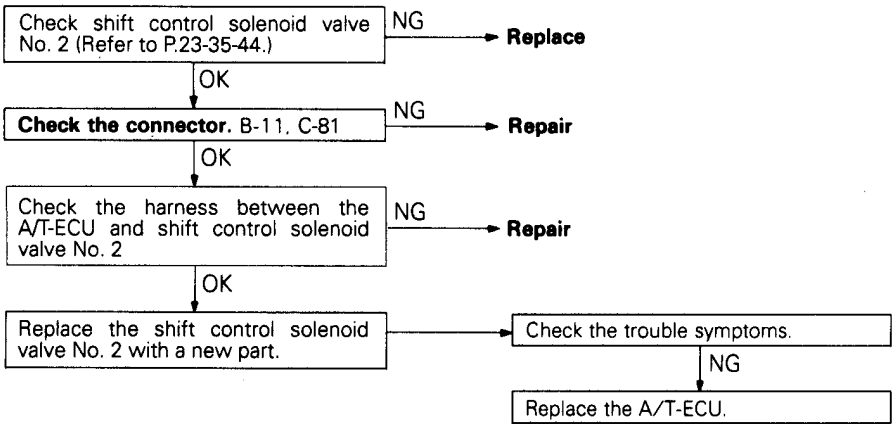
Code No. 38	Vehicle speed sensor system	Probable cause
[Comment]	If the vehicle moves 800 m or more while there is no output from the vehicle speed sensor during the time that 13 pulses (when the transfer control lever is at HIGH) or 25 pulses (when the transfer control lever is at LOW) are input from the A/T speed sensor, then there is judged to be an open circuit in the vehicle speed sensor, and diagnostic trouble code No. 38 is output.	• Malfunction of vehicle speed sensor • Malfunction of connector • Malfunction of A/T-ECU



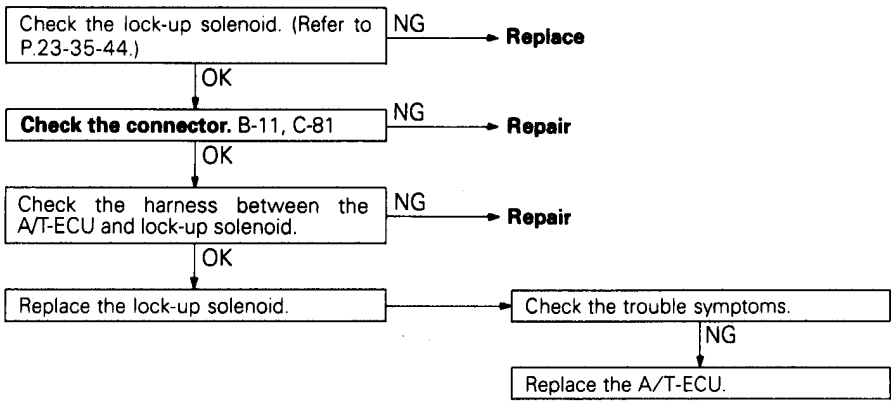
Code No. 41, 42	Shift control solenoid valve No. 1 system	Probable cause
[Comment]	If the resistance value of shift control solenoid valve No. 1 is large, there is an open circuit in shift control solenoid valve No. 1 and diagnostic trouble code No. 41 is output. If the resistance value is small, there is a short circuit in shift control solenoid valve No. 1 and diagnostic trouble code No. 42 is output.	• Malfunction of shift solenoid No. 1 • Malfunction of connector • Malfunction of A/T-ECU



Code No. 43, 44	Shift control solenoid valve No. 2 system	Probable cause
[Comment]	If the resistance value of shift control solenoid valve No. 2 is large, there is an open circuit in shift solenoid No. 2 and diagnostic trouble code No. 43 is output. If the resistance value is small, there is a short circuit in shift control solenoid valve No. 2 and diagnostic trouble code No. 44 is output.	• Malfunction of shift control solenoid valve No. 2 • Malfunction of connector • Malfunction of A/T-ECU



Code No. 47, 48	Lock-up solenoid system	Probable cause
[Comment]	If the resistance value of the lock-up solenoid is large, there is an open circuit in the lock-up solenoid and diagnostic trouble code No. 47 is output. If the resistance value is small, there is a short circuit in the lock-up solenoid and diagnostic trouble code No. 48 is output.	• Malfunction of lock-up solenoid • Malfunction of connector • Malfunction of A/T-ECU



INSPECTION CHART CLASSIFIED BY TROUBLE SYMPTOMS

Trouble symptom		Inspection procedure No.	Reference page
Communication with the MUT-II is not possible		1	P.23-35-17
Does not move	Does not move forward or reverse	2	P.23-35-18
	Does not move forward only	3	P.23-35-19
	Does not reverse only	4	P.23-35-19
Malfunction when shifting	Upshifting does not occur	5	P.23-35-20
	Downshifting does not occur	6	P.23-35-21
	Shifting point abnormality	7	P.23-35-22
	Upshifting occurs spontaneously	8	P.23-35-22
	Incorrect drive gear position	9	P.23-35-23
Large shocks		10	P.23-35-24
Slippage (vibration)		11	P.23-35-25
Lockup malfunction		12	P.23-35-26
Abnormal engine braking		13	P.23-35-26
Electronic circuit systems	Inhibitor switch system	14	P.23-35-27
	Pattern select switch system	15	P.23-35-28
	Overdrive switch system	16	P.23-35-29
	Stop lamp switch system	17	P.23-35-29
	Engine coolant temperature switch system	18	P.23-35-30
	Oil temperature sensor system	19	P.23-35-31

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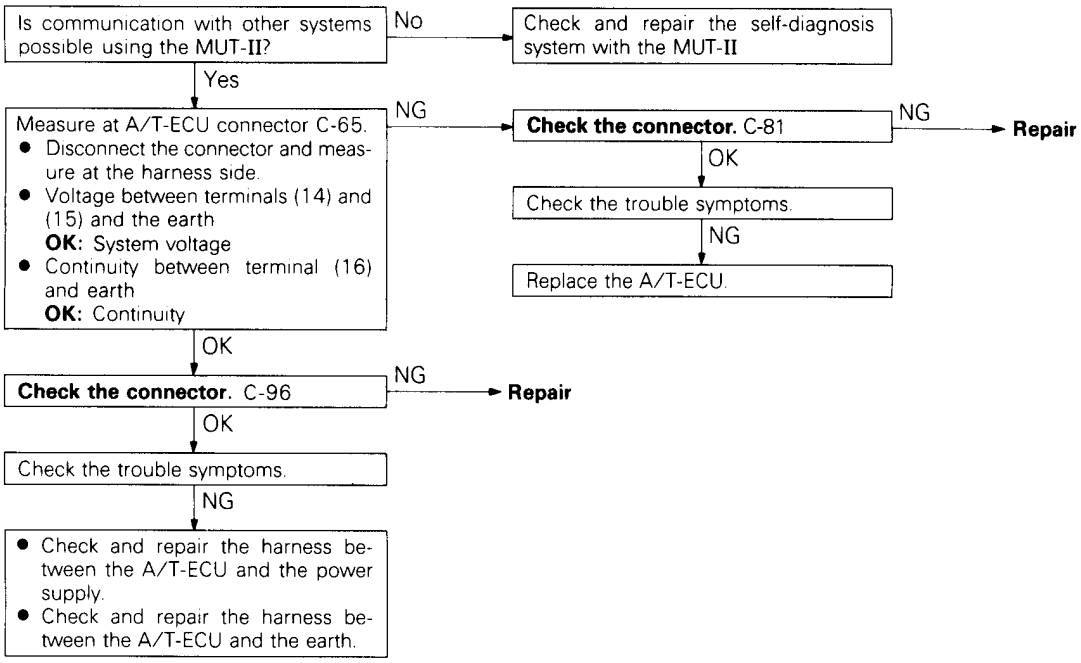
INSPECTION PROCEDURES FOR EACH TROUBLE SYMPTOM

INSPECTION PROCEDURE 1

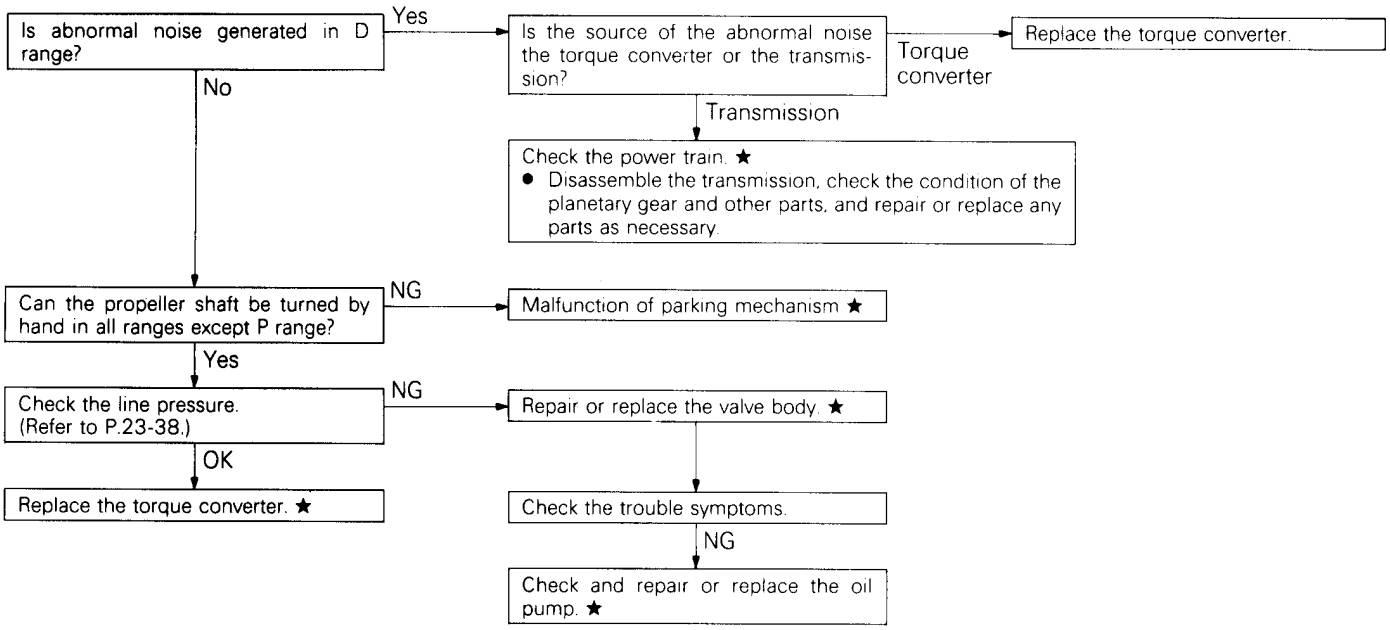
• Communication with the MUT-II is not possible	Probable cause
[Comment] If communication with the MUT-II is not possible, the cause is probably a malfunction in the self-diagnosis system or the A/T-ECU is not functioning.	• Malfunction of self-diagnosis system • Malfunction of A/T-ECU power circuit • Malfunction of A/T-ECU earth circuit • Malfunction of A/T-ECU



INSPECTION PROCEDURE 2

● Does not move forward or reverse	Probable cause
[Comment] When the engine is idling, the vehicle does not move forward or back even if the selector lever is shifted from N to D, 2, L or R range. In such cases, the cause is probably abnormal line pressure, or a malfunction of the torque converter, oil pump, parking mechanism or the power train.	● Abnormal line pressure ● Malfunction of power train ● Malfunction of oil pump ● Malfunction of valve body ● Malfunction of parking mechanism ● Malfunction of torque converter

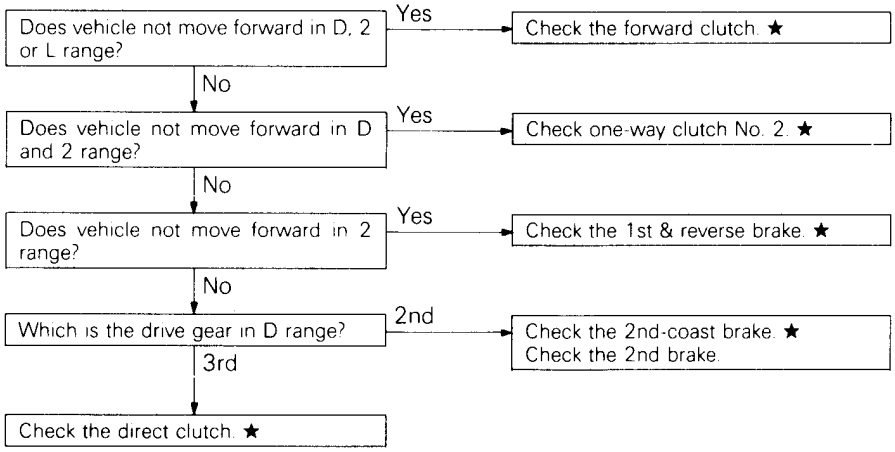
★ : Refer to the Transmission Workshop Manual.



INSPECTION PROCEDURE 3

● Does not move forward only	Probable cause
[Comment] When the engine is idling, the vehicle does not move forward even if the selector lever is shifted from N to D, 2 or L range. In such cases, the cause is probably a malfunction of the clutch or brake.	● Malfunction of forward clutch ● Malfunction of direct clutch ● Malfunction of one-way clutch No. 2 ● Malfunction of 2nd-coast brake ● Malfunction of 2nd brake ● Malfunction of 1st & reverse brake

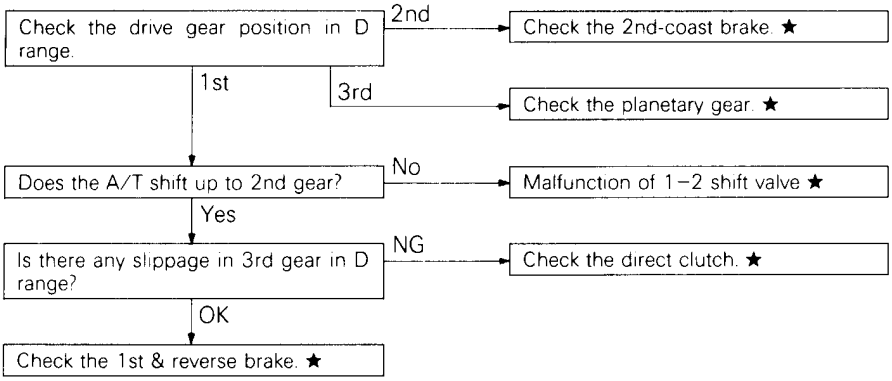
★ : Refer to the Transmission Workshop Manual.



INSPECTION PROCEDURE 4

● Does not reverse only	Probable cause
[Comment] When the engine is idling, the vehicle does not reverse even if the selector lever is shifted from N to R range. In such cases, the cause is probably a malfunction of a clutch, brake or the valve body.	● Malfunction of 2nd-coast brake ● Malfunction of direct clutch ● Malfunction of 1st & reverse brake ● Malfunction of valve body ● Malfunction of planetary gear

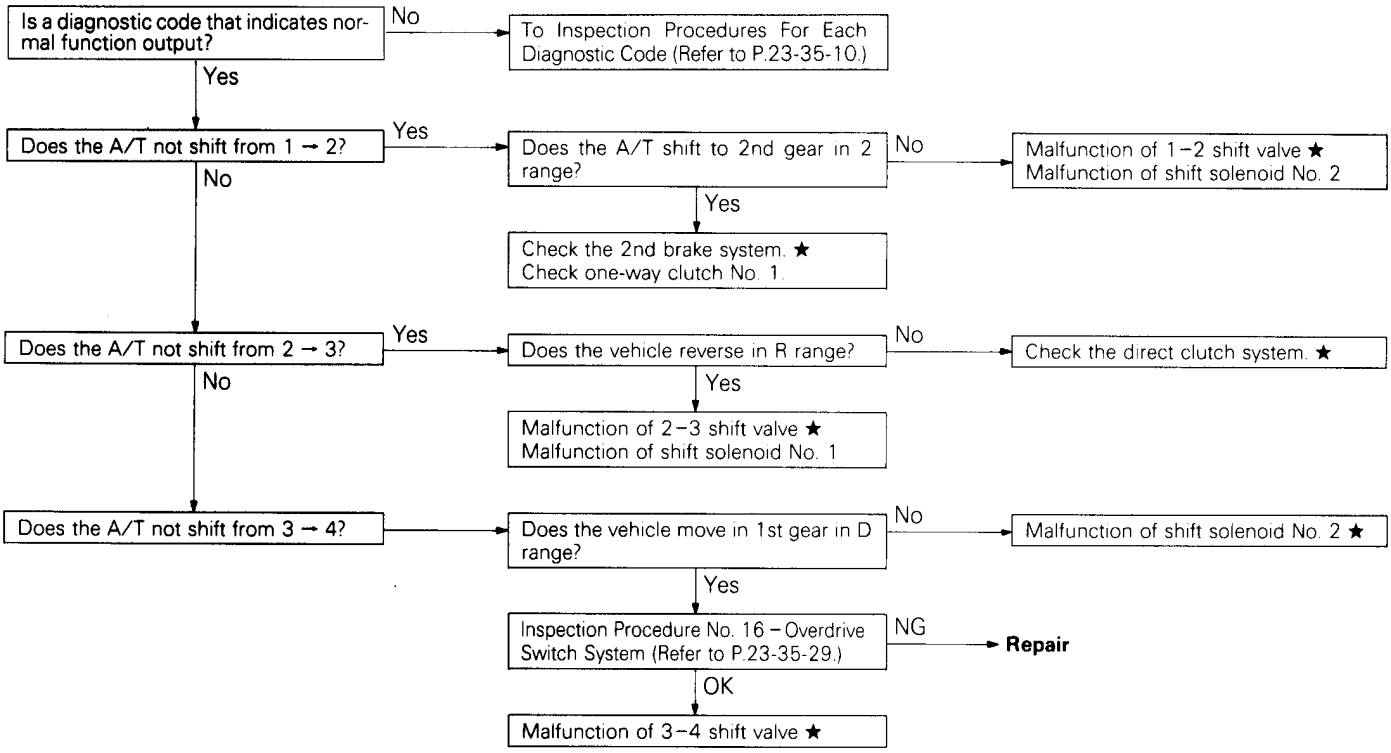
★ : Refer to the Transmission Workshop Manual.



INSPECTION PROCEDURE 5

● Upshifting does not occur	Probable cause
[Comment] Upshifting does not occur under conditions when upshifting should occur. Check shifting from 1 → 2, 2 → 3 and 3 → 4 respectively.	● Shift solenoid ● A/T-ECU ● Power train internal parts

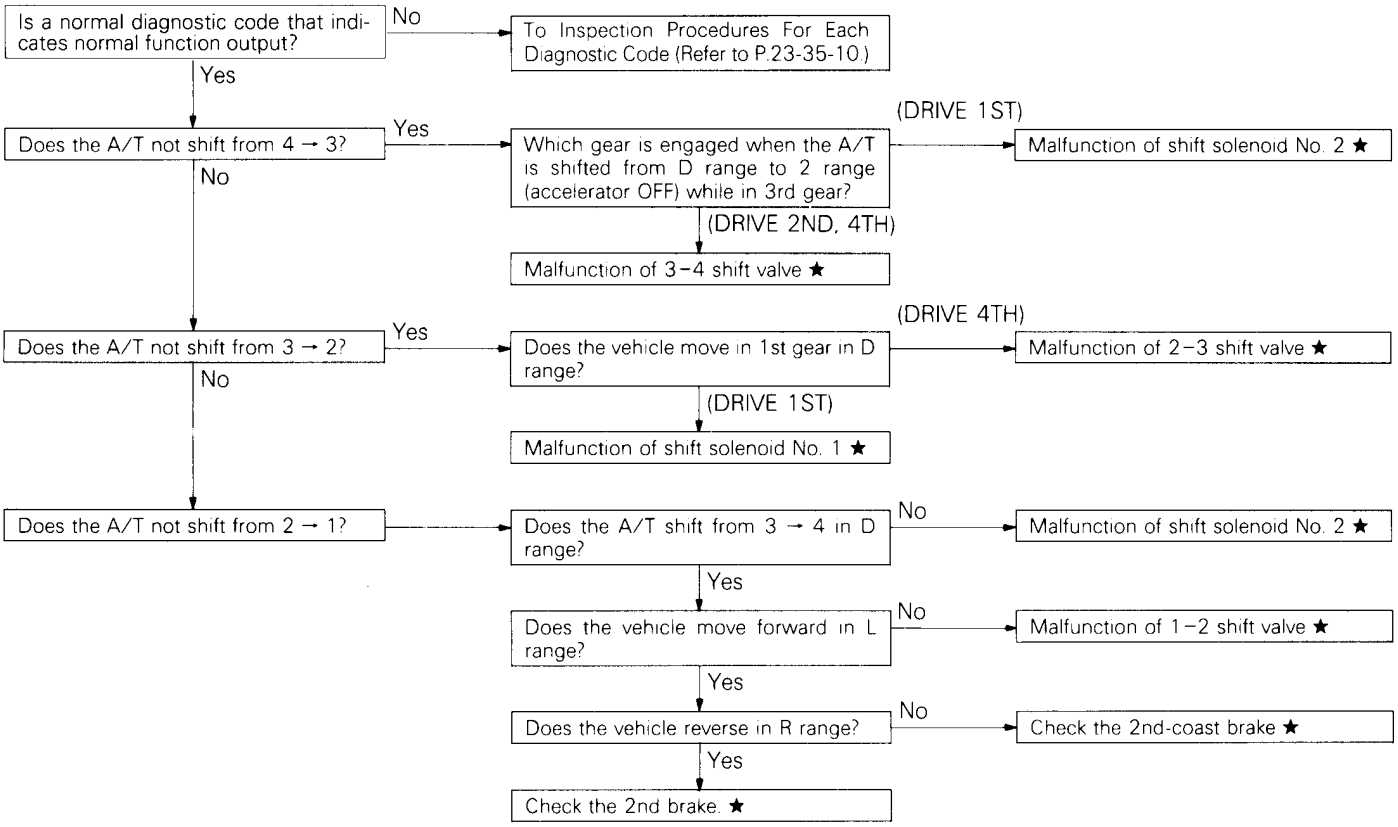
★ : Refer to the Transmission Workshop Manual.



INSPECTION PROCEDURE 6

● Downshifting does not occur	Probable cause
[Comment] Downshifting does not occur under conditions when downshifting should occur. Check shifting from 2 → 1, 3 → 2 and 4 → 3 respectively.	● Shift solenoid ● A/T-ECU ● Power train internal parts

★ : Refer to the Transmission Workshop Manual.



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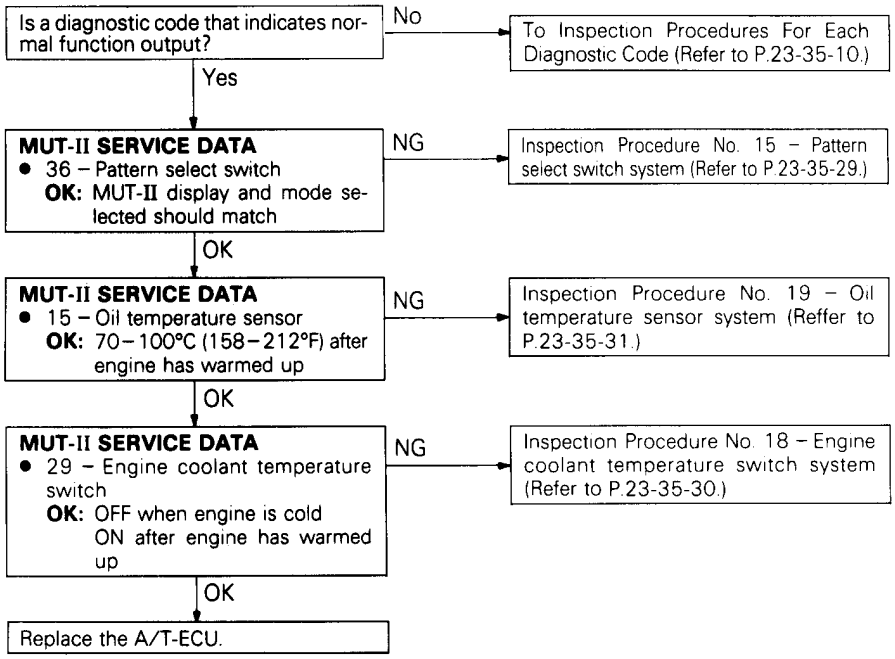
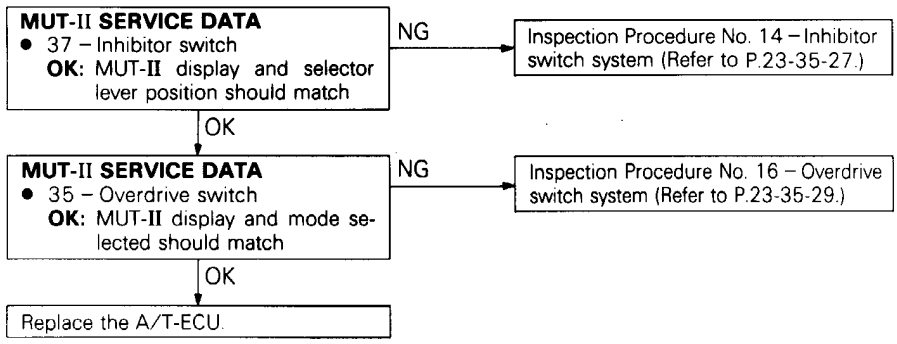
INSPECTION PROCEDURE 7

● Shifting point abnormality	Probable cause
[Comment] Shifting occurs at points which are different from the shift pattern. Note that the shift pattern will vary in different modes and at high oil temperatures.	● Throttle (lever) position sensor ● A/T speed sensor ● Oil temperature sensor ● Pattern selector switch ● Engine coolant temperature switch ● A/T-ECU



INSPECTION PROCEDURE 8

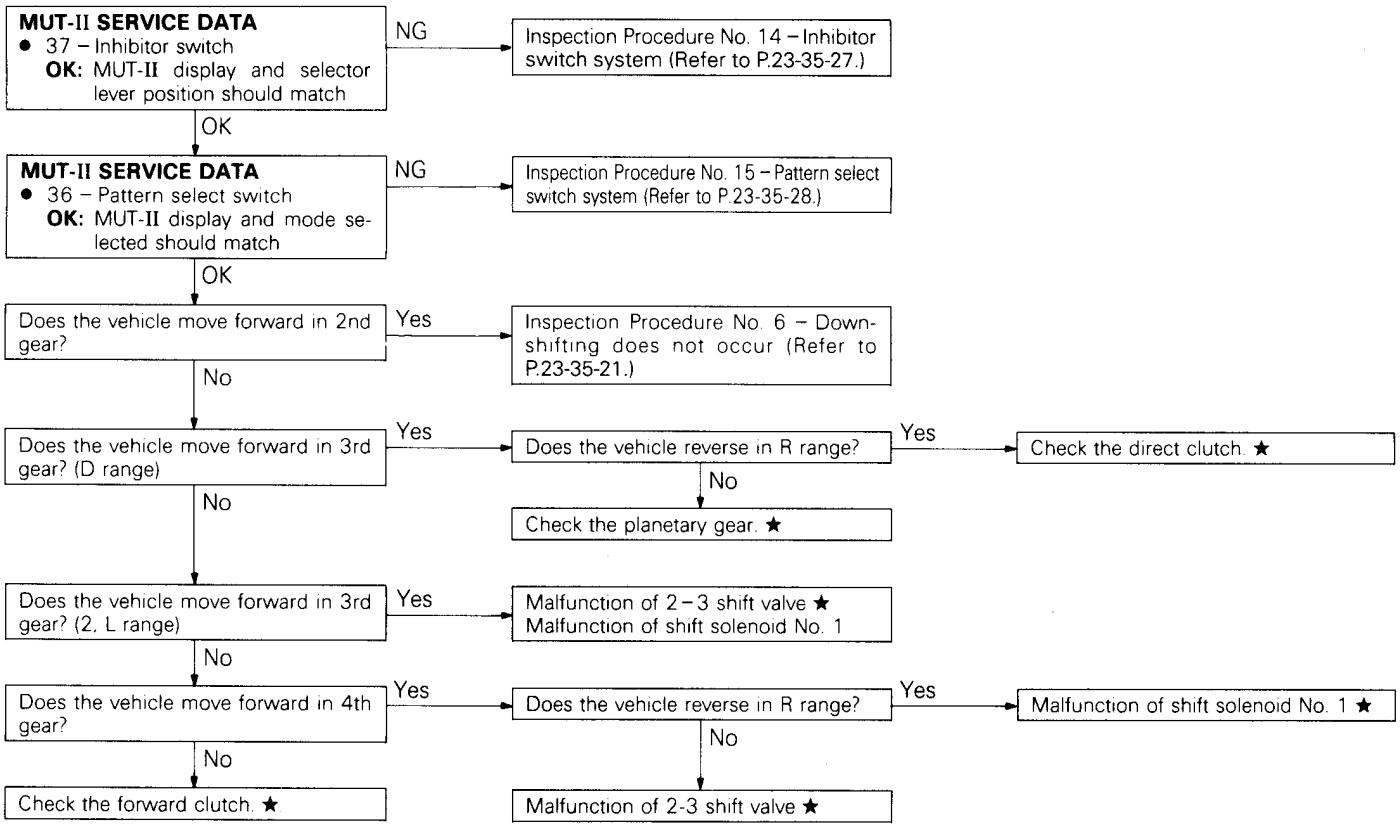
● Upshifting occurs spontaneously	Probable cause
[Comment] Upshifting occurs in ranges where upshifting should not occur when in 2nd gear in L range, 3rd gear in 2 range or 4th gear in D range when OD switch is OFF.	● Inhibitor switch ● Overdrive switch ● A/T-ECU



INSPECTION PROCEDURE 9

• Incorrect drive gear position	Probable cause
[Comment] Vehicle starts off in 2nd, 3rd or 4th gear when in D range. Often occurs when starting off is not smooth.	• Inhibitor switch • Pattern select switch • Direct clutch • Planetary gear • Valve body

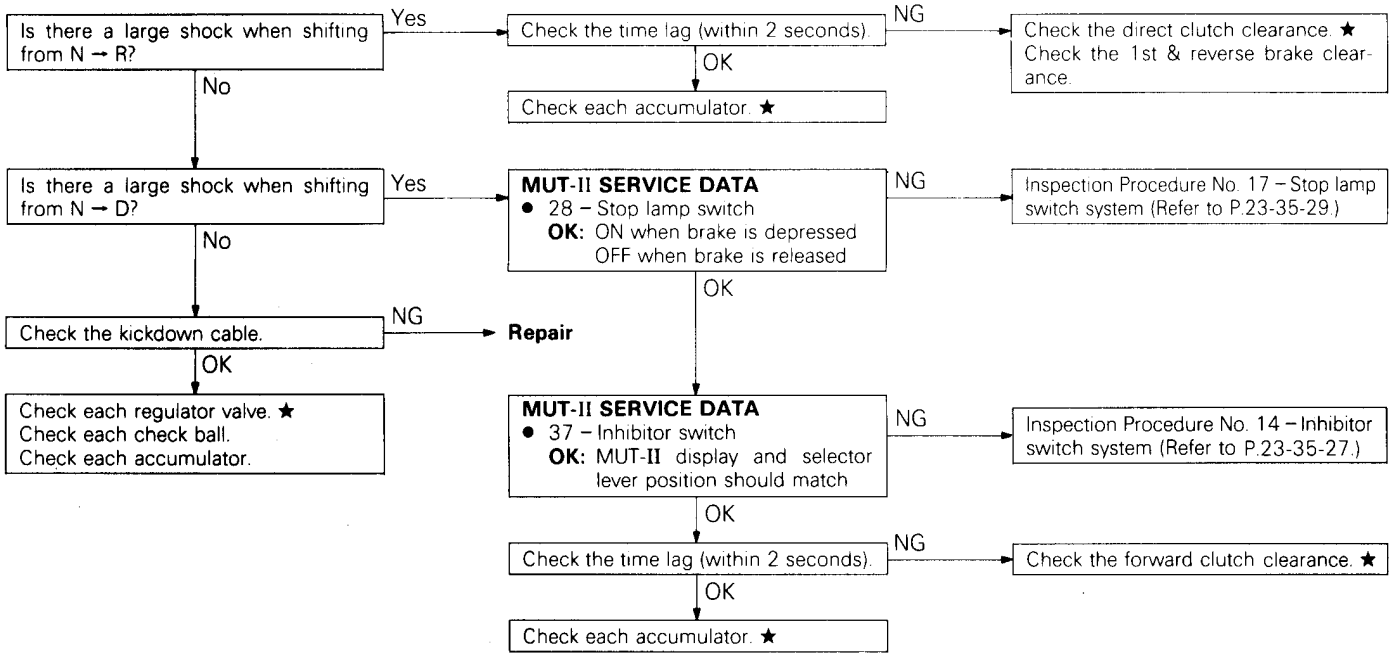
★ : Refer to the Transmission Workshop Manual.



INSPECTION PROCEDURE 10

● Large shocks	Probable cause
[Comment] Shocks accompany shifting from N → D, N → R and during each upshift and downshift.	● Direct clutch ● 1st & Rev brake ● Stop lamp switch ● Inhibitor switch ● Forward clutch ● Valve body

★ : Refer to the Transmission Workshop Manual.



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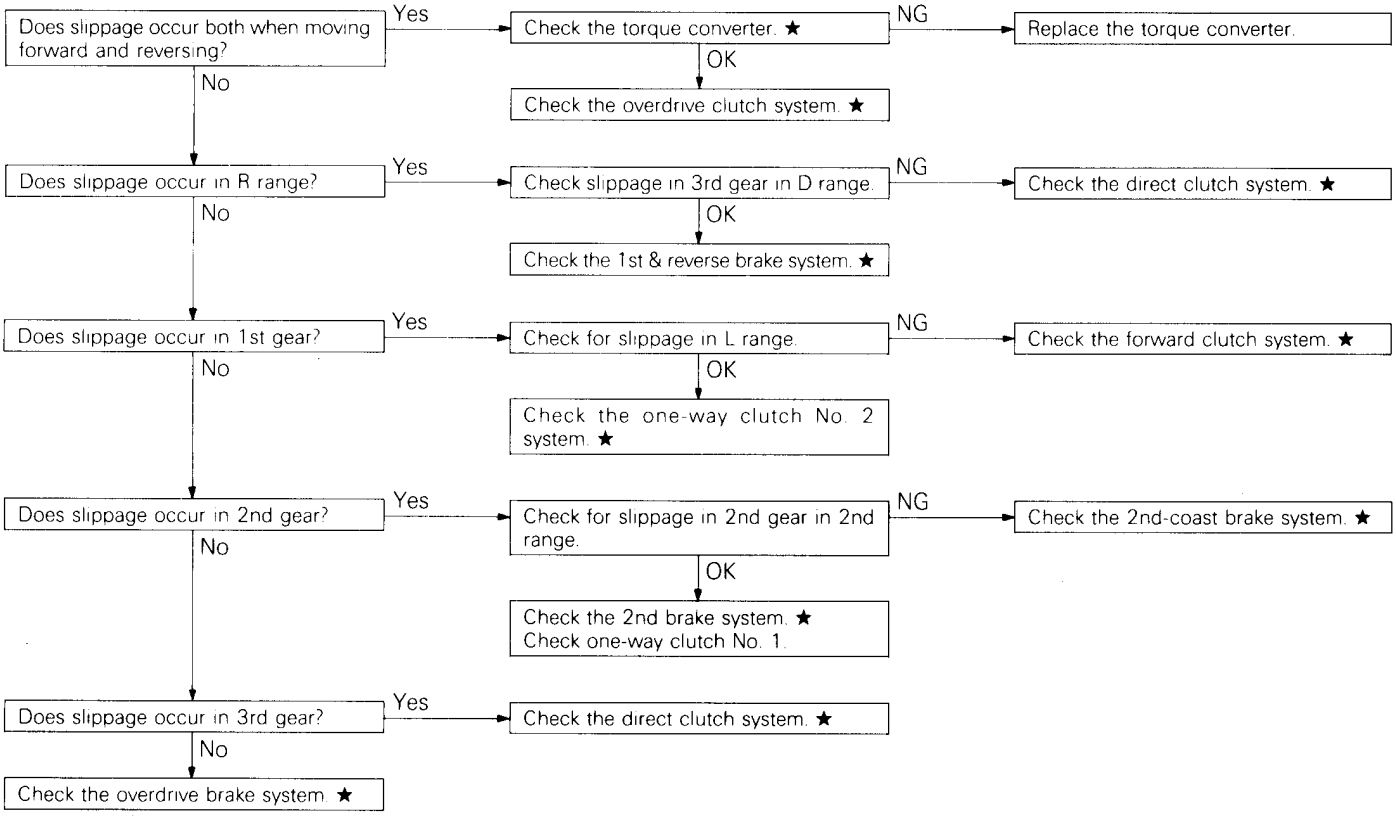
INSPECTION PROCEDURE 11

● Slippage (vibration)	Probable cause
[Comment] Occurs when a clutch or brake does not fully engage due to low hydraulic pressure or a worn facing. Appears as vibration when the problem is slight.	● Torque converter ● Direct clutch ● Forward clutch ● 2nd-coast brake ● 2nd brake ● Overdrive brake

★ : Refer to the Transmission Workshop Manual.



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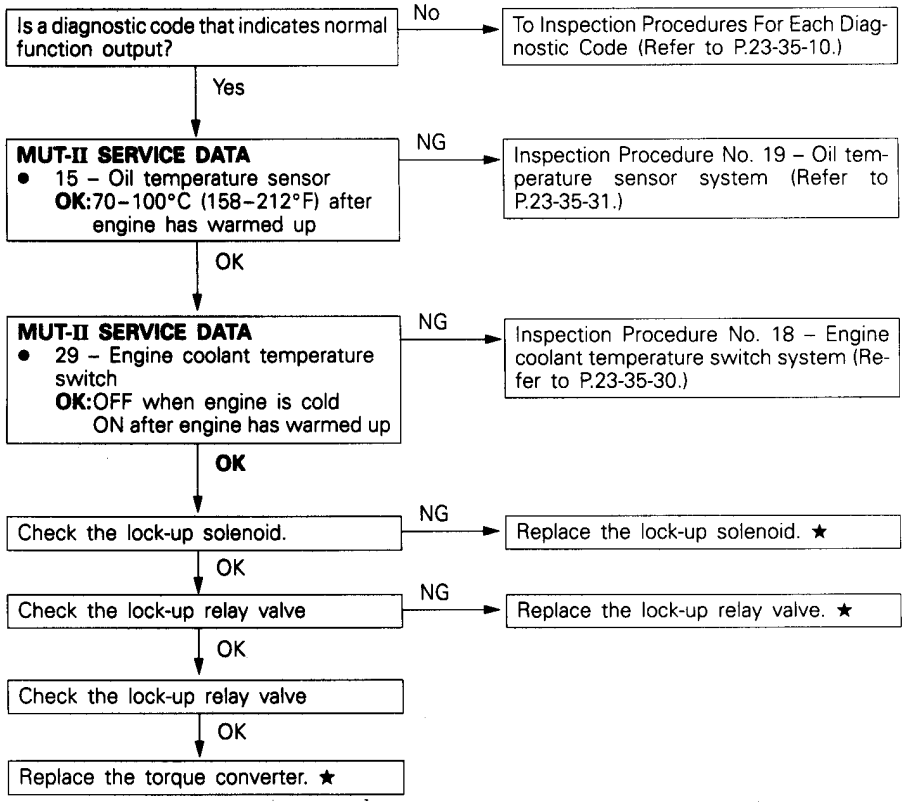
INSPECTION PROCEDURE 12

● Lockup abnormality	Probable cause
[Comment] When lock-up does not operate even though in the lock-up range, and also when lock-up is operating and the engine is idling but then stalls.	● Torque converter ● Valve body ● Oil temperature sensor ● Engine coolant temperature switch

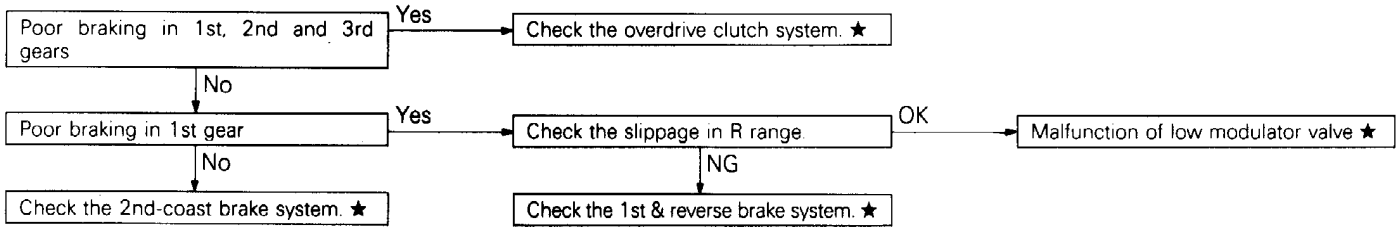
★ : Refer to the Transmission Workshop Manual.



INSPECTION PROCEDURE 13

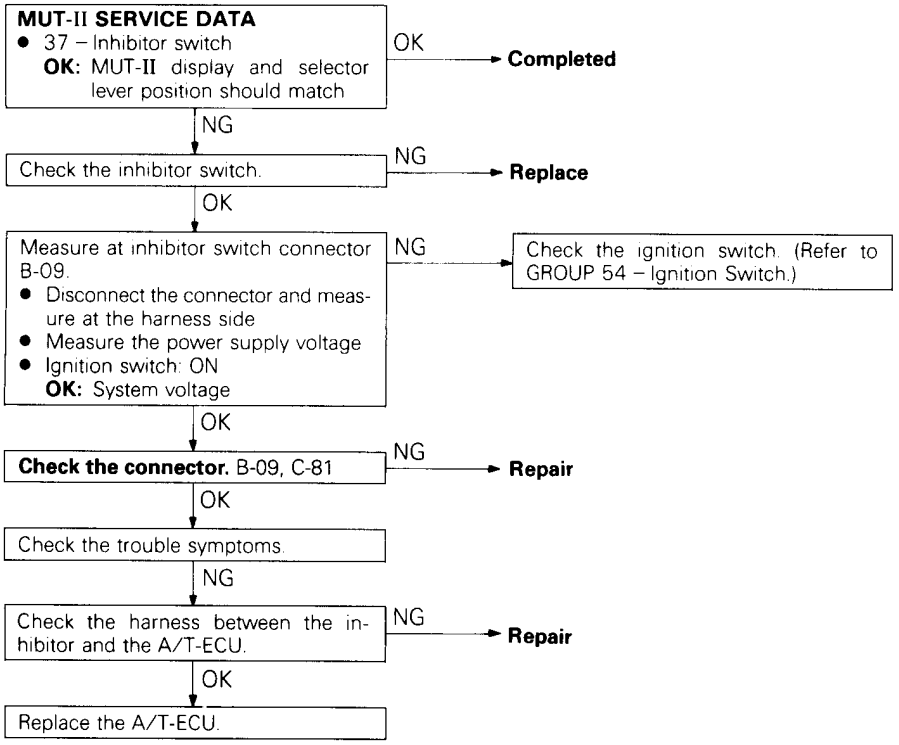
● Abnormal engine braking	Probable cause
[Comment] Engine braking effectiveness is poor after downshifting has occurred.	● Overdrive clutch ● 1st & Rev brake ● 2nd-coast brake ● Valve body

★ : Refer to the Transmission Workshop Manual.



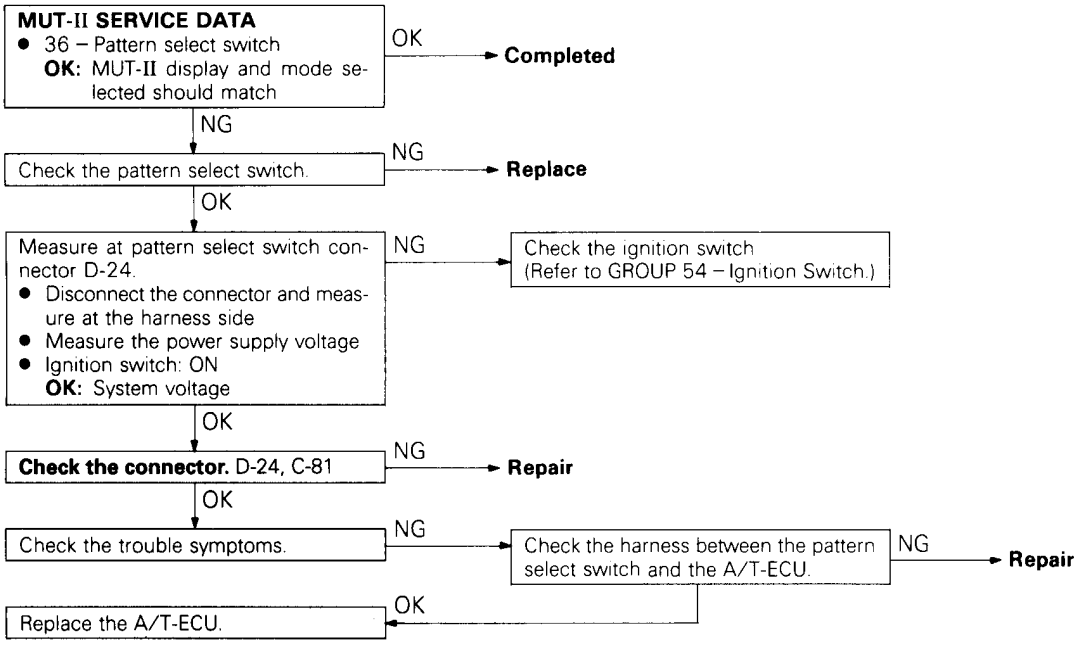
INSPECTION PROCEDURE 14

• Inhibitor switch system	Probable cause
[Comment] If the engine does not start in P or N range, the cause is probably a problem in the inhibitor switch system.	• Malfunction of inhibitor switch • Malfunction of connector • Malfunction of A/T-ECU



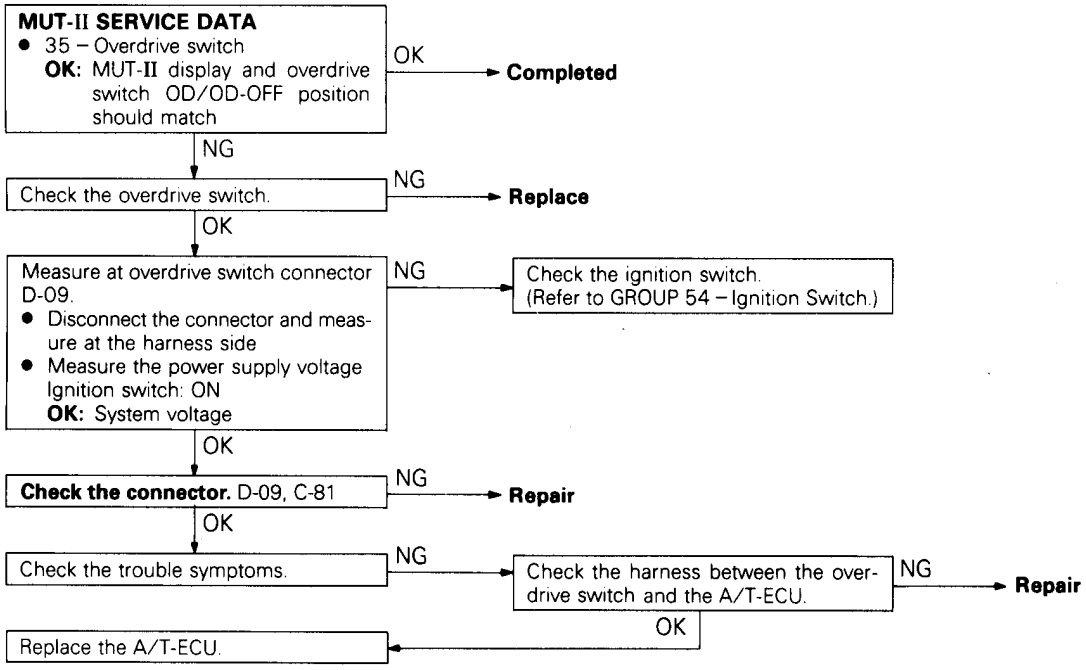
INSPECTION PROCEDURE 15

• Pattern select switch system	Probable cause
[Comment] If the shift pattern does not change when the pattern select switch is operated, the cause is probably a malfunction of the pattern select switch.	• Malfunction of pattern select switch • Malfunction of connector • Malfunction of A/T-ECU



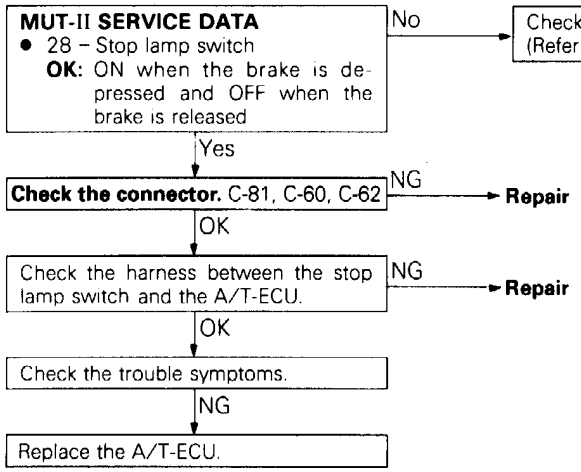
INSPECTION PROCEDURE 16

• Overdrive switch system	Probable cause
[Comment] If downshifting does not occur when overdrive is turned off while driving in 4th gear, or if shifting to 4th gear is not possible, the cause is probably a problem in the overdrive switch system.	• Malfunction of overdrive switch • Malfunction of connector • Malfunction of A/T-ECU



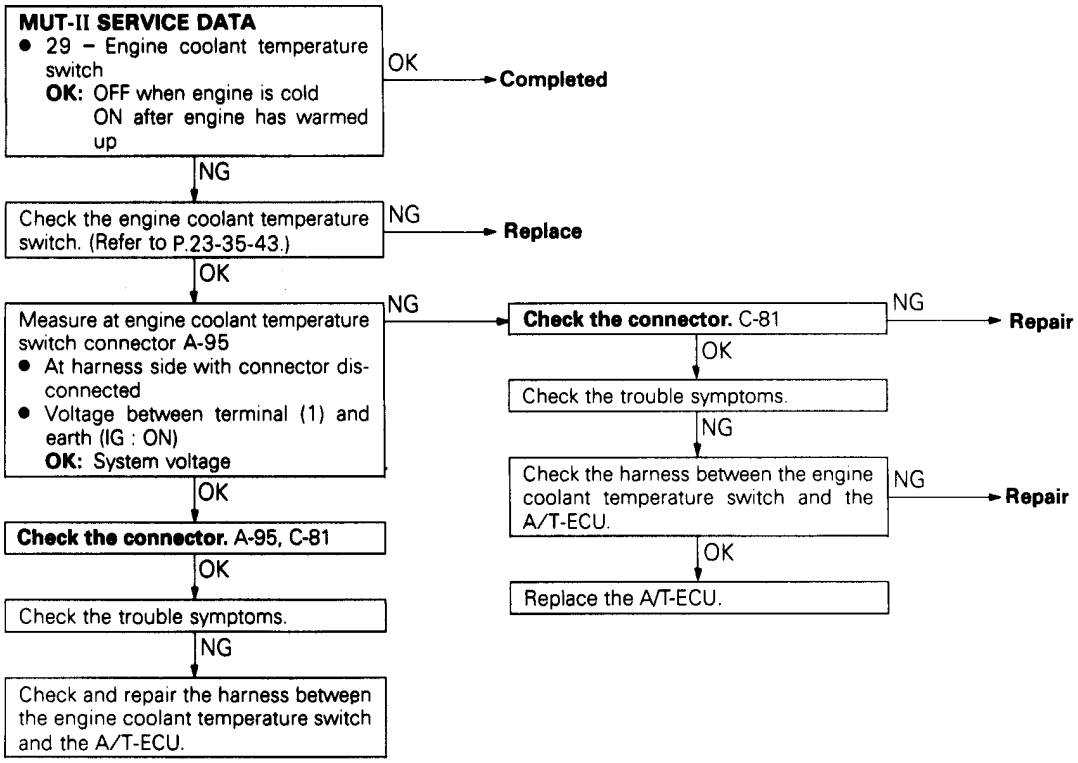
INSPECTION PROCEDURE 17

• Stop lamp switch system	Probable cause
[Comment] If large shocks occur during squat control, the cause is probably a problem with the stop lamp switch.	• Malfunction of stop lamp switch • Malfunction of connector • Malfunction of A/T-ECU



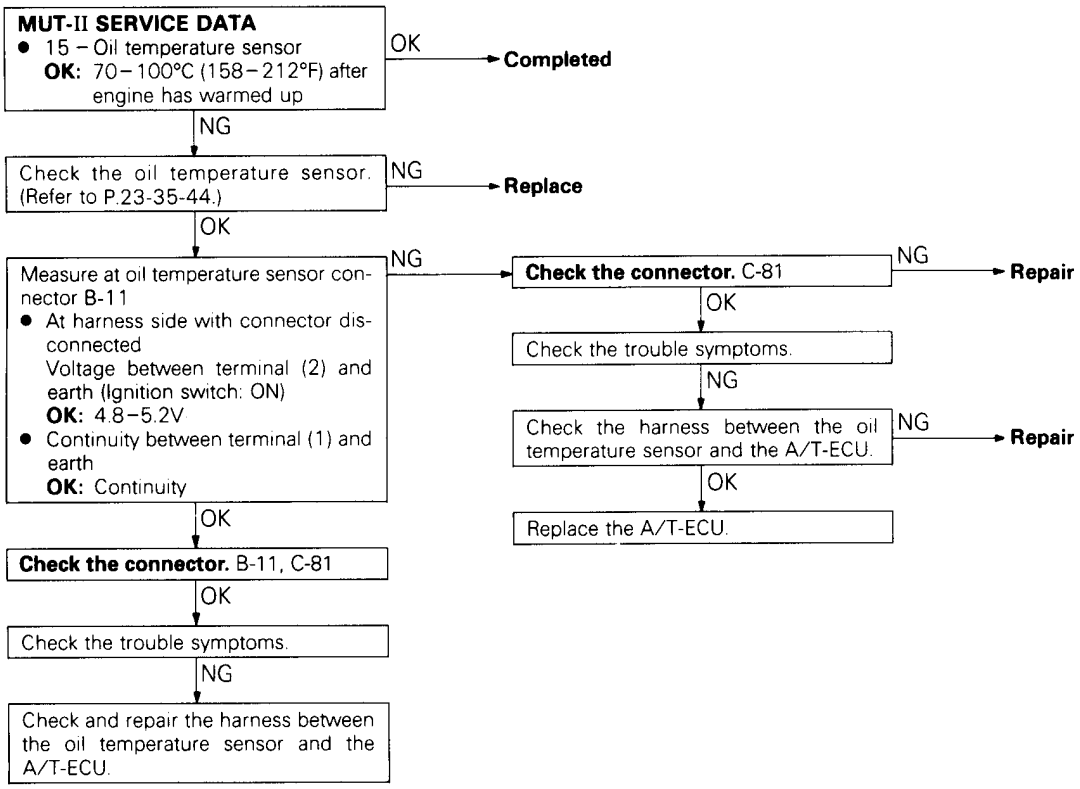
INSPECTION PROCEDURE 18

• Engine coolant temperature switch system	Probable cause
[Comment] The cause is probably a malfunction of the engine coolant tempearture switch: • When upshifting to the 4th gear does not occur in D range. (OD switch: ON) • When lock-up does not operate even though in the lock-up range. • When there is insufficient output while the engine is cold.	• Malfunction of engine coolant temperature switch • Malfunction of connector • Malfunction of A/T-ECU



INSPECTION PROCEDURE 19

● Oil temperature sensor system	Probable cause
[Comment] If the oil temperature warning lamp remains illuminated, the cause is probably a problem with the oil temperature sensor.	● Malfunction of oil temperature sensor ● Malfunction of connector ● Malfunction of A/T-ECU



SERVICE DATA REFERENCE TABLE

Item No.	Inspection item	Inspection conditions		Normal value
11	Throttle position sensor <Petrol powered vehicles>	Accelerator pedal position Engine: Idle Selector lever position: N	Fully closed	0 – 5%
			Depressed	Gradually rises from the above value
			Fully open (up to 2 seconds)	85 – 100%
	Lever position sensor <Diesel powered vehicles>	Accelerator pedal position Engine: Idle Selector lever position: N	Fully closed	0 – 20%
			Depressed	Gradually rises from the above value
			Fully open (up to 2 seconds)	90 – 100%
15	Oil temperature sensor	Warming up	Drive for 15 minutes or more so that the ATF temperature becomes 70 – 90°C (158 – 194°F)	Gradually rises to 70 – 90°C (158 – 194°F)
21	Wide open throttle switch	Accelerator pedal position Ignition switch: ON Engine: Stopped	Fully closed	OFF
			Fully open	ON
27	Shift position signal	Accelerator pedal position Engine: Idle (Vehicle stopped) Selector lever position: D Mode selection: Normal	Fully closed	1st
			N → D shift	1st → 3rd → 1st
		Selector lever position: L Mode selection: Normal	Idle (Vehicle stopped)	1st
		Selector lever position: 2 Mode selection: Normal	Idle (Vehicle stopped)	1st
			Driving at 40 km/h (20 seconds or more)	2
		Selector lever position: D Mode selection: Normal Overdrive: OFF	Driving at constant speed of 50 km/h (20 seconds or more)	3rd
		Selector lever position: D Mode selection: Normal Overdrive: ON	Driving at constant speed of 50 km/h (20 seconds or more)	4th
28	Stop lamp switch	Brake pedal position Ignition switch: ON Engine: Stopped	Depressed	ON
			Released	OFF

Item No.	Inspection item	Inspection conditions		Normal value
29	Engine coolant temperature switch	When engine changes from cold to warm	While engine is cold	OFF
			After engine has warmed up	ON
32	A/T speed sensor*	Selector lever position: D Mode selection: Normal Overdrive: ON	Driving at 30 km/h	25 – 35 km/h
			Driving at 50 km/h	42 – 58 km/h
35	Overdrive switch	Ignition switch: ON Engine: Stopped	Overdrive switch: ON	OD
			Overdrive: OFF	OD – OFF
36	Pattern select switch	Ignition switch: ON Engine: Stopped	Pattern select switch Power mode	Power
			Pattern select switch Hold mode	Hold
			Pattern select switch Normal mode	Normal
37	Inhibitor switch	Ignition switch: ON Engine: Stopped	Selector lever position: P Selector lever position: R Selector lever position: N Selector lever position: D Selector lever position: 2 Selector lever position: L	P, R, D P, R, D N P, R, D 2 L
39	Cruise control-ECU	Selector lever position: D Mode selection: Normal	Auto-cruise control OFF	OFF
			Auto-cruise control ON (climbing at 50 km/h)	ON
41	Shift solenoid No. 1	Selector lever position: D Mode selection: Normal	Driving at 10 km/h (Drive 1st)	ON
			Driving at 50 km/h (Drive 4th)	OFF
43	Shift solenoid No. 2	Selector lever position: D Mode selection: Normal Overdrive: OFF	Driving at 10 km/h (Drive 1st)	OFF
			Driving at 50 km/h (Drive 3rd)	ON
47	Lock-up solenoid	Selector lever position: D Mode selection: Normal Overdrive: ON	Driving at 10 km/h (Drive 1st)	OFF
			Driving at 50 km/h (Drive 4th)	ON

NOTE
*: Transfer lever position: 4H Range

REFERENCE FOR FAIL-SAFE/BACKUP FUNCTIONS

When malfunctions of the main sensors or actuators are detected by the self-diagnosis system, the vehicle is controlled by means of the pre-set control logic to maintain safe conditions for driving.

<table>
<tr><th>Malfunctioning item</th><th>Control contents during malfunction</th></tr>
<tr><td>A/T speed sensor</td><td>When there is an open circuit in the A/T speed sensor, vehicle speed detection is switched to the output from the vehicle speed sensor in the speedometer to maintain vehicle control.</td></tr>
<tr><td>Inhibitor switch</td><td>If there is an open circuit in the N, 2 or L signal line, driving is possible in the case of 2 and L (same as D range) so that control can be performed as if the range is D range, and driving is not possible in N range.
If more than one of the 2, L or N signals are input, the order of priority for control is L → 2 → N.</td></tr>
<tr><td>Throttle position sensor</td><td>If the output is 0.09 V or less or 4.95 V or more, the throttle is fully closed and gear shifting control is carried out.</td></tr>
<tr><td>Lock-up solenoid</td><td>If a problem is detected, lock-up is stopped over the whole range and the solenoid is turned OFF to prevent the engine from stalling during idling.</td></tr>
<tr><td>Shift control solenoid valve No. 1, No. 2</td><td>If a problem is detected, each solenoid stops operating and is turned OFF.
The gear shifting logic when a problem is detected is given in the table below.
<table>
<tr><th rowspan="2">Selector lever position</th><th colspan="3">Normal</th><th colspan="3">When the solenoid No.1 has broken</th><th colspan="3">When the solenoid No.2 has broken</th><th colspan="3">When the solenoids No.1 and No.2 have broken</th></tr>
<tr><th>Gear</th><th>S1</th><th>S2</th><th>Gear</th><th>S1</th><th>S2</th><th>Gear</th><th>S1</th><th>S2</th><th>Gear</th><th>S1</th><th>S2</th></tr>
<tr><td rowspan="4">D</td><td>1</td><td>O</td><td>X</td><td rowspan="3">3</td><td></td><td>X→O</td><td>1</td><td>O</td><td></td><td rowspan="4">O/D</td><td></td><td></td></tr>
<tr><td>2</td><td>O</td><td>O</td><td></td><td>O</td><td rowspan="2">O/D</td><td>O→X</td><td></td><td></td><td></td></tr>
<tr><td>3</td><td>X</td><td>O</td><td></td><td>O</td><td>X</td><td></td><td></td><td></td></tr>
<tr><td>O/D</td><td>X</td><td>X</td><td>O/D</td><td></td><td>X</td><td>X</td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="3">2</td><td>1</td><td>O</td><td>X</td><td rowspan="3">3</td><td></td><td>X→O</td><td>1</td><td>O</td><td></td><td rowspan="3">3</td><td></td><td></td></tr>
<tr><td>2</td><td>O</td><td>O</td><td></td><td>O</td><td rowspan="2">3</td><td>O→X</td><td></td><td></td><td></td></tr>
<tr><td>3</td><td>X</td><td>O</td><td></td><td>O</td><td>X</td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">L</td><td>1</td><td>O</td><td>X</td><td>1</td><td></td><td>X</td><td rowspan="2">1</td><td>O</td><td></td><td rowspan="2">1</td><td></td><td></td></tr>
<tr><td>2</td><td>O</td><td>O</td><td>2</td><td></td><td>O</td><td>O</td><td></td><td></td><td></td><td></td></tr>
</table>
O : Energized (ON)
X : Not energized (OFF)
S1 : Solenoid valve No. 1
S2 : Solenoid valve No. 2</td></tr>
</table>

A/T-ECU TERMINAL VOLTAGE REFERENCE CHART

Terminal No.	Inspection item	Inspection conditions	Standard value
1	Shift control solenoid valve No. 1	When in 1st or 2nd gear	System voltage
		When in 3rd or 4th gear	0 V
2	Shift control solenoid valve No. 2	When in 2nd or 3rd gear	System voltage
		When in 1st or 4th gear	0 V
3	Lock-up solenoid	When lock-up clutch is operating	System voltage
		When lock-up clutch is not operating	0 V
4	A/T speed sensor Earth side	Ignition switch: OFF	0V
		Ignition switch: ON	2.5 V
5	Inhibitor switch (N)	Selector lever position: N	System voltage
		Selector lever position: Other than N	0 V
6	Diagnostic output terminal	When MUT-II is not connected	System voltage
7	HOLD mode signal	When HOLD mode is selected	System voltage
		When mode other than HOLD mode is selected	0 V
8	Overdrive switch	Overdrive switch: ON (OD)	0 V
		Overdrive switch: OFF (OD – OFF)	System voltage
9	Vehicle speed sensor	Vehicle: Slowly moving forward	Alternates between 0 ⟷ approx. 5 V
10	A/T speed sensor output side	Vehicle: Stopped	Approx. 2.5 V
		Vehicle: Driving	Other than 2.5 V
11	Cruise control signal	When cruise control is requested	0 V
		When cruise control is not requested	System voltage
12	Oil temperature sensor	ATF temperature: 120°C (248°F)	Approx. 1.9 V
		ATF temperature: 150°C (302°F)	Approx. 1.1 V
13	Self-diagnosis control terminal	—	—
14	Power supply	Ignition switch: ON	System voltage
		Ignition switch: OFF	0 V
15	Backup power supply	Ignition switch: OFF	System voltage
16	Earth	Engine: Idling	0 V
17	Stop lamp switch	When brake pedal is depressed	0 V
		When brake pedal is released	System voltage
18	Inhibitor switch (2)	Selector lever position: 2	System voltage
		Selector lever position: Other than 2	0 V

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Terminal No.	Inspection item	Inspection conditions	Standard value
19	Inhibitor switch (L)	Selector lever position: L	System voltage
		Selector lever position: Other than L	0 V
20	Oil temperature warning lamp	When normal	0 V
		Ignition switch: For 5 seconds after turning ON	System voltage
21	Power mode signal	When POWER mode is selected	System voltage
		When mode other than POWER mode is selected	0 V
22	—	—	—
23	—	—	—
24	Engine coolant temperature signal	When engine coolant temperature is 30°C (86°F)	System voltage
		When engine coolant temperature is 80°C (176°F)	0 V
25	Wide open throttle switch	Accelerator pedal: Fully closed	System voltage
		Accelerator pedal: Fully open	0 V
26	Throttle position sensor <Petrol powered vehicles>	Accelerator pedal: Fully closed	0.3–1.0 V
		Accelerator pedal: Fully open	4.4–5.0 V
	Lever position sensor <Diesel powered vehicles>	Accelerator pedal: Fully closed	0.6–1.3 V
		Accelerator pedal: Fully open	4.3–5.0 V

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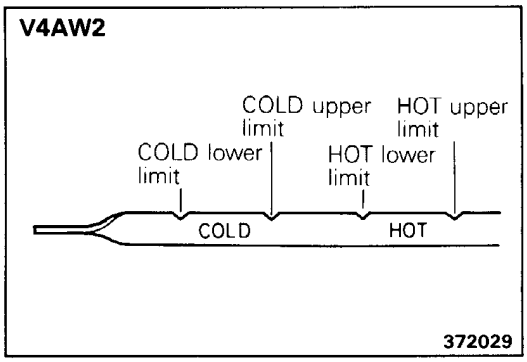
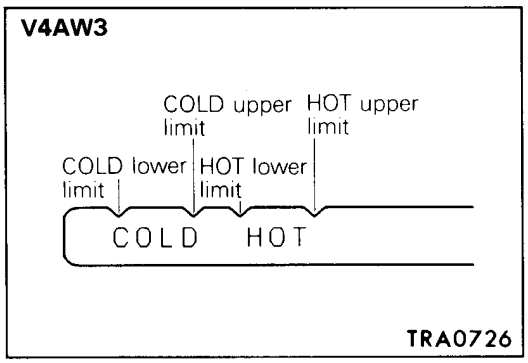
SERVICE ADJUSTMENT PROCEDURES

AUTOMATIC TRANSMISSION FLUID INSPECTION





(1) Place the vehicle on a level surface.
(2) Before removing the dipstick, wipe all dirt form area around the dipstick.
(3) With the selector lever in the "P" position and the parking brake applied, start the engine.
(4) The engine should be running at idle and the transmission should be warmed up sufficiently. [fluid temperature 70–80°C (158–176°F)]
(5) Move the selector lever through all positions to fill the torque converter and hydraulic circuit with fluid. Then place the lever in the "N" position.
(6) Check that fluid level is at oil level gauge "HOT". If fluid level is low, add fluid to "HOT" level.

Transmission fluid: DIA QUEEN ATF-SP or equivalent

NOTE
Low fluid level can allow the oil pump to take in air together with fluid, leading to various troubles. Air trapped in hydraulic circuit forms bubbles which make the fluid spongy. This lowers pressure and shows down pressure buildup. If the transmission has too much fluid, gears churn up foam and cause same conditions as when the fluid level is low, resulting in premature deterioration of ATF. In either case, air bubbles can cause overheating and fluid oxidation and varnishing, which can interfere with normal valve, clutch and servo operation. Foaming can also result in fluid escaping from the transmission vent where it may be mistaken for a fluid leak.

(7) Check fluid condition.

NOTE
When fluid smells burned, it is contaminated with metal bushing or friction material particles and hence a complete overhaul of the transmission is needed. Be sure to examine fluid on the dipstick closely.

(8) After fluid has been checked, insert the dipstick until it is seated fully to seal out water and dirt.

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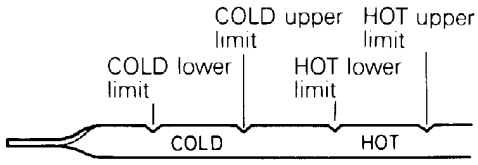
AUTOMATIC TRANSMISSION FLUID CHANGE

Caution
If ATF change is required due to damage to the transmission, be sure to clean the cooler system.

(1) Raise the vehicle on hoist. Place a drain container with large opening under the drain plug (located in bottom of the oil pan).
(2) Remove the drain plug to let ATF drain.
(3) Install the drain plug and new gasket and tighten to 21 Nm (2.1 kgm, 15 ft.lbs.).]

V4AW2



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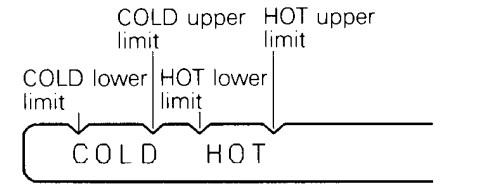
(4) Refill ATF through the oil level gauge hole until its level reached at COLD lower limit of the level gauge.
(5) Start the engine and allow to idle for at least two minutes. Then, with the parking brake and service brake applied, move the selector lever through all positions and finally place in the "N" or "P" position.
(6) After the transmission is warmed up to the normal operating temperature, recheck the fluid level, which must be between the HOT upper limit and HOT lower limit marks.
(7) Insert the dipstick fully to prevent dirt from entering the transmission.

V4AW3



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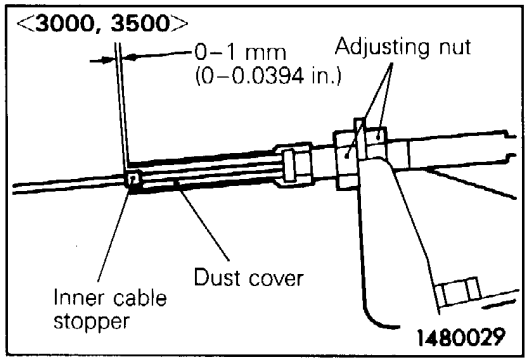
TRANSFER OIL INSPECTION AND CHANGE

Refer to GROUP 22 – Service Adjustment Procedures.

<3000, 3500>



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THROTTLE CABLE CHECK AND ADJUSTMENT

<3000, 3500>

(1) Check for defective or bent throttle lever or throttle cable bracket.
(2) With the accelerator depressed, check to be sure that the distance between the inner cable stopper and dust cover surface is within the standard value.
Standard value: 0–1 mm (0–0.0394 in.)
(3) If outside the standard value, adjust with adjusting nut.

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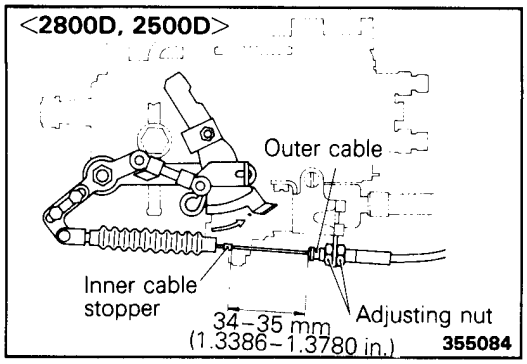


<2500D, 2800D>

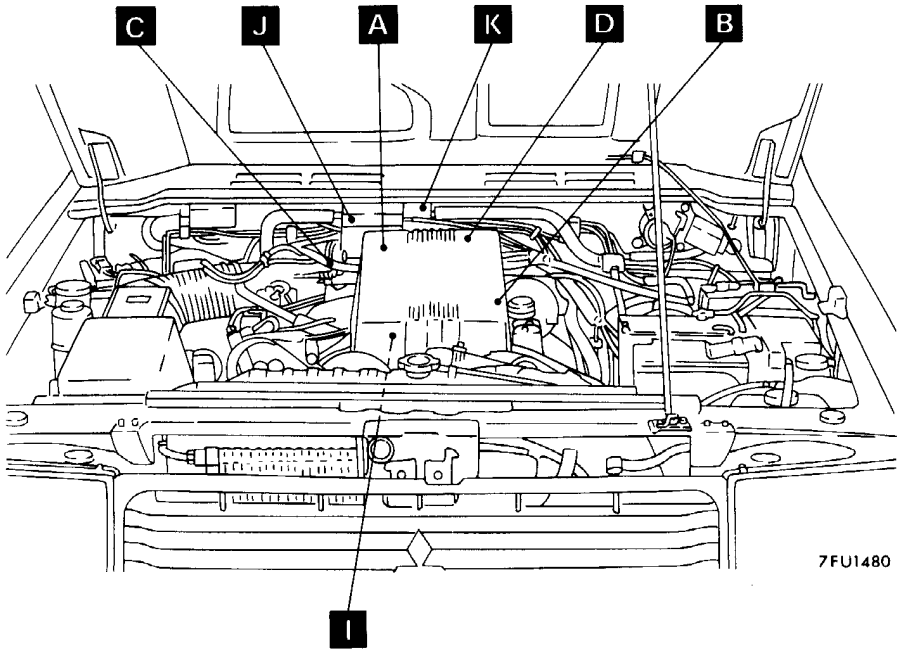
(1) Check for defective or bent throttle lever or throttle cable bracket.
(2) Remove outer cable side of boot to expose inner cable stopper.
(3) Pull throttle lever to fully open throttle valve and check that the distance between the inner cable stopper and outer cable ends is within the standard value.

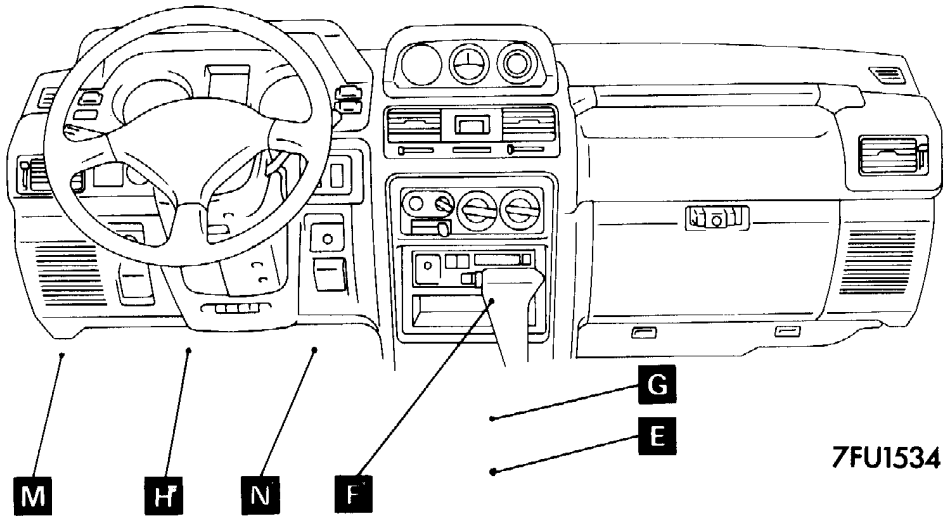
Standard value: 34 – 35 mm (1.3386 – 1.3780 in.)

(4) If outside the standard value, adjust with adjusting nut.

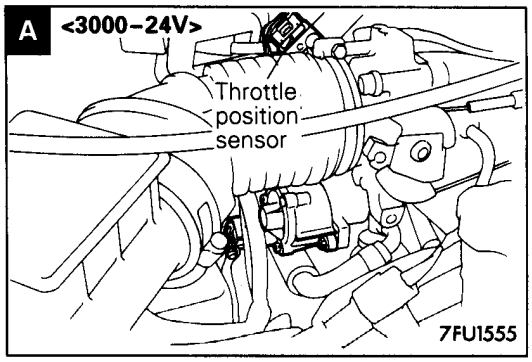
ELC-4A/T CONTROL COMPONENT LOCATION <V4AW3>

Name	Symbol	Name	Symbol
Throttle position sensor <3000–24V, 3500>	A	Stop lamp switch	H
Lever position sensor <2800D>	B	Engine coolant temperature switch	I
Inhibitor switch	C	Oil temperature sensor	J
A/T-speed sensor	D	Solenoid valves	K
Vehicle-speed sensor	E	A/T-ECU	L
Overdrive switch	F	Diagnosis connector	M
Pattern select switch	G	Wide open throttle switch	N

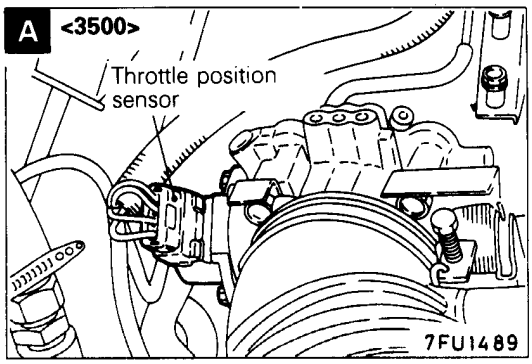




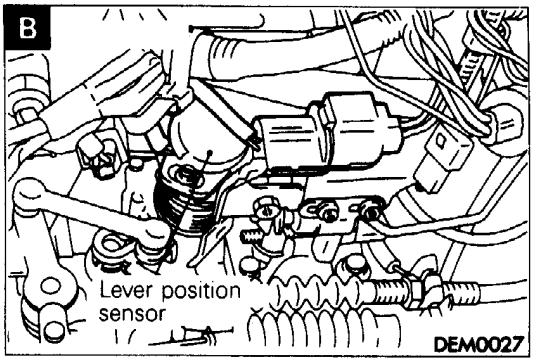
A <3000–24V>



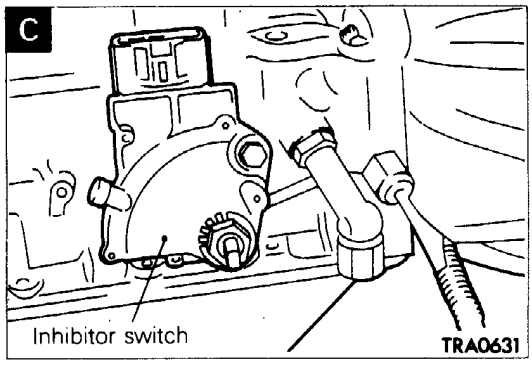
A <3500>



B



C



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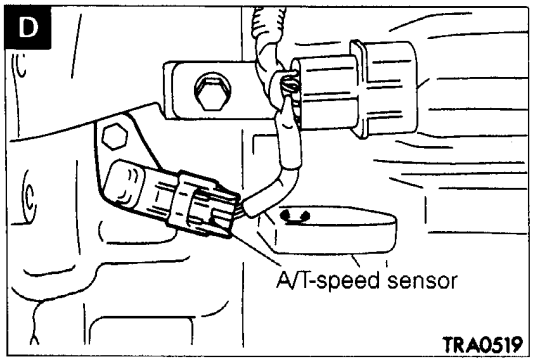

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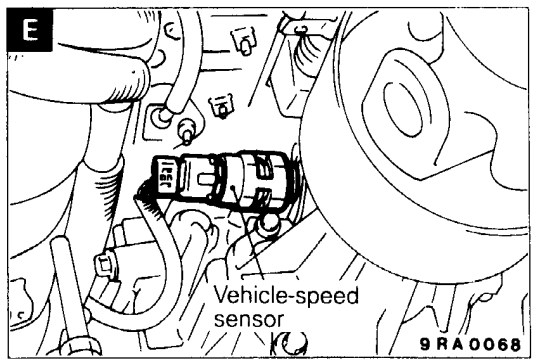

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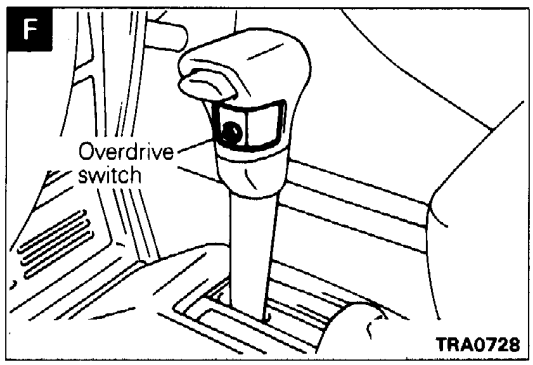

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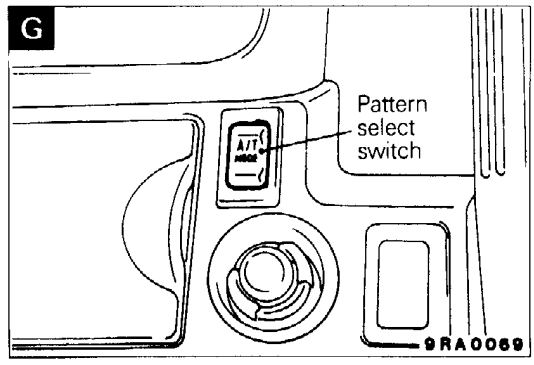

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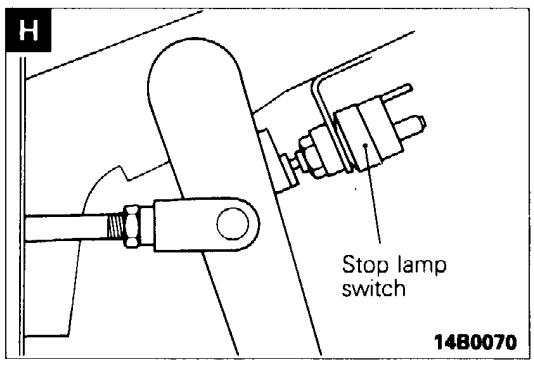

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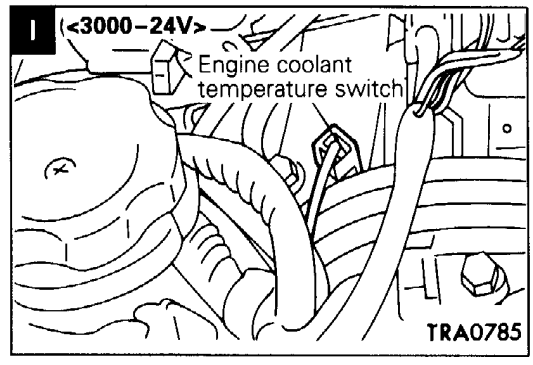

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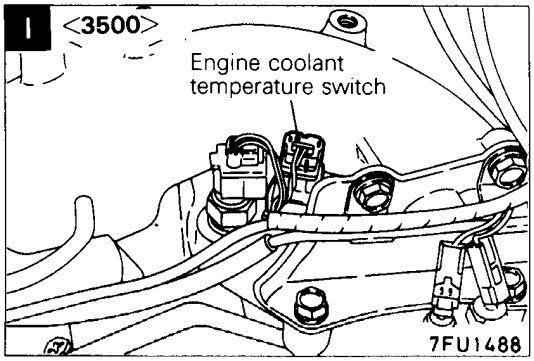
I <3500>



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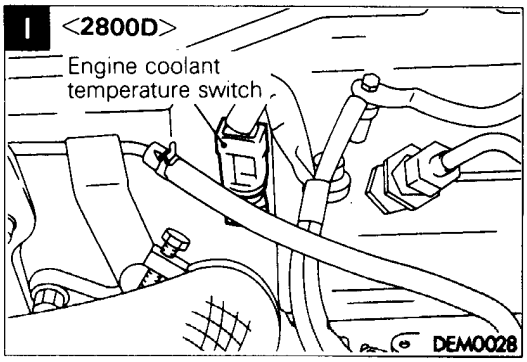

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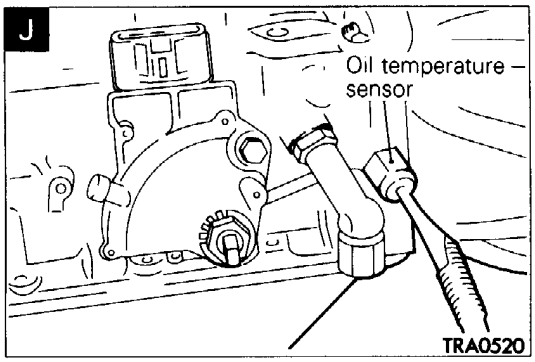

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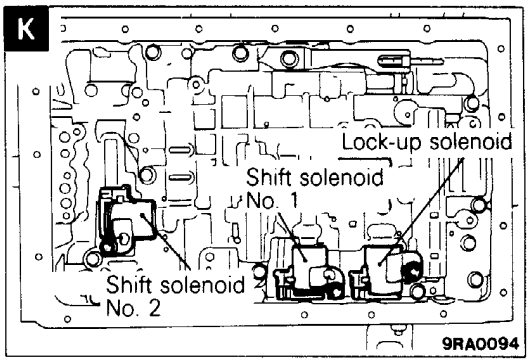

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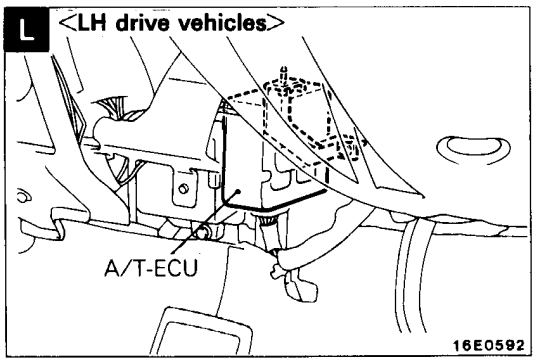

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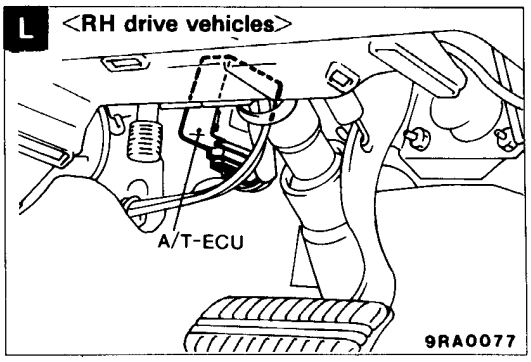

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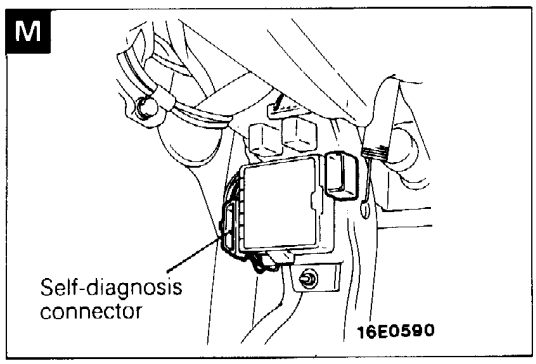

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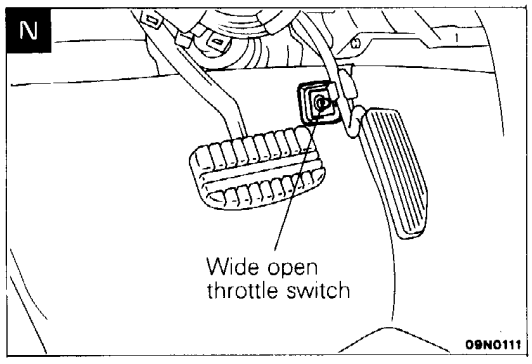


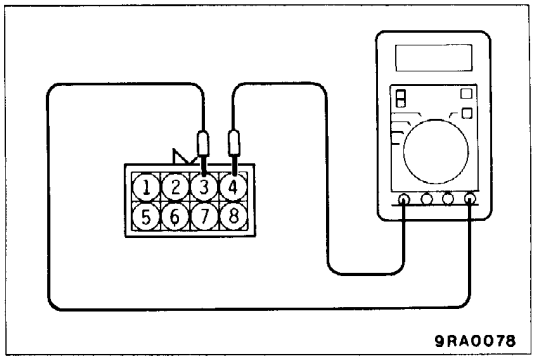
V4AW3 CONTROL COMPONENT INSPECTION

THROTTLE POSITION SENSOR <3000–24V, 3500>

Refer to GROUP 13 – Service Adjustment Procedures.

LEVER POSITION SENSOR <2800D>

Refer to GROUP 13 – Service Adjustment Procedures.



A/T-SPEED SENSOR

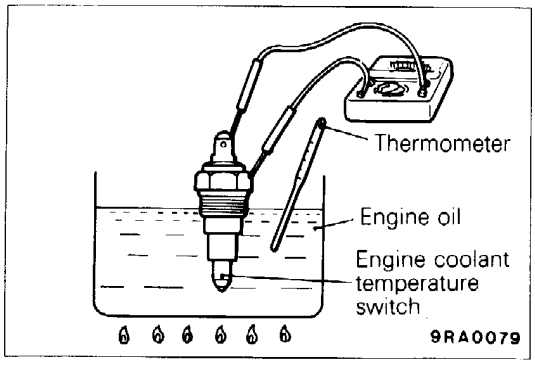
(1) Disconnect the sensor connector.
(2) Measure resistance value between terminal ③ and ④.
Standard value: 620 ± 60 Ω [at 20°C (68°F)]
(3) If outside the standard value, replace the sensor.

VEHICLE-SPEED SENSOR

Refer to GROUP 54 – Service Adjustment Procedures.

STOP LAMP SWITCH

Refer to GROUP 35 – Service Adjustment Procedures.

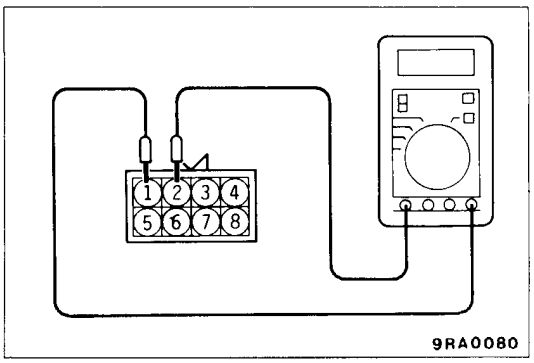


ENGINE COOLANT TEMPERATURE SWITCH

(1) Disconnect the switch connector.
(2) Check continuity between the terminal and the thread part.
Standard value:

Oil temperature	Continuity
30°C (86°F)	No continuity
60°C (140°F)	Continuity

(3) If outside the standard value, replace the switch.



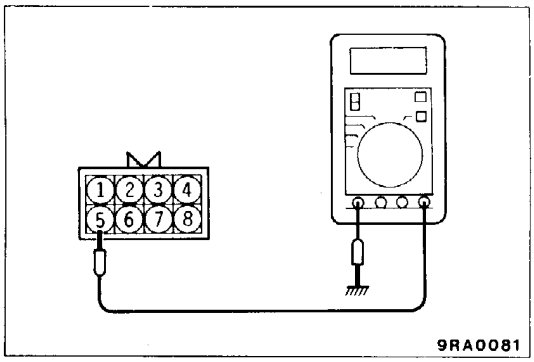
OIL TEMPERATURE SENSOR

(1) Disconnect the sensor connector.
(2) Measure resistance value between terminal ① and ②.

Standard value:

Oil temperature	Resistance value
25°C (77°F)	10 kΩ
120°C (248°F)	615 Ω

(3) If outside the standard value, replace the sensor.

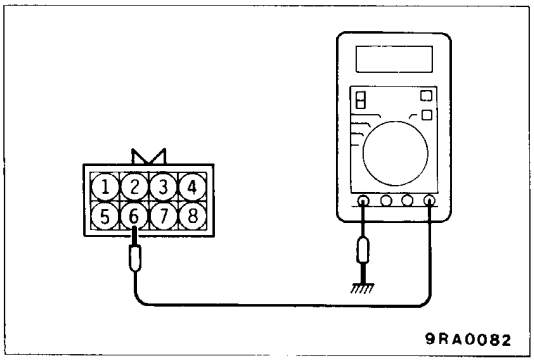


SHIFT CONTROL SOLENOID VALVE NO. 1

(1) Disconnect the solenoid connector.
(2) Measure resistance value between the terminal ⑤ and earth.

Standard value: 13 ± 2 Ω [at 25°C (77°F)]

(3) If outside the standard value, replace the solenoid assembly.

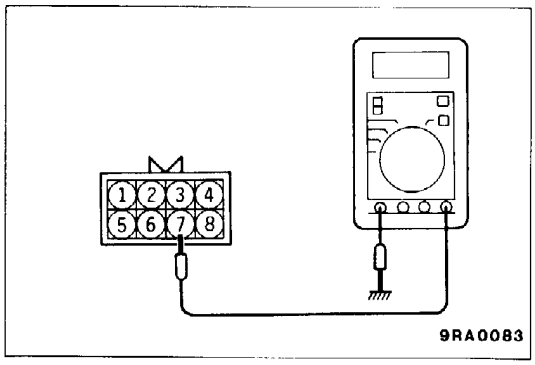


SHIFT CONTROL SOLENOID VALVE NO. 2

(1) Disconnect the solenoid connector.
(2) Measure resistance value between the terminal ⑥ and earth.

Standard value: 13 ± 2 Ω [at 25°C (77°F)]

(3) If outside the standard value, replace the solenoid assembly.



LOCK-UP SOLENOID

(1) Disconnect the solenoid connector.
(2) Measure resistance value between the terminal ⑦ and earth.

Standard value: 13 ± 2 Ω [at 25°C (77°F)]

(3) If outside the standard value, replace the solenoid assembly.

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CONVERTER STALL TEST

In this test, the engine maximum speed when the torque converter stalls with the shift lever in the "D" or "R" range is measured to check operation of the torque converter, starter and one-way clutch and check hlding performance of the transmission clutch (including brake).

Caution
Do not stand in front or at rear of the vehicle during this test.

(1) Check the transmission fluid level. The fluid temperature should be at the level after normal operation [70–80°C (158–176°F)]. The engine coolant temperature should also be at the level after normal operation [80–90°C (176–194°F)].
(2) Apply chocks to the rear wheels (right and left).
(3) Mount an engine tachometer.
(4) Apply fully the parking and service brakes.
(5) Start the engine.
(6) With the selector lever in the "D" range, fully depress the accelerator pedal and read off the engine maximum speed.

Standard value: 2,100–2,400 r/min. <V4AW2>
2,100–2,600 r/min. <V4AW3>

NOTE
When doing so, do not keep the engine running with throttle full open for more than necessary duration (5 seconds or more). If two or more stall tests are needed, place the selector lever in the "N" position and run the engine at about 1,000 r/min to allow the transmission fluid to cool before another stall test.

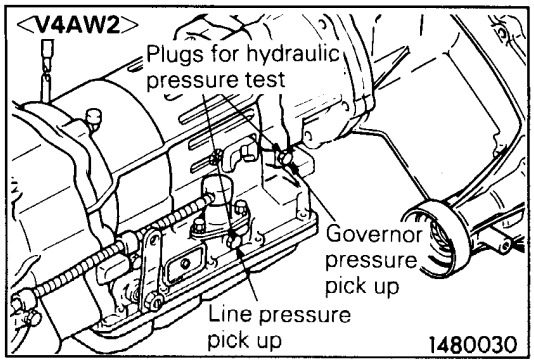
(7) Place the selector lever in the "R" range and perform the test as above.

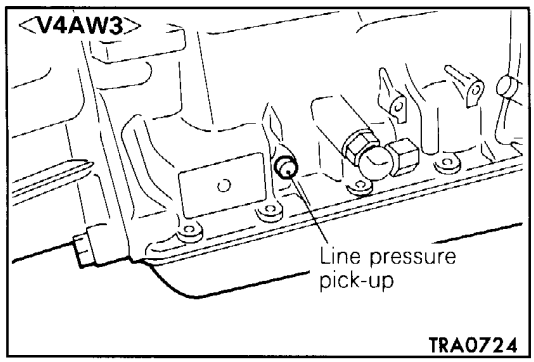
JUDGEMENT OF STALL TEST RESULTS
<V4AW2>

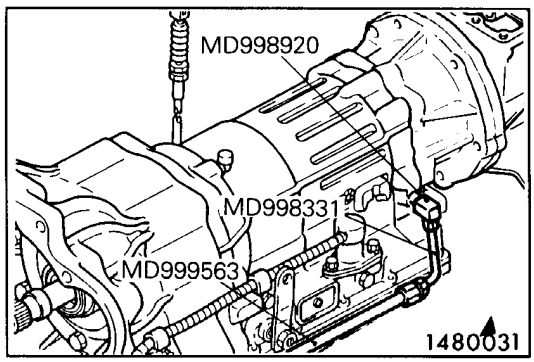
Stall speed in "D" and "R" range is equal to each other but lower than the nominal value.	(1) Engine output is low (2) Starter one-way clutch is faulty. (Faulty torque converter is suspected if it is lower than nominal by more than 600 r/min.)
Stall speed in "D" range is higher than nominal.	(1) O.D. clutch slipping. (2) O.D. one-way clutch faulty (3) Forward clutch slipping (4) One-way clutch No. 2 faulty (5) Low line pressure
Stall speed in "R" range is higher than nominal.	(1) O.D. clutch slipping. (2) O.D. one-way clutch faulty (3) Direct clutch slipping (4) Brake No. 3 slipping (5) Low line pressure

<V4AW3>

Stall speeds in each range are equal to each other but are lower than the standard value.	(1) Throttle valve is not fully open (2) Insufficient engine output (3) Malfunction of stator one-way clutch (Malfunction of torque converter could be the problem if the stall speed is lower than the standard value by 600 r/min or more)
Stall speeds in each range are equal to each other but are higher than the standard value.	(1) Low line pressure (2) Fluid level is not at standard level (insufficient fluid) (3) Malfunction of O.D. one-way clutch
Stall speed in D range is higher than the standard value	(1) Forward clutch slippage (2) Malfunction of O.D. one-way clutch (3) Malfunction of one-way clutch No. 2 (4) Low line pressure
Stall speed in R range is higher than the standard value	(1) Direct clutch slippage (2) 1st & reverse brake slippage (3) Low line pressure (4) Malfunction of O.D. one-way clutch







HYDRAULIC PRESSURE TEST

The hydraulic pressure tests (governor pressure and line pressure tests) are important in determining the causes of transmission failures. Before conducting these tests, fluid level and condition and throttle cable adjustment, etc. must be checked for defects or abnormalities. When conducting the tests, the engine and transmission should be at correct operating temperatures, [engine coolant 80–90°C (176–194°F), transmission fluid 70–80°C (158–176°F)].

GOVERNOR PRESSURE TEST <V4AW2 only>

(1) Place vehicle on a chassis dynamometer.
(2) Remove plug from governor pressure take off port.
(3) Install special tool as shown in figure and place the meter inside vehicles.
(4) Apply parking brake.
(5) Start engine.
(6) Release parking brakes.
(7) Shift to D and measure governor pressure at each output shaft r/min.

Standard value:

<V4AW2-3-O>

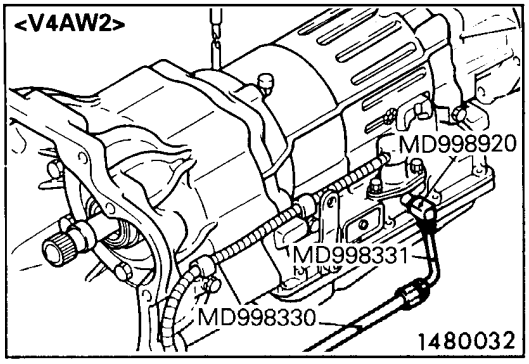
Output shaft speed (r/min)	Governor pressure kPa (kg/cm^2, psi)
1,000	110–140 (1.1–1.4, 15.6–19.9)
2,000	220–240 (2.2–2.4, 31.3–34.1)
3,200	410–470 (4.1–4.7, 58.3–66.8)

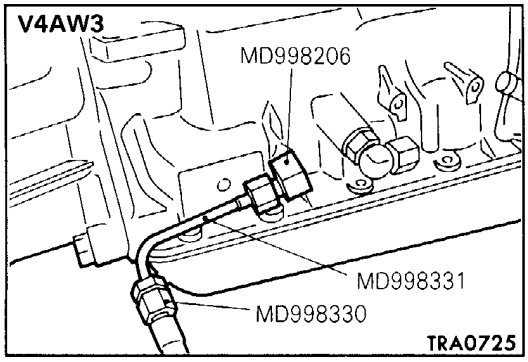
<V4AW2-3-L>

Output shaft speed (r/min)	Governor pressure kPa (kg/cm^2, psi)
1,000	140–170 (1.4–1.7, 19.9–24.2)
2,000	250–290 (2.5–2.9, 35.6–41.2)
3,200	410–470 (4.1–4.7, 58.3–66.8)

JUDGEMENT BY GOVERNOR PRESSURE

Governor pressure is not within the standard value	• Line pressure malfunction • Oil leak in governor circuit • Governor malfunction





LINE PRESSURE TEST

(1) Place the vehicle on a chassis dynamometer.
(2) Remove the plug from the line pressure take off port.
(3) Install special tool as shown in the figure and place the meter inside vehicle.
(4) Apply the parking brake.
(5) Start the engine.
(6) Place the selector lever in the "D" range.
(7) Depress the brake pedal firmly by the left foot and operates the accelerator pedal by the right foot to measure the line pressure at each engine rpm. If the measured pressure is not nominal, check adjustment of the throttle cable and readjust if necessary before conducting the test again.
(8) Place the selector lever in the "R" range and test as above. When measuring the hydraulic pressure for reverse, change the oil-pressure gauge to 3,000 kPa (30 kg/cm^2, 427 psi).

Standard value:

<V4AW2-2500D>

Items	Line pressure kPa (kg/cm^2, psi)	
	"D" range	"R" range
At idle	450–510 (4.5–5.1, 64–72.5)	620–700 (6.2–7.0, 88.2–99.5)
At stall	1,120–1,320 (1.12–13.2, 159.3–187.7)	1,500–1,900 (15–19, 213.3–270.2)

<V4AW2-3000-12V>

Items	Line pressure kPa (kg/cm^2, psi)	
	"D" range	"R" range
At idle	520–600 (5.2–6.0, 74–85)	790–910 (7.9–9.1, 112–129)
At stall	1,100–1,300 (11–13, 156–185)	1,600–2,000 (16–20, 228–284)

<V4AW3-3000-24V, 3500>

Items	Line pressure kPa (kg/cm^2, psi)	
	"D" range	"R" range
At idle	430–490 (4.3–4.9, 61–70)	520–620 (5.2–6.2, 74–88)
At stall	1,140–1,390 (11.4–13.9, 162–198)	1,400–1,750 (14.0–17.5, 199–249)

<V4AW3-2800D>

Items	Line pressure kPa (kg/cm^2, psi)	
	"D" range	"R" range
At idle	430–490 (4.3–4.9, 61–70)	530–630 (5.3–6.3, 75–90)
At stall	1,350–1,600 (13.5–16.0, 192–228)	1,670–2,020 (16.7–20.2, 238–287)

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JUDGEMENT BY LINE PRESSURE

<V4AW2>

Hydraulic pressure higher than nominal in all ranges	(1) Regulator valve faulty (2) Throttle valve faulty (3) Throttle control cable incorrectly adjusted
Hydraulic pressure lower than nominal in all ranges	(1) Oil pump faulty (2) Rgulator valve faulty (3) Throttle valve faulty (4) Throttle control cable incorrectly adjusted (5) O.D. clutch faulty
Hydraulic pressure lower than nominal in "D" range	(1) Large fluid leaks in "D" range hydraulic circuit (2) Forward clutch faulty (3) O.D. clutch faulty
Hydraulic pressure lower than nominal in "R" range	(1) Large fluid leaks in "R" range hydraulic circuit (2) Brake No. 3 faulty (3) Direct clutch faulty (4) O.D. clutch faulty

<V4AW3>

Hydraulic pressure in all ranges is higher than the standard value	(1) Malfunction of regulator valve (2) Malfunction of throttle valve (3) Incorrect throttle cable adjustment
Hydraulic pressure in all ranges is lower than the standard value	(1) Malfunction of oil pump (2) Malfunction of regulator valve (3) Malfunction of throttle valve (4) Incorrect throttle cable adjustment (5) Malfunction of O.D. direct clutch
Hydraulic pressure in D range is lower than the standard value	(1) Large fluid leaks in D range hydraulic circuit (2) Malfunction of forward clutch (3) Malfunction of O.D. direct clutch
Hydraulic pressure in R range is lower than the standard value	(1) Large fluid leaks in R range hydraulic circuit (2) Malfunction of 1st & reverse brake (3) Malfunction of direct clutch (4) Malfunction of O.D. direct clutch

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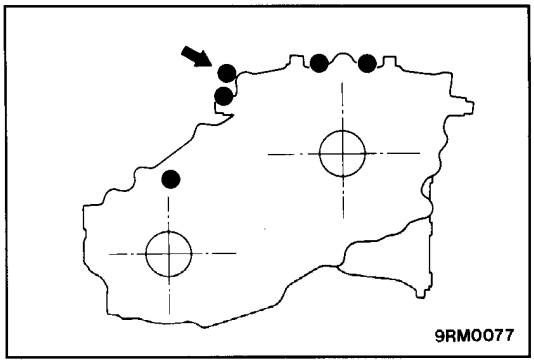
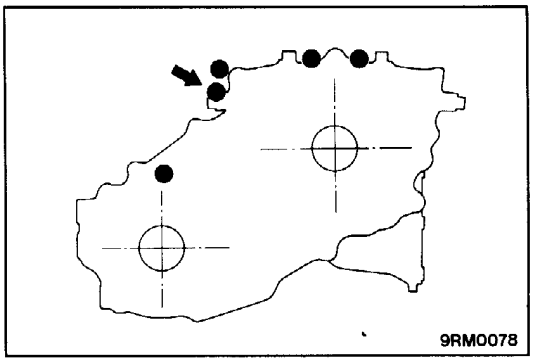


CENTRE DIFFERENTIAL LOCK DETECTION SWITCH CHECK

E22FFAA

Check the continuity between the brown connector terminal on the side of the transfer case and the transfer case.

Transfer control lever position	Continuity
4H	No continuity
4HLc	Continuity

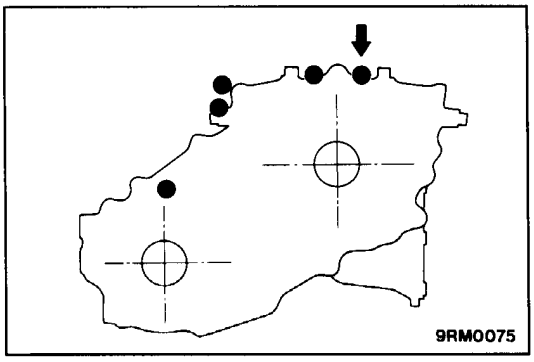


2WD/4WD DETECTION SWITCH CHECK

E22FGAA

Check the continuity between the black connector terminal on the side of the transfer case and the transfer case.

Transfer control lever position	Continuity
2H	Continuity
4H	No continuity

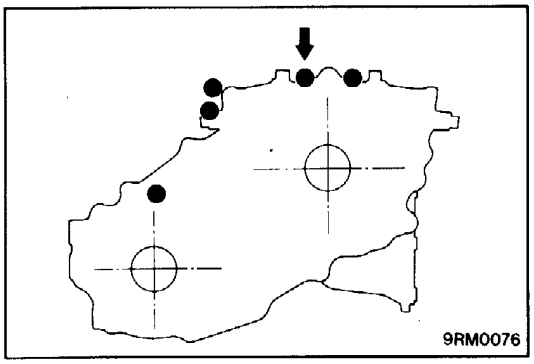


CENTRE DIFFERENTIAL LOCK OPERATION DETECTION SWITCH CHECK

E22FHAA

Check the continuity between the brown connector terminal on the top of the transfer case and the transfer case.

Transfer control lever position	Continuity
4H	No continuity
4HLc	Continuity

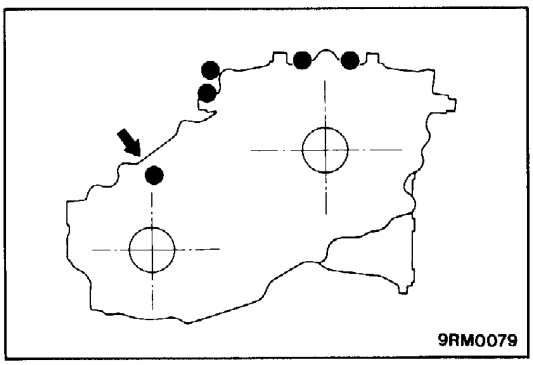


4WD OPERATION DETECTION SWITCH CHECK

E22FIAA

Check the continuity between the black connector terminal on the top of the transfer case and the transfer case.

Transfer control lever position	Continuity
2H	No continuity
4H	Continuity



HI/LO DETECTION SWITCH CHECK

E22FJAA

Check the continuity between the white connector terminal on the side of the transfer case and the transfer case.

Transfer control lever position	Continuity
4HLc	Continuity
N (between 4HLc and 4LLc)	No continuity
4LLc	Continuity

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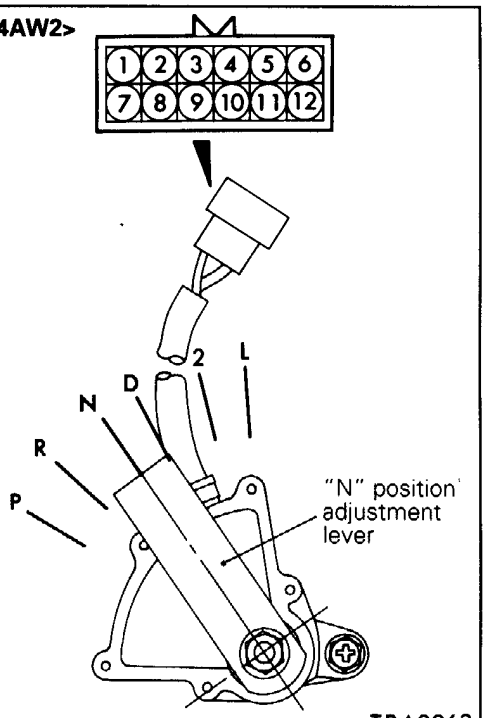
<V4AW2>



TRA0263

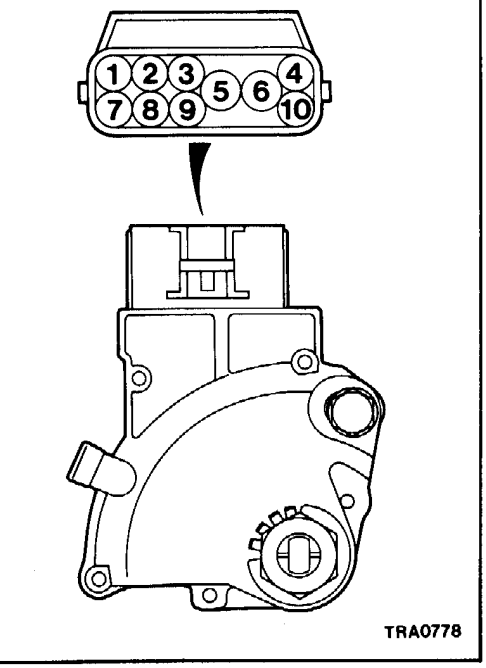
INHIBITOR SWITCH CHECK

E23FYAA

<V4AW2>

Item	Terminal No.								
	1	2	3	4	5	6	7	9	12
P						○	○	○	○
R					○			○	
N				○			○	○	○
D			○					○	
2	○							○	
L		○						○	

<V4AW3>



TRA0778

<V4AW3>

Item	Terminal No.								
	1	2	3	5	6	7	8	9	10
P	○			○	○				○
R	○							○	
N	○			○	○	○			
D	○						○		
2	○		○						
L	○	○							

NOTE

○—○ indicate that there is a continuity between the terminals.

NOTES

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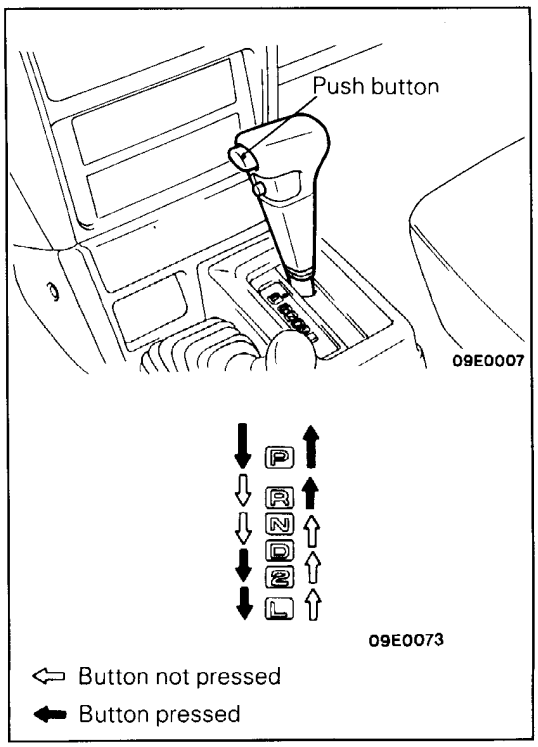
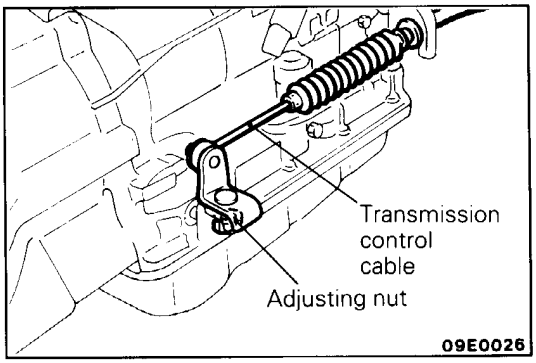


SELECTOR LEVER OPERATION CHECK E23FOAB

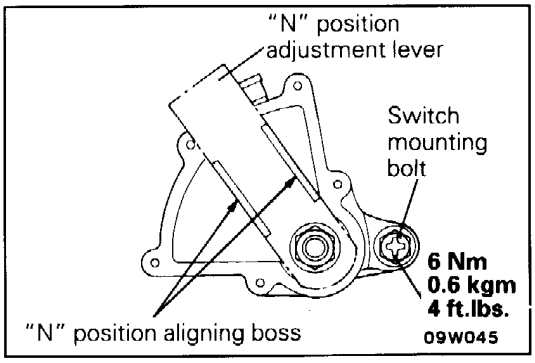
1. Shift selector lever to each range and check that lever moves smoothly and is controled. Check that position indicator is correct.
2. Check to be sure the selector lever can be shifted to each position (by button operation as shown in the illustration).
3. Start the engine and check if the vehicle moves forward when the selector lever is shifted from N to D, and moves backward when shifted to R.
4. When the shift lever malfunctions, adjust control cable and selector lever sleeve. Check for worn shift lever assembly sliding parts.



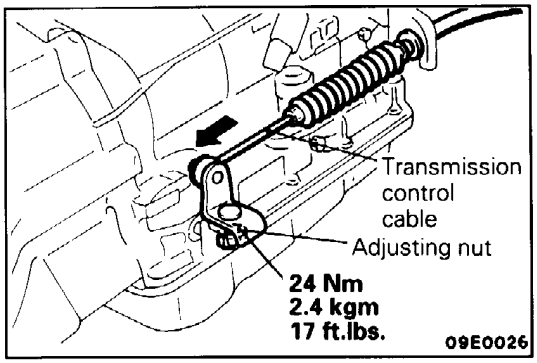
ADJUSTMENT OF INHIBITOR SWITCH AND CONTROL CABLE E23FOAH

INHIBITOR SWITCH

(1) Move the selector lever to the "N" position.
(2) Loosen the adjusting nut of the control cable.



(3) Loosen the inhibitor switch mounting bolt.
(4) Adjust by turning the inhibitor switch so that the bosses for aligning the "N" position on the inhibitor switch are aligned with the "N" position adjustment lever.
(5) Tighten the inhibitor switch mounting bolt to the specified torque.



(6) Gently pull the end of the transmission control cable in the direction of the arrow and tighten the adjusting nut to the specified torque.
(7) Check that the selector lever is in the "N" position.
(8) Check that each range on the transmission side operates and functions correctly for each position of the selector lever.

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CONTROL CABLE

Whether control cable is properly adjusted can be confirmed by checking whether inhibitor switch is performing well.

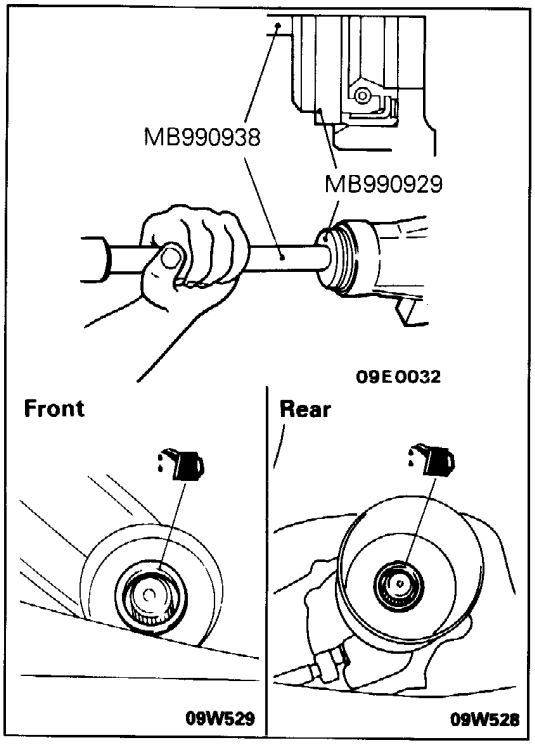
1. Apply parking brakes and service brakes securely.
2. Place selector lever to "R" range.
3. Set ignition key to "ST" position.
4. Slowly move the selector lever upward until it clicks as it fits in notch of "P" range. If starter motor operates when lever makes a click, "P" position is correct.
5. Then slowly move selector lever to "N" range by the same procedure as in foregoing paragraph. If starter motor operates when selector lever fits in "N", "N" position is correct.
6. Also check to be sure the vehicle doesn't begin to move and the lever doesn't stop between P-R-N-D.
7. The control cable is properly adjusted if, as described above, the starter motor starts at both the "P" range and the "N" range.

4WD INDICATOR CONTROL UNIT CHECK E23FKAA

Refer to GROUP 22–Service Adjustment Procedures.

SPEEDOMETER CABLE REPLACEMENT E23FPAD

Refer to GROUP 22–Service Adjustment Procedures.



TRANSFER OIL SEALS REPLACEMENT E22FAAF

1. Disconnect the propeller shaft from the transfer. (Refer to GROUP 25–Propeller Shaft.)
2. Using a flat-tip (–) screwdriver, remove the oil seal.
3. Using the special tool, tap the transfer oil seal into the transfer. Note in illustration the direction of installation of transfer oil seal.
4. Apply a coating of the transmission oil to the lip of the oil seal.

Transmission oil:
Hypoid gear oil API GL-4, SAE 75W-90 or 75W-85W

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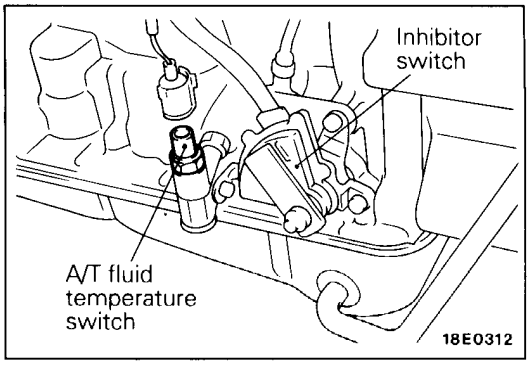
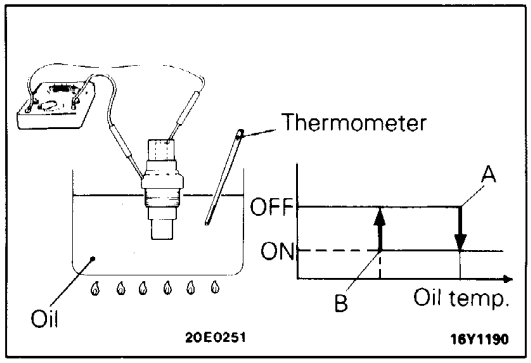


AUTOMATIC TRANSMISSION FLUID TEMPERATURE SWITCH CHECK

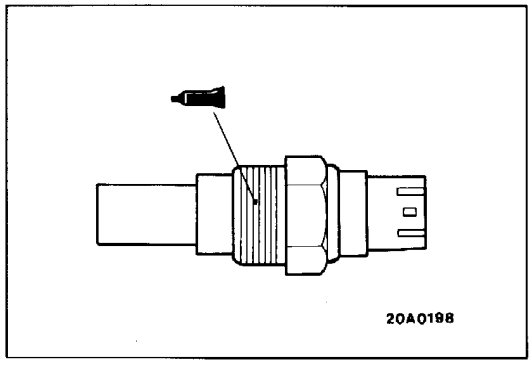
1. Remove the automatic transmission fluid temperature switch from the automatic transmission.

Caution
Use care to prevent foreign subject from entering the automatic transmission fluid temperature switch mounting hole.



2. Immerse the automatic transmission fluid temperature switch in fluid up to the threaded portion as shown in the illustration.
3. Use a circuit tester or the like to check continuity when oil temperature changes.
   The switch is judged good if the conditions are in the following ranges.

Item	Temperature °C (°F)
Continuity is present (temperature at point A)	143–151 (289–304)
No continuity is present (temperature at point B)	125 (257) or less



4. Apply recommended sealant sparingly to the thread of automatic transmission fluid temperature switch.
   (Models not equipped with O-ring in the sensor mounting hole)

   Specified sealant: 3M ATD Part No. 8660 or equivalent
5. Install the automatic transmission fluid temperature switch.

   Tightening torque: 30 Nm (3.0 kgm, 22 ft.lbs.)
6. Check automatic transmission fluid for quantity.

NOTES

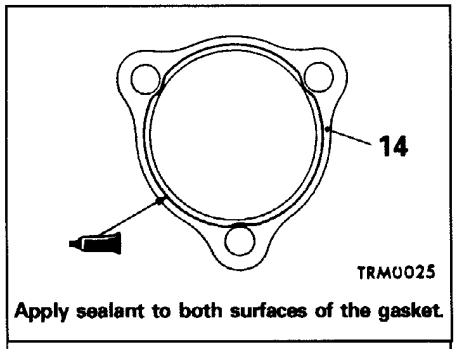
TRANSMISSION CONTROL

E23IA--

REMOVAL AND INSTALLATION

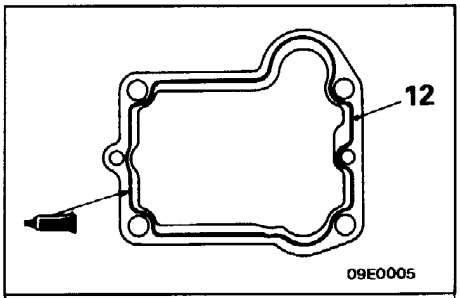
<L.H. drive vehicles>

Pre-removal and Post-installation Operation
- Removal and Installation of Front Console Assembly (Refer to GROUP 52–Floor Console.)

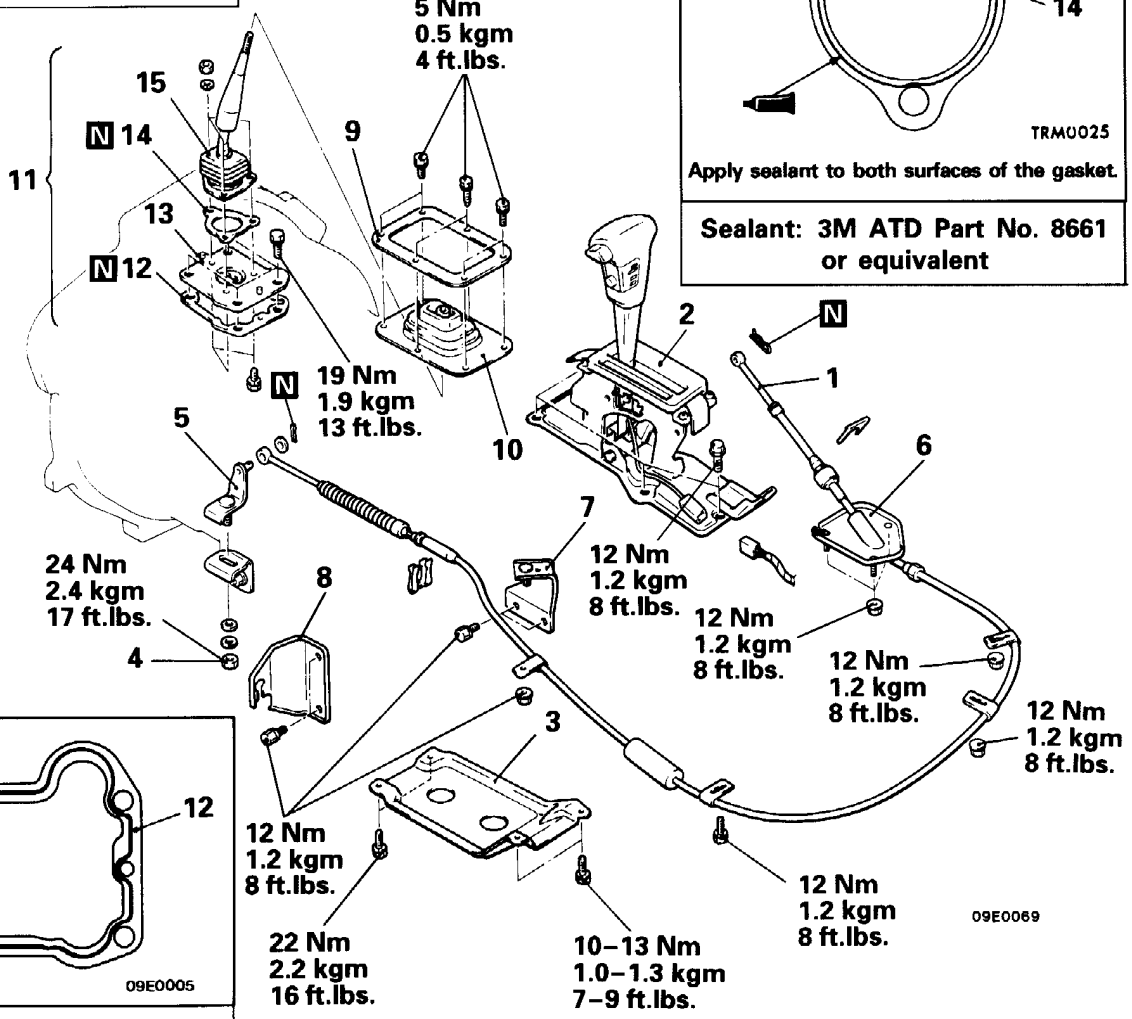


Apply sealant to both surfaces of the gasket.

Sealant: 3M ATD Part No. 8661 or equivalent



Sealant: 3M ATD Part No. 8661 or equivalent



Selector lever assembly removal steps

1. Connection for transmission control cable assembly (selector lever assembly side)
2. Selector lever assembly

Transmission control removal steps

1. Connection for transmission control cable assembly (selector lever assembly side)
3. Transfer case protector
4. Connection for transmission control cable assembly (transmission side)
5. Upper lever
6. Transmission control cable assembly
7. Cable bracket
8. Cable end bracket

Transfer control lever assembly removal steps

9. Retainer
10. Control lever boot
11. Transfer control lever assembly
12. Gasket
13. Stopper plate
14. Gasket
15. Transfer control lever

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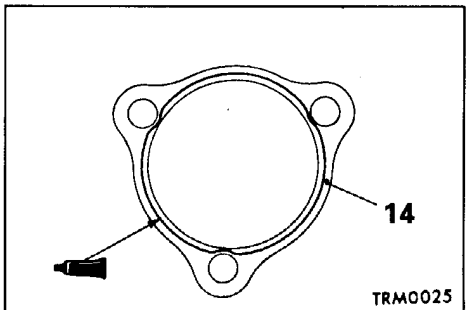
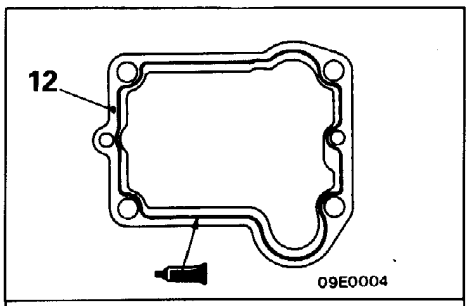
<R.H. drive vehicles>

Pre-removal and Post-installation Operation
- Removal and Installation of Front Console Assembly (Refer to GROUP 52–Floor Consle.)

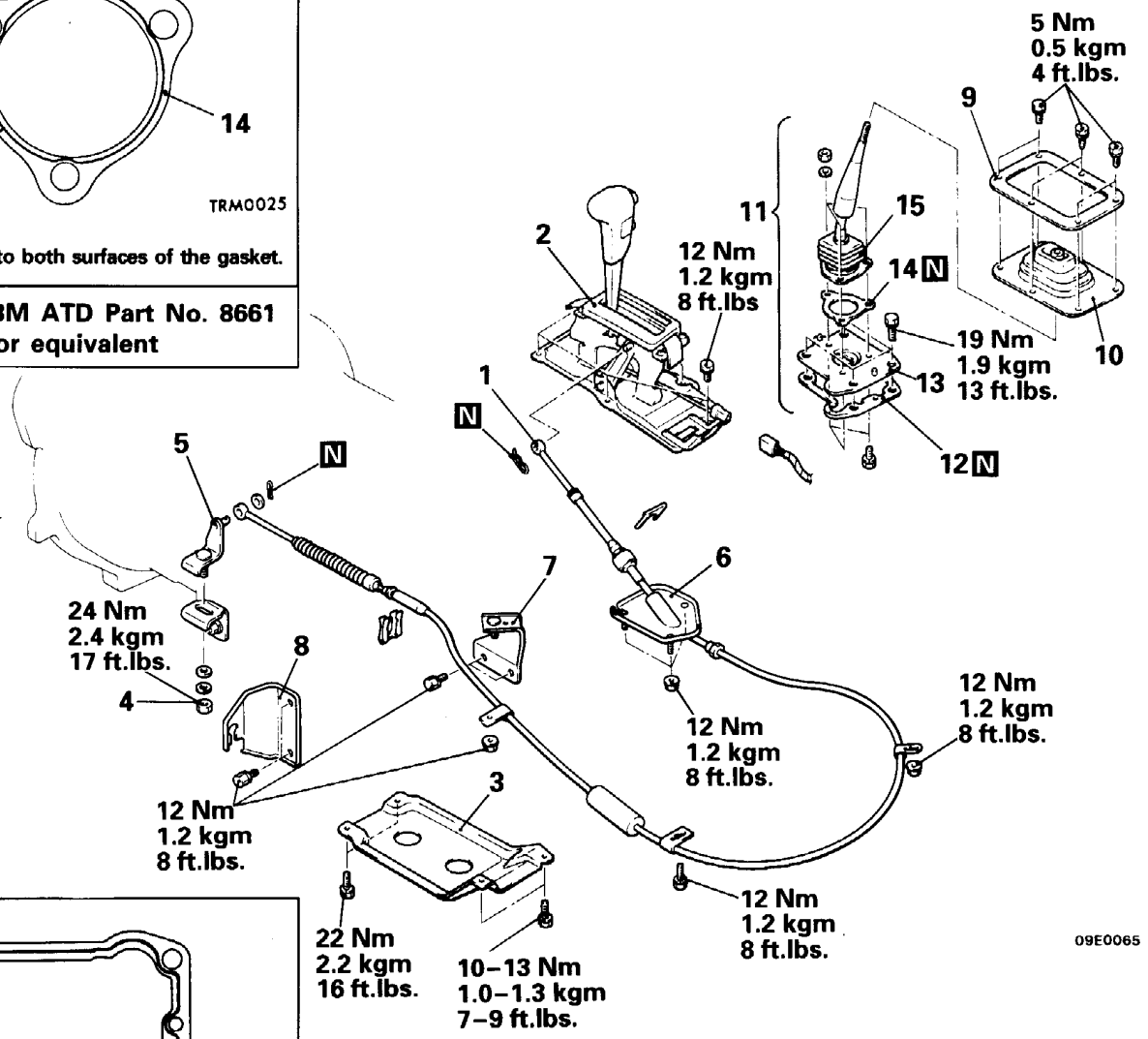


Apply sealant to both surfaces of the gasket.

Sealant: 3M ATD Part No. 8661 or equivalent



Sealant: 3M ATD Part No. 8661 or equivalent



Selector lever assembly removal steps

1. Connection for transmission control cable assembly (selector lever assembly side)
2. Selector lever assembly

Transmission control removal steps

1. Connection for transmission control cable assembly (selector lever assembly side)
3. Transfer case protector
4. Connection for transmission control cable assembly (transmission side)
5. Upper lever
6. Transmission control cable assembly
7. Cable bracket
8. Cable end bracket

Transfer control lever assembly removal steps

9. Retainer
10. Control lever boot
11. Transfer control lever assembly
12. Gasket
13. Stopper plate
14. Gasket
15. Transfer control lever

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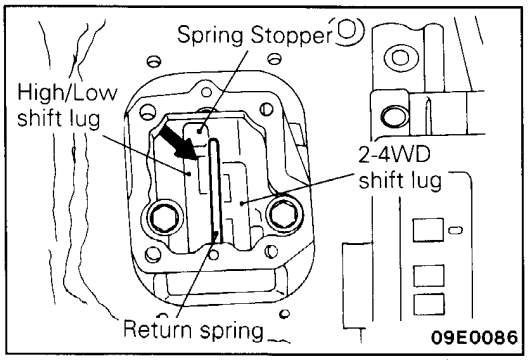
SERVICE POINTS OF REMOVAL E23IBAE

11. REMOVAL OF TRANSFER CONTROL LEVER ASSEMBLY

When removing the transfer control lever assembly, move the transfer control lever to the 2H (2 wheel drive-high range) position.

INSPECTION E23ICAJ

- Check the transmission control cable assembly for function and for damage.

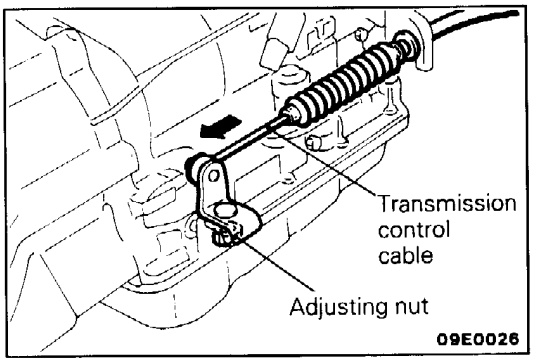


SERVICE POINTS OF INSTALLATION E23IDAK

11. INSTALLATION OF TRANSFER CONTROL LEVER ASSEMBLY

(1) Remove the adhesive sticking to the transfer control lever assembly mounting bolts.
(2) Use a tap (M8 × 1.25) to remove the adhesive sticking to the transfer control lever assembly installation holes.
(3) Check to be sure that the return spring is set to the spring stopper of the 2-4WD shift lug, and then install the control lever in the position shown by the arrow (⬅).
(4) Apply specified adhesive to the threads of the lever assembly mounting bolts, and then tighten the transfer control lever.

Specified adhesive: 3M Stud Locking No. 4710 or equivalent



1. INSTALLATION OF TRANSMISSION CONTROL CABLE ASSEMBLY (SELECTOR LEVER ASSEMBLY SIDE)

After installing the transmission control cable, adjust it by the following procedure.

(1) Move the selector lever to the "N" position.
(2) Loosen the adjusting nut, gently pull the end of the transmission control cable in the direction of the arrow and then tighten the adjusting nut.

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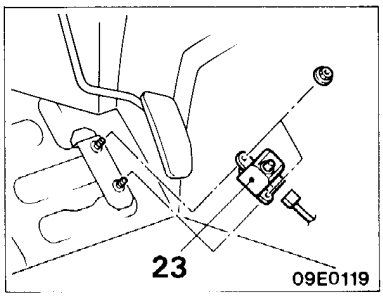
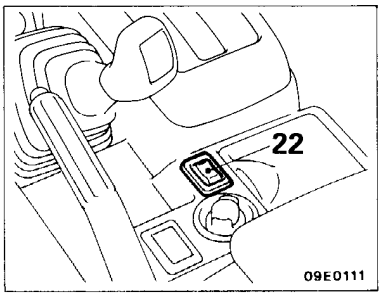
SELECTOR LEVER ASSEMBLY

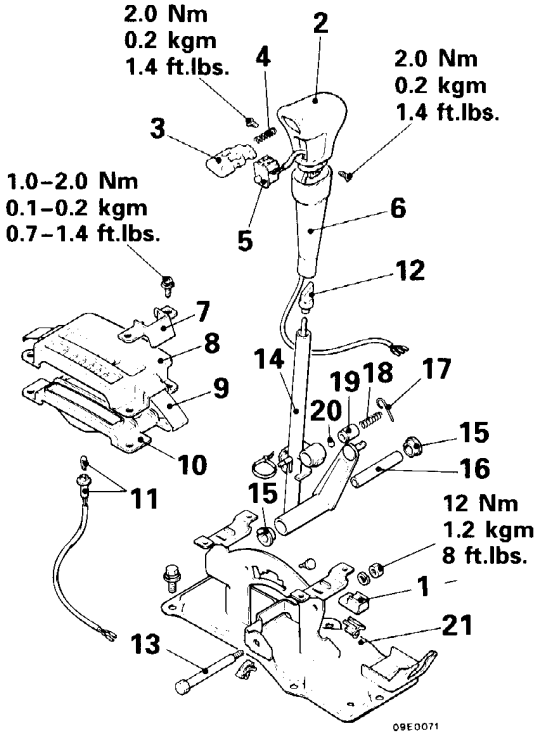
E23NA--

DISASSEMBLY AND REASSEMBLY

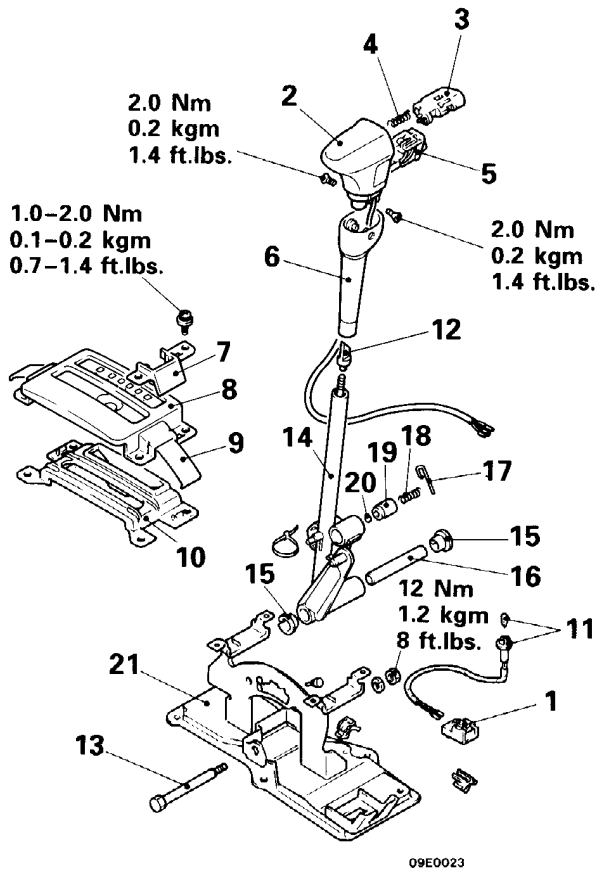




<L.H. drive vehicles>

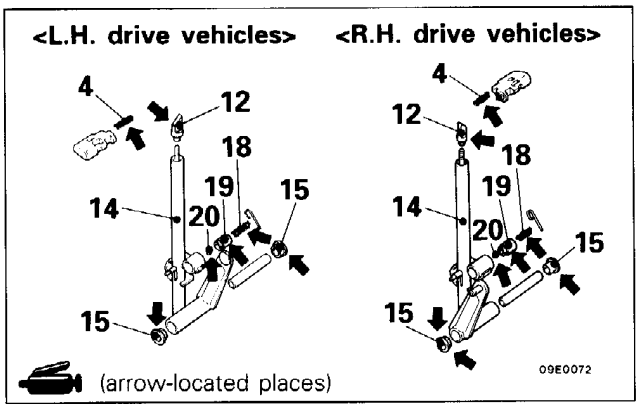


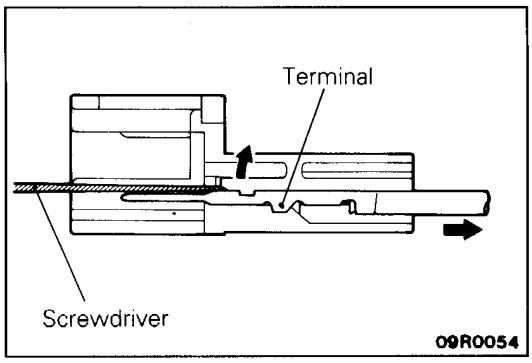
<R.H. drive vehicles>



Removal steps

- ◆◆ 1. Overdrive switch/position lamp switch connector case
- ◆◆ 2. Selector knob
- 3. Push button
- 4. Spring
- ◆◆ 5. Overdrive switch
- 6. Knob cover
- 7. Guide
- 8. Upper panel
- 9. Slider
- 10. Lower panel
- 11. Position indicator lamp assembly
- ◆◆ 12. Sleeve
- 13. Bolt
- 14. Selector lever assembly
- 15. Bushing
- 16. Pipe
- 17. Pin
- 18. Spring
- 19. Support
- 20. Steel ball
- 21. Bracket assembly
- 22. Pattern select switch } <V4AW3>
- 23. Wide open throttle switch }

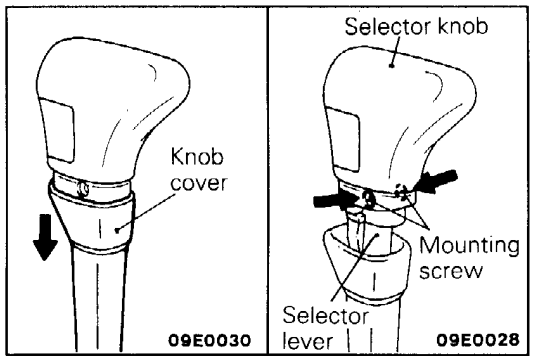




SERVICE POINTS OF DISASSEMBLY E23NBAB

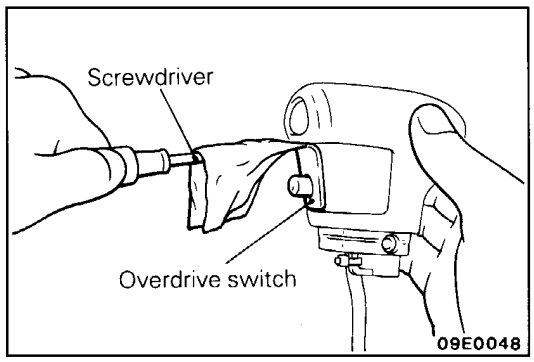
1. REMOVAL OF OVERDRIVE SWITCH/POSITION LAMP CONNECTOR CASE

Use a minus screwdriver or similar to remove the overdrive switch/position lamp connector case from the terminal.



2. REMOVAL OF SELECTOR KNOB

(1) Press the knob cover downwards.
(2) Remove the front and back mounting screws and remove the selector knob from the selector lever.



5. REMOVAL OF OVERDRIVE SWITCH

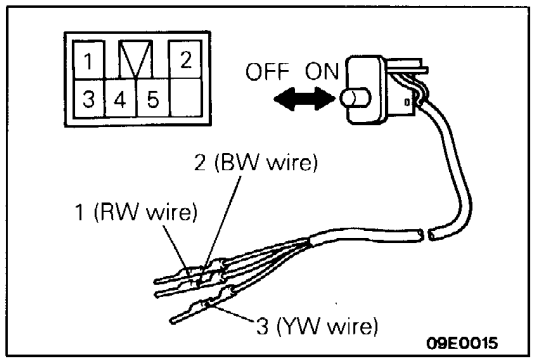
Use a minus screwdriver or similar to remove the overdrive switch.

INSPECTION E23NCAB

- Check the detent plate for wear.
- Check the bushing for wear or damage.
- Check the spring for damage or deterioration.

OVERDRIVE SWITCH

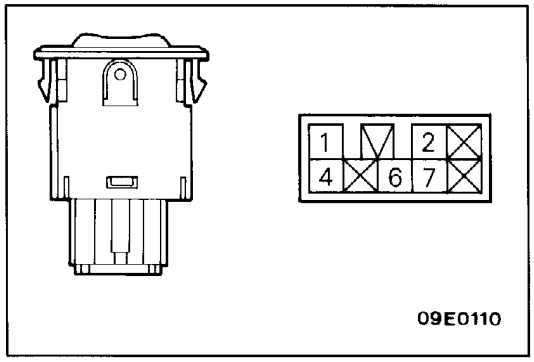
Check for continuity between terminals when the switch is OFF and when ON.



Switch position \ Terminal	3	4	5
OD ON	○		○
OD OFF	○	○	

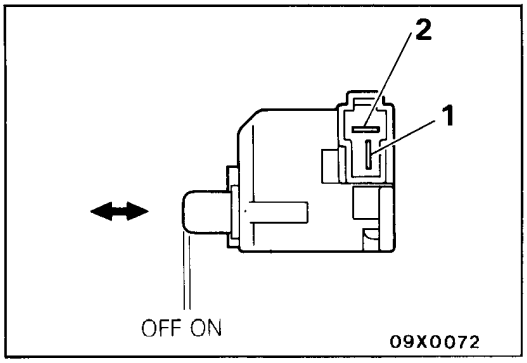
NOTE
○—○ Indicate that there is continuity between the terminals.

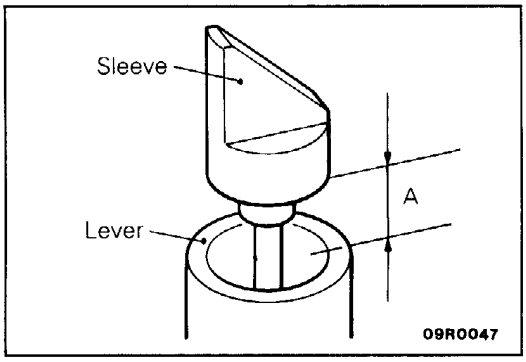
PATTERN SELECT SWITCH <V4AW3>



Switch position \ Terminal	1	2	6	4		7
HOLD	○	○				
POWER	○		○	○	◎	○

NOTE
○—○ indicates that there is continuity between the terminals.





WIDE OPEN THROTTLE SWITCH

Check for continuity between terminals when the switch is off and when ON.

	1	2
ON	○———	———○
OFF		

NOTE
○–○ indicates that there is continuity between the terminals.

SERVICE POINTS OF REASSEMBLY E23NDAB

12. INSTALLATION OF SLEEVE

Move the selector lever to the "N" position and adjust the sleeve by turning it so that the distance A between the sleeve and the tip of the lever is at the standard value.

Standard value (A): 18.2–18.9 mm (0.717–0.744 in.)

NOTES

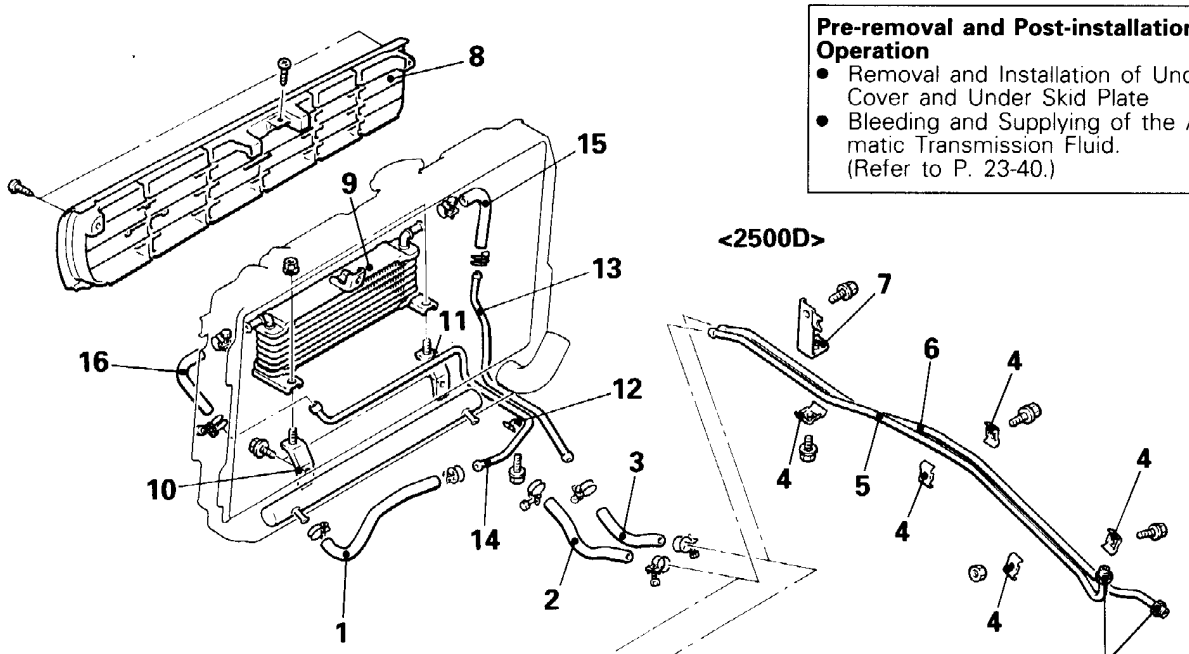
TRANSMISSION OIL COOLER, HOSES, PIPES

E23KA--

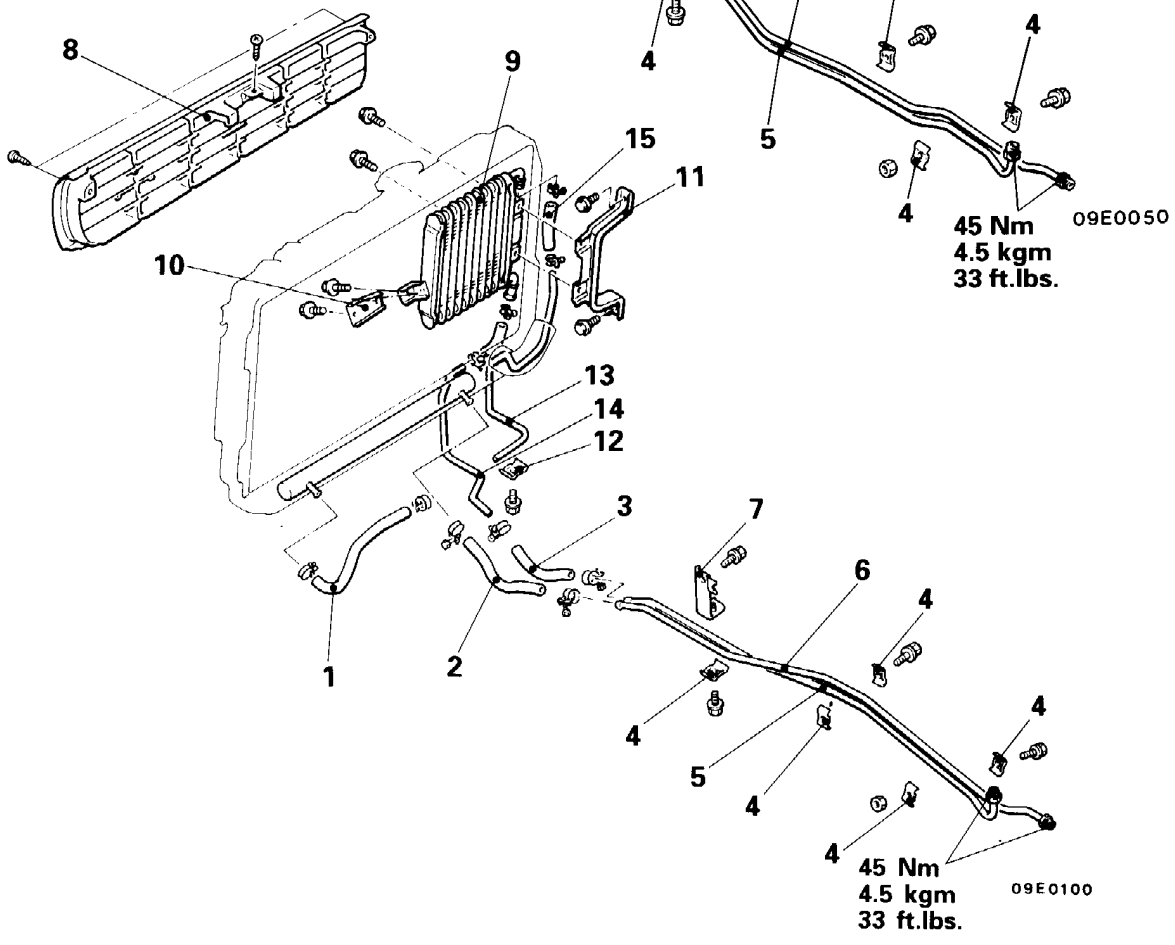
REMOVAL AND INSTALLATION

<3000, 3500, 2500D>

Pre-removal and Post-installation Operation
- Removal and Installation of Under Cover and Under Skid Plate
- Bleeding and Supplying of the Automatic Transmission Fluid. (Refer to P. 23-40.)



<2800D>



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◆◆ 1. Hose A
◆◆ 2. Hose B
◆◆ 3. Hose C

Feed pipe A, Return pipe A removal steps

◆◆ 4. Clamp
◆◆ 5. Feed pipe A
◆◆ 6. Return pipe A
7. Pipe bracket

Oil cooler assembly removal steps

8. Radiator grill
9. Oil cooler assembly
10. Oil cooler bracket (L.H.)
11. Oil cooler bracket (R.H.)

Feed pipe B, Return pipe B removal steps

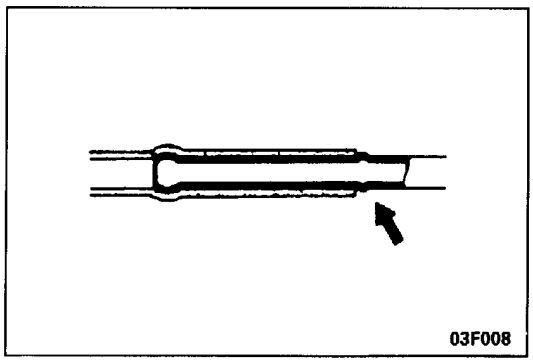
8. Radiator grill
12. Clamp
◆◆ 13. Feed pipe B
◆◆ 14. Return pipe B

Hose D, Hose E removal steps

8. Radiator grill
◆◆ 15. Hose D
◆◆ 16. Hose E

INSPECTION E23KCAD

- Check the hose and pipe for crack, damage and clog.
- Check for rusted or clogged radiator oil cooler.
- Check oil cooler fins for bend, damage, and clogged foreign matter.



SERVICE POINTS OF INSTALLATION E23KDAC

16. INSTALLATION OF HOSE E/15. HOSE D/14. RETURN PIPE B/13. FEED PIPE B

When connecting hoses to pipes with a stepped part, insert securely as far as the stepped part.

6. INSTALLATION OF RETURN PIPE A/5. FEED PIPE A/4. CLAMP

(1) Provisionally tighten the return pipe A and feed pipe A flare nuts to the transmission and transfer, and after clamping the pipes with each clamp, fully tighten the flare nuts.
Also, tighten all of the clamps, starting with those that are the closest to the transmission and transfer assembly.
(2) When connecting the pipes to the hoses, insert securely as far as the stepped part.

3. INSTALLATION OF HOSE C/2. HOSE B/1. HOSE A

When connecting hoses to pipes with a stepped part,insert securely as far as the stepped part.

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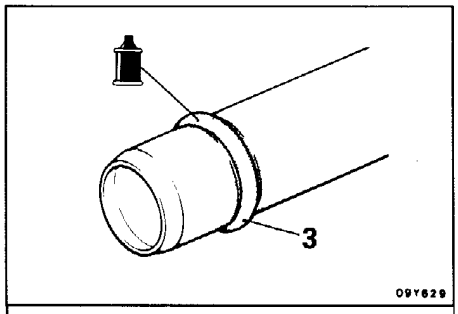
TRANSMISSION AND TRANSFER ASSEMBLY

E23LA--

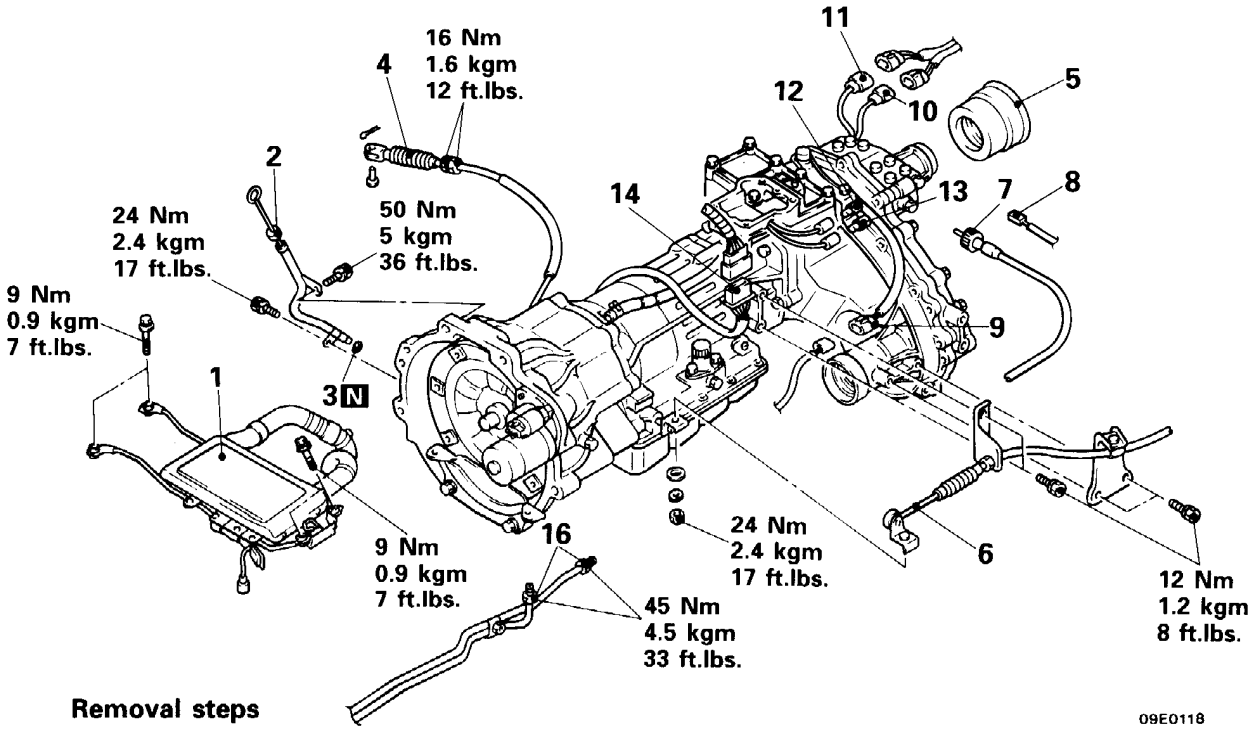
REMOVAL AND INSTALLATION

<2500D>

Pre-removal and Post-installation Operation
- Removal and Installation of Transfer Control Lever Assembly. (Refer to P. 23-45, 46.)
- Removal and Installation of Transfer Case Protector
- Removal and Installation of Front Exhaust Pipe
- Draining and Supplying of Automatic Transmission Fluid and Transfer Oil (Refer to P. 23-40 and GROUP 22–Service Adjustment Procedures.)
- Removal and Installation of Front and Rear Propeller Shaft (Refer to GROUP 25–Propeller Shaft.)

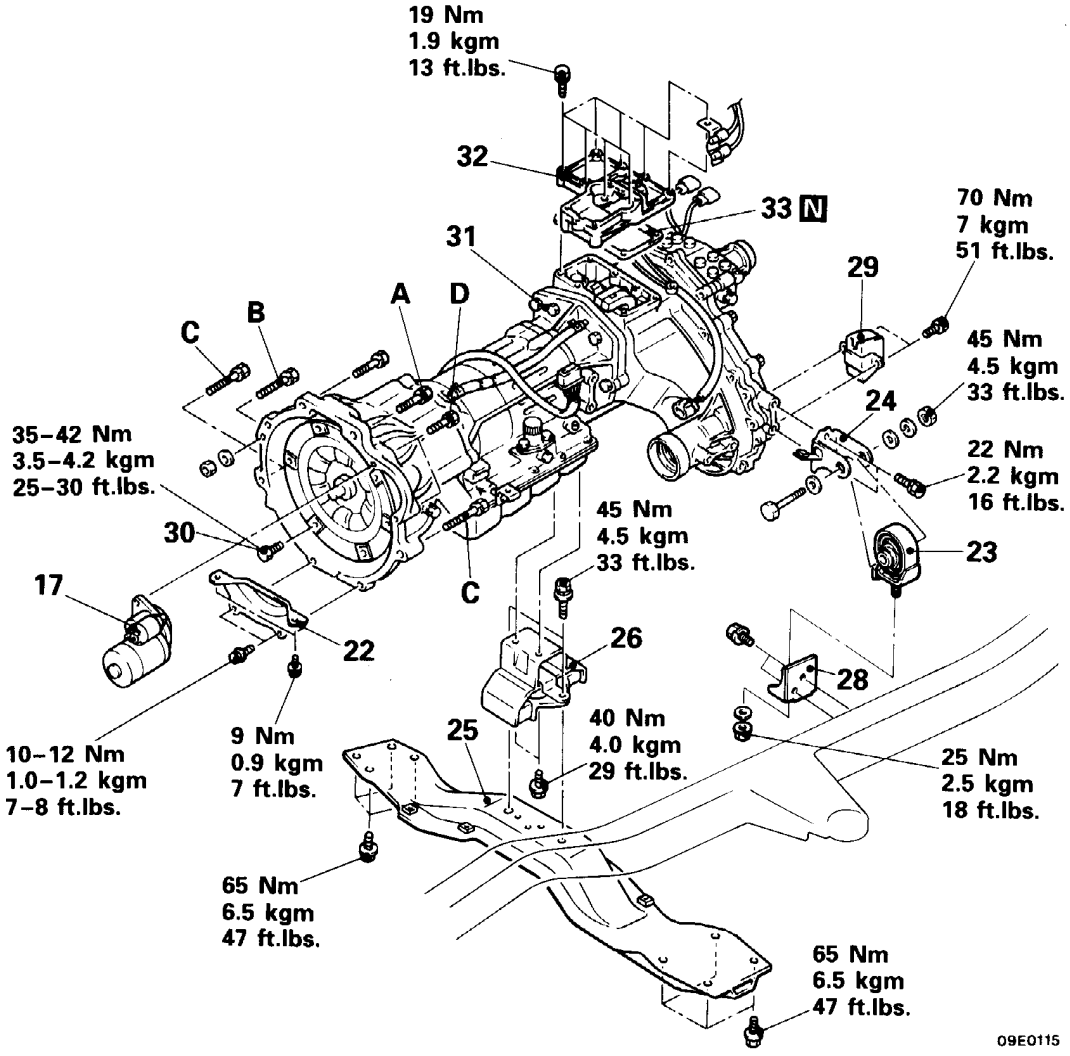


Fluid: Dia Queen ATF SP, ATF DEXRON II or equivalent

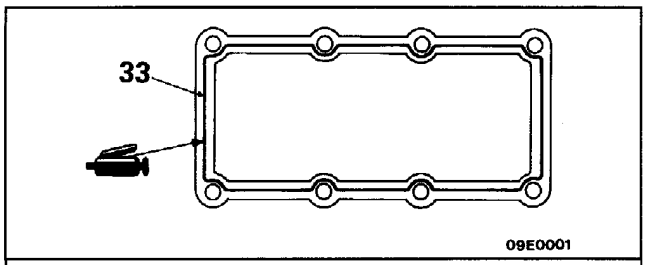


Removal steps

1. Intercooler
2. Oil filler pipe
3. O-ring
4. Connection for throttle control cable
5. Dust seal guard
6. Connection for transmission control cable
7. Connection for speedometer cable <Vehicles built up to October, 1993>
8. Speed sensor connector <Vehicles built from November, 1993>
9. HI/LO detection switch connector
10. 4WD operation detection switch connector
11. Center diffenential lock operation detection switch connector
12. Center differential lock detection switch connector
13. 2WD/4WD detection switch connector
14. Inhibitor switch connector
16. Connection for oil cooler pipe

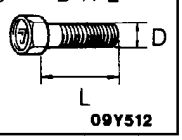


17. Starter motor
22. Bell housing cover
23. Transfer roll stopper
24. Transfer mounting bracket
25. No. 2 crossmember
26. Engine mount rear insulator
28. Transfer case protector bracket
29. Mass damper
30. Torque converter connecting bolt
31. Transmission and transfer assembly
32. Control housing
33. Gasket



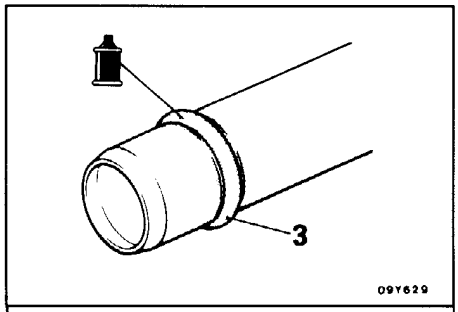
Sealant: 3M ATD Part No. 8661 or equivalent

	Nm	kgm	ft.lbs.	O.D. × Length mm (in.)	Bolt identification
A	50	5.0	36	10 × 40 (0.4 × 1.6)	D × L
B	24	2.4	17	8 × 25 (0.3 × 1.0)	
C	50	5.0	36	10 × 65 (0.4 × 2.6)	
D	31	3.1	22	10 × 60 (0.4 × 2.4)	

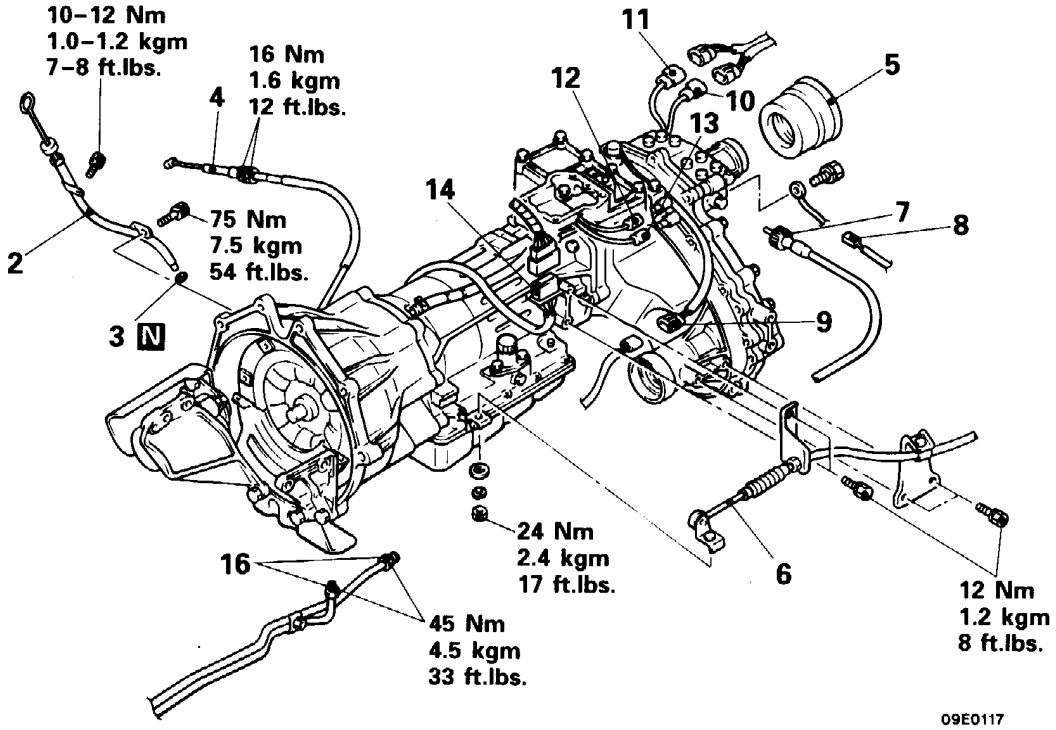


<3000–12 VALVE>

Pre-removal and Post-installation Operation
- Removal and Installation of Transfer Control Lever Assembly. (Refer to P. 23-45, 46.)
- Removal and Installation of Transfer Case Protector
- Removal and Installation of Front Exhaust Pipe
- Draining and Supplying of Automatic Transmission Fluid and Transfer Oil (Refer to P. 23-40 and GROUP 22–Service Adjustment Procedures.)
- Removal and Installation of Front and Rear Propeller Shaft (Refer to GROUP 25–Propeller Shaft.)

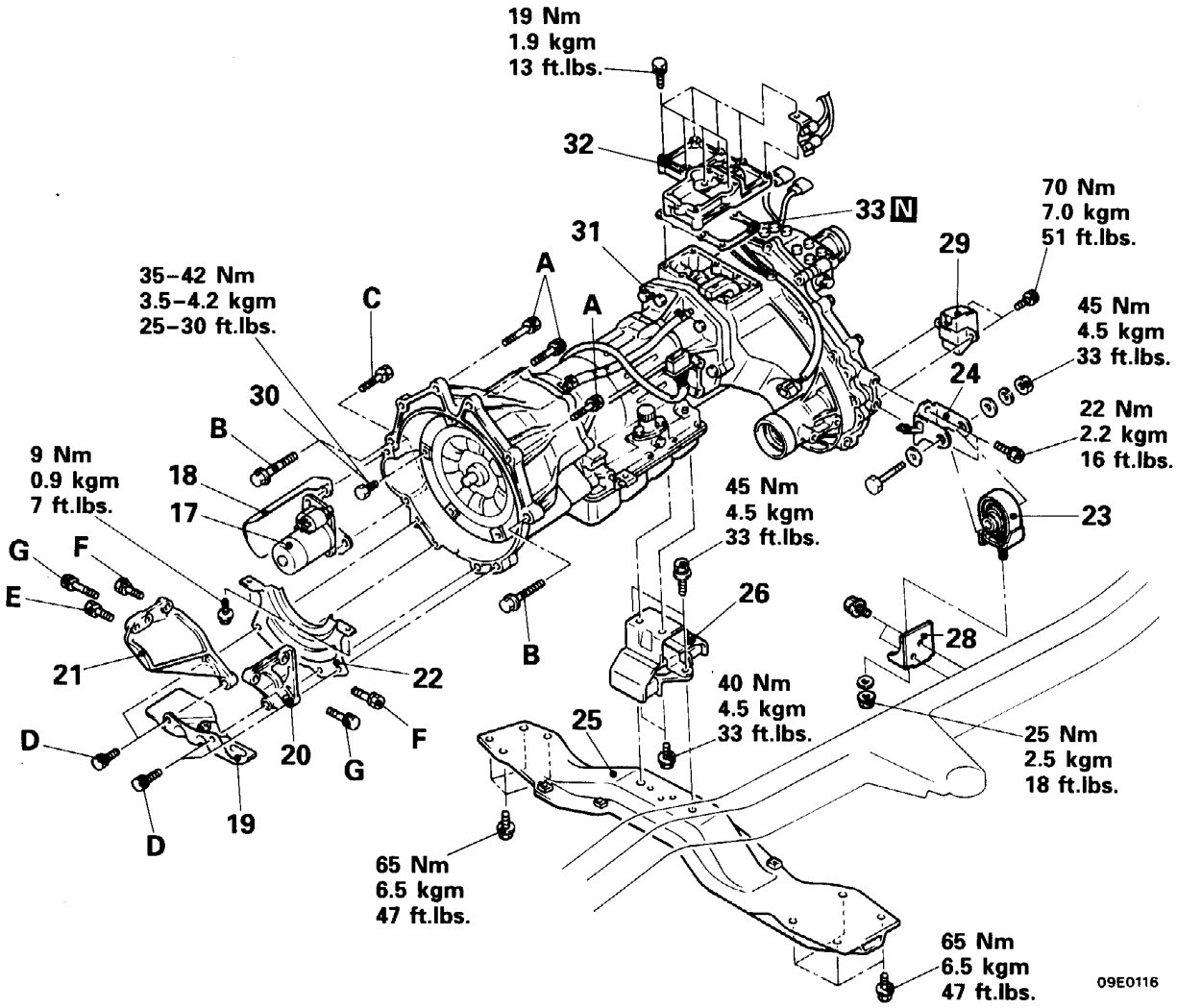


Fluid: Dia Queen ATF SP, ATF DEXRON II or equivalent

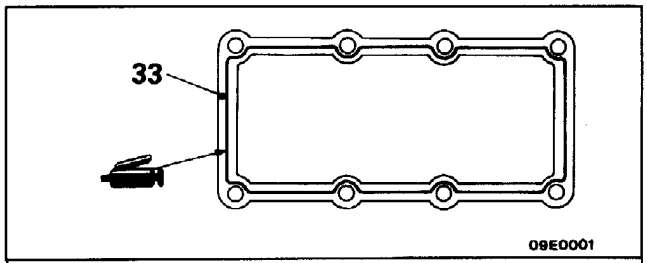


Removal steps

2. Oil filler pipe
3. O-ring
◆◆ 4. Connection for throttle control cable
5. Dust seat guard
◆◆ 6. Connection for transmission control cable
7. Connection for speedometer cable <Vehicles built up to October, 1993>
8. Speed sensor connector <Vehicles built from November, 1993>
9. HI/LO detection switch connector
10. 4WD operation detection switch connector
11. Center differential lock operation detection switch connector
12. Center differential lock detection switch connector
13. 2WD/4WD detection switch connector
14. Inhibitor switch connector
16. Connection for oil cooler pipe

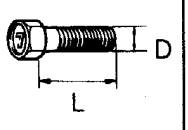


17. Starter motor
18. Starter cover
19. Heat protector
20. Transmission stay (L.H.)
21. Transmission stay (R.H.)
22. Bell housing cover
23. Transmission roll stopper
24. Transfer mounting bracket
25. No. 2 crossmember
26. Engine mount rear insulator
28. Transfer case protector bracket
29. Mass damper
30. Torque converter connecting bolt
31. Transmission and transfer assembly
32. Control housing
33. Gasket



Sealant: 3M ATD Part No. 8661 or equivalent

	Nm	kgm	ft.lbs.	O.D. × Length mm (in.)	Bolt identification
A	75	7.5	54	12 × 40 (0.5 × 1.6)	
B	90	9.0	65	12 × 55 (0.5 × 2.2)	D × L
C	31	3.1	22	10 × 55 (0.4 × 2.2)	
D	36	3.6	26	10 × 40 (0.4 × 1.6)	
E	75	7.5	54	12 × 35 (0.5 × 1.4)	
F	42	4.2	31	10 × 30 (0.4 × 1.2)	
G	75	7.5	54	12 × 50 (0.5 × 2.0)	



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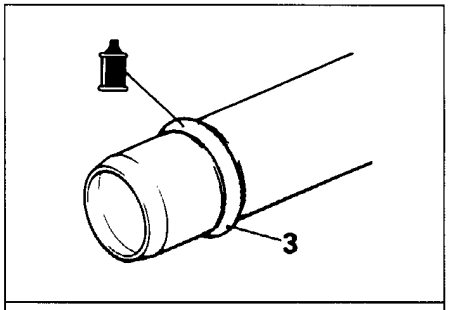
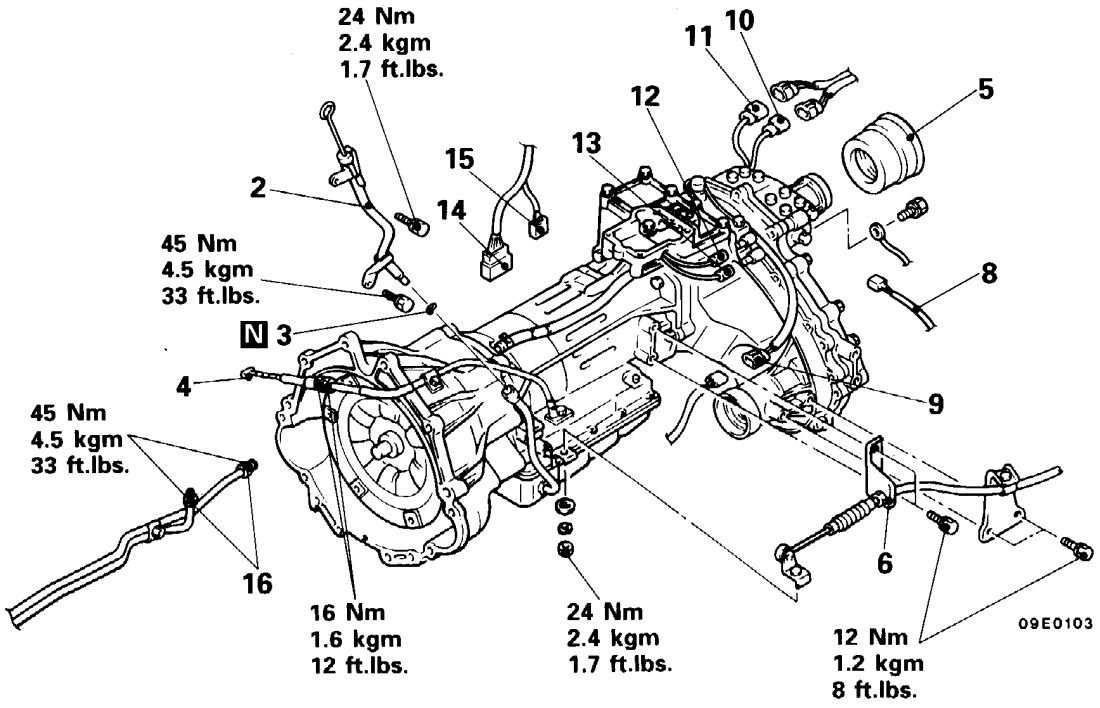
<3000–24 VALVE, 3500>

Pre-removal and Post-installation Operation
- Removal and Installation of Transfer Control Lever Assembly. (Refer to P. 23-45, 46.)
- Removal and Installation of Transfer Case Protector
- Removal and Installation of Front Exhaust Pipe
- Draining and Supplying of Automatic Transmission Fluid and Transfer Oil (Refer to P. 23-40 and GROUP 22–Service Adjustment Procedures.)
- Removal and Installation of Front and Rear Propeller Shaft (Refer to GROUP 25–Propeller Shaft.)



Fluid: Dia Queen ATF SP, ATF DEXRON II or equivalent



Removal steps
2. Oil filler pipe
3. O-ring
4. Connection for throttle control cable
5. Dust seal guard
6. Connection for transmission control cable
8. Speed sensor connector
9. HI/LO detection switch connector
10. 4WD operation detection switch connector
11. Center differential lock operation detection switch connector
12. Center differential lock detection switch connector
13. 2WD/4WD detection switch connector
14. Inhibitor switch connector
15. Solenoid valve connector
16. Connection for oil cooler pipe

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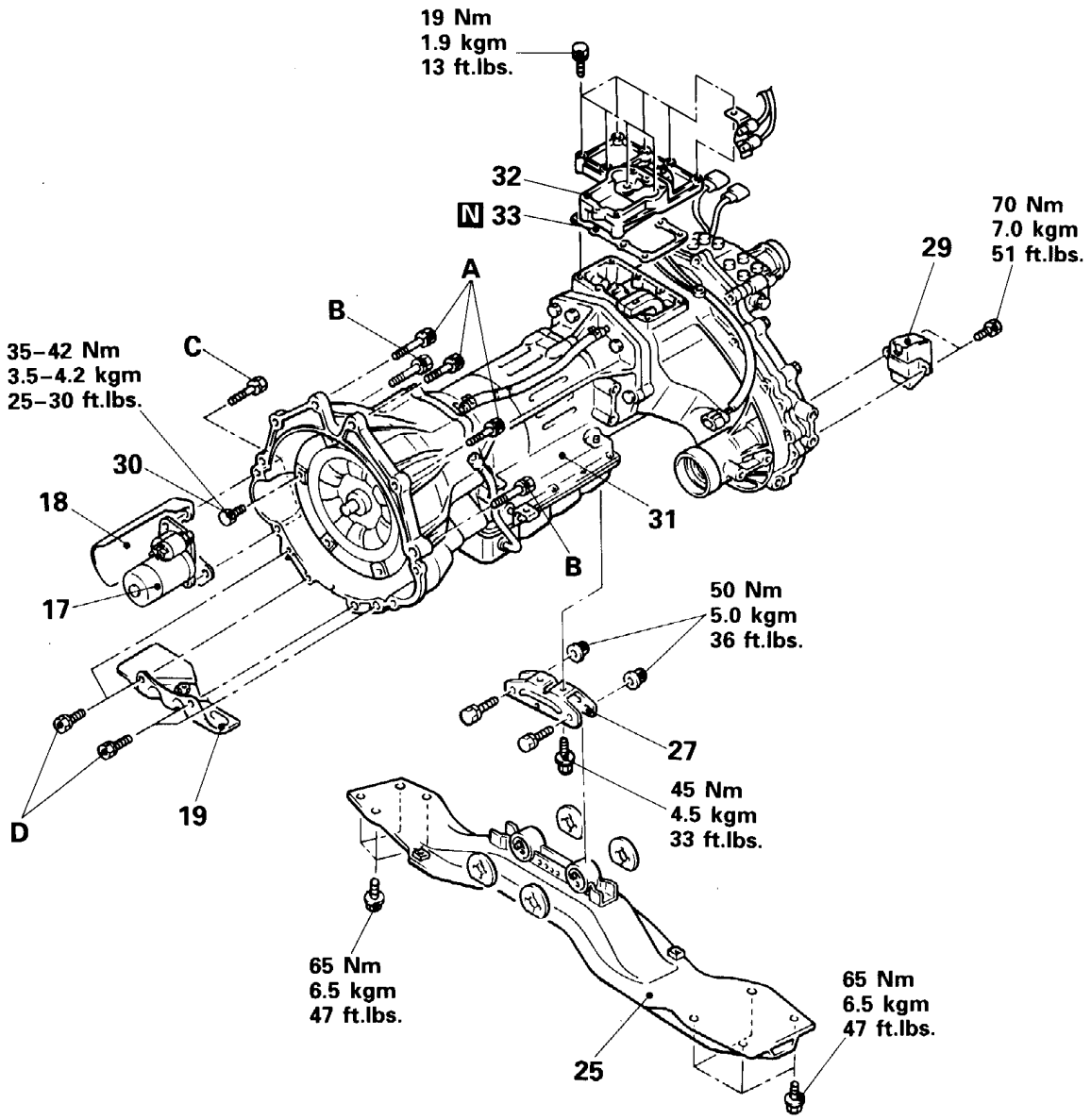
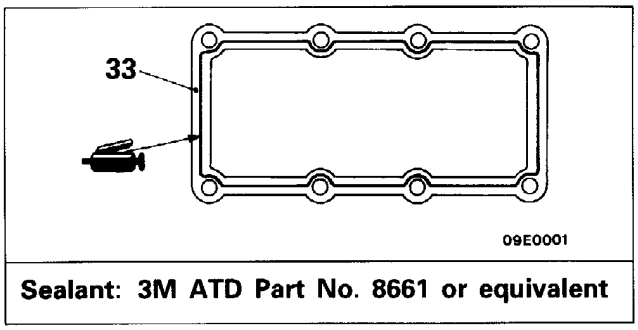




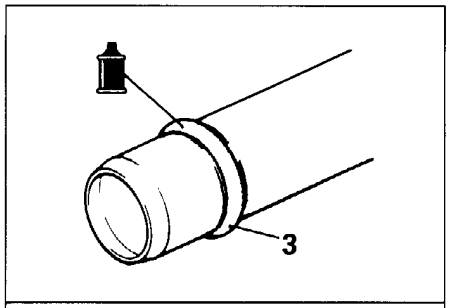
Sealant: 3M ATD Part No. 8661 or equivalent

17. Starter motor
18. Starter cover
19. Heat protector
25. No. 2 crossmember
27. Engine rear mount bracket
29. Mass damper
30. Torque converter connecting bolt
31. Transmission and transfer assembly
32. Control housing
33. Gasket

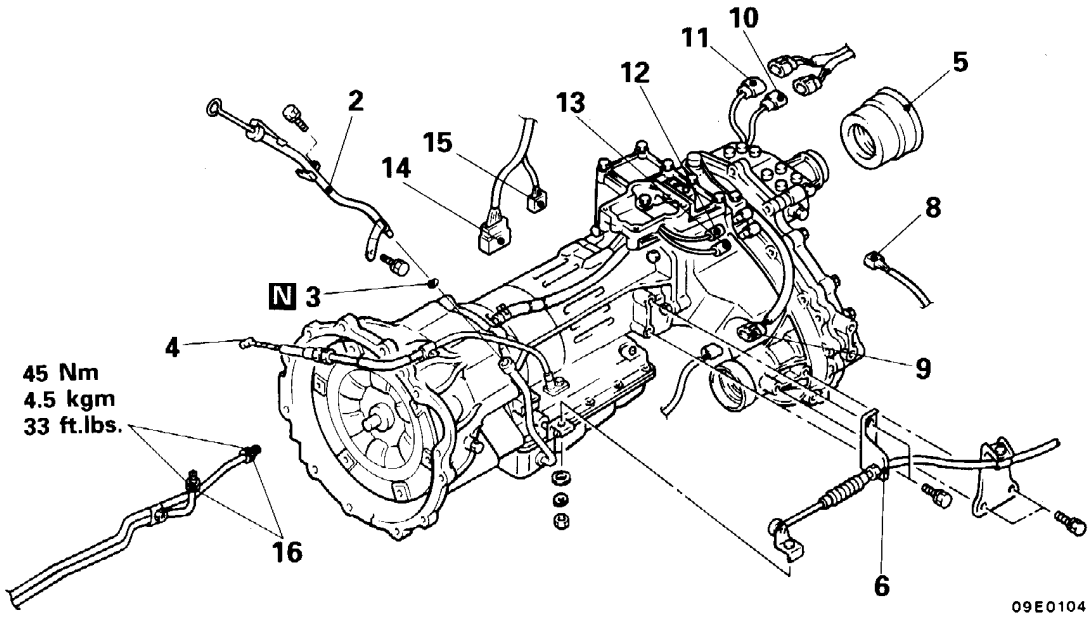
	Nm	kgm	ft.lbs.	O.D. × Length mm (in.)	Bolt identification
A	75	7.5	54	⑦ 12 × 40 (0.5 × 1.6)	⑦ D × L
B	90	9.0	65	⑦ 12 × 55 (0.5 × 2.2)	D, L
C	31	3.1	22	⑦ 10 × 55 (0.4 × 2.2)	
D	36	3.6	26	⑦ 10 × 40 (0.4 × 1.6)	09Y512

<2800D>

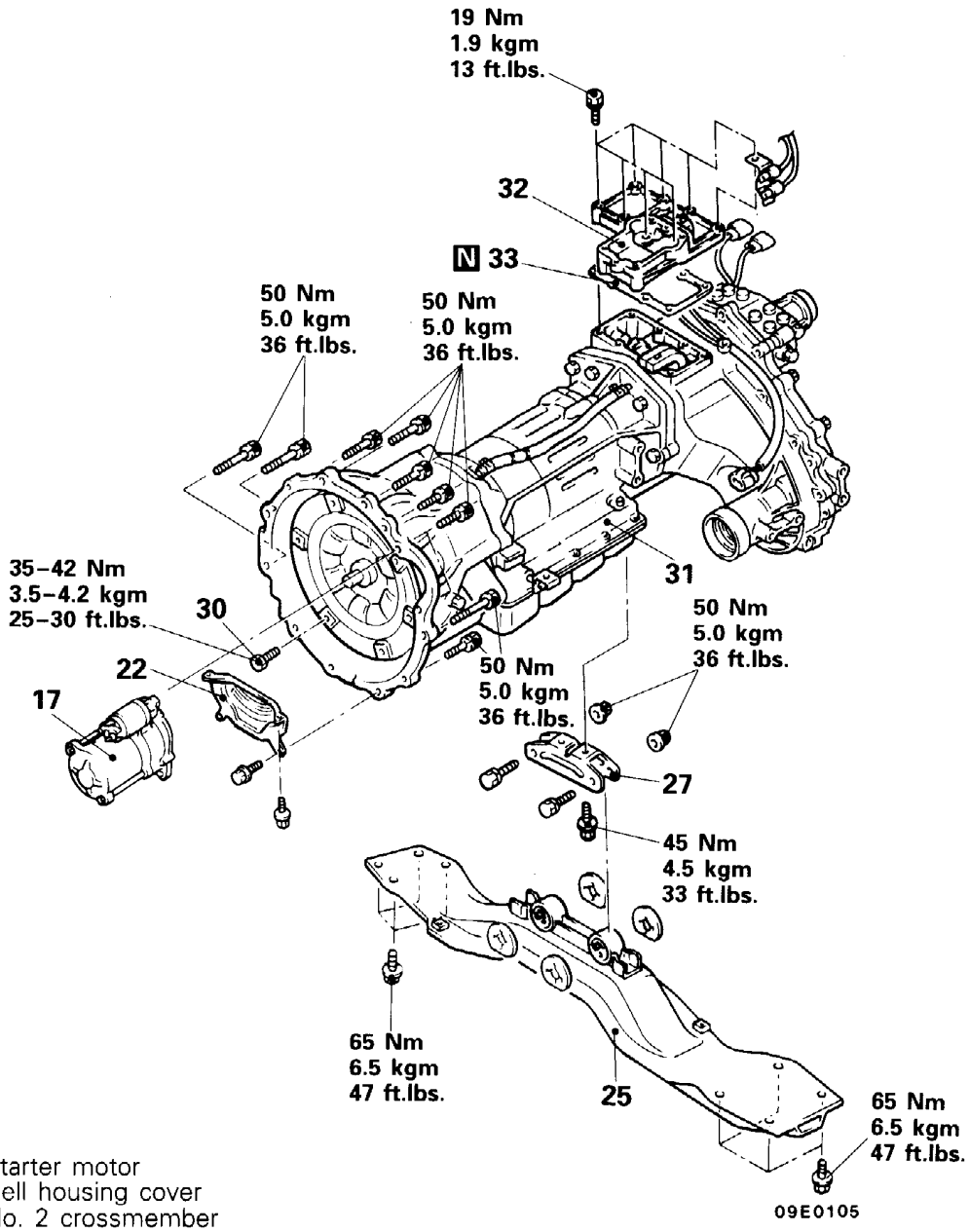
Pre-removal and Post-installation Operation
- Removal and Installation of Transfer Control Lever Assembly. (Refer to P. 23-45, 46.)
- Removal and Installation of Transfer Case Protector
- Removal and Installation of Front Exhaust Pipe
- Draining and Supplying of Automatic Transmission Fluid and Transfer Oil (Refer to P. 23-40 and GROUP 22–Service Adjustment Procedures.)
- Removal and Installation of Front and Rear Propeller Shaft (Refer to GROUP 25–Propeller Shaft.)
- Removal and Installation of Intercooler (Refer to GROUP 15–Intercooler.)



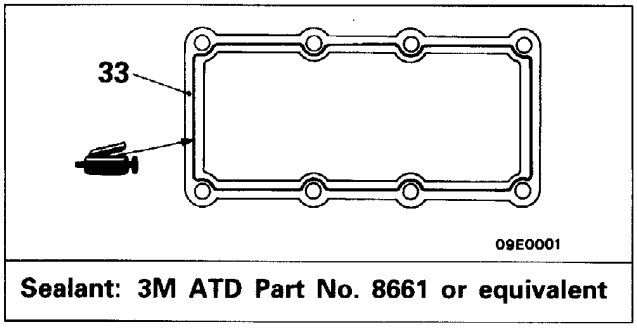
Fluid: Dia Queen ATF SP, ATF DEXRON II or equivalent



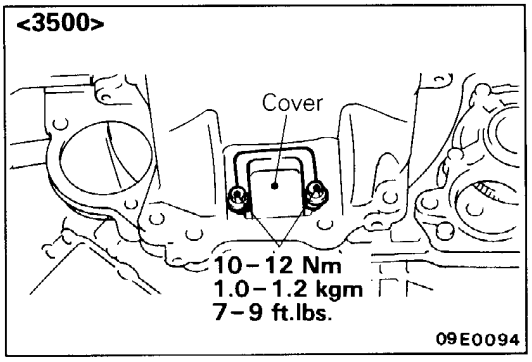
Removal steps
2. Oil filler pipe
3. O-ring
4. Connection for throttle control cable
5. Dust seat guard
6. Connection for transmission control cable
8. Speed sensor connector
9. HI/LO detection switch connector
10. 4WD operation detection switch connector
11. Center differential lock operation detection switch connector
12. Center differential lock detection switch connector
13. 2WD/4WD detection switch connector
14. Inhibitor switch connector
15. Solenoid valve connector
16. Connection for oil cooler pipe



17. Starter motor
22. Bell housing cover
25. No. 2 crossmember
27. Engine rear mount bracket
30. Torque converter connecting bolt
31. Transmission and transfer assembly
32. Control housing
33. Gasket



Sealant: 3M ATD Part No. 8661 or equivalent



SERVICE POINTS OF REMOVAL E23LBAK

23. REMOVAL OF TRANSFER ROLL STOPPER

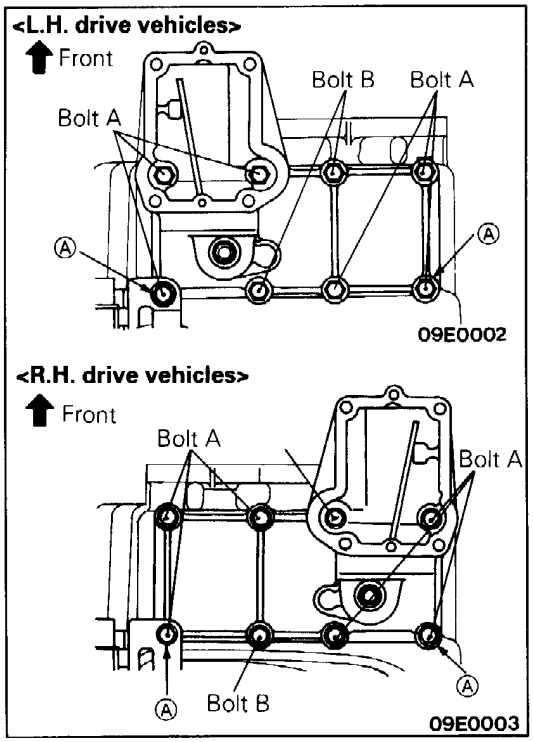
Before removing the transfer roll stopper, support the transmission and transfer assembly with a transmission jack.

30. REMOVAL OF TORQUE CONVERTER CONNECTING BOLT
31. TRANSMISSION AND TRANSFER ASSEMBLY

(1) Remove the cover from the oil pan upper. <3500>
(2) Remove the connecting bolts (6 places) while turning the crank shaft.
(3) Gently lower the rear section of the transmission and transfer assembly to remove the assembly from the engine.

Caution
When removing the transmission and transfer assembly, push the torque converter over to the transmission and transfer assembly side so it does not remain on the engine side.

(4) Next, tilt the front section of the transmission and transfer assembly downwards and gently lower it, being careful that the rear section of the transfer does not touch the No.4 crossmember.



SERVICE POINTS OF INSTALLATION E23LDAK

32. INSTALLATION OF CONTROL HOUSING

(1) Remove the adhesive sticking to the bolts attached to portion Ⓐ.
(2) Use a tap (M8 x 1.25) to remove the adhesive sticking to the screw holes (portion Ⓐ).
(3) Apply specified adhesive to the threads of the mounting bolts (portion Ⓐ).

Specified adhesive:
3M Stud Locking No. 4710 or equivalent

(4) The dimensions of the mounting bolts vary according to their mounting locations, so do not confuse them when installing.

Bolt to be used	O.D. × Length mm (in.)	Bolt identification
A	⑦ 8 × 25 (0.3 × 1.0)	⑦ D × L
B	⑦ 8 × 27 (0.3 × 1.1) Reame bolt	D, L 09Y512

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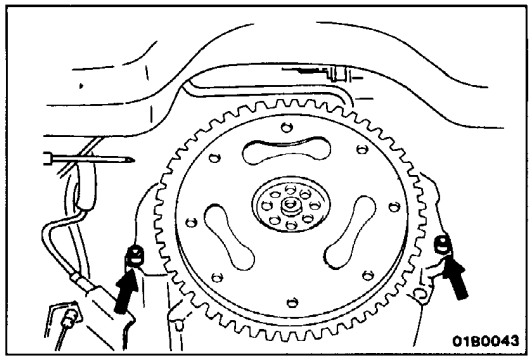
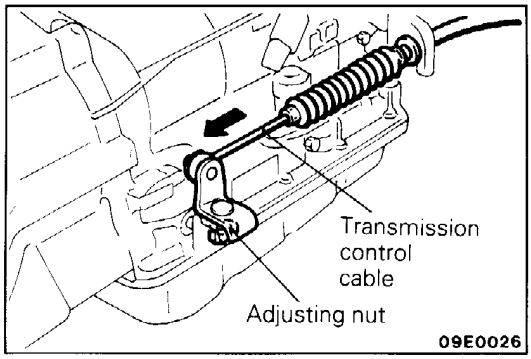


31. INSTALLATION OF TRANSMISSION AND TRANSFER ASSEMBLY

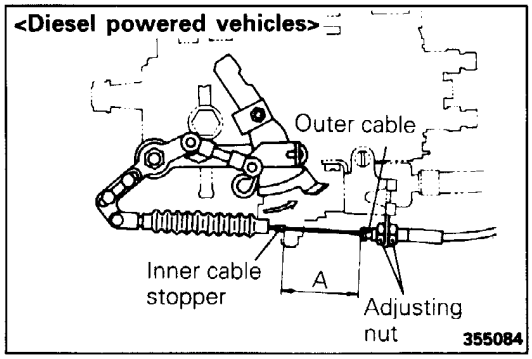
(1) Align the engine transmission mounting bolt holes with the transmission and transfer assembly as shown in the illustration, and connect the transmission and transfer assembly to the engine.



6. INSTALLATION OF TRANSMISSION CONTROL CABLE ASSEMBLY

After installing the transmission control cable, adjust it by the following procedure.

(1) Move the selector lever to the "N" position.
(2) Loosen the adjusting nut, gently pull the end of the transmission control cable in the direction of the arrow and then tighten the adjusting nut to the specified torque.



4. INSTALLATION OF THROTTLE CONTROL CABLE

After installing the throttle control cable, adjust it by the following procedure.

<Diesel powered vehicles>

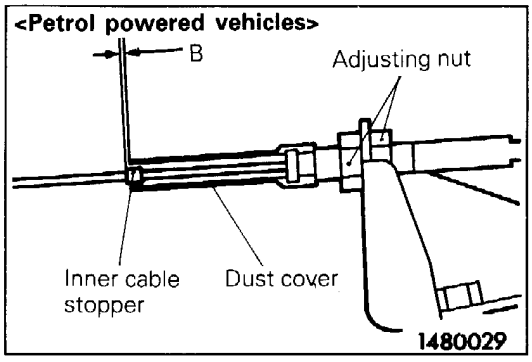
(1) Remove the cable from the boot outer cable side until the inner cable stopper can be seen.
(2) Open the throttle lever completely and adjust the cable with the adjusting nut so that the distance between the inner cable stopper and the outer cable end is at the standard value.

Standard value (A): 34–35 mm (1.34–1.38 in.)

<Petrol powered vehicles>

Open the throttle lever completely and adjust the cable with the adjusting nut so that the distance between the inner cable stopper and the dust cover end is at the standard value.

Standard value (B): 0–1 mm (0–0.04 in.)



NOTES

PROPELLER SHAFT

CONTENTS

E25AA--

SPECIFICATIONS **2**
Service Specifications 2
Lubricants 2
SPECIAL TOOLS **2**
PROPELLER SHAFT **3**

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SPECIFICATIONS

SERVICE SPECIFICATIONS

E25CB--

Items		Specifications
Standard value		
Clearance between snap ring and groove wall of yoke	mm (in.)	0.06 (0.0024) or less
Limit		
Propeller shaft runout	mm (in.)	
Front propeller shaft		0.6 (0.024)
Rear propeller shaft		0.6 (0.024)

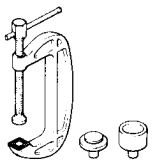
LUBRICANTS

E25CD--

Item	Specified lubricant	Quantity
Sleeve yoke Sleeve flange	Hypoid gear oil SAE 75W-85W conforming to API GL-4 or higher	As required

SPECIAL TOOLS

E25DA--

Tool	Number	Name	Use
	MB990840	Universal joint remover/installer	Disassembly and reassembly of universal joint
	MB991410	Colar	

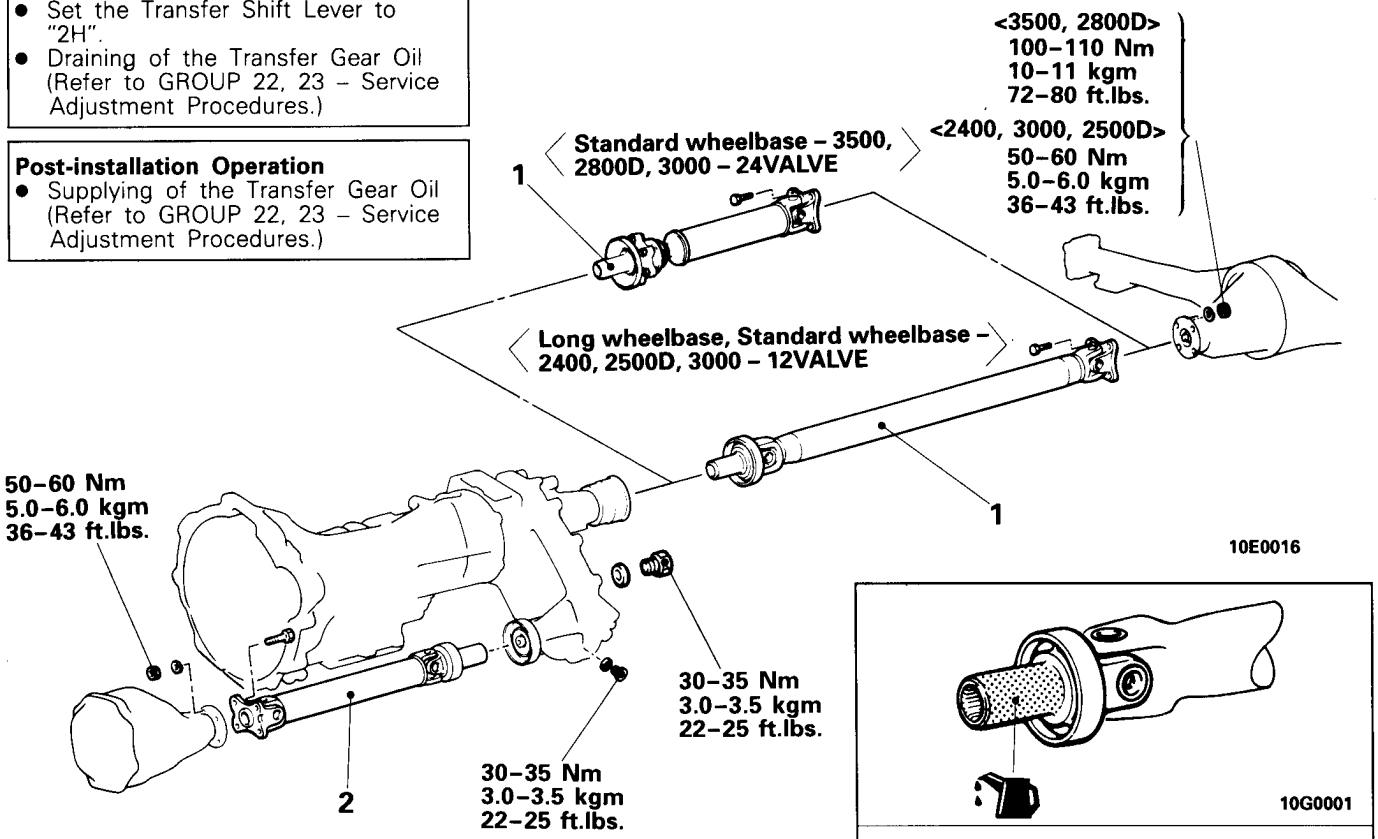
PROPELLER SHAFT

REMOVAL AND INSTALLATION

E25GA--

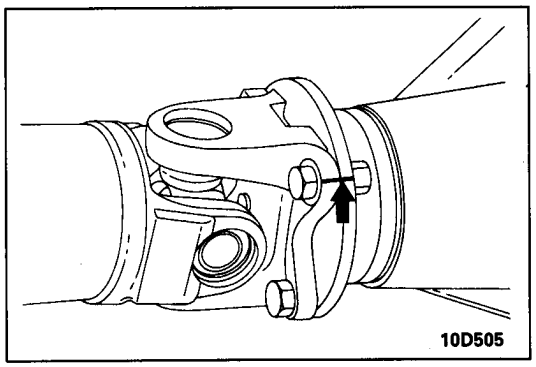
Pre-removal Operation
- Set the Transfer Shift Lever to "2H".
- Draining of the Transfer Gear Oil (Refer to GROUP 22, 23 – Service Adjustment Procedures.)

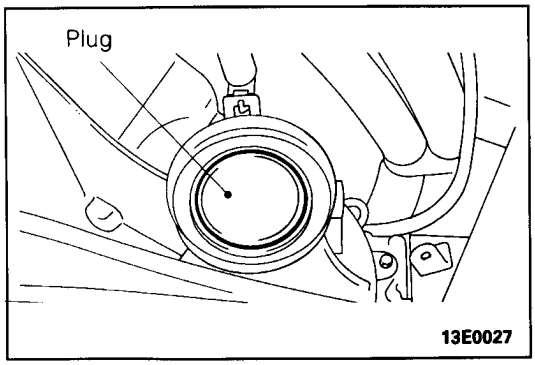
Post-installation Operation
- Supplying of the Transfer Gear Oil (Refer to GROUP 22, 23 – Service Adjustment Procedures.)



Gear oil: Hypoid gear oil API GL-4, SAE 75W-90 or 75W-85W

Removal steps
- 1. Rear propeller shaft
- 2. Front propeller shaft





SERVICE POINTS OF REMOVAL

E25GBAG

1. REMOVAL OF REAR PROPELLER SHAFT/2. FRONT PROPELLER SHAFT

(1) Make mating marks on the flange yoke and the differential companion flange.

(2) Use the plug as a cover so that no foreign material gets into the transmission or transfer.

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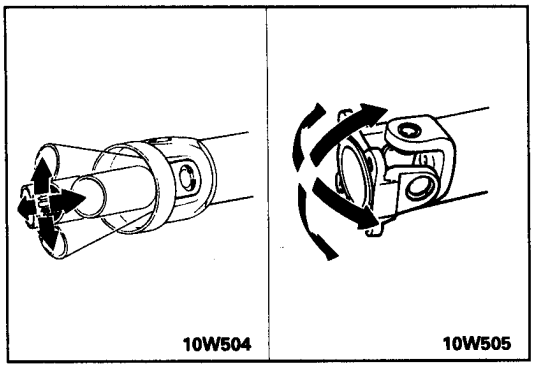
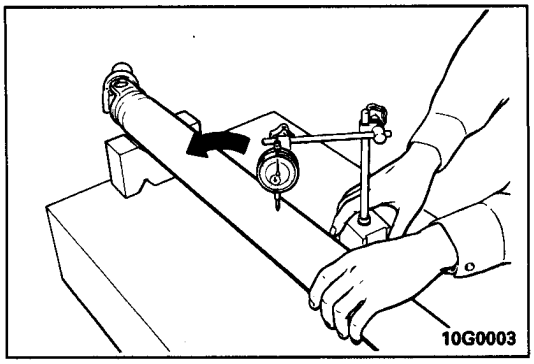


INSPECTION E25GCAH

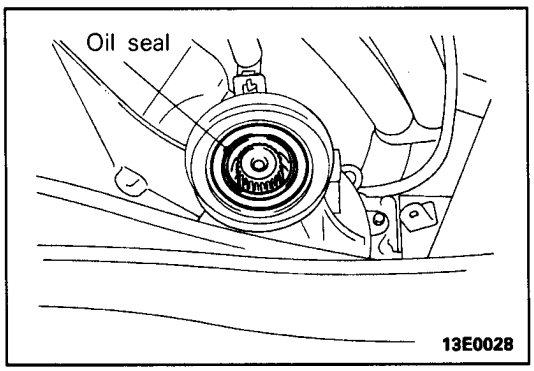
- Check the universal joints for smooth operation in all directions.
- Check the sleeve yoke and flange yoke for wear, damage or cracks.
- Check the propeller shaft yokes for wear, damage or cracks.
- Check the propeller shaft for bends, twisting or damage.



PROPELLER SHAFT RUNOUT

Measure the propeller shaft runout with a dial indicator.

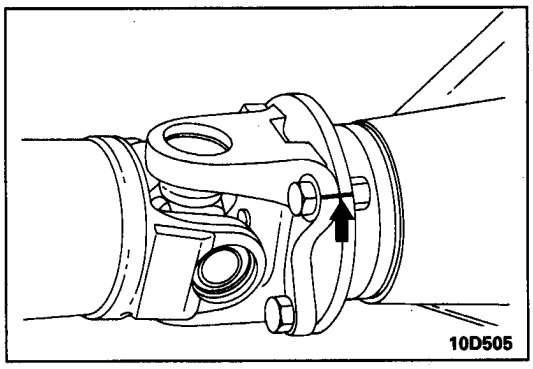
Limit: Front propeller shaft 0.6 mm (0.024 in.)
Rear propeller shaft 0.6 mm (0.024 in.)



SERVICE POINTS OF INSTALLATION E25GDAI

2. INSTALLATION OF FRONT PROPELLER SHAFT/1. REAR PROPELLER SHAFT

Caution
Be careful not to damage the oil seal lip section of the transmission and transfer.



Install the propeller shaft to the companion flange so that the mating marks are aligned.

Caution
If the threads of the bolts and nuts are stained with oil or grease, they can become loose. Completely remove oil or grease from the threads before tightening the bolts and nuts.

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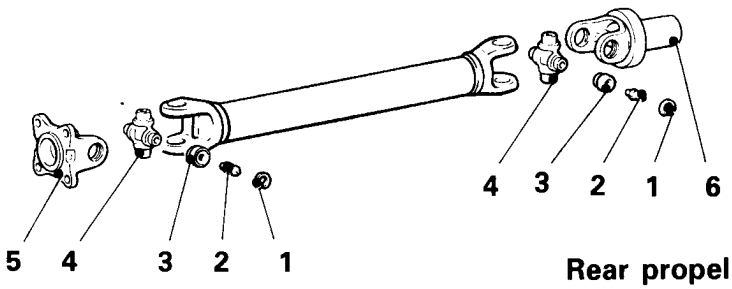
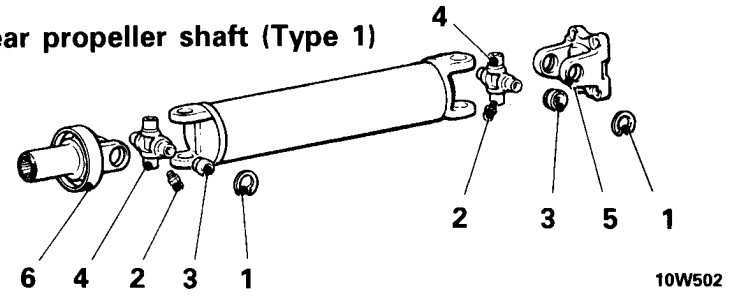
DISASSEMBLY AND REASSEMBLY

E25GE--

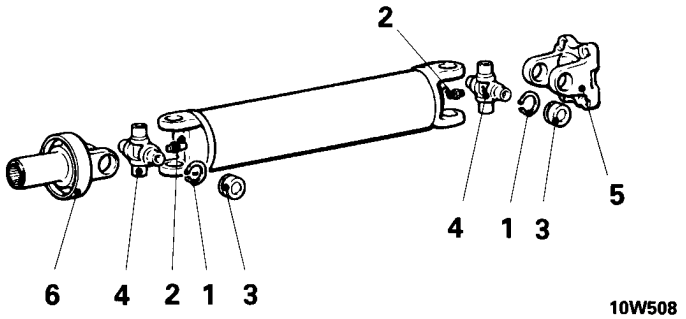
Front propeller shaft



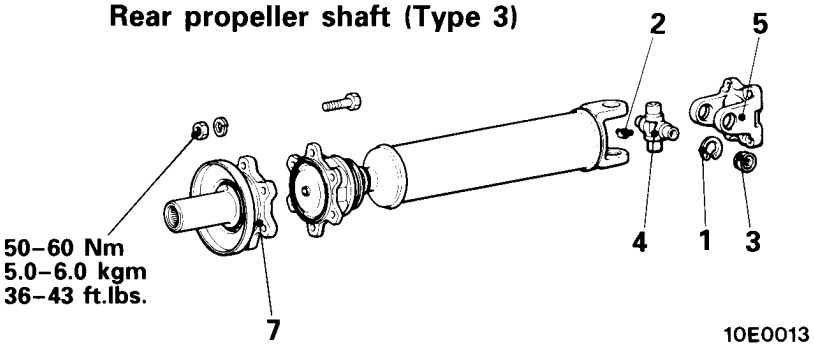
Rear propeller shaft (Type 1)

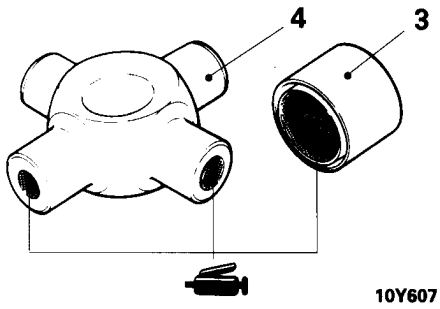


Rear propeller shaft (Type 2)



Rear propeller shaft (Type 3)

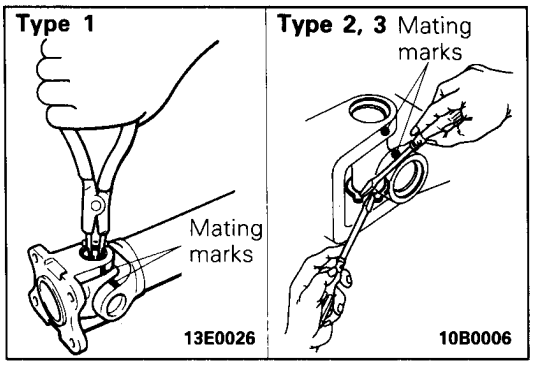




Caution
Do not apply grease excessively. Otherwise, faulty fitting of bearing caps and errors in the selection of snap rings may result.

Disassembly steps

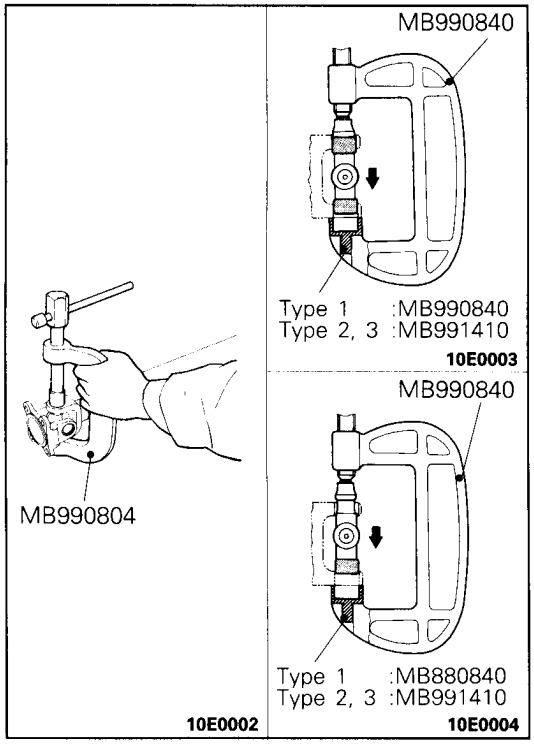
1. Snap ring
2. Grease fitting
3. Journal bearing
4. Journal
5. Flange yoke
6. Sleeve yoke
7. Sleeve flange



SERVICE POINTS OF DISASSEMBLY E25GFAL

1. REMOVAL OF SNAP RING

Make mating marks on the yokes of the universal joint that is to be disassembled.

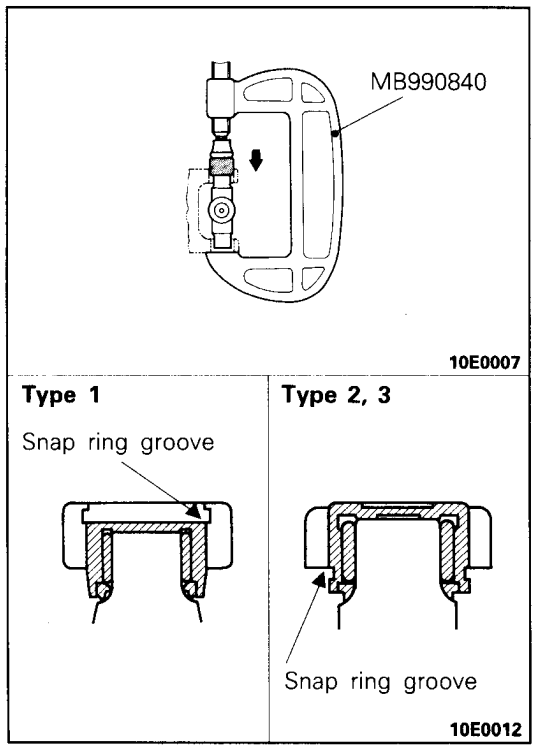


3. REMOVAL OF JOURNAL BEARING

(1) Use the special tool to press in the journal bearing on one side, and take out the journal bearing on the opposite side.

(2) Insert the special tool in the other side and press the journal to remove the first journal bearing that was pushed.

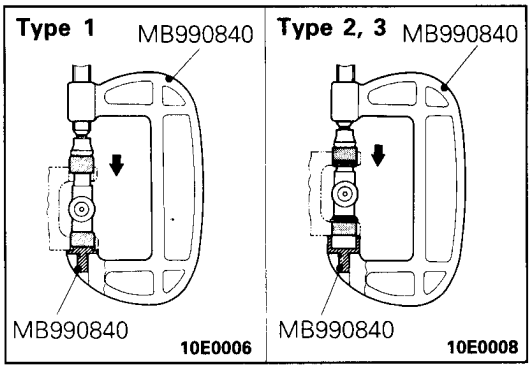
Caution
Do not tap the journal bearings to remove them, as this will upset the balance of the propeller shaft.



SERVICE POINTS OF REASSEMBLY E25GHAK

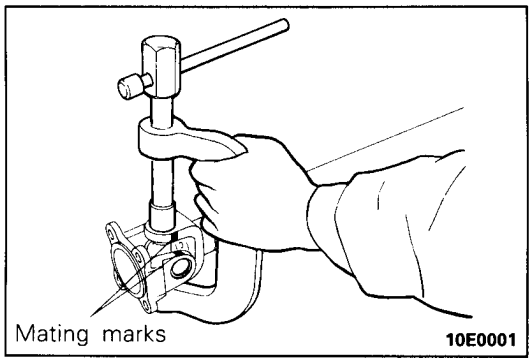
4. INSTALLATION OF JOURNAL/3. JOURNAL BEARING

(1) Fit the journal onto the yoke.
(2) Use the special tool to press the journal bearing into the yoke until the snap ring groove is fully visible.



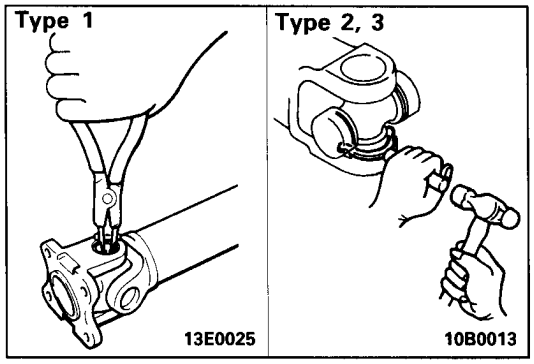
(3) Use the special tool to press the opposite side journal bearing into the yoke.

Caution
Be careful when pressing the journal bearings, as if they are pressed at an angle, the inside of the journal bearings will be damaged by the journal.

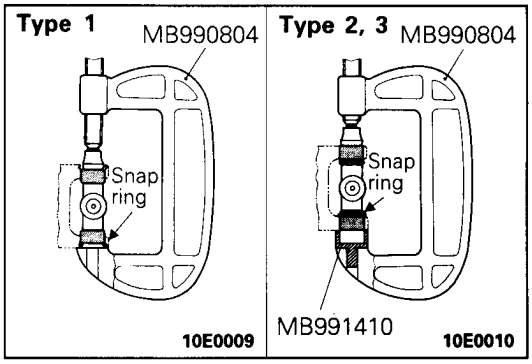


(4) Align the mating marks on the yoke and propeller shaft, and install the propeller shaft journal bearings in the method described in (2) and (3) above.

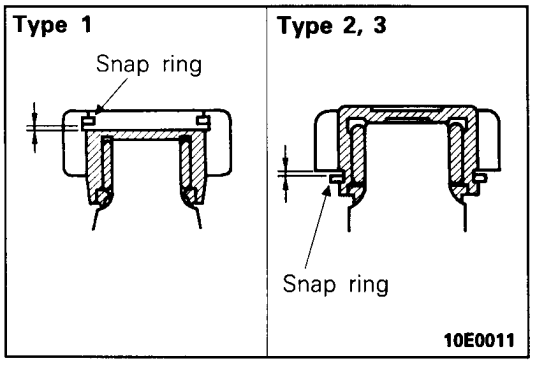
1. INSTALLATION OF SNAP RING



(1) Install a snap ring to one side of the journal.



(2) Use the special tool at the opposite side of the installed snap ring to press in the journal bearing towards the snap ring.



(3) Install the snap ring on the opposite side, and measure the clearance of the snap ring groove with a thickness gauge.

Standard value: 0.06 mm (0.0024 in.) or less

Caution
Always use snap rings of equal thicknesses on both sides.

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(4) If the clearance exceeds the standard value, adjust by changing the thickness of the snap ring.

	Snap ring thickness mm (in.)	Identification colour
Front propeller shaft Rear propeller shaft (type 1)	1.28 (0.050)	–
	1.31 (0.052)	Yellow
	1.34 (0.053)	Blue
	1.37 (0.054)	Purple
Rear propeller shaft (type 2)	1.50 (0.059)	–
	1.55 (0.061)	Yellow
	1.60 (0.063)	Blue
	1.65 (0.065)	Purple

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FRONT AXLE

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E26AA--

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SPECIFICATIONS

E26CA--

GENERAL SPECIFICATIONS

<Vehicles built up to October, 1993>

Items	2400	3000	2500D
Front axle hub bearing Type	Taper roller bearing	Taper roller bearing	Taper roller bearing
Drive shaft Joint type Outer Inner	 Birfield joint Double-offset joint	 Birfield joint Double-offset joint	 Birfield joint Double-offset joint
Differential Final drive gear type Reduction ratio 2-door models 4-door models Pinion gear type 2-door models 4-door models	 Hypoid gear 4.875 4.875 2 pinion 4 pinion	 Hypoid gear 4.875 4.625 or 4.875* 2 pinion 2 pinion	 Hypoid gear 4.625 or 4.875* 4.875 or 5.285* 2 pinion or 4 pinion* A/T: 2 pinion M/T: 4 pinion

NOTE
*: Vehicles with wide fender

<Vehicles built from November, 1993>

Items	2400, 3000 – 12VALVE	3500	2500D	2800D	3000 – 24VALVE
Front axle hub bearing Type	Taper roller bearing	Taper roller bearing	Taper roller bearing	Taper roller bearing	Taper roller bearing
Drive shaft Joint type Outer Inner	 Birfield joint Double-offset joint	 Birfield joint Double-offset joint	 Birfield joint Double-offset joint	 Birfield joint Double-offset joint	 Birfield joint Double-offset joint
Differential Final drive gear type Reduction ratio 2-door models 4-door models Pinion gear type 2-door models 4-door models	 Hypoid gear 4.875 4.875 2 pinion 2 pinion	 Hypoid gear 4.636 4.636 2 pinion 2 pinion	 Hypoid gear 4.625 or 4.875* 4.875 or 5.285* 2 pinion or 4 pinion* A/T: 2 pinion M/T: 4 pinion	 Hypoid gear 4.636 4.900 2 pinion 2 pinion	 Hypoid gear 4.636 or 4.875* 4.636 or 4.875* 2 pinion 2 pinion

NOTE
*: Vehicles with wide fender

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SERVICE SPECIFICATIONS

E26CB--

Items	Specifications
Standard value	
Drive shaft axial play mm (in.)	0.4–0.7 (0.016–0.028)
Solenoid valve resistance [at 20°C (60°F)] Ω	36–46
Front hub play in the axial direction mm (in.)	0.05 (0.0020) or less
Front hub turning resistance Nm (kgcm, in.lbs.)	0.3–1.3 (3–13, 2.6–11.3)
[Spring scale reading] N (kg, lbs.)	5–18 (0.5–1.8, 1.1–4.0)
Automatic free-wheeling hub	
Brake assembly thickness mm (in.)	10.5 (0.413)
Setting of D.O.J. boot length mm (in.)	77–83 (3.03–3.27)
Clutch gear play (bearing axial play) mm (in.)	0.05–0.40 (0.0020–0.0160)
Final drive gear backlash mm (in.)	0.11–0.16 (0.0043–0.0063)
Differential gear backlash mm (in.)	
<2 pinion differential>	0–0.076 (0–0.0030)
<4 pinion differential>	0.01–0.25 (0.0004–0.0098)
Drive pinion rotation torque Nm (kgcm, in.lbs.)	
Without oil seal	0.3–0.5 (3.0–5.0, 2.6–4.3)
With anti-rust agent	0.15–0.25 (1.5–2.5, 1.3–2.2)
With oil seal	0.5–0.7 (5.0–7.0, 4.3–6.1)
With gear oil applied	0.35–0.45 (3.5–4.5, 3.1–3.9)
Limit	
Front axle total backlash	
Vehicles with free-wheeling hub mm (in.)	14 (0.55)
Vehicles without free-wheeling hub mm (in.)	11 (0.43)
Automatic free-wheeling hub	
Free-wheeling hub turning resistance Nm (kgcm, in.lbs.)	1.0 (10, 8.7)
[Sprint scale reading] N (kg, lbs.)	14 (1.4, 3.1)
Brake assembly thickness mm (in.)	9.6 (0.378)
Return spring deterioration mm (in.)	35 (1.38)
Shift spring deterioration mm (in.)	30 (1.18)
Drive gear runout mm (in.)	0.05 (0.0020)
Differential gear backlash <2 pinion differential> mm (in.)	0.2 (0.0079)

LUBRICANTS

E26CD--

Items	Specified lubricants	Quantity
Front axle gear oil Front differential	Hypoid gear oil API classification GL-5 or higher SAE viscosity No. 90, 80W	1.20 dm^3 (1.27 U.S. qts., 1.05 Imp. qts)
D.O.J. boot grease	Repair kit grease	100 g (3.5 oz.)

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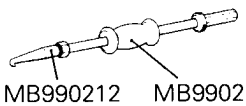
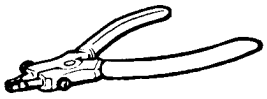
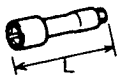
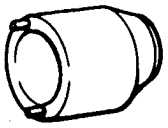
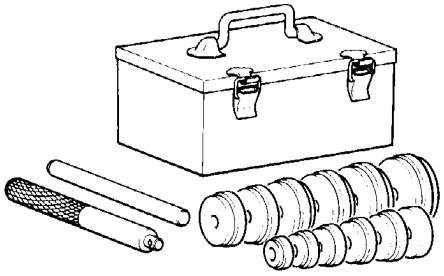
SEALANTS AND ADHESIVES

E26CE--

Items	Specified sealants and adhesives	Characteristics
Contact surface of drive flange or free-wheeling hub and front axle hub Contact surface of hub cap and drive flange Contact surface of differential cover and differential carrier Free-wheeling clutch assembly	3M ATD Part No. 8661, 8663 or equivalent	Semi-drying sealant
Drive gear threaded hole	3M Stud Locking 4170 or equivalent	Anaerobic sealant

SPECIAL TOOLS

Tool	Number	Name	Use
 MB990212 MB990211	MB990590	Sliding hammer	Removal of differential carrier oil seal Removal and installation of inner shaft (Used together with MB990906)
	MB990628	Snap ring pliers	Removal and installation of drive shaft snap ring Removal and installation of manual free-wheeling hub snap ring
 L : 90 mm (3.54 in.) : MD998051 (MD998001) L : 80 mm (3.15 in.) : MD998360	MD998051 (MD998001) MD998360	Cylinder head bolt wrench	Removal and installation of automatic free-wheeling hub
	MB990954	Lock nut wrench	Removal and adjustment of lock nut
	MB990925	Bearing and oil seal installer set	Driving-out of front axle hub bearing outer race (MB990939) Press-fitting of front axle hub bearing outer race (MB990938, MB990935) Driving-out of knuckle needle bearing (MB990939) Driving-out of drive pinion bearing outer race (MB990939) Press-fitting of drive pinion front bearing outer race (MB990938, MB990936) Press-fitting of drive pinion rear bearing outer race (2400, 2500D, 3000-A/T : MB990938, MB990933) (3000-M/T, 3500, 2800D : MB990938, MB990934) Press-fitting of drive shaft oil seal (MB990938, MB990934)

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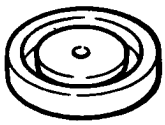
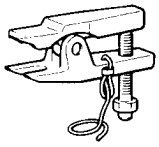
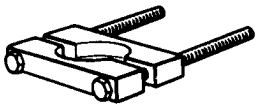
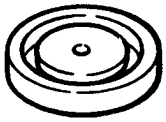
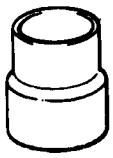
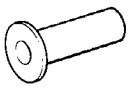
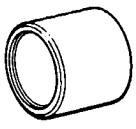
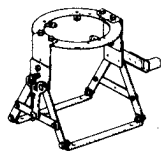
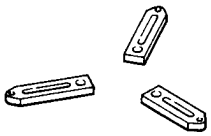
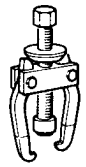
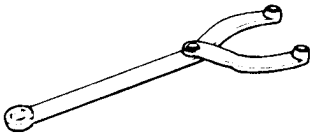
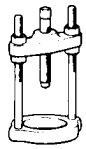
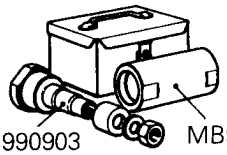
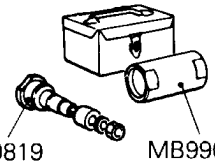
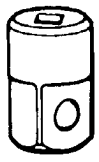
Tool	Number	Name	Use
	MB990985	Oil seal installer	Press-fitting of knuckle oil seal (Used together with MB990938)
	MB990811	Differential side bearing cup	Disassembly and reassembly of automatic free-wheel hub Removal of side bearing inner race (Used together with MB990810)
	MB991113, MB990635 or MB991406	Steering linkage puller	Disconnection of tie rod Disconnection of upper ball joint (MB991113, MB990635 or MB991406) Disconnection of lower ball joint (MB991406)
	MB990956	Needle bearing installer	Press-fitting of knuckle needle bearing (Used together with MB990938)
	MB990906	Drive shaft attachment	Removal and installation of inner shaft (Used together with MB990211)
	MB990560	Bearing remover	Removal and press-fitting of inner shaft bearing
	MB990955	Oil seal installer	Press-fitting of housing tube dust seal Press-fitting of front axle hub oil seal (Used together with MB990938)
	MB990799	Ball joint remover and installer	Installation of free-wheel clutch bearing
	MB991168	Differential oil seal installer	Installation of free-wheel clutch oil seal
	MB990890 or MB990891	Rear suspension bushing base	Installation of free-wheel clutch bearing

Tool	Number	Name	Use
	MB990909	Working base	Support of front differential carrier assembly
	MB991116	Adapter	
	MB990810	Side bearing puller	Removal of side bearing inner race (Used together with MB990811)
	MB990767	End yoke holder	Removal and installation of companion flange
	MB990339	Bearing puller	Removal of drive pinion front bearing inner race
	MB990648	Bearing remover	
 MB990903 MB990552	MB990901	Pinion height gauge set	Measurement of drive pinion height <2400, 2500D, 3000-A/T>
 MB990819 MB990552	MB990818	Pinion height gauge set	Measurement of drive pinion height <3000-M/T, 3500, 2800D>
	MB991151	Torque wrench	Measurement of drive pinion preload
	MB990326	Preload socket	

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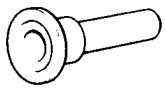
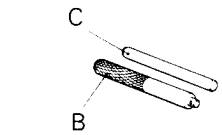
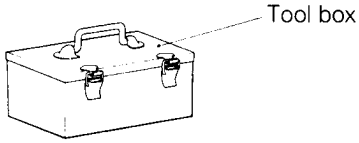
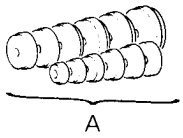
Tool	Number	Name	Use
	MB990802	Bearing installer	Press-fitting of drive pinion front bearing inner race Press-fitting of side bearing inner race
	MB990031 or MB990699	Drive pinion oil seal installer	Press-fitting of drive pinion oil seal
	MB990813	Tap	Removal of adhesive

MB990925



Bar (snap-in type)





Installer adapter

	Contents of new tool (MB990925)	O.D. mm (in.)		Contents of new tool (MB990925)	O.D. mm (in.)
A	MB990926	39 (1.54)	A	MB990933	63.5 (2.50)
	MB990927	45 (1.77)		MB990934	67.5 (2.66)
	MB990928	49.5 (1.95)		MB990935	71.5 (2.81)
	MB990929	51 (2.01)		MB990936	75.5 (2.97)
	MB990930	54 (2.13)		MB990937	79 (3.11)
	MB990931	57 (2.24)	B	MB990938	—
	MB990932	61 (2.40)	C	MB990939	—

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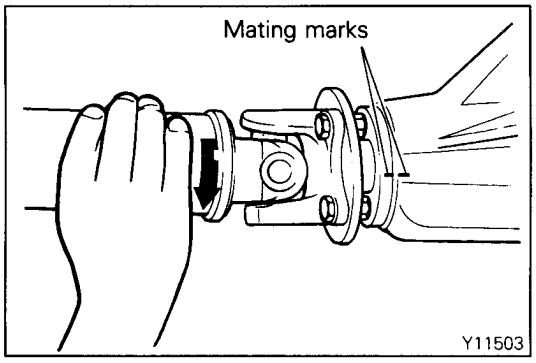
SERVICE ADJUSTMENT PROCEDURES

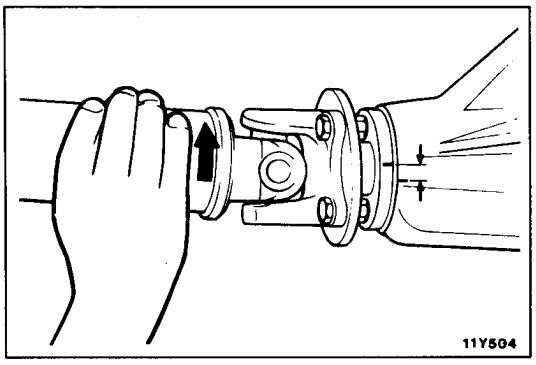
FRONT AXLE TOTAL BACKLASH CHECK E26FBAA

1. If the vehicle vibrates and produces a booming sound, measure the front axle total backlash by the following procedure to see if the differential carrier assembly requires removal.
   (1) On vehicles with free-wheeling hub, shift into 4-wheel drive position.

   NOTE
   On vehicles with manual free-wheeling hub, place the control handle in the LOCK position.
   On vehicles with automatic free-wheeling hub, place the transfer shift lever in 4H position and drive the vehicle 1 to 2 meters (3.3 to 6.5 ft.) to engage the hub with the drive shaft.
   For vehicles with super select 4WD, place the transfer control lever in 4H position and drive the vehicle until the 4WD indicator changes from flashing to illuminated.



   (2) Hold the wheels and place the transfer control lever in 2H position.

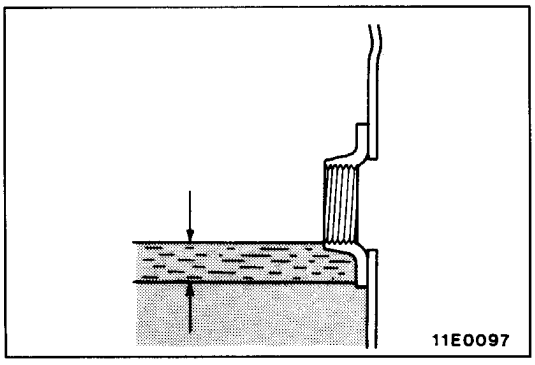


   (3) Turn the companion flange clockwise until all play is removed. Mate mark on the dust cover of the companion flange with that on the differential carrier.
   (4) Turn the companion flange counterclockwise until all play is removed and measure the amount of distance through which the mating marks moved.

   Limit:
   Vehicles with free-wheeling hub
   14 mm (0.55 in.)
   Vehicles without free-wheeling hub
   11 mm (0.43 in.)

2. If the backlash exceeds the limit, remove the differential carrier assembly and final drive gear, and check for differential gear meshing condition and drive shaft or inner shaft spline looseness.

FRONT AXLE GEAR OIL LEVEL CHECK E26FCAA



Remove the filler plug, and check the gear oil level. Check that gear oil level is not 8 mm (0.31 in.) below the bottom of filler plug hole.

Specified gear oil: Hypoid gear oil API classification GL-5 or higher, SAE viscosity No. 90, 80W [1.20 dm^3 (1.27 U.S.qts., 1.05 Imp.qts.)]

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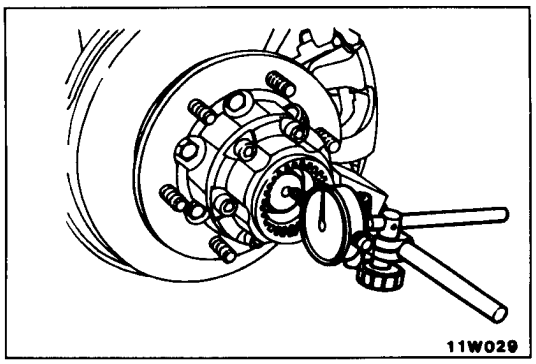
DRIVE SHAFT AXIAL PLAY CHECK E26FDAA

VEHICLES WITH AUTOMATIC FREE-WHEELING HUB

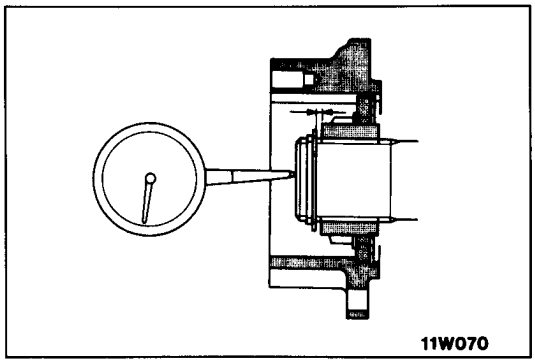
1. Place the free-wheeling hub in the free condition.

   NOTE
   The free condition can be obtained by shifting the transfer shift lever to the 2H position and then moving in reverse for 1 to 2 meters (3.3 to 6.5 ft.)
2. Jack the vehicle up and remove the front wheels.
3. Remove the free-wheeling hub cover.



4. Rotate the drive shaft forward, and backward and then set the drive shaft to the position (the position where axial play is maximum) mid-way between where the rotation feels "heavy" for each (where there is a stopping feeling).
5. Set the dial gauge as shown in the figure; then move the drive shaft in the axial direction and measure the play.

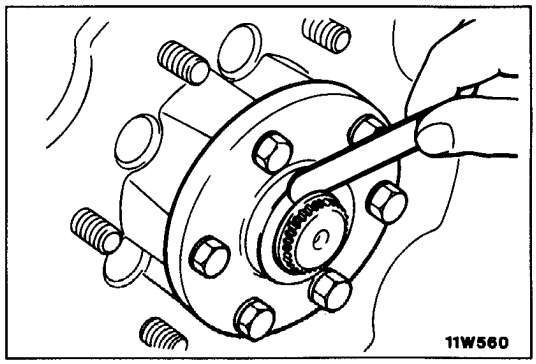
   Standard value: 0.4–0.7 mm (0.016–0.028 in.)
6. If the play is out of standard value, adjust by adding or removing shims.



VEHICLES WITH MANUAL FREE-WHEELING HUB

1. Jack the vehicle up and remove the front wheels.
2. Move the control handle for the free-wheeling hub to the FREE position.
3. Remove the free-wheeling hub cover.
4. Set the dial gauge as shown in the figure; then move the drive shaft in the axial direction and measure the play.

   Standard value: 0.4–0.7 mm (0.016–0.028 in.)
5. If the play is out of standard value, adjust by adding or removing shims.



VEHICLES WITHOUT FREE-WHEELING HUB

1. Jack the vehicle up and remove the front wheels.
2. Remove the hub cap.
3. Manually push the drive shaft in the direction in which it will closely contact the knuckle.
4. As shown in the figure, use a thickness gauge to measure the clearance between the drive flange and snap ring.

   Standard value: 0.4–0.7 mm (0.016–0.028 in.)
5. If the play is out of standard value, adjust by adding or removing shims.

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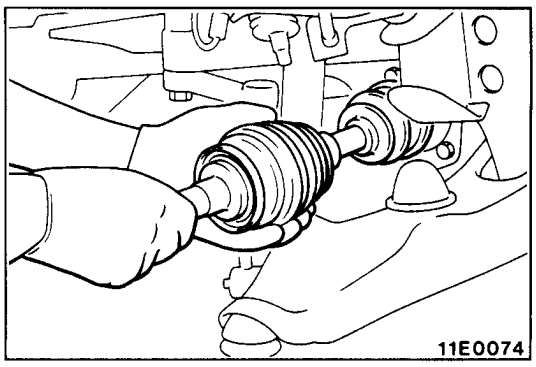
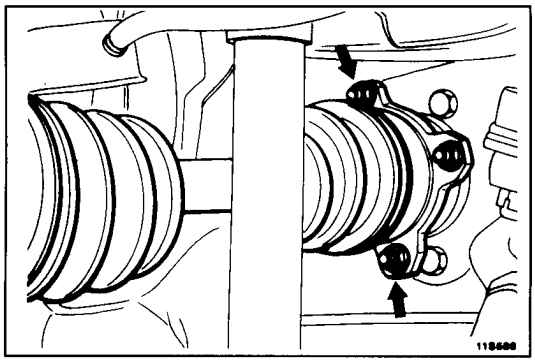


DIFFERENTIAL CARRIER OIL SEAL REPLACEMENT

E26FFAE

1. Remove the under cover.
2. Remove the front hub and knuckle assembly.
3. Remove the left drive shaft.

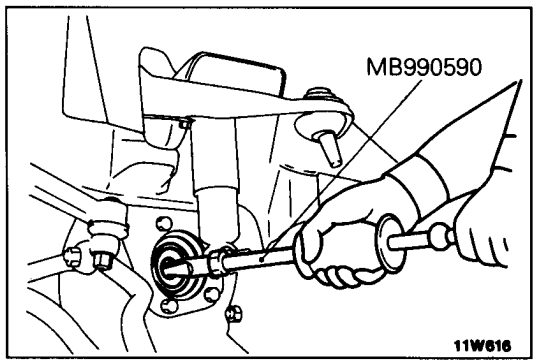
Caution
When pulling the left drive shaft from the differential carrier assembly, be careful that the drive shaft spline does not damage the oil seal.

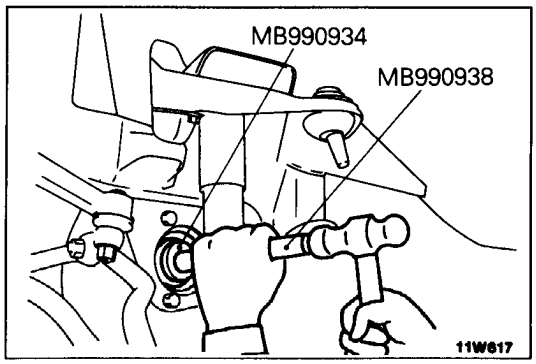


4. Remove the right drive shaft from the inner shaft assembly.
5. After removing the shock absorber (RH) lower mounting bolt, remove the inner shaft.

Caution
When pulling the inner shaft assembly from the differential carrier, be careful that the spline of the inner shaft does not damage the oil seal.

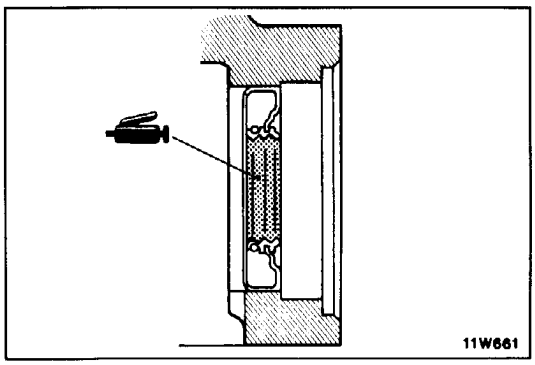
6. For vehicles with super select 4WD, remove the actuator mounting bolt from the housing tube and remove the harness from the clamp.
7. Remove the differential mounting bracket (R.H.) and housing tube.
8. Use the special tool to remove the oil seal.





9. Press-fit the oil seal positively by using the special tools.

NOTE
For vehicles with 4-pinion type differential, there is a white painted identification mark on the metal ring of the oil seal.



10. Apply multi-purpose grease to the lip of the oil seal and install it to the drive shaft (LH).
For the right side, apply multi-purpose grease to the lip of the oil seal and install to the housing tube and differential mounting bracket (RH).

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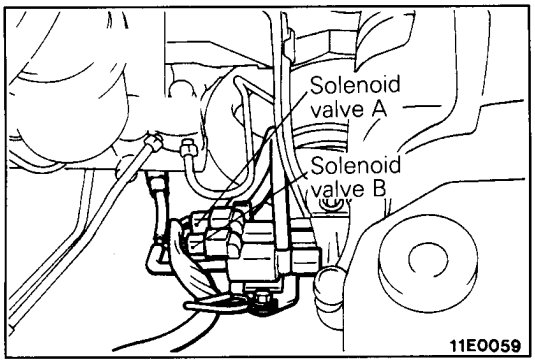
11. Install the inner shaft and drive shaft (RH).

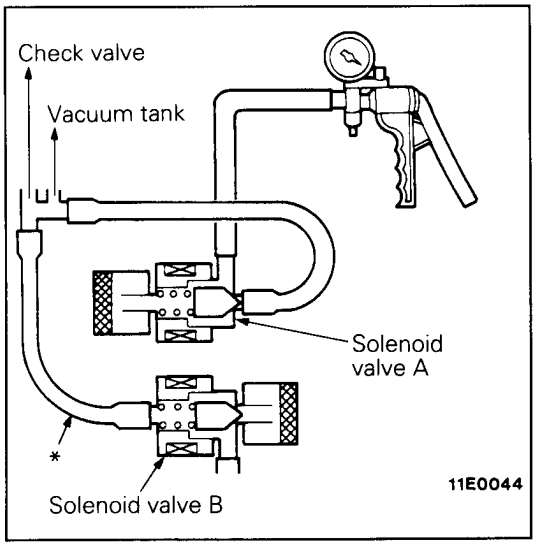
Caution
1. Do not damage the lip of the oil seal.
2. The circlip attached to the BJ side of the drive shaft should be replaced with a new clip.

12. Install the actuator and secure the harness with the clamp.
13. Install the shock absorber.
14. Install the hub and knuckle assembly.
15. Install the under cover.

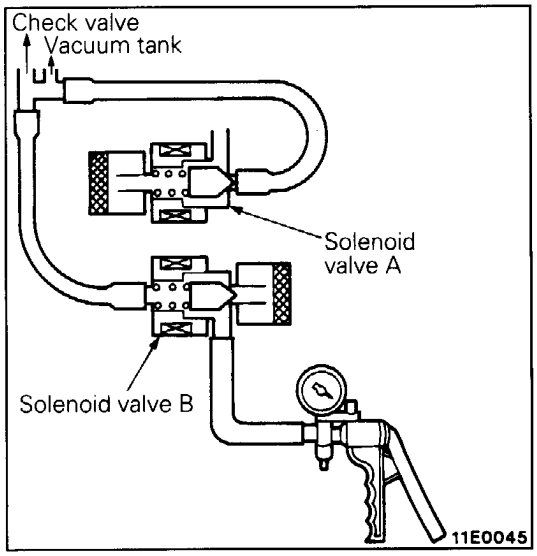


SOLENOID VALVE OPERATION CHECK

(1) Remove the vacuum hoses (blue stripe, yellow stripe) from the solenoid valves.
(2) Disconnect the harness connectors.



(3) Connect a hand vacuum pump to solenoid valve A. Apply negative pressure and carry out the following inspections.
1. Even if the hand pump is operated with no other operation, no negative pressure develops.
2. Even when battery voltage is applied to solenoid valve A, the condition is the same as in (1), but when the vacuum hose of solenoid valve B is blocked by bending at the * mark, negative pressure is maintained.
3. When battery voltage is applied to solenoid valves A and B, negative pressure is maintained.



(4) Connect the hand vacuum pump to solenoid valve B. Apply negative pressure and carry out the following inspections.
1. With no other operation, negative pressure is maintained.
2. When battery voltage is applied to solenoid valve B, negative pressure equalizes.
3. When battery voltage is applied to solenoid valve A, negative pressure equalizes.

(5) Measure the resistance of the solenoid valves.

Standard value: 36–46 Ω [at 20°C (60°F)]

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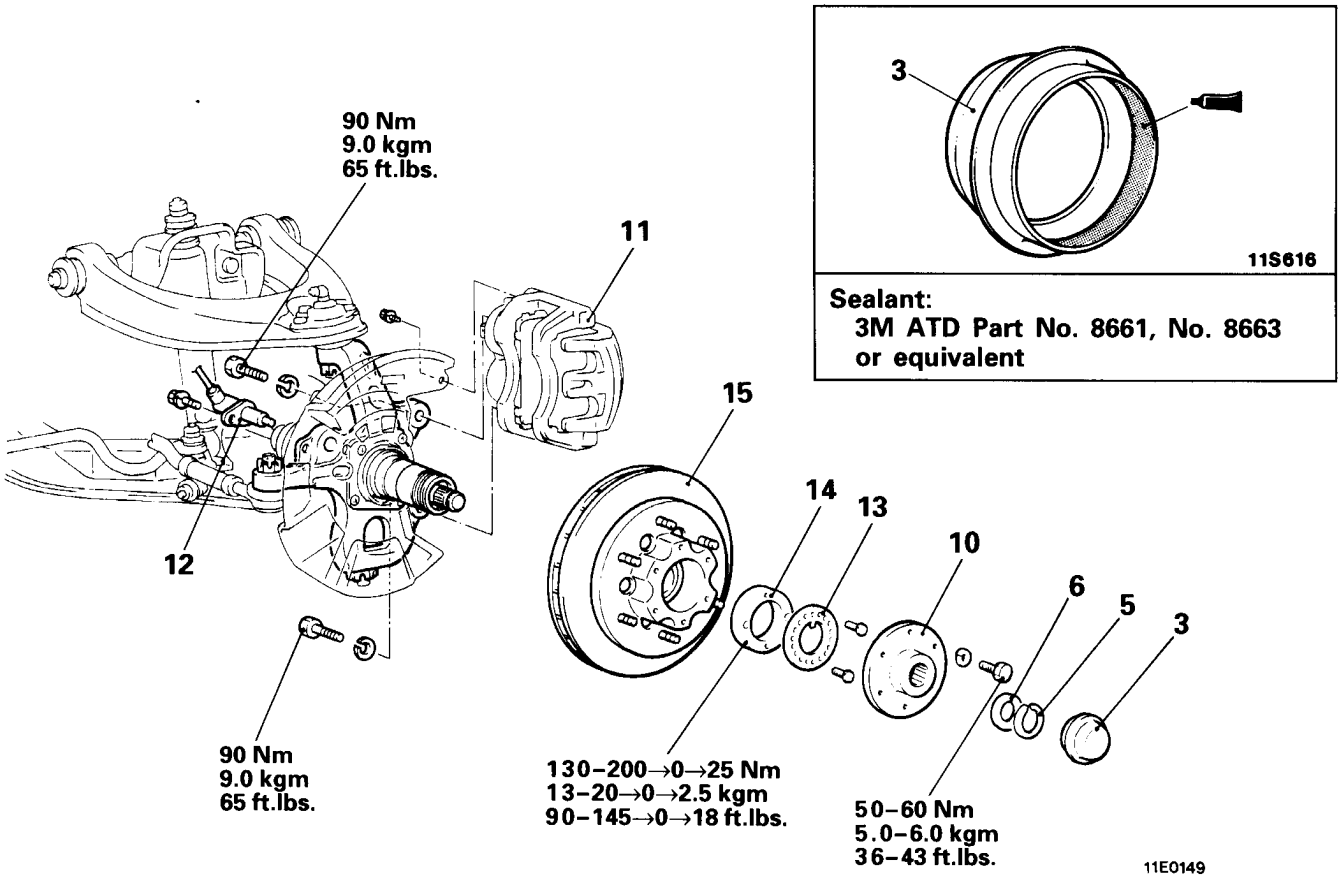
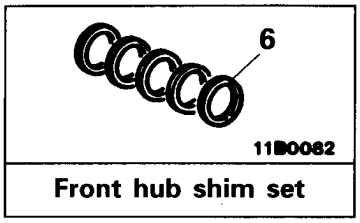
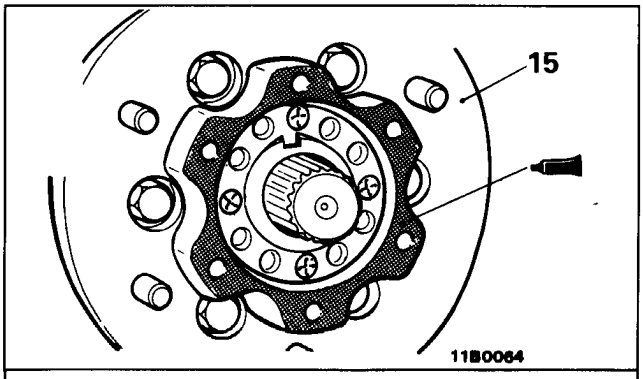
AXLE HUB

E26IA--

REMOVAL AND INSTALLATION (Vehicles without Free-wheeling Hubs)







Removal steps

3. Hub cap
- ◆◆ • Adjustment of drive shaft axial play
- ◆◆ 5. Snap ring
6. Shim
10. Drive flange
- ◆◆ 11. Front brake assembly
12. Speed sensor <Vehicles with ABS>
(refer to GROUP 35 – Wheel Speed Sensor.)
13. Lock washer
- ◆◆ • Adjustment of wheel bearing preload
- ◆◆ 14. Lock nut
- ◆◆ 15. Front hub assembly

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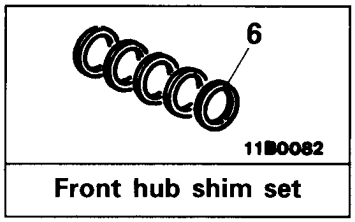
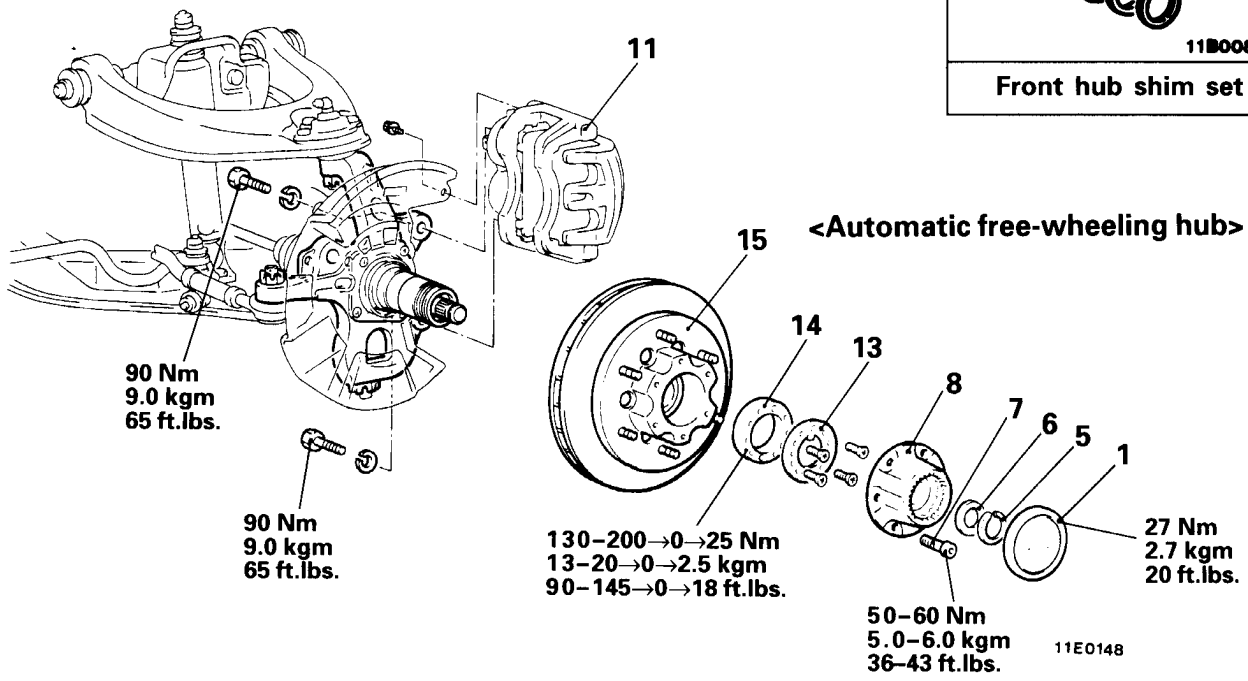
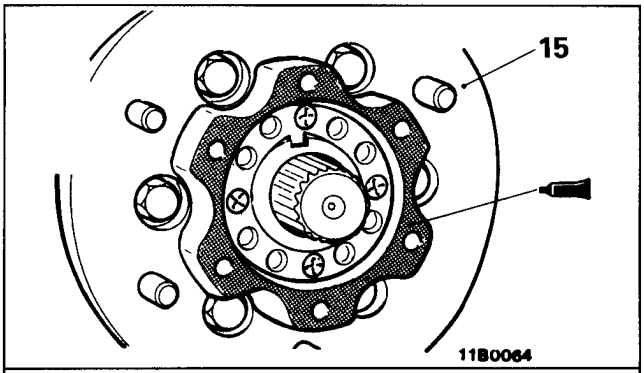
REMOVAL AND INSTALLATION (Vehicles with Free-wheeling Hubs)



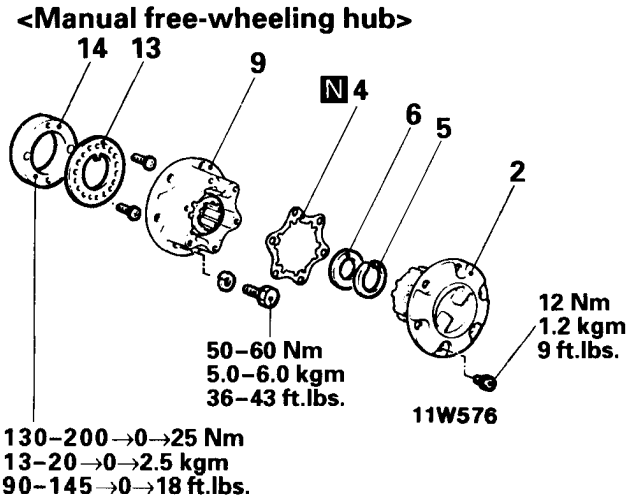
Front hub shim set





Sealant: 3M ATD Part No. 8661, No. 8663 or equivalent

Caution
Make sure that there is no excess specified sealant on the hub outside surface.



Removal steps
<Vehicles with automatic free-wheeling hub>

- 1. Cover
- • Adjustment of drive shaft axial play
- 5. Snap ring
- 6. Shim
- • Adjustment of automatic free-wheeling hub turning resistance
- 7. Bolts
- 8. Automatic free-wheeling hub assembly
- 11. Front brake assembly
- 13. Lock washer
- • Adjustment of wheel bearing preload
- 14. Lock nut
- 15. Front hub assembly

Removal steps
<Vehicles with manual free-wheeling hub>

- 2. Free-wheeling hub cover
- • Adjustment of drive shaft axial play
- 4. Gasket
- 5. Snap ring
- 6. Shim
- 9. Manual free-wheeling hub assembly
- 11. Front brake assembly
- 13. Lock washer
- • Adjustment of wheel bearing preload
- 14. Lock nut
- 15. Front hub assembly

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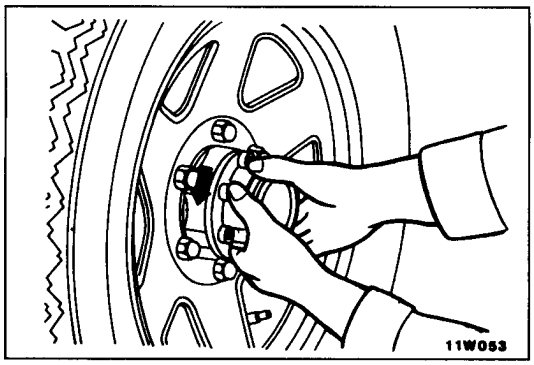

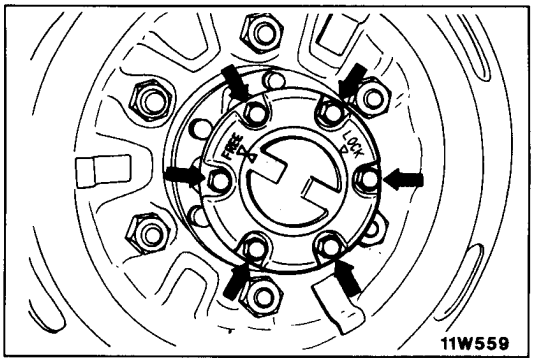

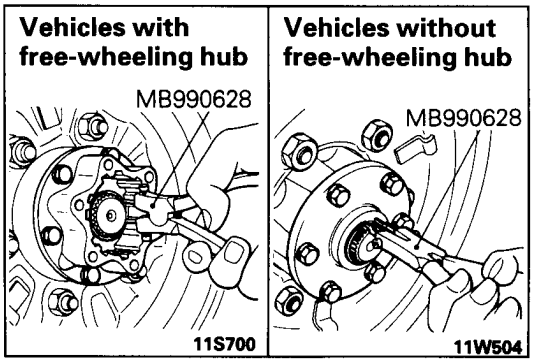

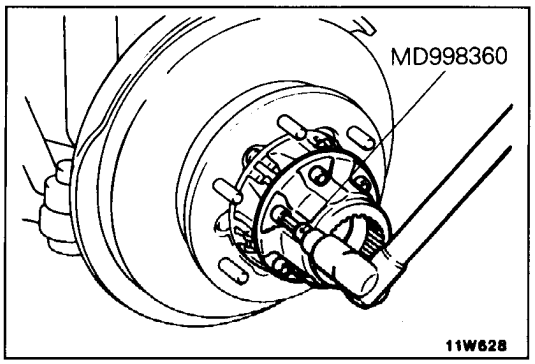

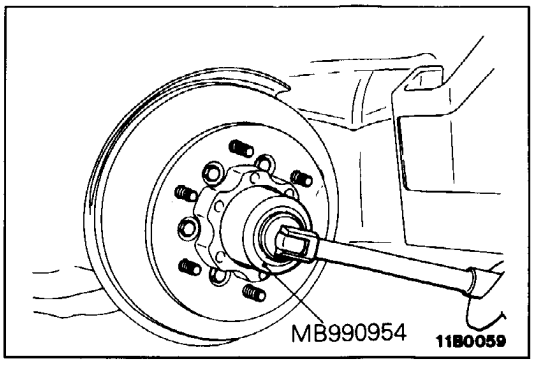

SERVICE POINTS OF REMOVAL E26IBAG

1. REMOVAL OF COVER

(1) Place the free-wheeling hub in the free condition.

NOTE
The free condition can be obtained by shifting the transfer shift lever to the 2H position and then moving in reverse for 1 to 2 meters (3.3 to 6.5 ft.).

(2) Remove the automatic free-wheeling hub cover.

NOTE
When the cover cannot be loosened by hand, use an oil filter wrench with a protective cloth in between not to damage the cover.

2. REMOVAL OF FREE-WHEELING HUB COVER

(1) Set the control handle to the FREE position.
(2) Remove the free-wheeling hub cover.

5. REMOVAL OF SNAP RING

7. REMOVAL OF BOLTS (Vehicles with automatic free-wheeling hub)

11. REMOVAL OF FRONT BRAKE ASSEMBLY

(1) Remove the front brake assembly with the brake hose connected.
(2) Use wire to suspend the front brake assembly from the upper arm so that the front brake assembly won't fall.

Caution
Do not twist the brake hose.

14. REMOVAL OF LOCK NUT/15. FRONT HUB ASSEMBLY

(1) After the lock washer has been removed, remove the lock nut with the special tool.
(2) Remove the front hub assembly from the knuckle together with the inner and outer bearings.

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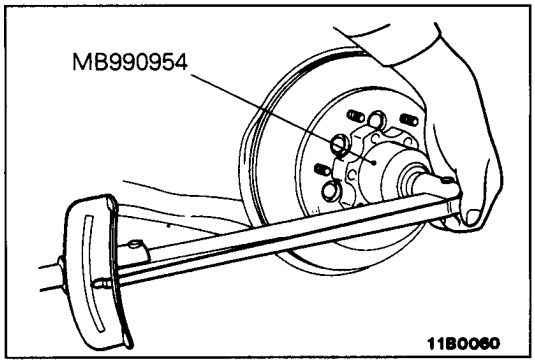

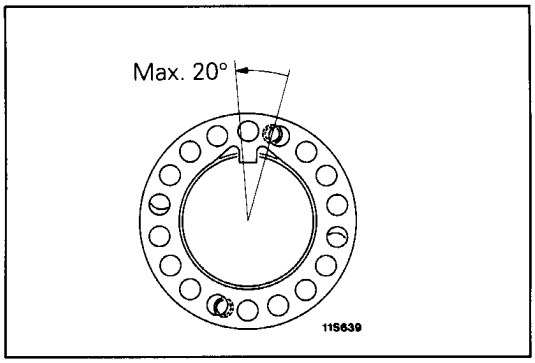

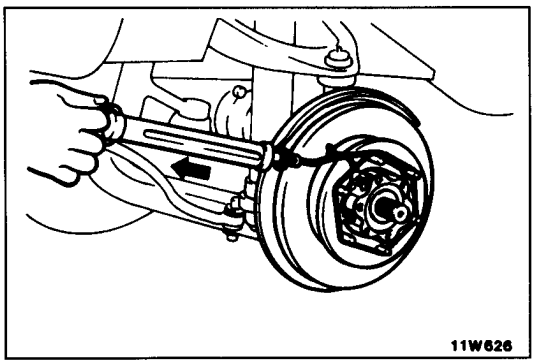

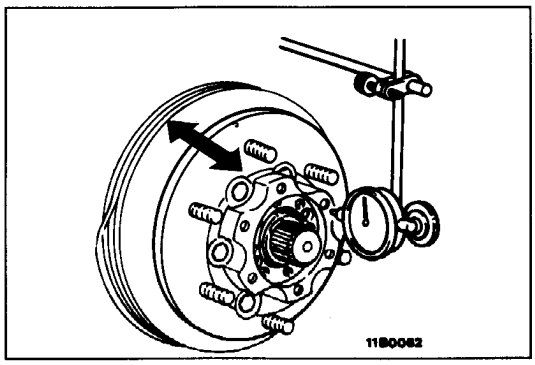

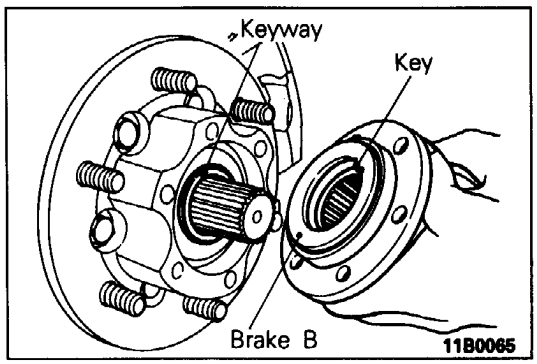

SERVICE POINTS OF INSTALLATION E26IDAH

• ADJUSTMENT OF WHEEL BEARING PRELOAD

(1) Using the special tool, tighten the lock nut by the following procedures.

Tighten to 130–200 Nm
(13–20 kgm, 94–145 ft.lbs.)
↓
Loosen to 0 Nm (0 kgm, 0 ft.lbs.)
↓
Retighten to 25 Nm (2.5 kgm, 18 ft.lbs.)
and then loosen 30°–40°

(2) Install the lock washer. If the hole position is not aligned with the lock nut, move it within a range of not more than 20° until the holes are aligned.

(3) Loosen the lock nut approximately 30 to 40 degrees to adjust the front hub's turning resistance and play in the axial direction so that they agree with the standard values.

Standard value: 0.3–1.3 Nm
(3–13 kgcm, 2.6–11.3 in.lbs.)
[Spring scale reading]
5–18 N
(0.5–1.8 kg, 1.1–4.0 lbs.)
Standard value: 0.05 mm (0.0020 in.) or less

NOTE
If adjustment is not possible, the bearing may be incorrectly installed; check and, if necessary, repair.
The lubrication condition should as also be checked.

(4) Mount the lock washer. If the lock washer holes do not align with the lock nut holes, loosen the lock nut to align them.

8. INSTALLATION OF AUTOMATIC FREE-WHEELING HUB ASSEMBLY

(1) Align the key of the brake (B) and the keyway of knuckle spindle and loosely install the automatic free-wheeling hub assembly.
(2) Check that the hub proper and automatic free-wheeling hub assembly are brought into intimate contact when the assembly is forced lightly against the hub proper. If not, turn the hub until intimate contact is achieved.

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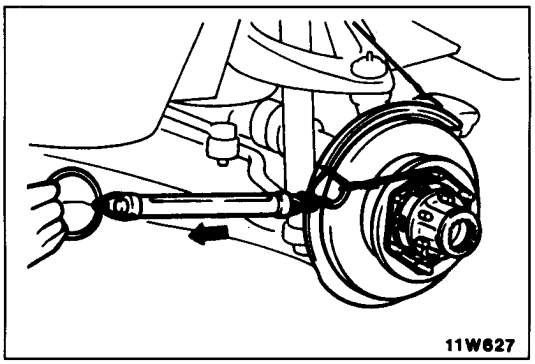


- **ADJUSTMENT OF AUTOMATIC FREE-WHEELING HUB TURNING RESISTANCE**

  Check the automatic free-wheeling hub turning resistance by the following procedure.

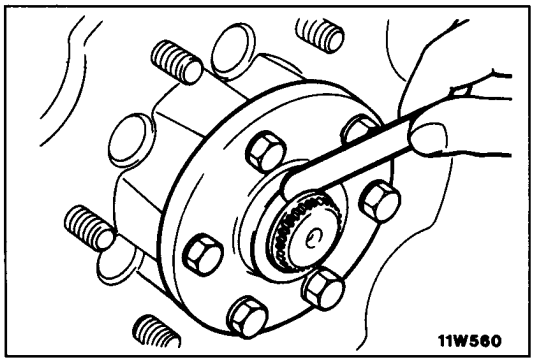
  (1) Use a spring scale to measure the front hub turning resistance again. Subtract the value measured before the installation of the automatic free-wheeling hub from that measured here to find the turning resistance of the free-wheeling hub.

  Limit: 1.0 Nm (10 kgcm, 8.7 in. lbs.)
  [Spring scale reading] 14 N (1.4 kg, 3.1 lbs.)

  (2) If the free-wheeling hub turning resistance exceeds the limit, disassemble and reassemble the free-wheeling hub again.

- **ADJUSTMENT OF DRIVE SHAFT AXIAL PLAY**

  After the installation of shim and snap ring, check the drive shaft axial play by the following procedure.

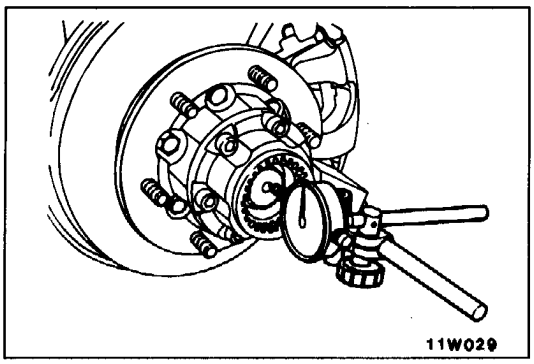


<Vehicles with drive flange>

(1) Install the shim and snap ring to the drive shaft.
(2) Push the drive shaft in by hand towards the knuckle until they touch.
(3) Measure the clearance between the drive flange and the spacer with a thickness gauge as shown in the illustration.

Standard value: 0.4–0.7mm (0.016–0.028in.)

(4) If the amount of play is outside the standard value, adjust by selecting a shim that will bring the play to the standard value.



<Vehicles with free-wheeling hubs>

(1) Rotate the drive shaft forward, and backward and then set the drive shaft to the position (the position where axial play is maximum) mid-way between where the rotation feels "heavy" for each (where there is a stopping feeling).
(2) Set the dial gauge as shown in the figure; then move the drive shaft in the axial direction and measure the play.

Standard value: 0.4–0.7 mm (0.016–0.028 in.)

(3) If the play is out of standard value, adjust by adding or removing shims.

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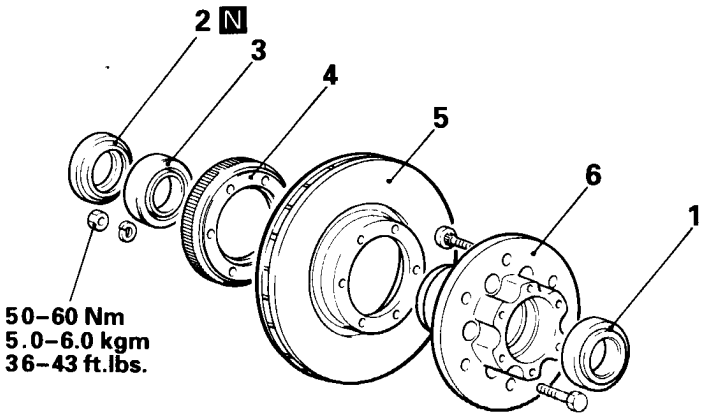
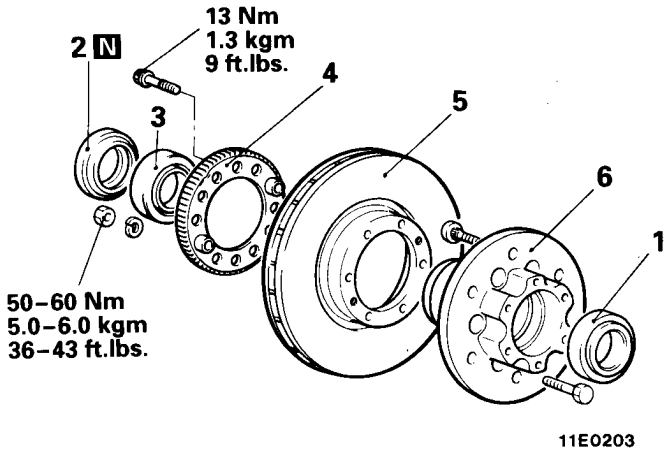
DISASSEMBLY AND REASSEMBLY (Front Axle Hub) E26II--

<Vehicles built up to May, 1994>

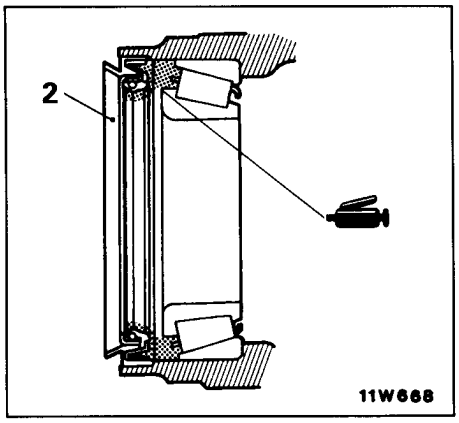


11E0077

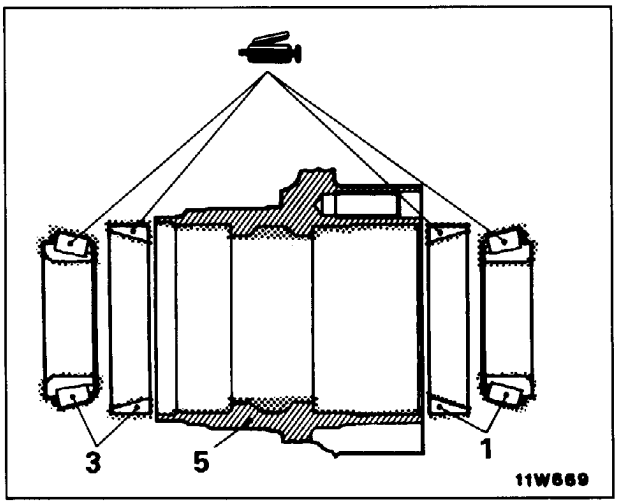
<Vehicles built from June, 1994>



11E0203



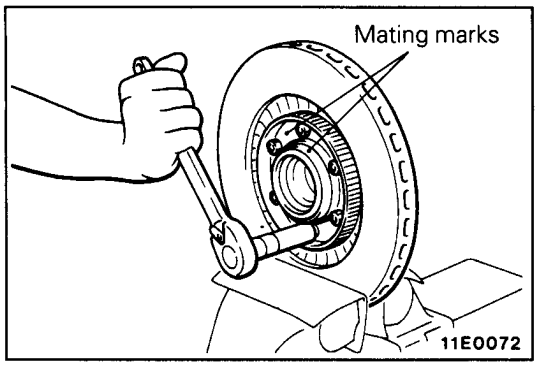
11W668



11W669

Disassembly steps

1. Outer bearing
2. Oil seal
3. Inner bearing
4. Rotor <Vehicles with ABS>
5. Brake disc
6. Front hub

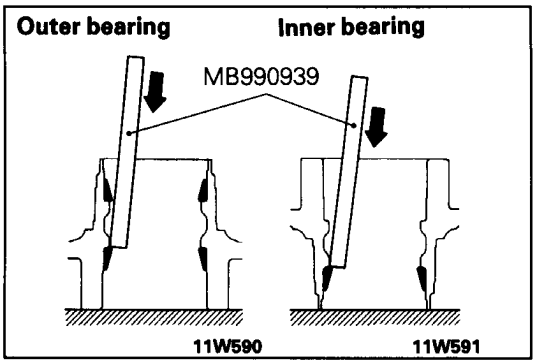


SERVICE POINTS OF DISASSEMBLY E26IJAB

5. REMOVAL OF BRAKE DISC

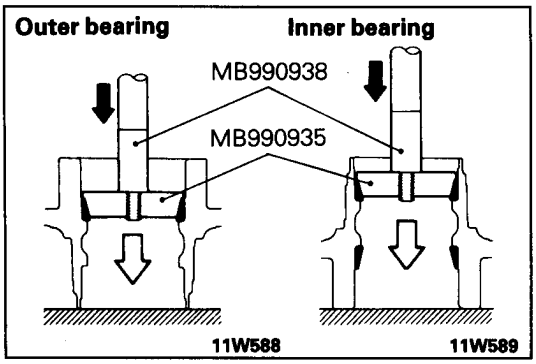
Make the mating marks on the brake disc and front hub, and then separate the front hub and brake disc, if necessary.

Caution
Lock disc in vise and grip with copper or aluminum board.



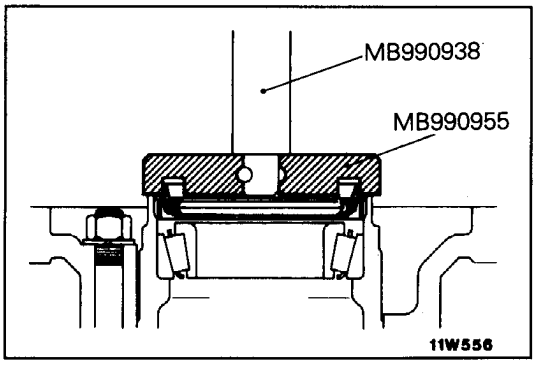
BEARING REPLACEMENT E26IKAD

(1) Wipe off grease from the front hub interior.
(2) Using the special tool, drive out the inner and outer bearing outer races by tapping them uniformly.



(3) Press-fit the inner and outer bearing outer races by using the special tools.

NOTE
The bearing inner race and bearing outer race should be replaced as an assembly.

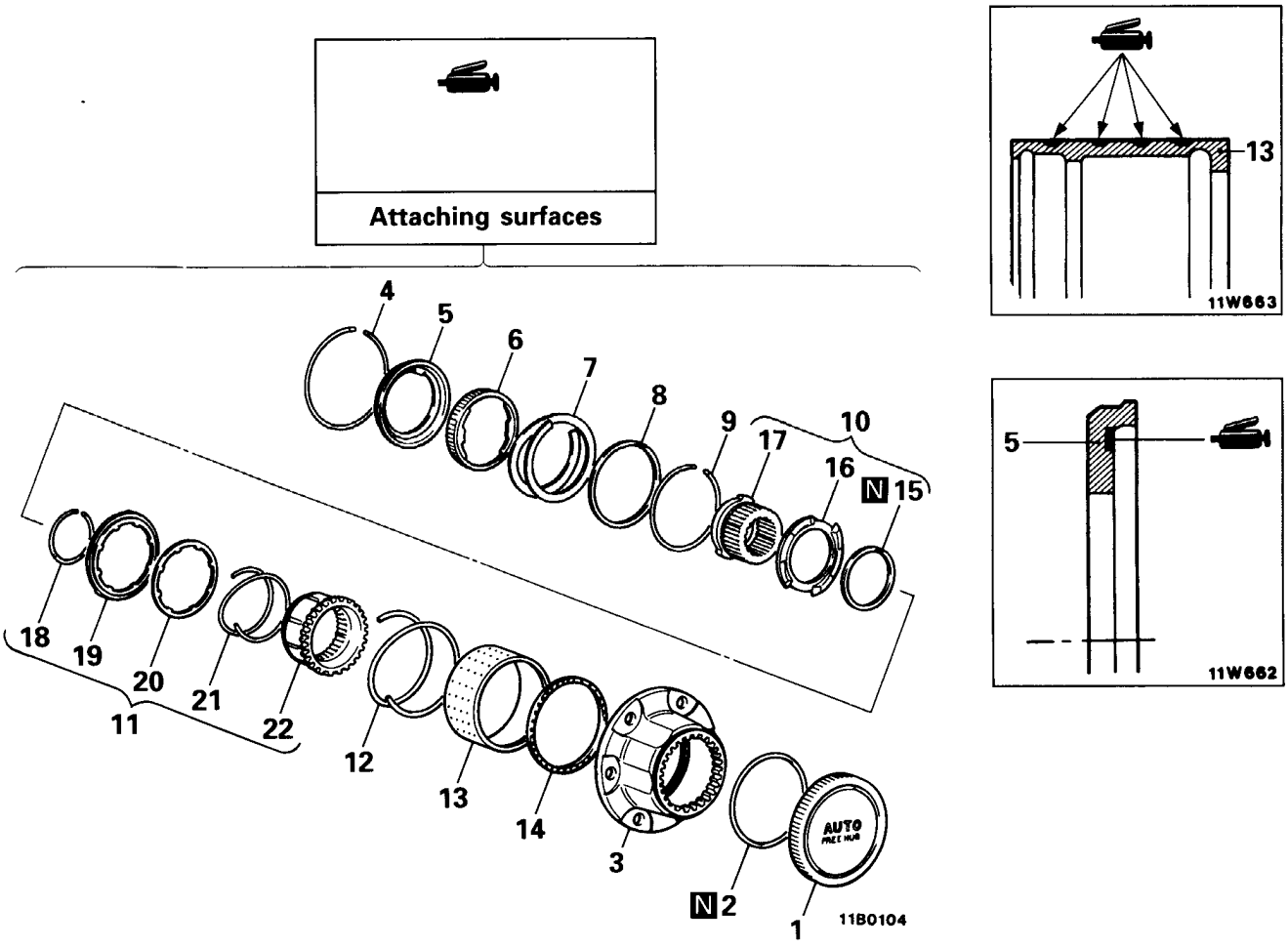


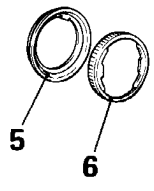
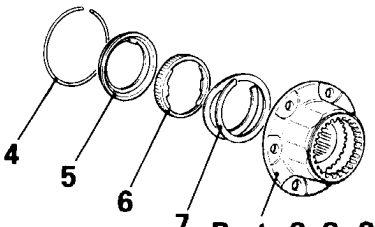
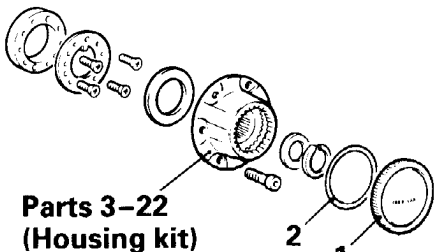
SERVICE POINTS OF REASSEMBLY E26INAD

2. INSTALLATION OF OIL SEAL

AUTOMATIC FREE-WHEELING HUB

DISASSEMBLY AND REASSEMBLY



 11E0134	 Parts 3, 8–22 (Housing assembly) 11E0133	 11E0132
Brake kit	Housing kit	Automatic free-wheeling hub kit

Disassembly steps

1. Hub cover
2. O-ring
3. Housing
4. ◆◆ Housing C-ring
5. Brake (B)
6. Brake (A)
7. Brake spring
8. Housing snap ring
9. ◆◆ Retainer (B) C-ring
10. ◆◆ Drive gear assembly
11. ◆◆ Slide gear assembly
12. ◆◆ ◆◆ Return spring
13. Retainer (B)
14. Retainer bearing
15. Drive gear snap ring
16. Retainer (A)
17. Drive gear
18. ◆◆ Slide gear C-ring
19. Cam
20. Spring holder
21. Shift spring
22. Slide gear

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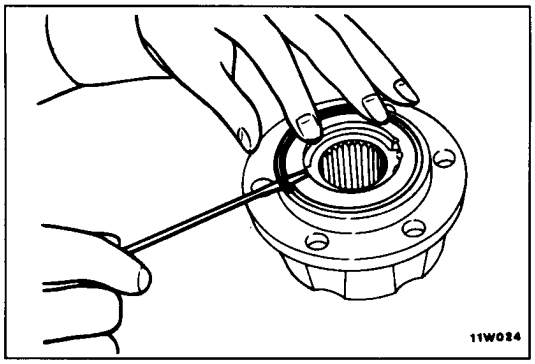
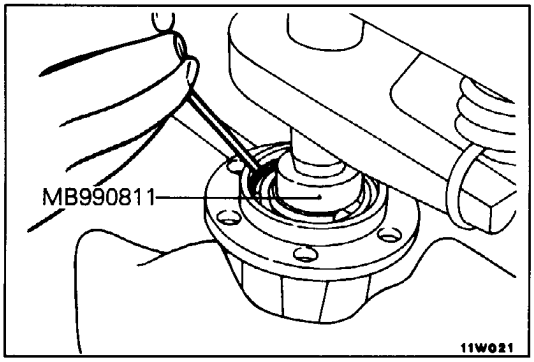


SERVICE POINTS OF DISASSEMBLY E26JBAC

4. REMOVAL OF HOUSING C-RING

NOTE
The ring is easily removable by pushing the brake (B) in and using a small-end screwdriver, etc.

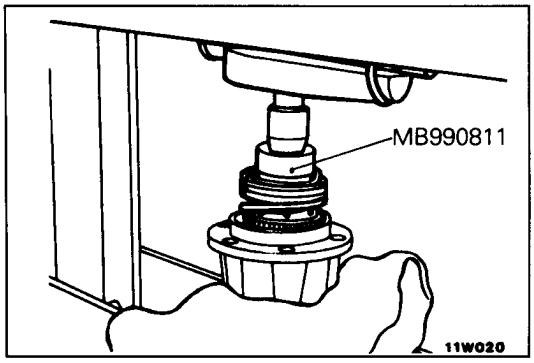


9. REMOVAL OF RETAINER (B) C-RING

Using a special tool, lightly push the drive gear in and remove the retainer (B) C-ring.

NOTE
Since the return spring relaxes approx. 40 mm (1.57 in.), the stroke of the press should be set to more than 40 mm (1.57 in.)

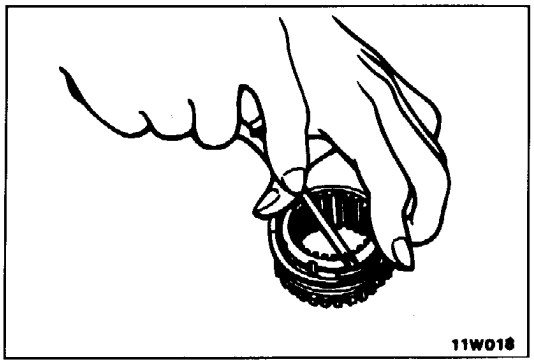
Caution
1. **Place a protective cover not to damage the cover attaching surface of the housing before setting on the press table.**
2. **Make sure that the pressing force does not exceed 200 N (20 kg, 44.1 lbs.).**



10. REMOVAL OF DRIVE GEAR ASSEMBLY/11. SLIDE GEAR ASSEMBLY/12. RETURN SPRING

Slowly reduce the pressure of the press until the return spring fully relaxes.

Caution
When the pressure of press is removed, make sure that the retainer (A) is not caught by the retainer (B).



18. REMOVAL OF SLIDE GEAR C-RING

Push the cam in and remove the slide gear C-ring with the spring compressed.

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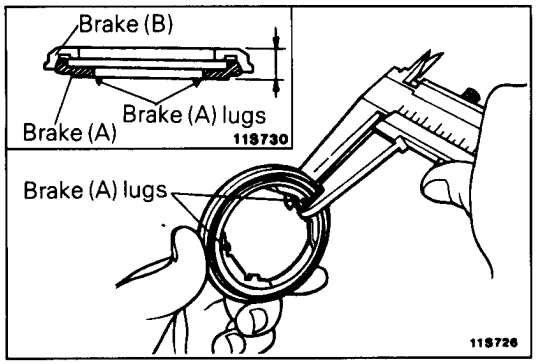

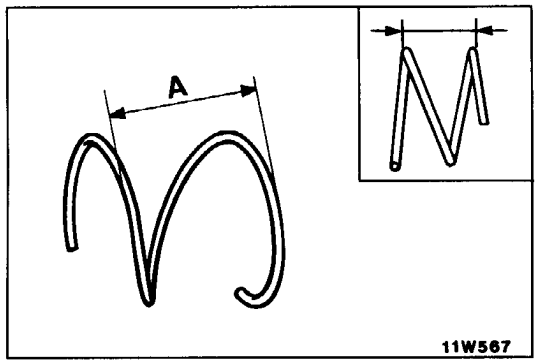

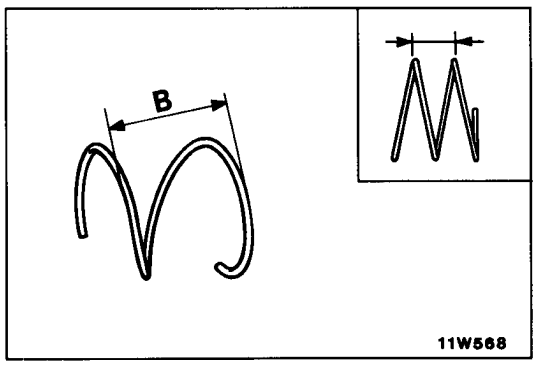

INSPECTION E26ICAC

BRAKE ASSEMBLY THICKNESS

Check the brake assembly thickness by following the steps below.

(1) Assemble brake (A) and brake (B) and then use slide calipers to measure the thickness of the assembly at the two lugs on brake (A).

Standard value: 10.5 mm (0.413 in.)
Limit: 9.6 mm (0.378 in.)

NOTE
Measure each side separately.

(2) If the measured value is below the limit, replace brake (A) and brake (B) as a set.

DETERIORATION OF RETURN SPRING

Check the return spring for deterioration by following the steps below.

(1) Measure the dimension A shown in illustration at the opposite side of spring end.

Limit: 35 mm (1.38 in.)

Caution
To measure the dimension A shown in illustration, measure the dimension from the outermost extremity of one wire diameter to that of the other wire diameter.

(2) If the measured value is below the limit, replace the spring.

DETERIORATION OF SHIFT SPRING

Check the shift spring for deterioration by following the steps below.

(1) Measure the dimension B shown in illustration at the opposite side of spring end.

Limit: 30 mm (1.18 in.)

Caution
To measure the dimension B shown in illustration, measure the dimension from the outermost extremity of one wire diameter to that of the other wire diameter.

(2) If the measured value is below the limit, replace the spring.

SERVICE POINTS OF REASSEMBLY E26JDAC

12. INSTALLATION OF RETURN SPRING

Install the return spring with the smaller coil diameter side toward the cam.

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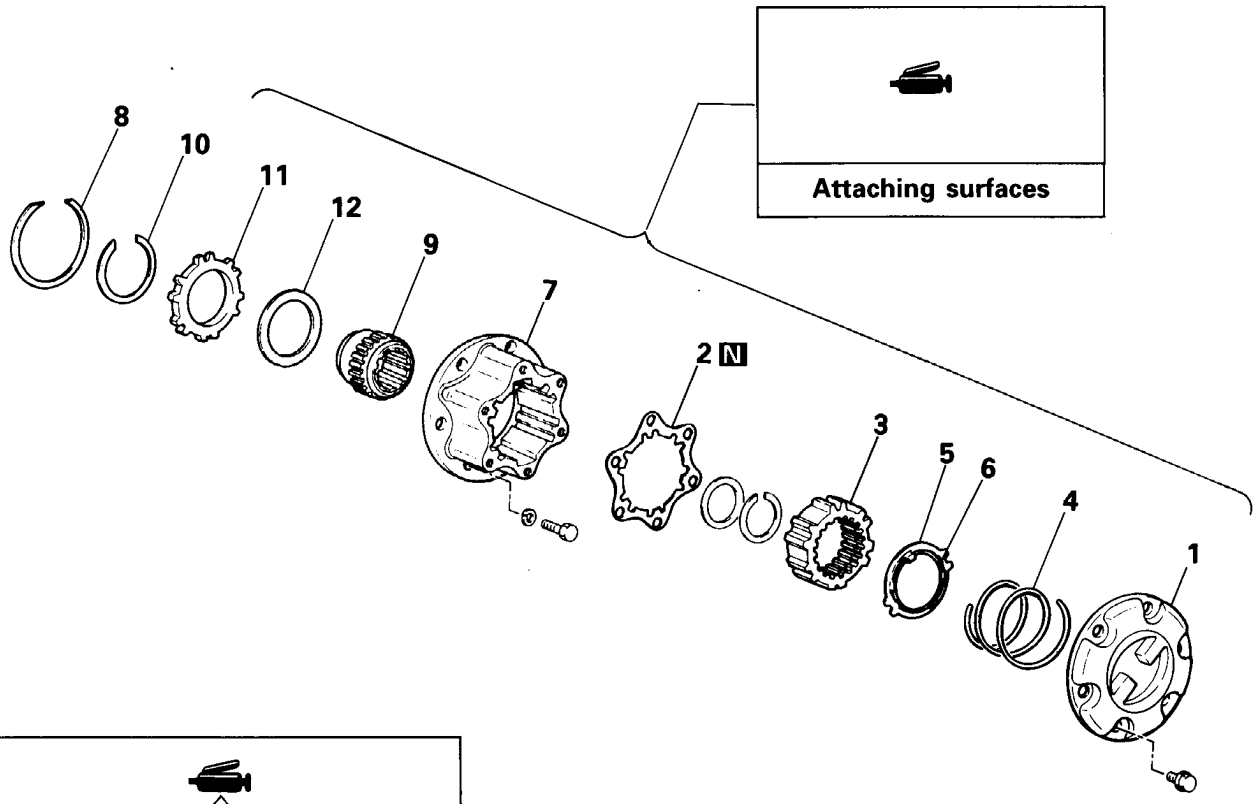
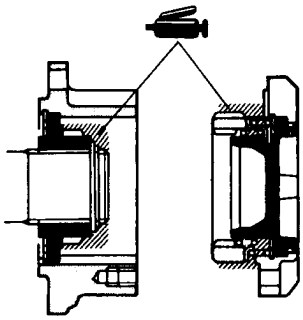
MANUAL FREE-WHEELING HUB

E26JA-B

DISASSEMBLY AND REASSEMBLY

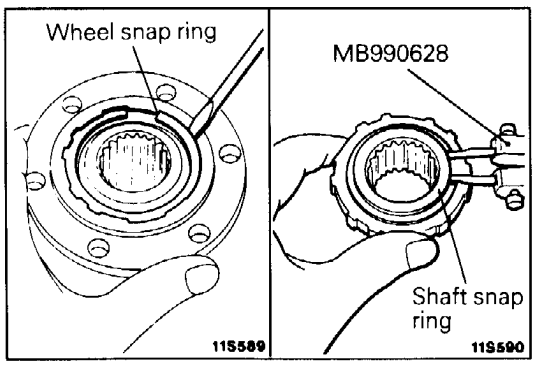




NOTE
A liberal amount of grease should be applied, especially when grease is wiped away or a new free-wheeling hub is installed.

Disassembly steps

1. Free-wheeling hub cover
2. Gasket
3. Free-wheeling hub clutch
4. Compression spring
5. Follower
6. Tension spring
7. Free-wheeling hub body
8. ◆◆ Wheel snap ring
9. Inner hub
10. ◆◆ Shaft snap ring
11. Free-wheeling hub ring
12. Spacer



SERVICE POINTS OF DISASSEMBLY

E26JBBC

8. REMOVAL OF WHEEL SNAP RING/10. SHAFT SNAP RING

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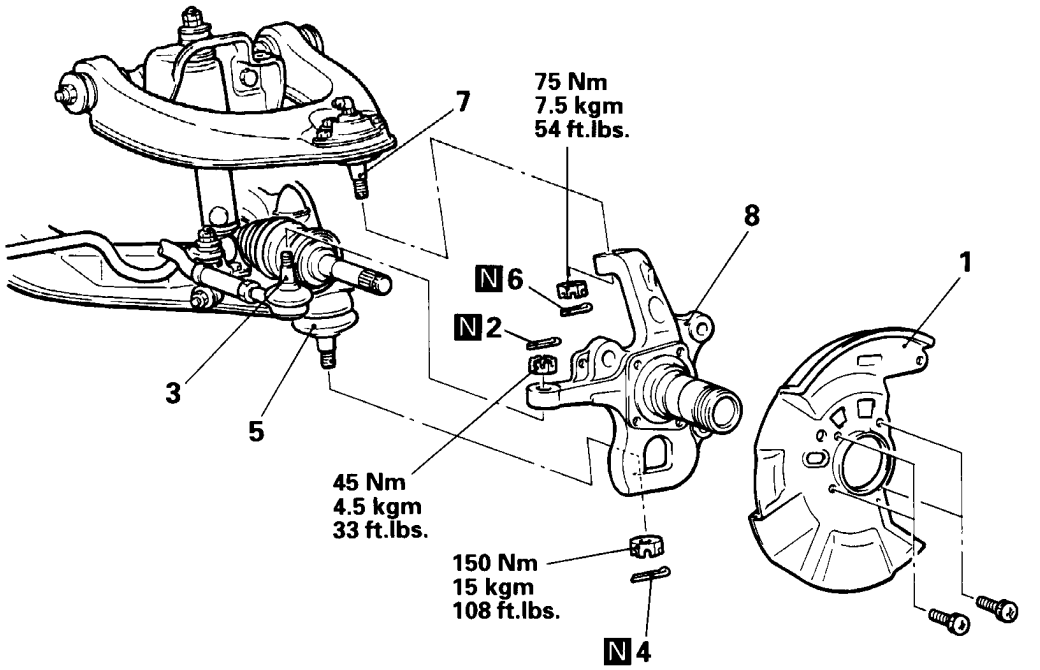
KNUCKLE

REMOVAL AND INSTALLATION

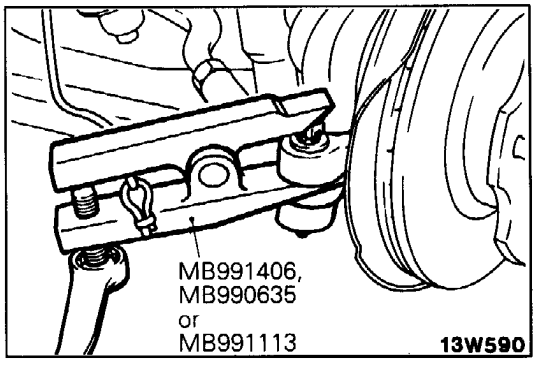
E26NA--

Pre-removal and post-installation Operation
- Removal and Installation of the Front Hub (Refer to P.26-12.)



Removal steps

1. Dust cover
2. Split pin
3. ◆◆ Connection for tie rod assembly and knuckle
4. Split pin
5. ◆◆ Connection for lower ball joint and knuckle
6. Split pin
7. ◆◆ Connection for upper ball joint and knuckle
8. Knuckle



SERVICE POINTS OF REMOVAL

E26NBAF

3. DISCONNECTION OF TIE ROD ASSEMBLY AND KNUCKLE

Caution

1. Use cord to bind the special tool closely so it won't become separated.

2. The nut should be loosened only, not removed.

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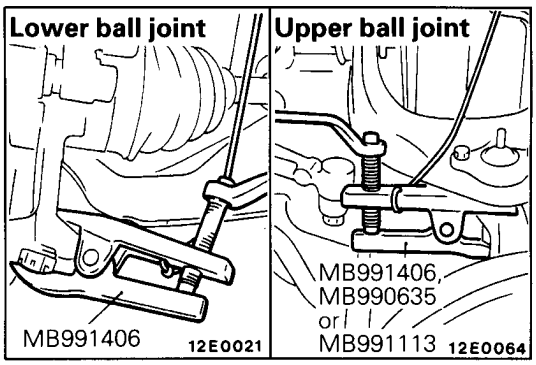
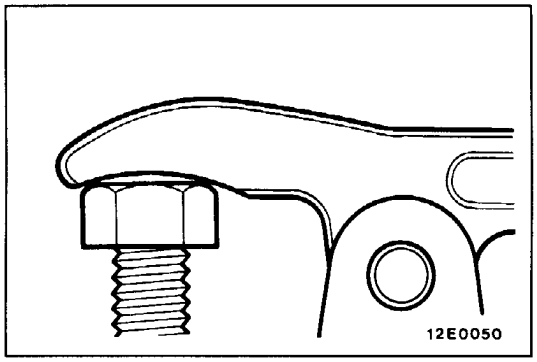


5. DISCONNECTION OF LOWER BALL JOINT AND KNUCKLE/7. UPPER BALL JOINT AND KNUCKLE

Caution

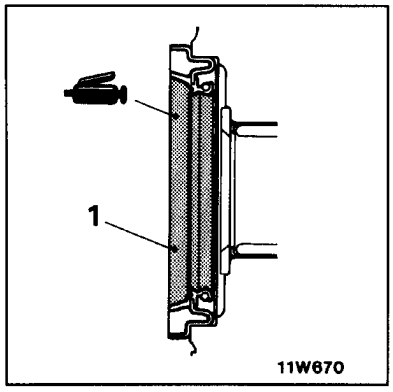
1. **Support the lower arm with a jack when removing the knuckle from the lower ball joint or the upper ball joint.**
2. **After the knuckle has been removed, lower the jack slowly.**

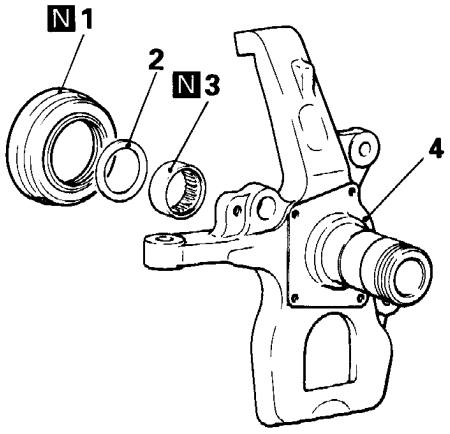


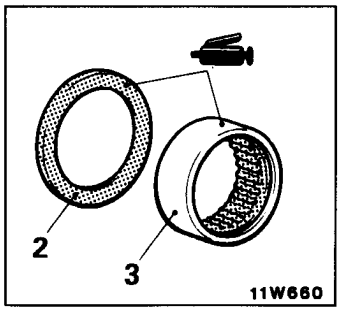
3. **Insert the special tool securely.**

DISASSEMBLY AND REASSEMBLY

E26NJ--

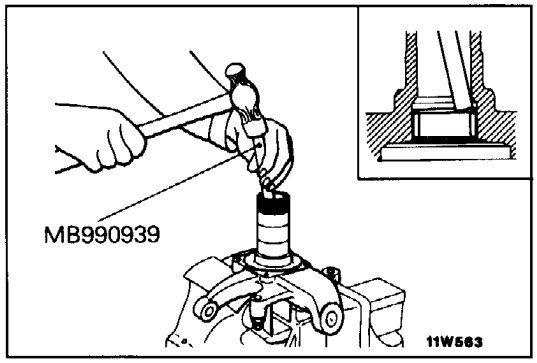






Disassembly steps

- ◆◆ 1. Oil seal
- ◆◆ 2. Spacer
- ◆◆◆◆ 3. Needle bearing
- 4. Knuckle



SERVICE POINTS OF DISASSEMBLY

E26NKAB

3. REMOVAL OF NEEDLE BEARING

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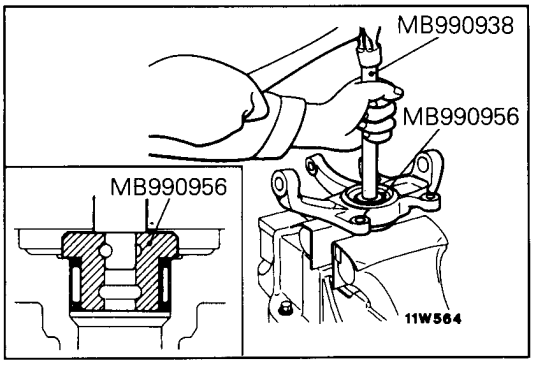
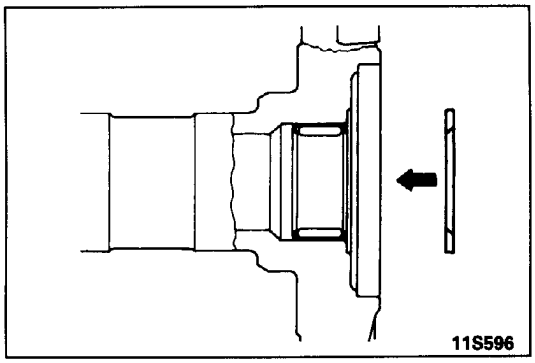
SERVICE POINTS OF REASSEMBLY E26NMAB



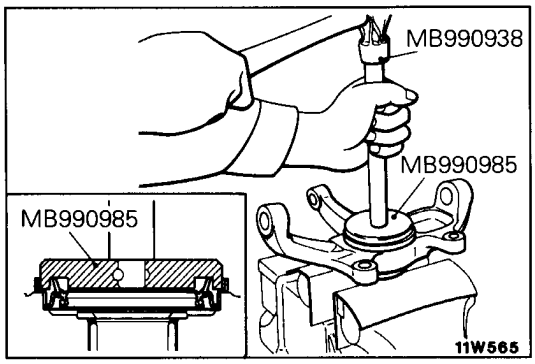
3. INSTALLATION OF NEEDLE BEARING

Caution
Use care to prevent driving the needle bearing too far in.



2. INSTALLATION OF SPACER

Install the spacer to the knuckle with the chamfered side toward the centre of vehicle.



1. INSTALLATION OF OIL SEAL

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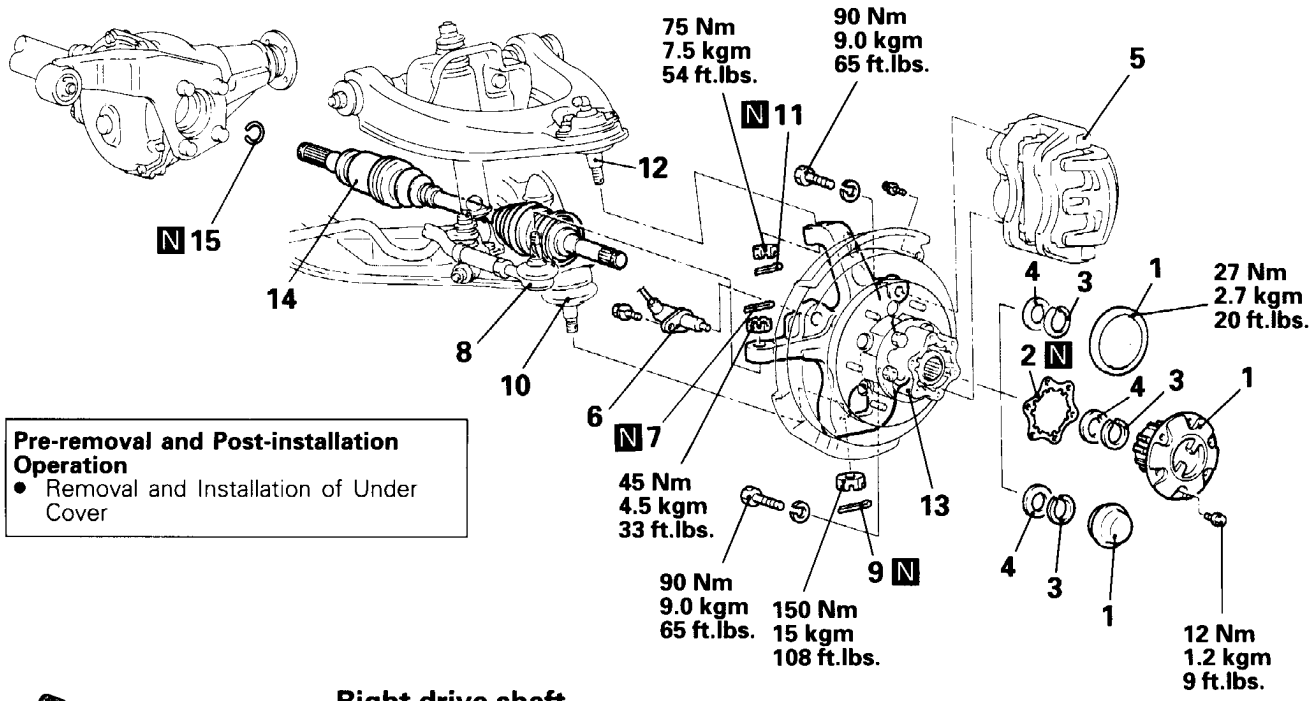
DRIVE SHAFT

REMOVAL AND INSTALLATION

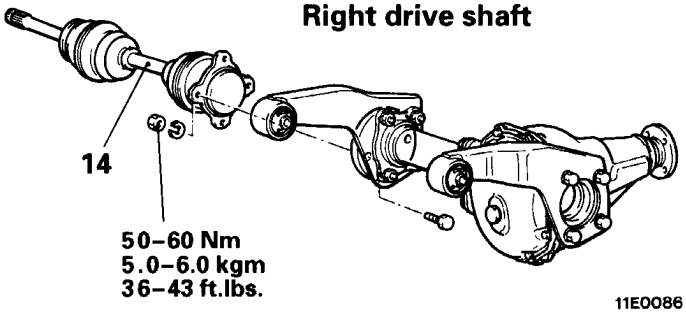
E26QA--

Left drive shaft



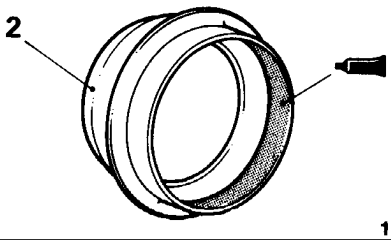
Pre-removal and Post-installation Operation
- Removal and Installation of Under Cover

Right drive shaft



11E0086

11E0150



11S616

Sealant:
3M ATD Part No. 8661, No. 8663 or equivalent

Removal steps

◆◆ 1. Cover
<Automatic free-wheeling hub>
Free-wheeling hub cover
<Manual free-wheeling hub>
Hub cap
<Drive flange>
2. Gasket (Manual free-wheeling hub)
◆◆ 3. Snap ring
4. Shim
◆◆ 5. Front brake assembly
6. Speed sensor <Vehicles with ABS>
(Refer to GROUP 35 – Wheel Speed Sensor.)
7. Split pin
◆◆ 8. Connection of tie rod assembly and knuckle
9. Split pin
◆◆ 10. Connection of lower ball joint and knuckle
11. Split pin
◆◆ 12. Connection of upper ball joint and knuckle
13. Front hub and knuckle assembly
◆◆ ◆◆ 14. Drive shaft
15. Circlip

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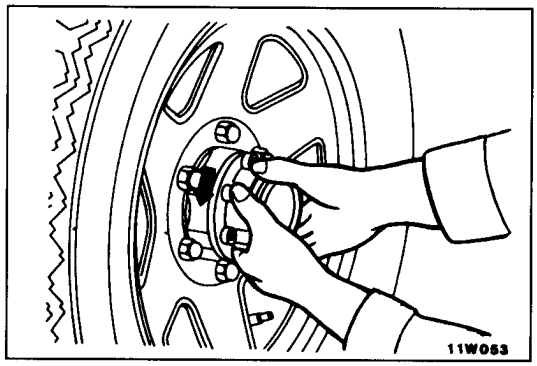

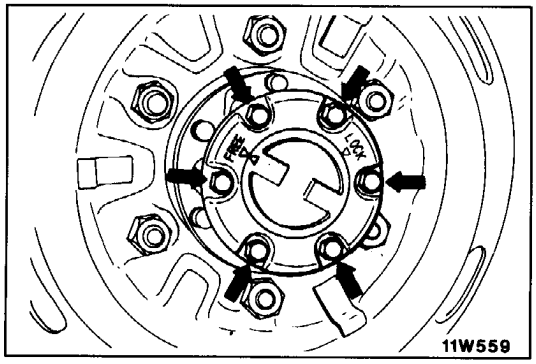

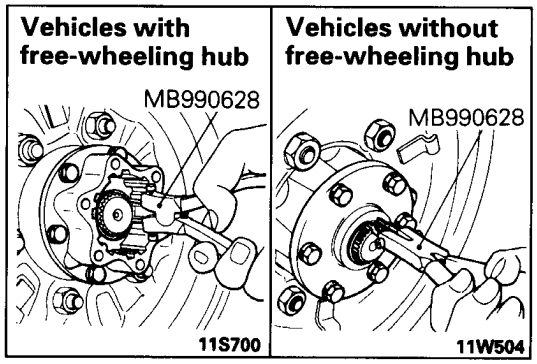

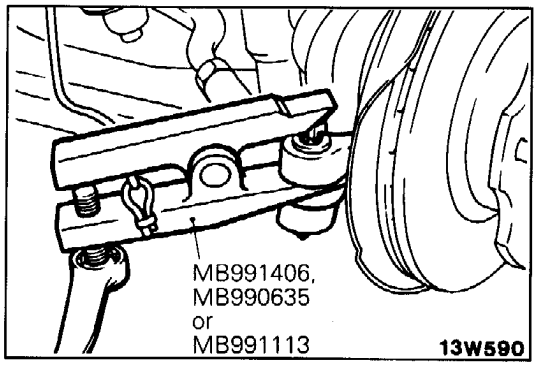

SERVICE POINTS OF REMOVAL E26IBAG

1. REMOVAL OF COVER <AUTOMATIC FREE-WHEELING HUB>

(1) Place the free-wheeling hub in the free condition.

NOTE
The free condition can be obtained by shifting the transfer shift lever to the 2H position and then moving in reverse for 1 to 2 meters (3.3 to 6.5 ft.).

(2) Remove the automatic free-wheeling hub cover.

NOTE
When the cover cannot be loosened by hand, use an oil filter wrench with a protective cloth in between not to damage the cover.

1. REMOVAL OF FREE-WHEELING HUB COVER <MANUAL FREE-WHEELING HUB>

(1) Set the control handle to the FREE position.
(2) Remove the free-wheeling hub cover.

3. REMOVAL OF SNAP RING

5. REMOVAL OF FRONT BRAKE ASSEMBLY

(1) Remove the front brake assembly with the brake hose connected.
(2) Use wire to suspend the front brake assembly from the upper arm so that the front brake assembly won't fall.

Caution
Do not twist the brake hose.

8. DISCONNECTION OF TIE ROD ASSEMBLY AND KNUCKLE

Caution
1. **Use cord to bind the special tool closely so it won't become separated.**
2. **The nut should be loosened only, not removed.**

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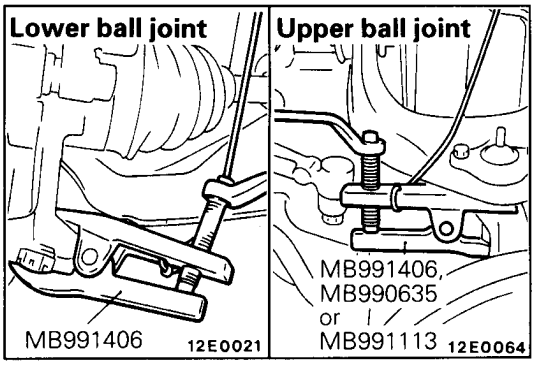
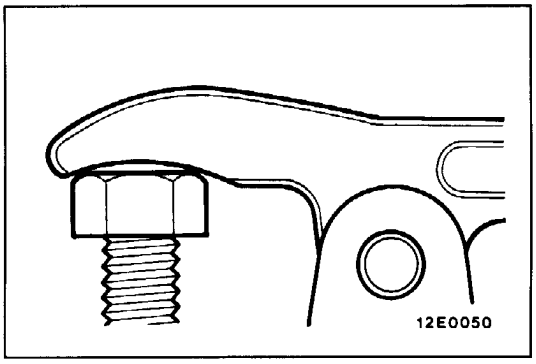


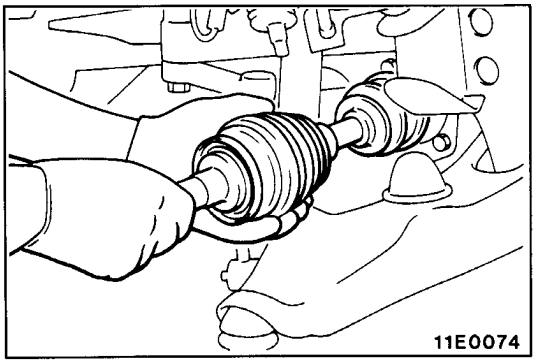
10. DISCONNECTION OF LOWER BALL JOINT AND KNUCKLE/12. UPPER BALL JOINT AND KNUCKLE

Caution

1. **Support the lower arm with a jack when removing the knuckle from the lower ball joint or the upper ball joint.**
2. **After the knuckle has been removed, lower the jack slowly.**



3. **Insert the special tool securely.**

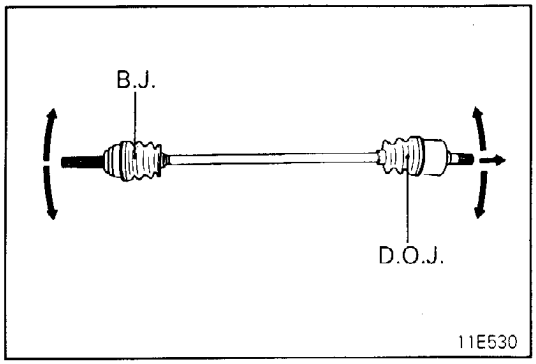


14. REMOVAL OF DRIVE SHAFT

FOR LEFT DRIVE SHAFT

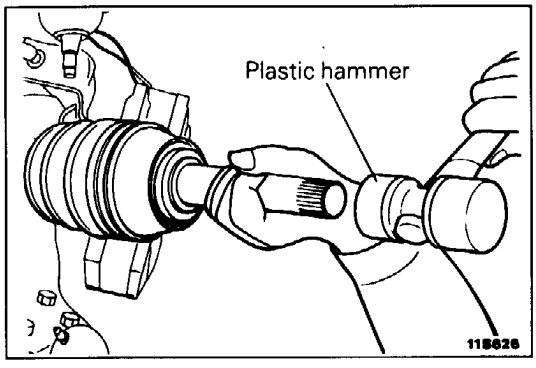
Caution

When pulling the drive shaft out from the differential carrier, be careful that the spline part of the drive shaft does not damage the oil seal.



INSPECTION E26QCAC

- Check ball joint for operating condition and excessive looseness.



SERVICE POINTS OF INSTALLATION E26QDAG

14. INSTALLATION OF DRIVE SHAFT

FOR LEFT DRIVE SHAFT

Caution

Be careful not to damage the lip of the oil seal. Replace the circlip which is attached to the B.J. side spline part with a new one.

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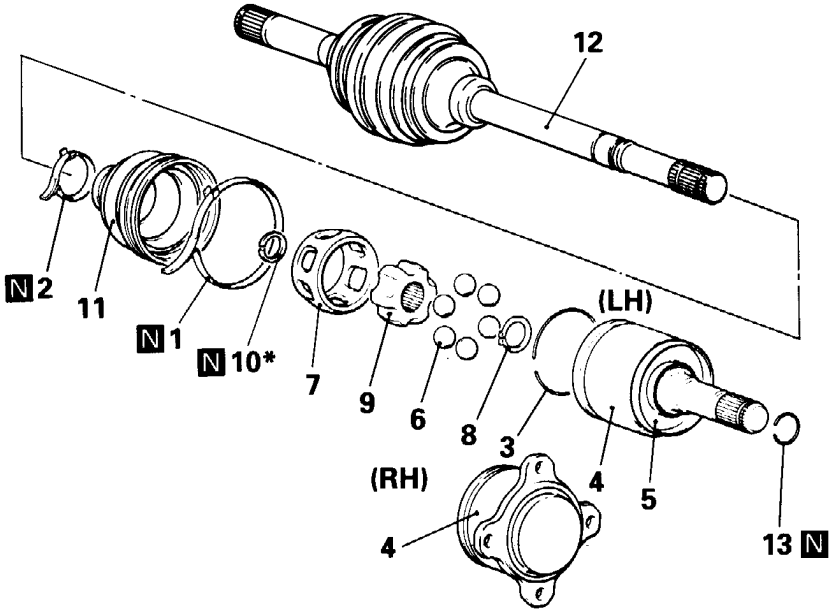
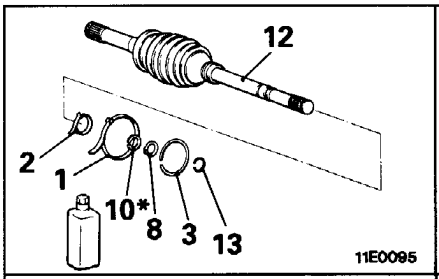
DISASSEMBLY AND REASSEMBLY

E26QE--

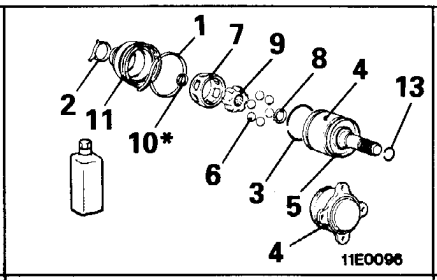
Left drive shaft



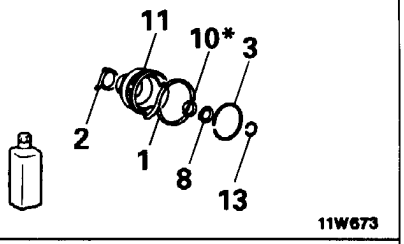
11E0078



B.J. repair kit LH



D.O.J. repair kit



Boot repair kit (D.O.J.)

Disassembly steps

1. D.O.J. boot band (large)
2. D.O.J. boot band (small)
3. Circlip
4. D.O.J. outer race
5. Dust cover
6. Balls
7. D.O.J. cage
8. Snap ring
9. D.O.J. inner race
10. Circlip
11. D.O.J boot
12. B.J. assembly
13. Circlip

Reassembly steps

12. B.J. assembly
2. D.O.J. boot band (small)
11. D.O.J. boot
1. D.O.J. boot band (large)
7. D.O.J. cage
10. Circlip
9. D.O.J. inner race
8. Snap ring
6. Balls
4. D.O.J. outer race
3. Circlip
13. Circlip
5. Dust cover

NOTE
*: 3000-M/T

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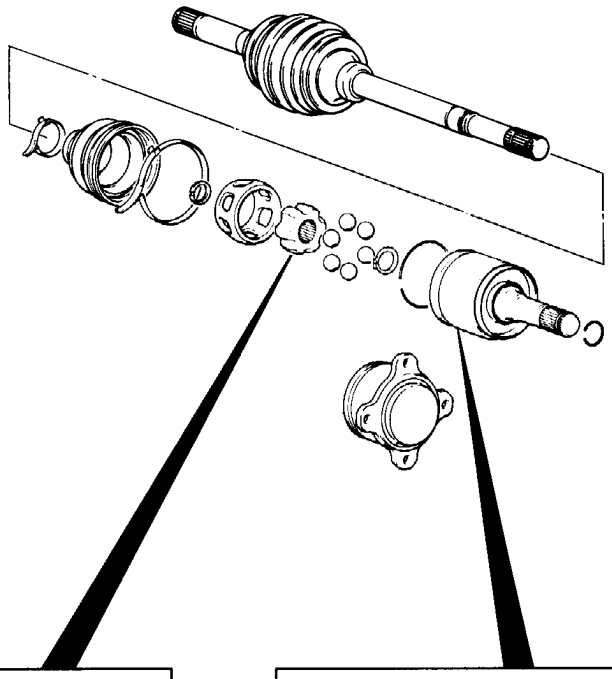
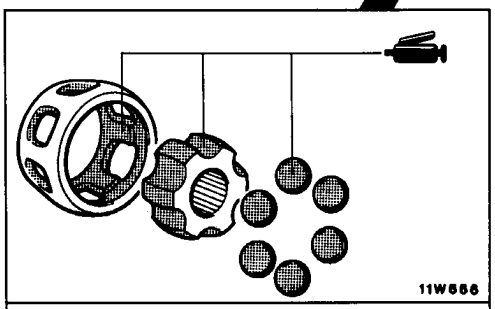
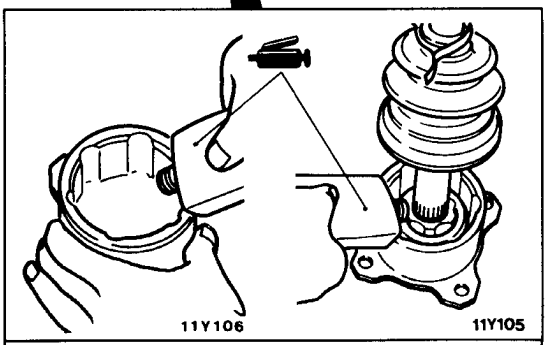
LUBRICATION POINTS



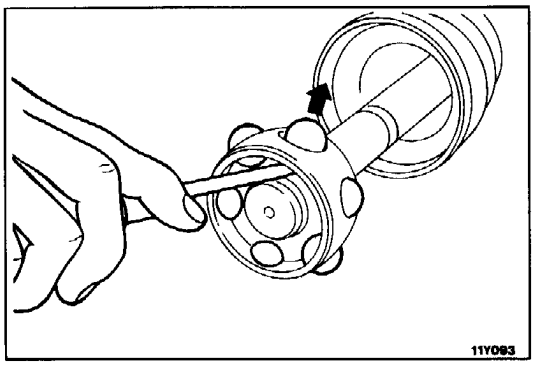


Grease: Repair kit grease



Grease: Repair kit grease
100 g (3.5 oz.)

NOTE
The grease in the repair kit should be divided in half for use, respectively, at the joint and inside the boot.



SERVICE POINTS OF DISASSEMBLY E26QFAK

6. REMOVAL OF BALLS

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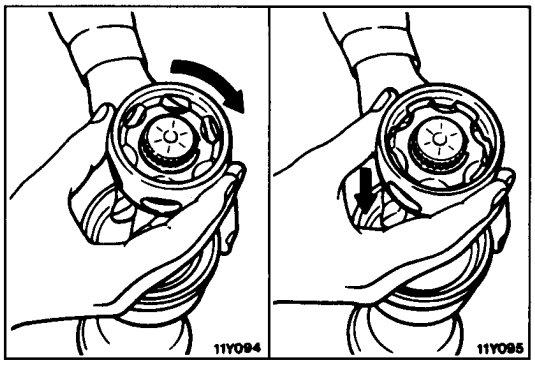
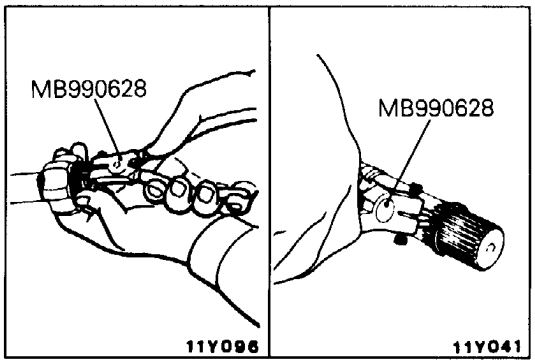


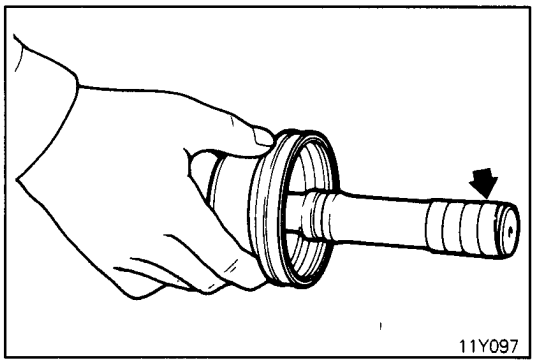
7. REMOVAL OF D.O.J. CAGE

Remove the D.O.J. cage from the D.O.J. inner race in the direction of the B.J.



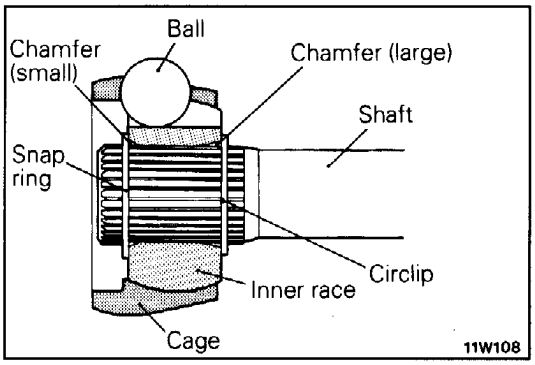
8. REMOVAL OF SNAP RING/10. CIRCLIP

(1) Remove the snap ring from the drive shaft with special tool, and then withdraw the D.O.J. inner race and D.O.J. cage from the drive shaft.
(2) Remove the circlip from the drive shaft with special tool.



11. REMOVAL OF D.O.J. BOOT

(1) Wrap plastic tape around the spline part on the D.O.J. side of the drive shaft so that D.O.J. boot is not damaged when they are removed.
(2) Withdraw the D.O.J. boot from the drive shaft.



SERVICE POINTS OF REASSEMBLY

7. INSTALLATION OF D.O.J. CAGE/9. D.O.J. INNER RACE/8. SNAP RING/6. BALLS

Install the cage, balls and inner race to the drive shaft, and fit the snap ring securely to the groove in the drive shaft.

Caution
For 3000-M/T, the inner race should be installed so that the large chamfer on the spline section is on the drive shaft side.

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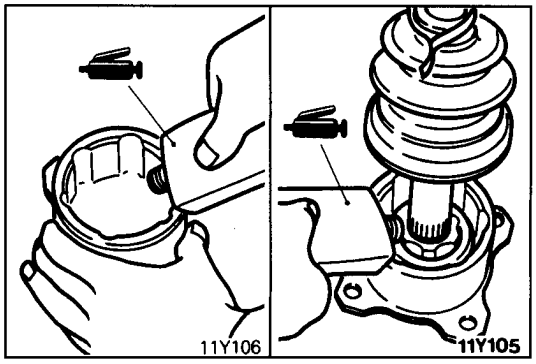


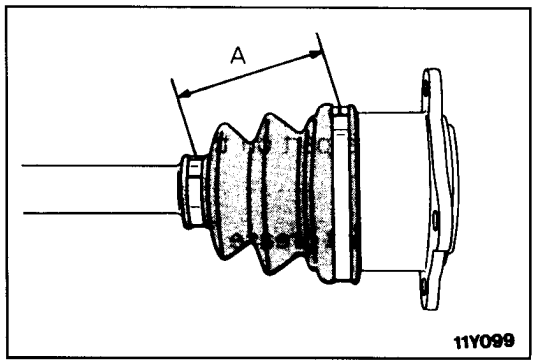
4. INSTALLATION OF D.O.J. OUTER RACE

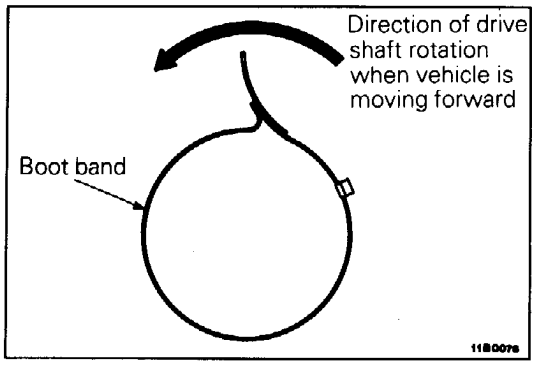
(1) Fill the inside of the D.O.J. outer race and D.O.J. boot with the specified grease.

Specified grease: Repair kit grease 100g (3.5 oz.)

NOTE
The grease in the repair kit should be divided in half for use, respectively, at the joint and inside the boot.

Caution
The drive shaft joint use special grease. Do not mix old and new or different types of grease.





(2) Install the circlip onto the D.O.J. outer race. Place the D.O.J. boot over the D.O.J. outer race, and then use boot band (small) to secure the boot.

Caution
Do not secure the boot band (large).

(3) Secure the driveshaft, and then move the D.O.J. outer race until it is at the position where the D.O.J. boot assembly dimension is the standard value.

Standard value (A): 77–83 mm (3.03–3.27 in.)

(4) Remove a part of the D.O.J. boot from the D.O.J. outer race and release the air within the boot.

(5) Secure the boot band (large) on D.O.J. boot.

Caution
Be sure that the installation direction of the boot bands is correct.

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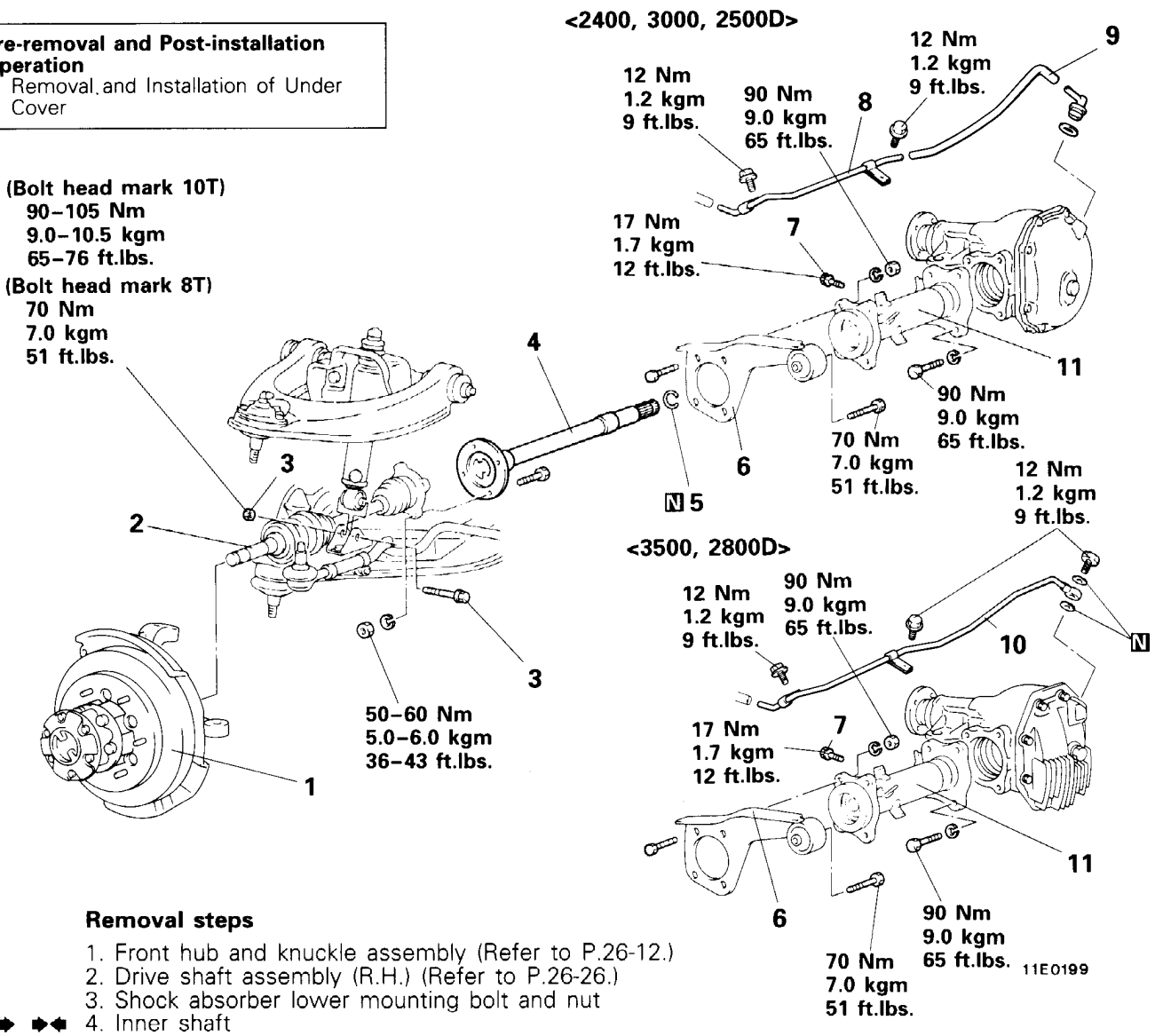
INNER SHAFT

E26TA--

REMOVAL AND INSTALLATION

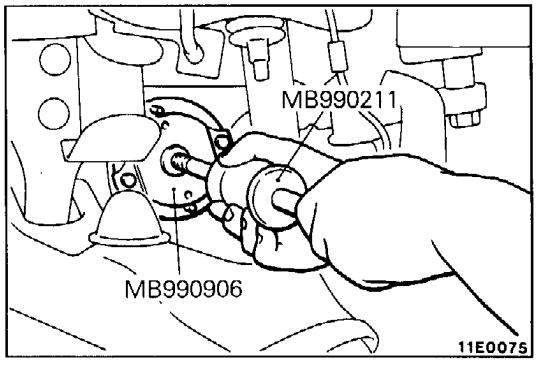
Pre-removal and Post-installation Operation
- Removal and Installation of Under Cover



Removal steps

1. Front hub and knuckle assembly (Refer to P.26-12.)
2. Drive shaft assembly (R.H.) (Refer to P.26-26.)
3. Shock absorber lower mounting bolt and nut
4. Inner shaft
5. Circlip
6. Differential mounting bracket (R.H.)
7. Actuator mounting bolt <Super Select 4WD>
8. Breather pipe
9. Breather hose
10. Breather pipe
11. Housing tube

<8. 9. <Vehicles built from November, 1993>>



SERVICE POINTS OF REMOVAL

E26TBAAa

4. REMOVAL OF INNER SHAFT

Attach the special tools to the flange of the shaft, and pull the inner shaft out from the front differential carrier.

Caution
When pulling the inner shaft out from the front differential carrier, be careful that the spline part of the inner shaft does not damage the oil seal.

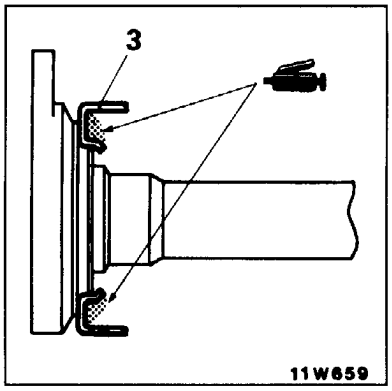
SERVICE POINTS OF INSTALLATION E26TDAD

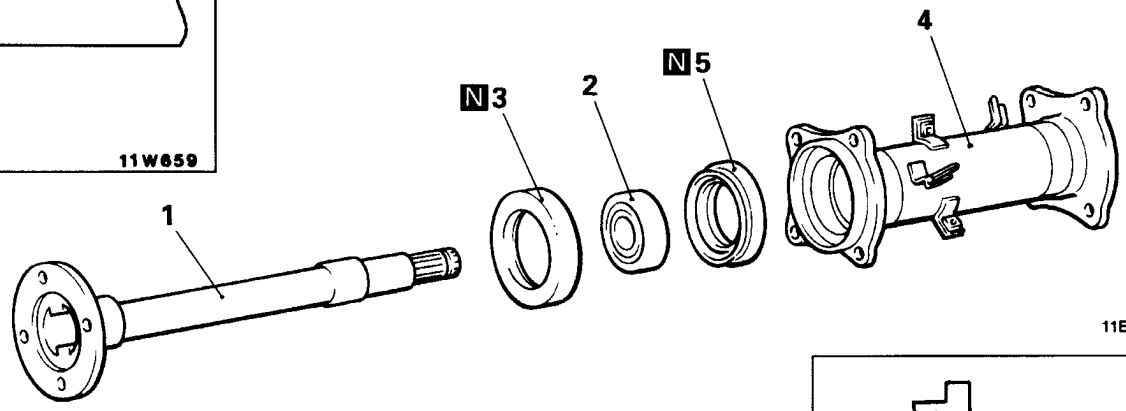
4. INSTALLATION OF INNER SHAFT

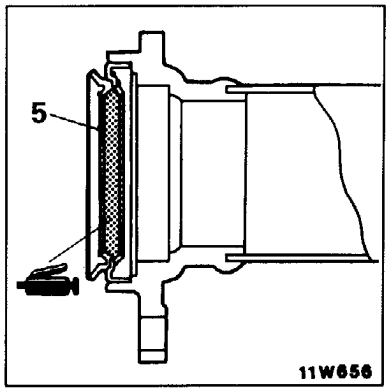
Drive the inner shaft into the front differential carrier by using the special tools (MB990906 and MB990211).

Caution
Be careful not to damage the lip of the dust seal and oil seal.

DISASSEMBLY AND REASSEMBLY

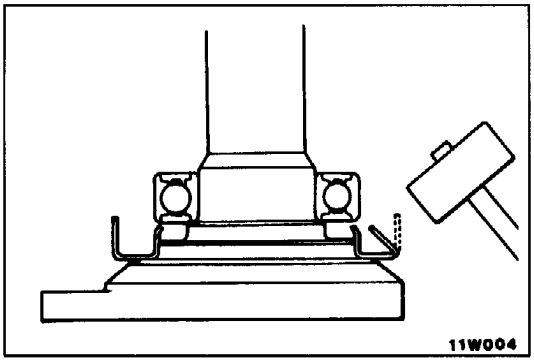






Disassembly steps

1. Inner shaft
2. Bearing
3. Dust cover
4. Housing tube
5. Dust seal



SERVICE POINTS OF DISASSEMBLY E26TFAC

2. REMOVAL OF BEARING

(1) Bend the outside periphery of dust cover inward with a hammer.

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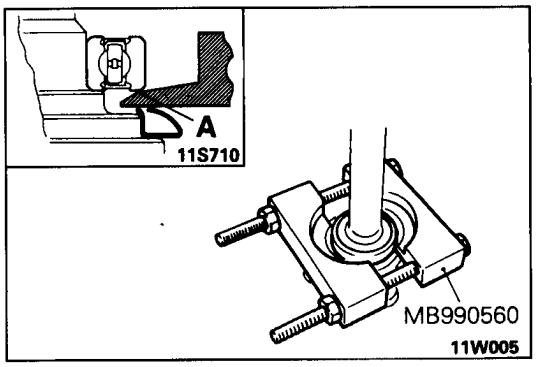
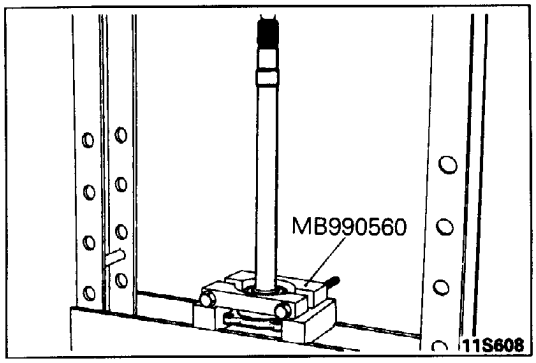


(2) After the special tool has been installed as shown, tighten the nut of the special tool until the portion "A" of the special tool touches the bearing outer race.

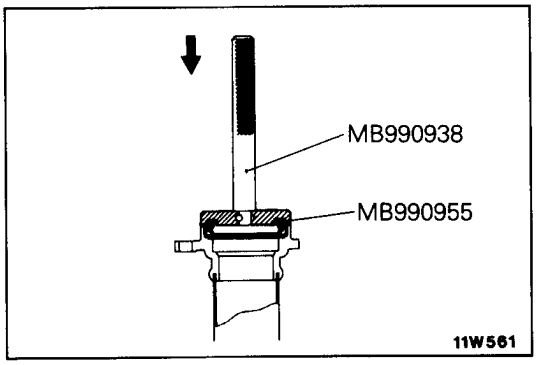


(3) Press out the inner shaft from the bearing.

Caution
Do not allow the inner shaft to drop.

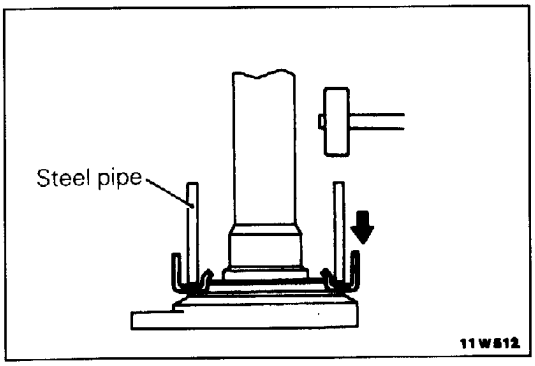
SERVICE POINTS OF REASSEMBLY E26TGAC

5. INSTALLATION OF DUST SEAL



Press-fit the new dust seal into the housing tube by using the special tools, until it is flush with the housing tube end face.

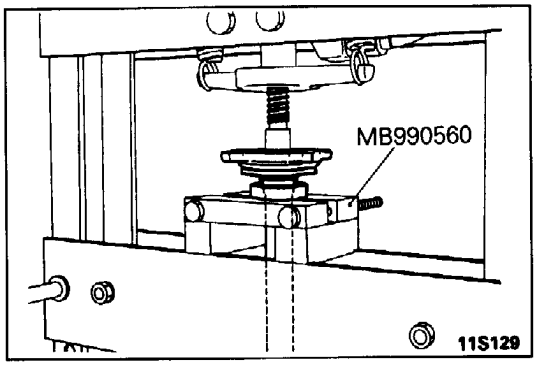
3. INSTALLATION OF DUST COVER



Using a steel pipe, force a new dust cover onto the inner shaft.

Steel pipe	mm (in.)
Overall length	50 (1.7)
Outside diameter	75 (3.0)
Wall thickness	4 (0.2)

2. INSTALLATION OF BEARING



Using the special tool, force the bearing onto the inner shaft.

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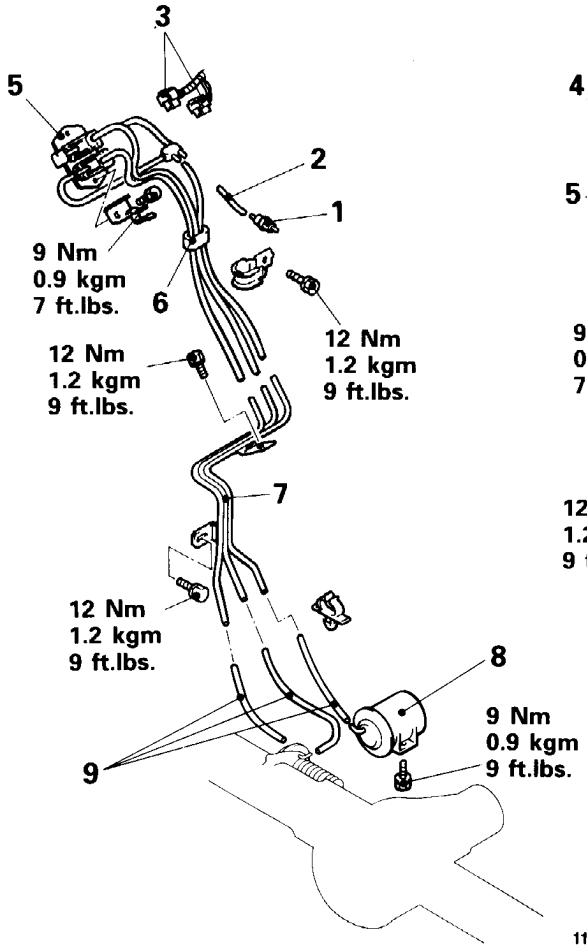
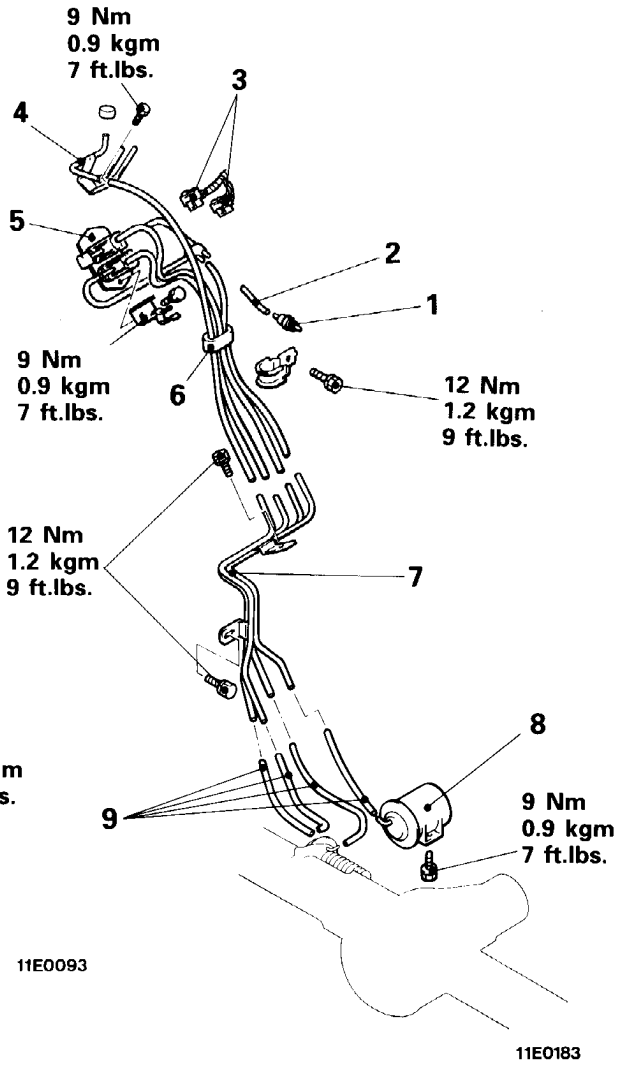
SOLENOID VALVE AND VACUUM HOSE

REMOVAL AND INSTALLATION

<Vehicles built up to October, 1993>

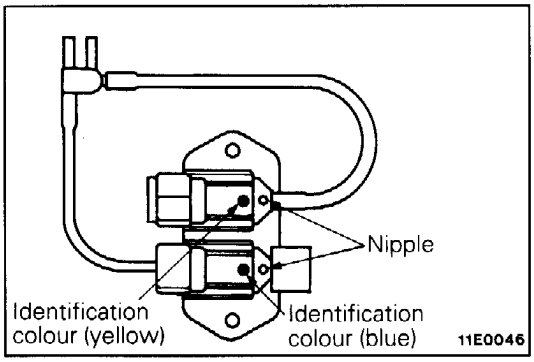


<Vehicles built from November, 1993>



Removal steps

1. Check valve
2. Vacuum hose
3. Solenoid valve connector
4. Vacuum pipe
◆◆ 5. Solenoid valve assembly
◆◆ 6. Vacuum hose
7. Vacuum pipe assembly
8. Vacuum tank
◆◆ 9. Vacuum hose



SERVICE POINTS OF INSTALLATION

9. INSTALLATION OF VACUUM HOSE

Install the vacuum hose so that the identification colours match those of the pipe assembly and the actuator. Furthermore, there are no identification colours on the vacuum hose at the vacuum tank connection.

6. INSTALLATION OF VACUUM HOSE/5. SOLENOID VALVE ASSEMBLY

Install the vacuum hose and solenoid valve assembly so that the colours of the identification marks are matched.

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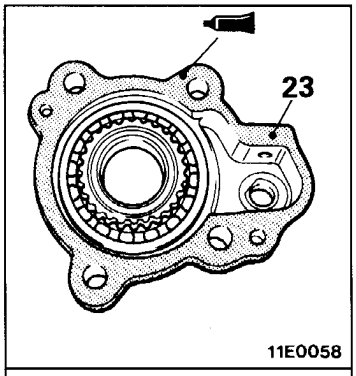
NOTES

DIFFERENTIAL CARRIER AND FREE-WHEELING CLUTCH

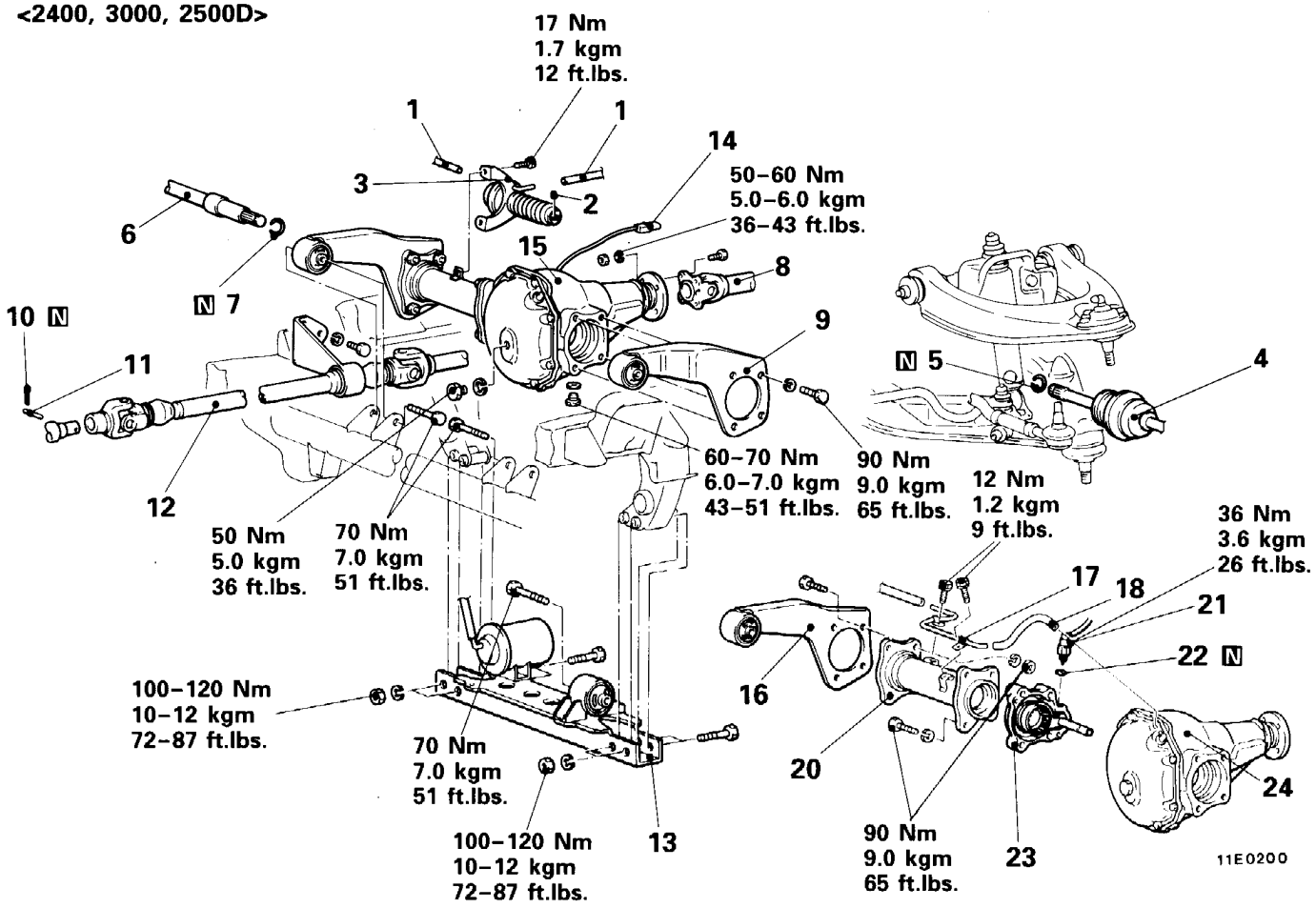
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operations
(1) Removal and Installation of Under Cover
(2) Draining and Supplying of Gear Oil (Refer to P.26-8.)



Sealant: 3M ATD Part No. 8663, 8661 or equivalent

<2400, 3000, 2500D>



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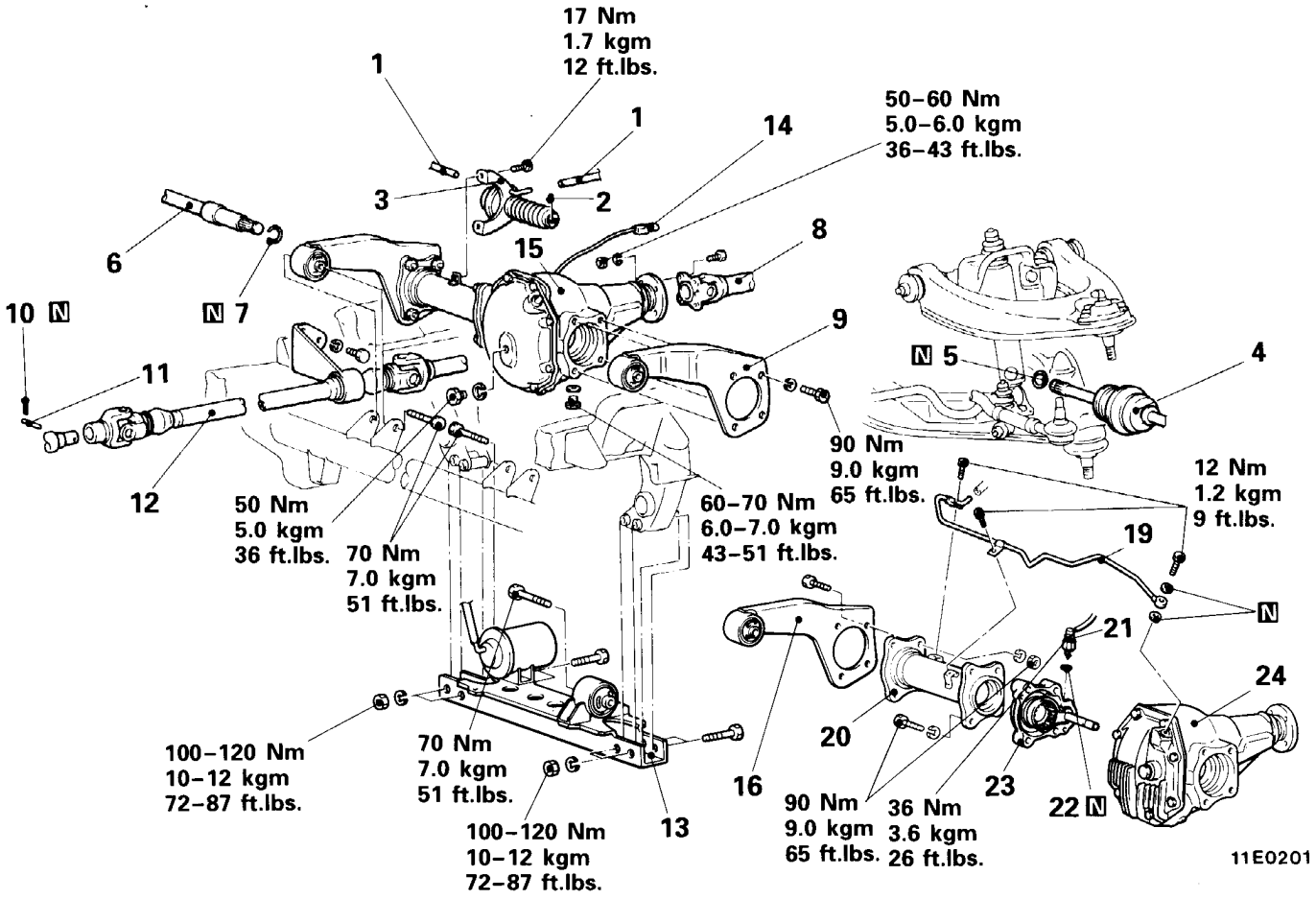

Removal steps

- ◆◆ 1. Vacuum hose
- 2. Pin
- 3. Actuator assembly
- 4. Drive shaft (Refer to P.26-26.)
- 5. Circlip
- 6. Inner shaft (Refer to P.26-33.)
- 7. Circlip
- ◆◆ ◆◆ 8. Connection for front propeller shaft
- 9. Differential mounting bracket (L.H.)
- 10. Split pin } <M/T>
- 11. Share pin }
- 12. Front shaft assembly
- 13. Front suspension crossmember
- 14. Free-wheeling engage switch connector
- 15. Front differential carrier assembly, housing tube and differential mounting bracket (R.H.)
- 16. Differential mounting bracket (R.H.)
- 17. Breather pipe } <Vehicles built from
- 18. Breather hose } November, 1993>
- 19. Breather pipe
- 20. Housing tube
- 21. Free-wheeling engage switch
- 22. Gasket
- ◆◆ 23. Free-wheeling clutch assembly
- 24. Front differential carrier assembly

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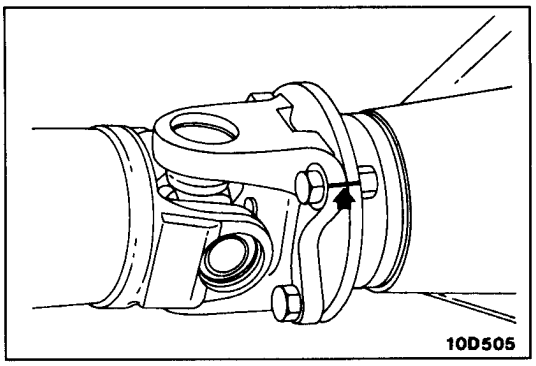
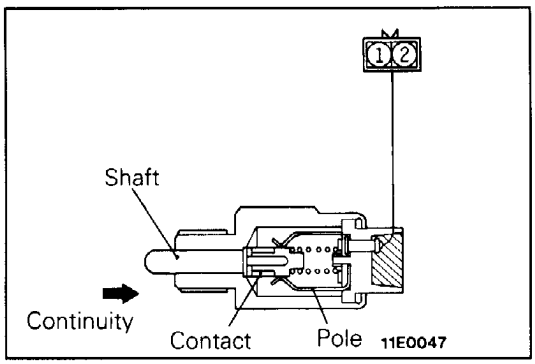


SERVICE POINTS OF REMOVAL

8. REMOVAL OF FRONT PROPELLER SHAFT

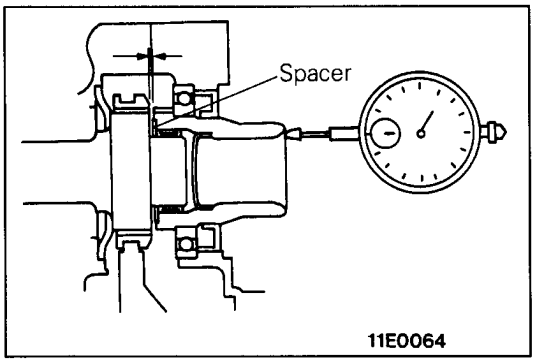
Install the front propeller shaft so that the mating marks of the flange yoke and the differential carrier companion flange are aligned.



INSPECTION

FREE-WHEEL ENGAGE SWITCH

The switch is normal if there is continuity when the shaft is pushed in, and no continuity when the shaft is released.



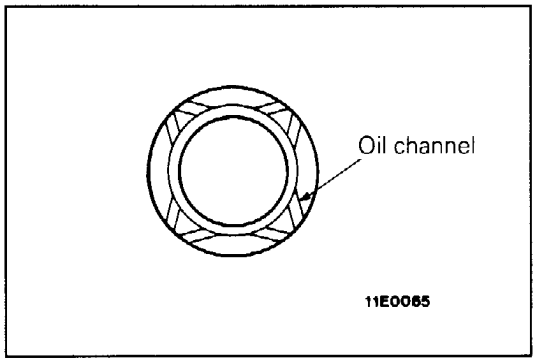
SERVICE POINTS OF INSTALLATION

23. INSTALLATION OF FREE-WHEELING CLUTCH ASSEMBLY

(1) After installing the free-wheeling clutch assembly, select a spacer so that the clutch gear play (bearing looseness) is within the standard value.

Standard value: 0.05–0.40mm (0.0020–0.0160in.)

(2) Install the spacer so that the oil channel side is on the differential gear side.



8. INSTALLATION OF FRONT PROPELLER SHAFT

Install the front propeller shaft so that the mating marks of the flange yoke and the differential carrier companion flange are aligned.

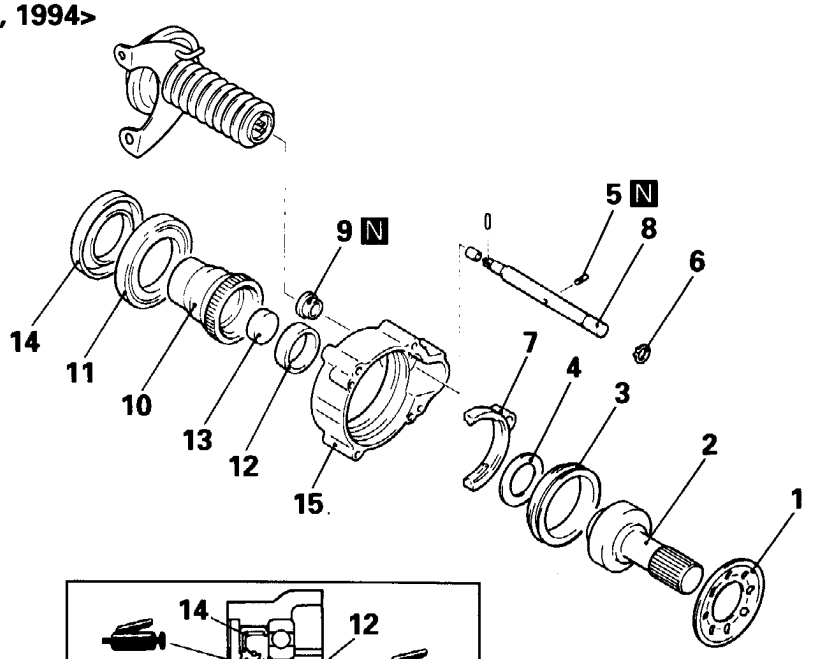
1. INSTALLATION OF VACUUM HOSE

Install the vacuum hoses so that they match the identification colours of the actuator assembly nipple.

FREE-WHEELING CLUTCH

DISASSEMBLY AND REASSEMBLY

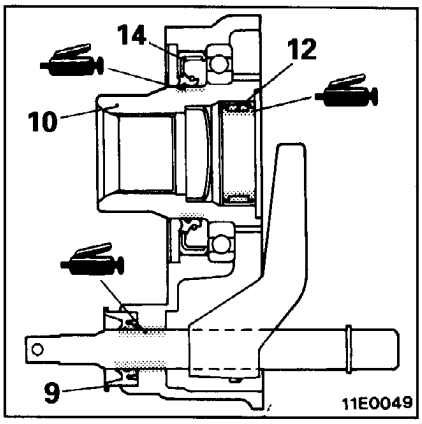
<Vehicles built up to May, 1994>



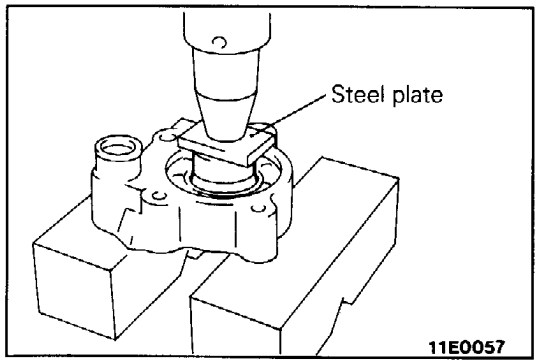
11E0094

Removal steps

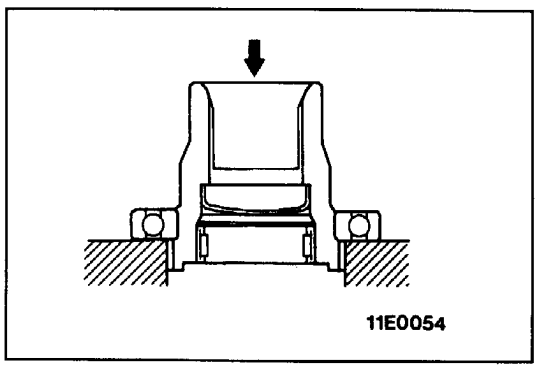
- ◆◆ 1. Thrust bushing
- 2. Main shaft
- 3. Clutch sleeve
- 4. Spacer
- ◆◆ 5. Spring pin
- 6. Snap ring
- 7. Shift fork
- 8. Shift rod
- ◆◆ 9. Oil seal
- ◆◆◆◆ 10. Clutch gear
- ◆◆◆◆ 11. Bearing
- ◆◆ 12. Needle bearing
- ◆◆ 13. Cap
- ◆◆ 14. Oil seal
- 15. Clutch housing



11E0049



11E0057



11E0054

SERVICE POINTS OF DISASSEMBLY

10. REMOVAL OF CLUTCH GEAR/11. BEARING

(1) Use a press and steel plate to remove the clutch gear and bearing together.

(2) Use a press to hold the supports against the bearing inner race, and separate the clutch gear and bearing.

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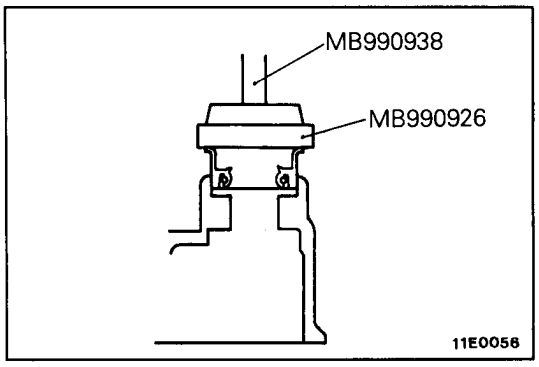
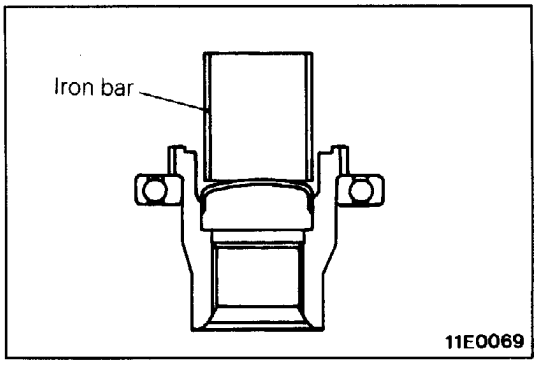


SERVICE POINTS OF REASSEMBLY

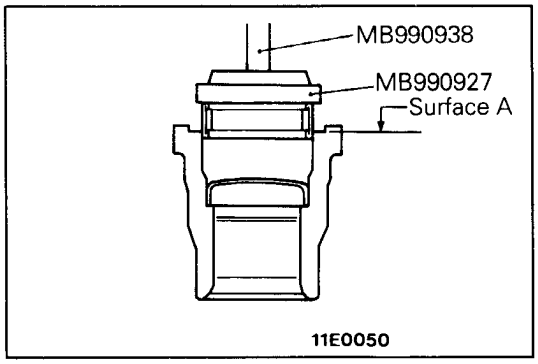
14. INSTALLATION OF OIL SEAL



13. INSTALLATION OF CAP

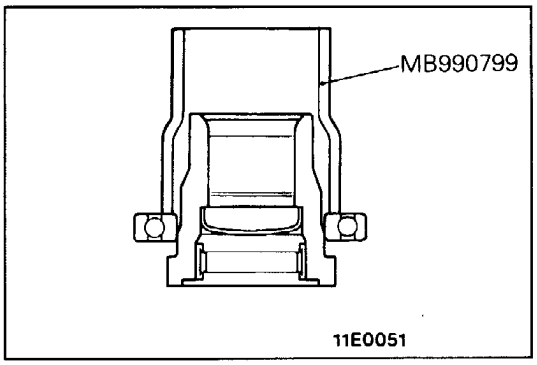
Use an iron bar with an outside diameter of approximately 30–35 mm (1.18–1.38 in.) to push in the sealing cap.

Caution
Be careful not to make a dent in the curved surface of the cylinder cap.



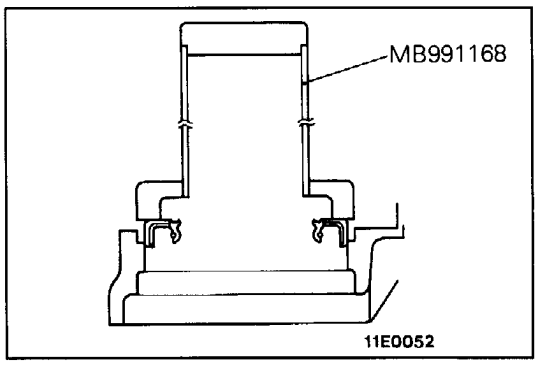
12. INSTALLATION OF NEEDLE BEARING

Use the special tools to press-fit the clutch cap until it is flush with surface A of the clutch gear.



11. INSTALLATION OF BEARING/10. CLUTCH GEAR/9. OIL SEAL

(1) Use the special tool to press-fit the bearing to the shoulder of the clutch gear.



(2) Use the special tool to tap the oil seal until it is flush with the clutch housing.

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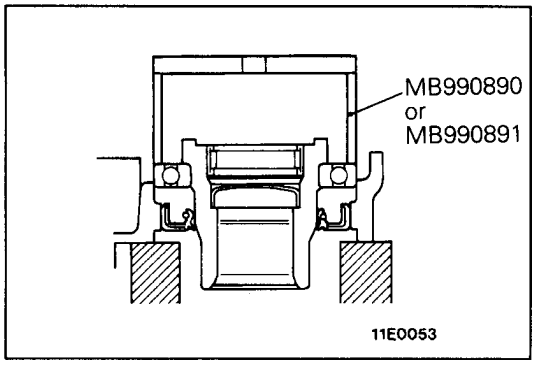
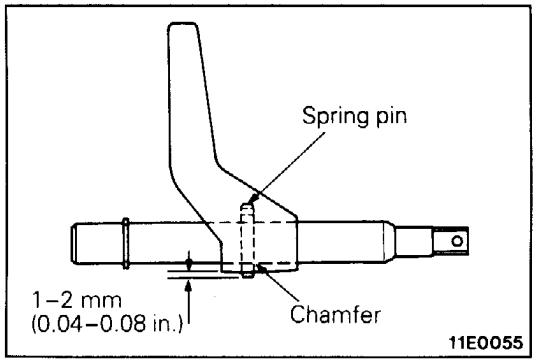


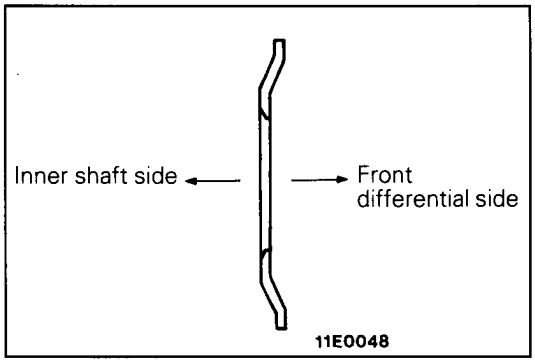
(3) Use the special tool to press-fit the bearing to the side of the clutch housing.

Caution
Place the special tool against the outer race of the bearing.



5. INSTALLATION OF SPRING PIN

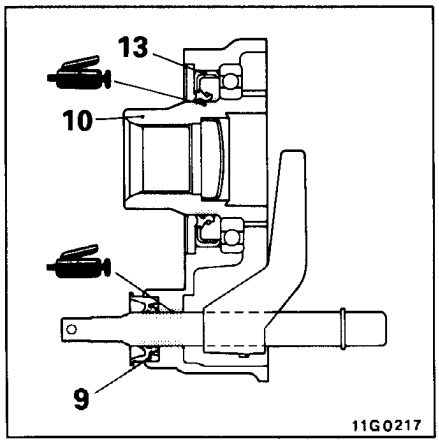
Tap the spring pin from the chamfered side of the shift rod until the projection length is at the length shown in the illustration.

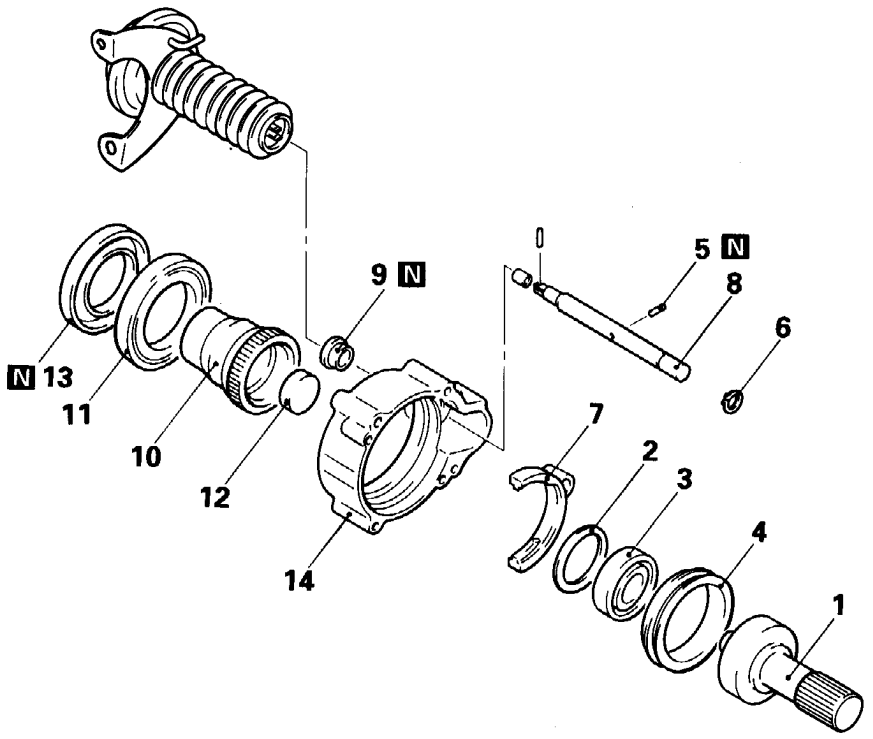


1. INSTALLATION OF THRUST BUSHING

Install the thrust bushing in the direction shown in the illustration.

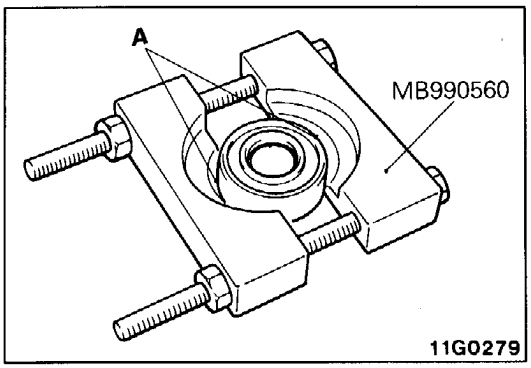
<Vehicles built from June, 1994>

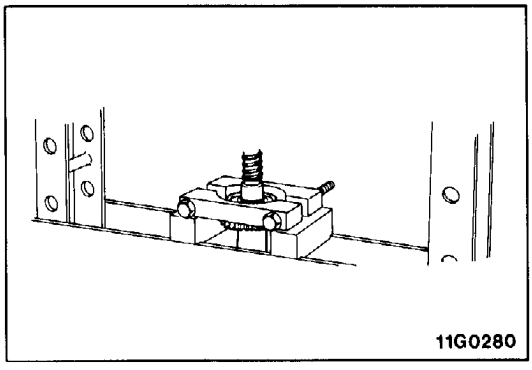




Removal steps

- 1. Main shaft
- 2. Spacer
- 3. Bearing
- 4. Clutch sleeve
- 5. Spring pin
- 6. Snap ring
- 7. Shift fork
- 8. Shift rod
- 9. Oil seal
- 10. Clutch gear
- 11. Bearing
- 12. Cap
- 13. Oil seal
- 14. Clutch housing





SERVICE POINTS OF DISASSEMBLY

1. REMOVAL OF MAIN SHAFT / 3. BEARING

(1) Install the special tool a shown in the figure and tighten the nut of the special tool until the portion "A" touches the bearing outer race.

(2) Remove the bearing from the main shaft with a press.

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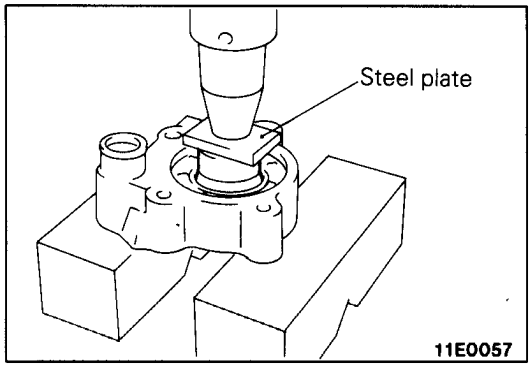
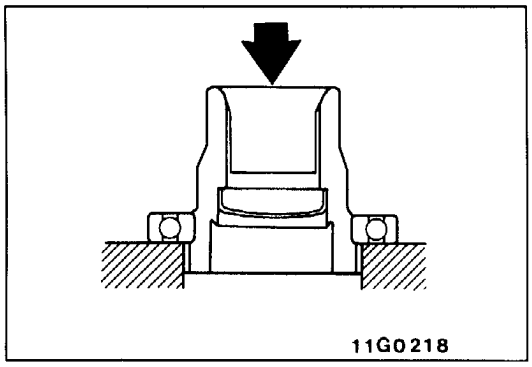


10. REMOVAL OF CLUTCH GEAR / 11. BEARING

(1) Use a press and steel plate to remove the clutch gear and bearing together.

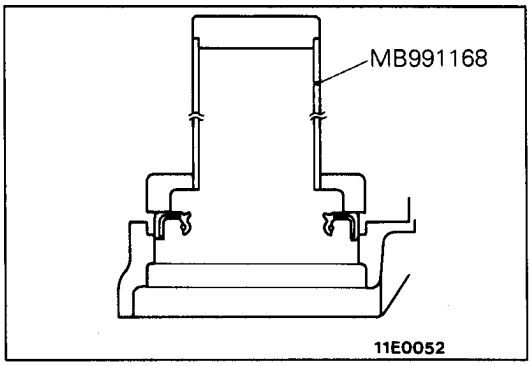


(2) Use a press to hold the supports against the bearing inner race, and separate the clutch gear and bearing.

SERVICE POINTS OF REASSEMBLY

13. INSTALLATION OF OIL SEAL

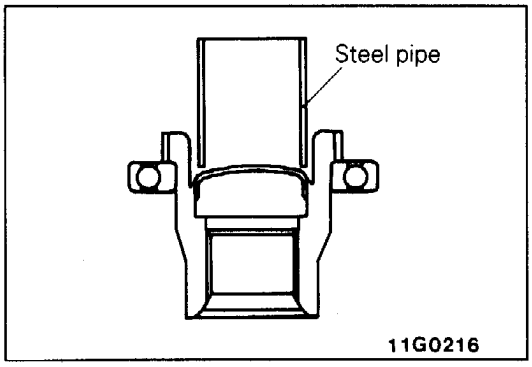
Use the special tool to tap the oil seal until it is flush with the clutch housing.



12. INSTALLATION OF CAP

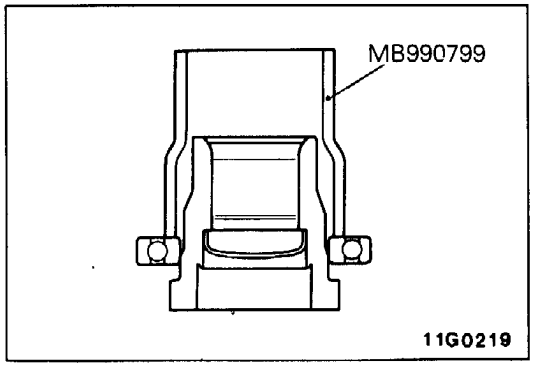
Use a steel pipe with an outside diameter of approximately 30 – 35 mm (1.18 – 1.38 in.) to push in the sealing cap.

Caution
Be careful not to make a dent in the curved surface of the cylinder cap.



11. INSTALLATION OF BEARING / 10. CLUTCH GEAR

(1) Use the special tool to press-fit the bearing to the shoulder of the clutch gear.



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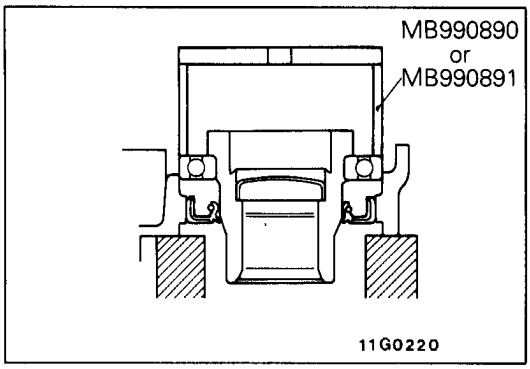
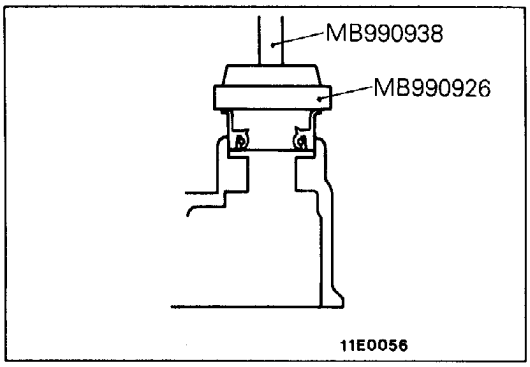


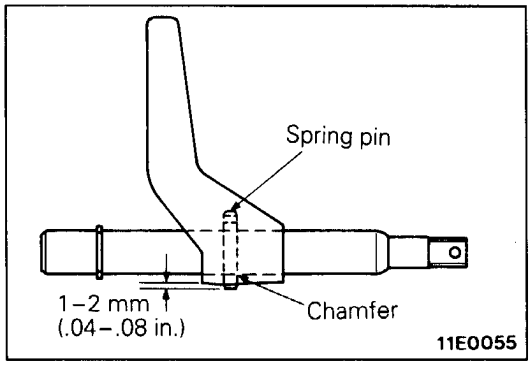
(2) Use the special tool to press-fit the bearing to the side of the clutch housing.

Caution
Place the special tool against the outer race of the bearing.



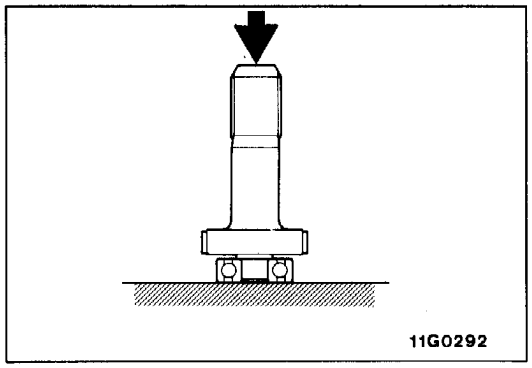
9. INSTALLATION OF OIL SEAL

Use the special tool to tap the oil seal.



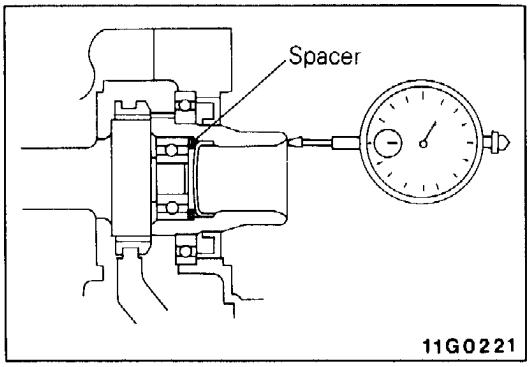
5. INSTALLATION OF SPRING PIN

Tap the spring pin from the chamfered side of the shift rod until the projection length is at the length shown in the illustration.



3. INSTALLATION OF BEARING

Press in the bearing up to the shoulder of the main shaft.



2. INSTALLATION OF SPACER

(1) Install the free-wheeling clutch and then select a spacer so that the axial play of the clutch gear (bearing play) is within the standard value.

Standard value: 0.05 – 0.30 mm (0.0020 – 0.0120 in.)

(2) If the axial play is not within the standard value, disassemble the clutch and select a spacer again.

NOTE
Spacer thickness is every 0.25 mm (0.010 in.).

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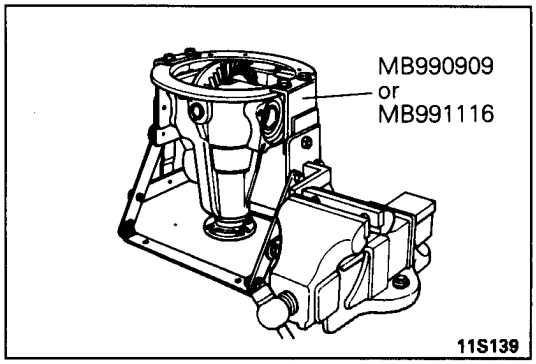

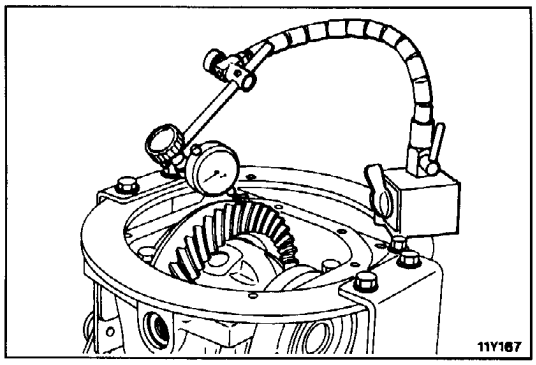

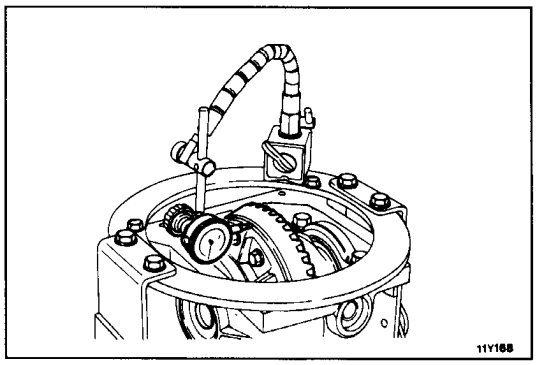

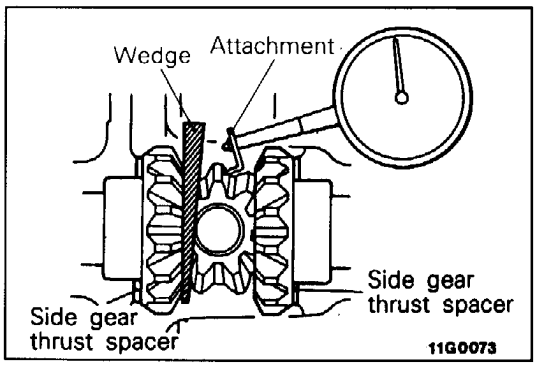

DIFFERENTIAL CARRIER E26WCAC

INSPECTION BEFORE DISASSEMBLY

Remove the cover and gasket. Hold the special tool in a vise, and install the differential carrier assembly to the special tool.

FINAL DRIVE GEAR BACKLASH

Check the final drive gear backlash by following the steps below.

(1) With the drive pinion locked in place, measure the final drive gear backlash with a dial indicator on the drive gear.

NOTE
Measure at four points or more on the circumference of the drive gear.

Standard value: 0.11–0.16 mm (0.0043–0.0063 in.)

(2) If the backlash is not within the standard value, adjust it by using the side bearing adjustment spacers.

DRIVE GEAR RUNOUT

Check the drive gear runout by following the steps below.

(1) Measure the drive gear runout at the shoulder on the reverse side of the drive gear.

Limit: 0.05 mm (0.0020 in.)

(2) If the runout exceeds the limit, check for improper tightening of the drive gear and differential case.

DIFFERENTIAL GEAR BACKLASH <EXCLUDING 4 PINION DIFFERENTIAL>

Check the differential gear backlash by following the steps below.

(1) While locking the side gear with the wedge, measure the differential gear backlash with a dial indicator on the pinion gear.

NOTE
The measurement should be made for both pinion gears individually.

Standard value: 0–0.076 mm (0–0.0030 in.)
Limit: 0.2 mm (0.0079 in.)

(2) If the backlash exceeds the limit, adjust by using the side gear thrust spacers.

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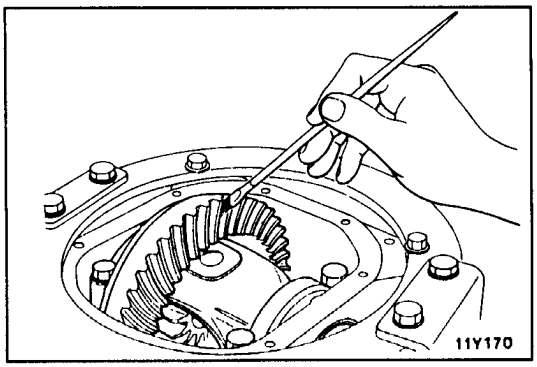
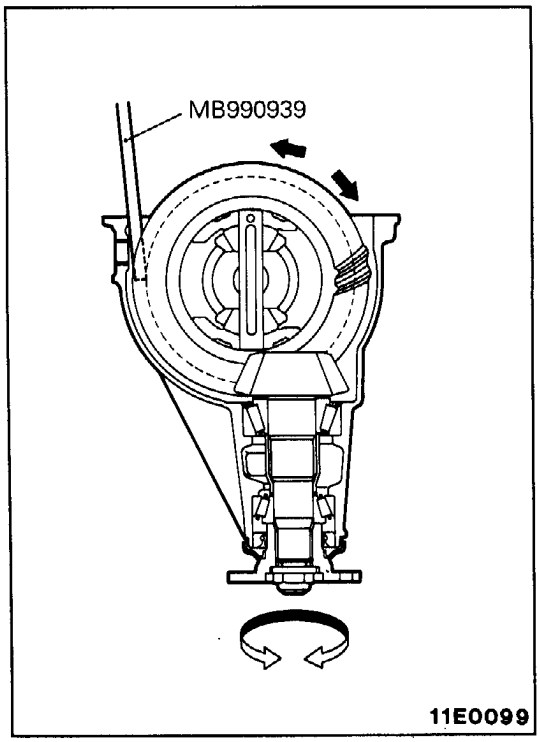


FINAL DRIVE GEAR TOOTH CONTACT

Check the final drive gear tooth contact by following the steps below.

(1) Apply a thin, uniform coat of machine blue to both surfaces of the drive gear teeth.



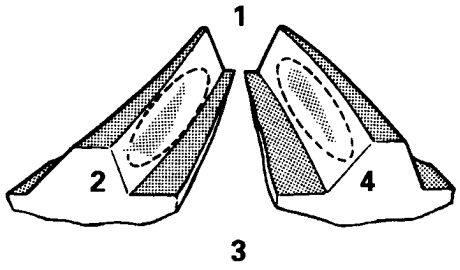
(2) Insert a brass rod between the differential carrier and the differential case, and then rotate the companion flange by hand (once in the normal direction, and then once in the reverse direction) while applying a load to the drive gear, so that the revolution torque [approximately 2.5–3.0 Nm (25–30 kgcm, 28–33 in.lbs.)] is applied to the drive pinion.

Caution
If the drive gear is rotated too much, the tooth contact pattern will become unclear and difficult to check.

(3) Check the tooth-contact condition of the drive gear and drive pinion.

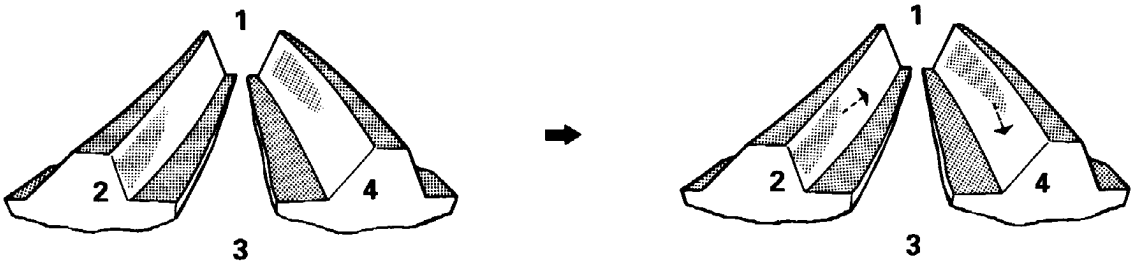
Standard tooth contact pattern

1 Narrow tooth side
2 Drive-side tooth surface (the side applying power during forward movement)
3 Wide tooth side
4 Coast-side tooth surface (the side applying power during reverse movement)



Problem	Solution

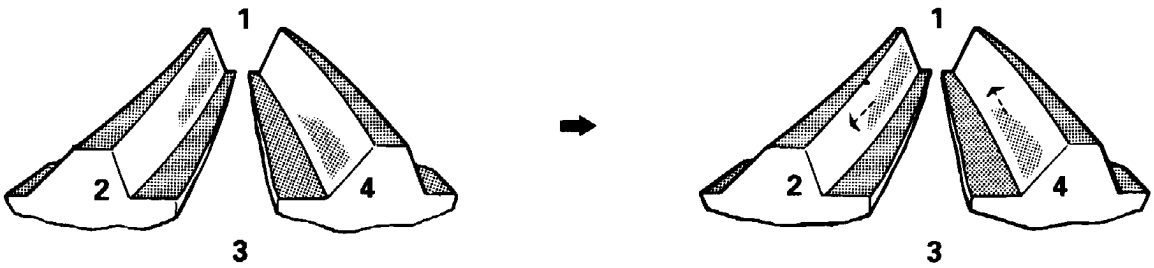
Tooth contact pattern resulting from excessive pinion height



The drive pinion is positioned too far from the centre of the drive gear.

Increase the thickness of the pinion height adjusting shim, and position the drive pinion closer to the centre of the drive gear.
Also, for backlash adjustment, position the drive gear farther from the drive pinion.

Tooth contact pattern resulting from insufficient pinion height



The drive pinion is positioned too close to the centre of the drive gear.

Decrease the thickness of the pinion height adjusting shim, and position the drive pinion farther from the centre of the drive gear.
Also, for backlash adjustment, position the drive gear closer to the drive pinion.

11S642

NOTE
Checking the tooth contact pattern is the way to confirm that the adjustments of the pinion height and backlash have been done properly. Continue to adjust the pinion height and backlash until the tooth contact pattern resembles the standard pattern.

If, even after adjustments have been made, the correct tooth contact pattern cannot be obtained, it means that the drive gear and the drive pinion have become worn beyond the allowable limit. Replace the gear set.

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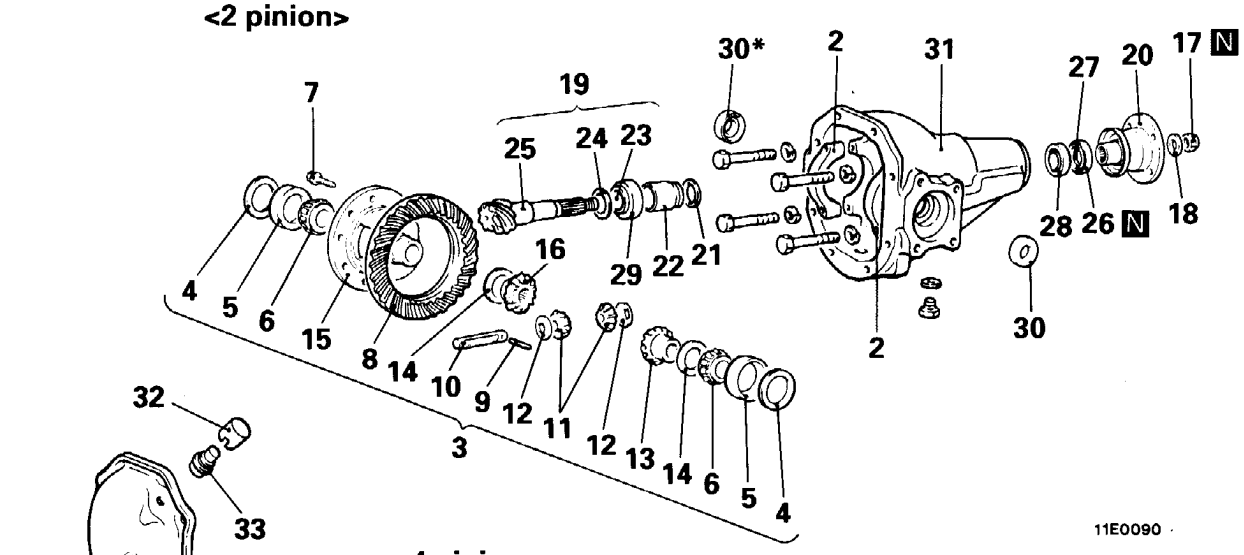
DISASSEMBLY

E26WO--

Inspection before Disassembly
- Final Drive Gear Backlash
- Drive Gear Runout
- Differential Gear Backlash <excluding 4 pinion>
- Final Drive Gear Tooth Contact

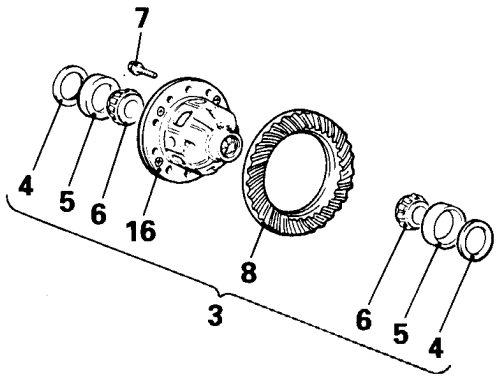
Refer to P.26-41.

<2 pinion>



11E0090

<4 pinion>



11E0091

Disassembly steps

1. Cover
2. Bearing cap
3. ◆◆ Differential case assembly
4. Side bearing adjusting spacer
5. Side bearing outer race
6. ◆◆ Side bearing inner race
7. Bolt (10)
8. ◆◆ Drive gear
9. ◆◆ Lock pin
10. Pinion shaft
11. Pinion gear
12. Pinion washer
13. Side gear
14. Side gear thrust spacer
15. Differential case
16. 4 pinion case assembly
17. ◆◆ Companion flange self-locking nut
18. Washer
19. ◆◆ Drive pinion assembly
21. Drive pinion rear shim (for preload adjustment)
22. Drive pinion spacer
20. Companion flange
23. ◆◆ Drive pinion front bearing inner race
24. Drive pinion front shim (for pinion height adjustment)
25. Drive pinion
27. Drive pinion rear bearing inner race
26. Oil seal
28. ◆◆ Drive pinion rear bearing outer race
29. ◆◆ Drive pinion front bearing outer race
30. Oil seal
31. Gear carrier
32. Plug cover
33. Vent plug

NOTE
*: Part Time 4WD

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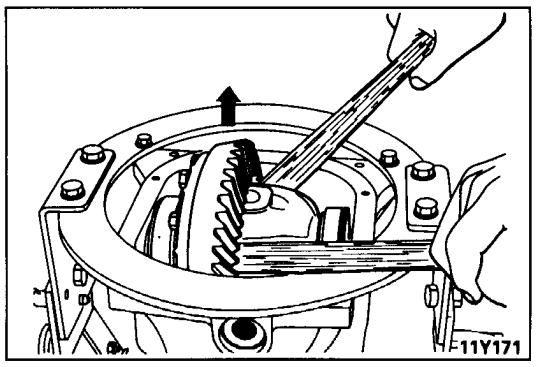
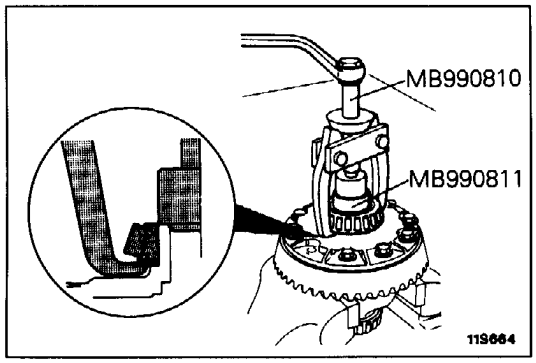


SERVICE POINTS OF DISASSEMBLY E26WFAD

3. REMOVAL OF DIFFERENTIAL CASE ASSEMBLY

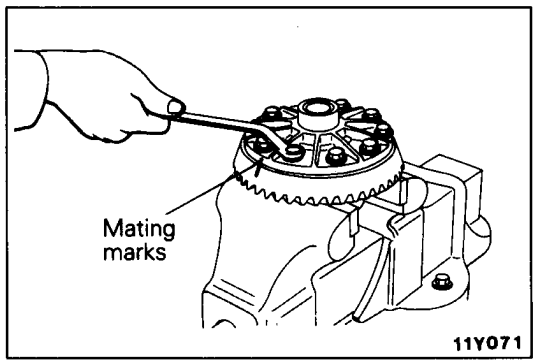
Caution
When taking out the differential case assembly, be careful not to drop and damage the side bearing outer races.

NOTE
Keep the right and left side bearings and side bearing adjusting spacers separate, so that they do not become mixed at the time of reassembly.



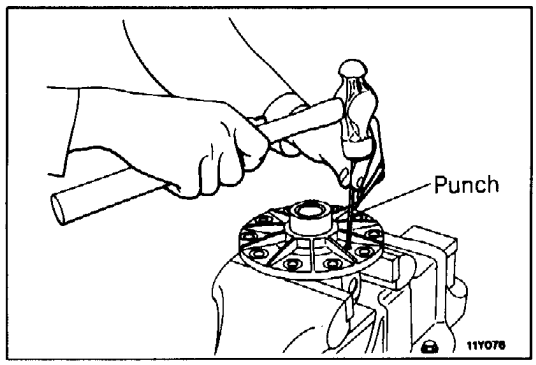
6. REMOVAL OF SIDE BEARING INNER RACE

NOTE
There are two notches provided (at the differential case side) for the claw part of the special tool; use the special tool at that position.

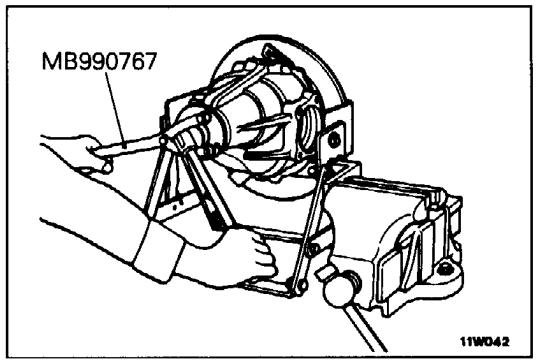


8. REMOVAL OF DRIVE GEAR

(1) Make the mating marks to the differential case and the drive gear.
(2) Loosen the drive gear attaching bolts in diagonal sequence to remove the drive gear.



9. REMOVAL OF LOCK PIN



17. REMOVAL OF COMPANION FLANGE SELF-LOCKING NUT

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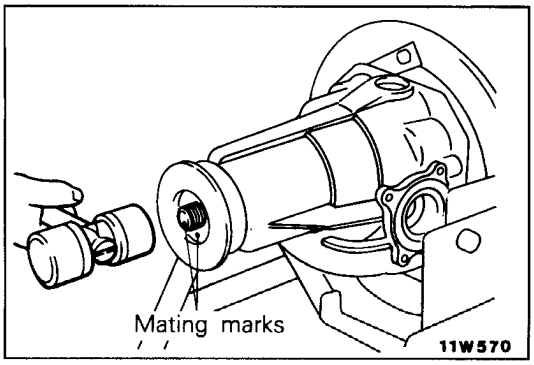
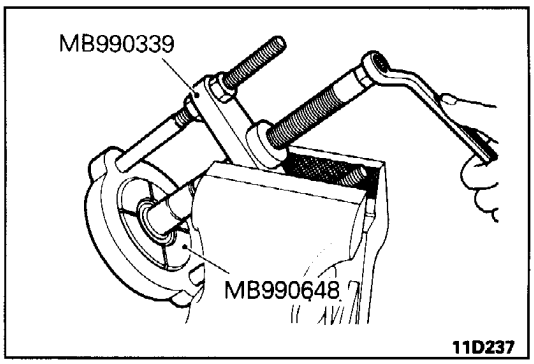


19. REMOVAL OF DRIVE PINION ASSEMBLY

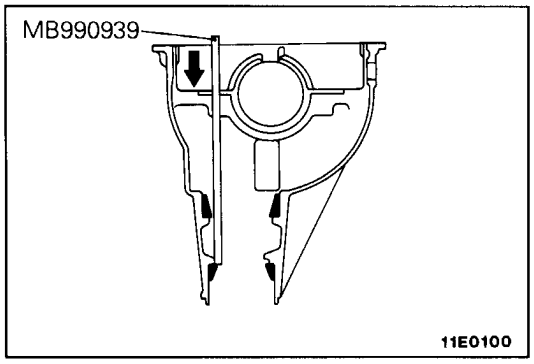
(1) Make mating marks on the drive pinion and companion flange.

Caution
The mating mark made on the companion flange must not be on the coupling surface of the flange yoke and the front propeller shaft.

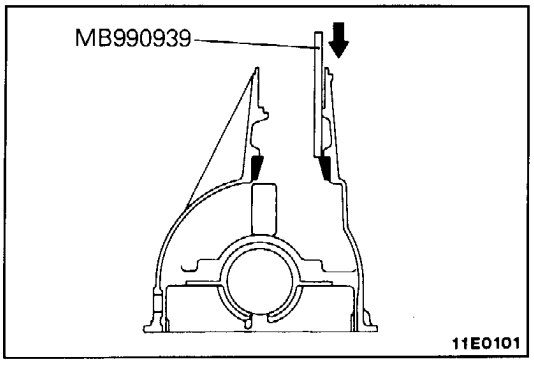
(2) Drive out the drive pinion together with the drive pinion spacer and drive pinion shims.



23. REMOVAL OF DRIVE PINION FRONT BEARING INNER RACE



28. REMOVAL OF DRIVE PINION REAR BEARING OUTER RACE



29. REMOVAL OF DRIVE PINION FRONT BEARING OUTER RACE

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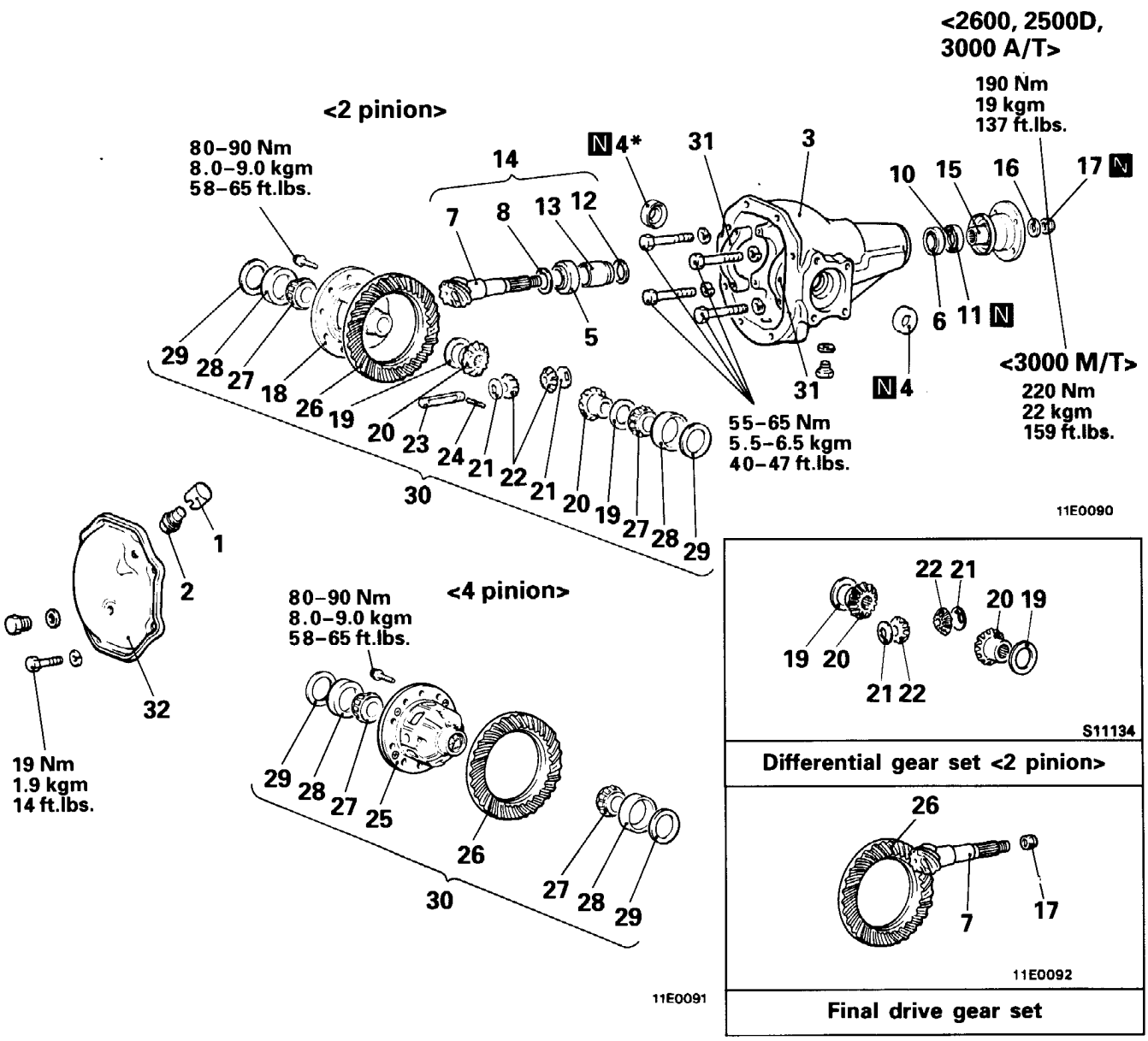
REASSEMBLY

E26WP--



Differential gear set <2 pinion>

Final drive gear set

Reassembly steps

1. Vent plug
2. Plug cover
3. Gear carrier
- ◆◆ 4. Oil seal
- ◆◆ 5. Drive pinion front bearing outer race
- ◆◆ 6. Drive pinion rear bearing outer race
- ◆◆ • Adjustment of pinion height
7. Drive pinion
8. Drive pinion front shim (for pinion height adjustment)
9. Drive pinion front bearing inner race
- ◆◆ • Adjustment of drive pinion turning torque
10. Drive pinion rear bearing inner race
11. Oil seal
12. Drive pinion rear shim (for turning torque adjustment)
13. Drive pinion spacer
14. Drive pinion assembly
15. Companion flange
16. Washer
17. Companion flange self-locking nut
18. Differential case
19. Side gear thrust spacer
20. Side gear
21. Pinion washer
22. Pinion gear
- ◆◆ • Adjustment of differential gear backlash <2 pinion>
23. Pinion shaft
- ◆◆ 24. Lock pin
25. 4 pinion case assembly
- ◆◆ 26. Drive gear
- ◆◆ 27. Side bearing inner race
28. Side bearing outer race
- ◆◆ • Adjustment of final drive gear backlash
29. Side bearing adjusting spacer
30. Differential case assembly
31. Bearing cap
32. Cover

NOTE
*: Part Time 4WD

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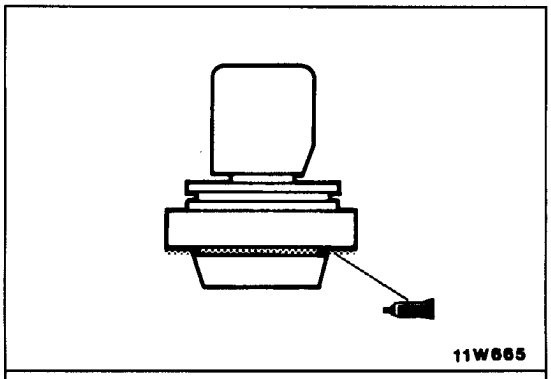
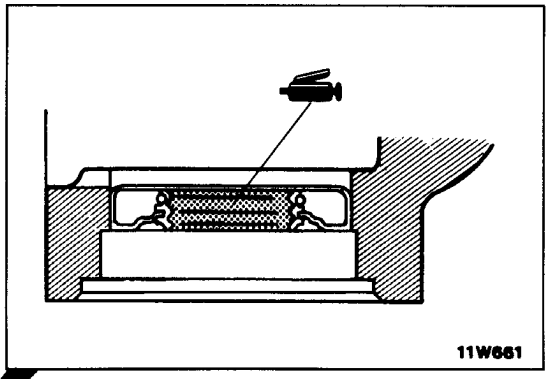
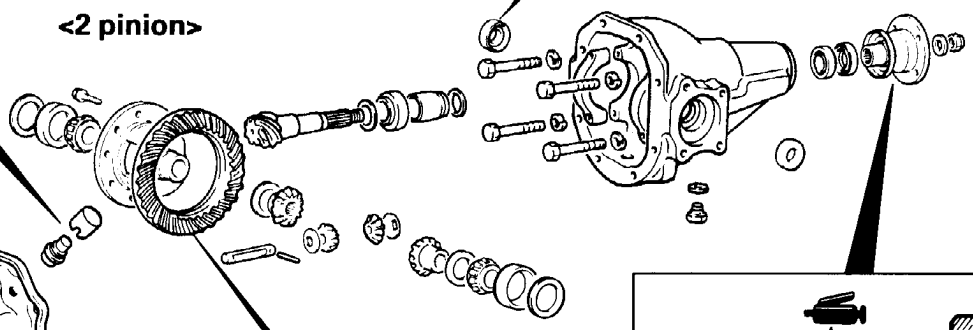
LUBRICATION, SEALING AND ADHESION POINTS

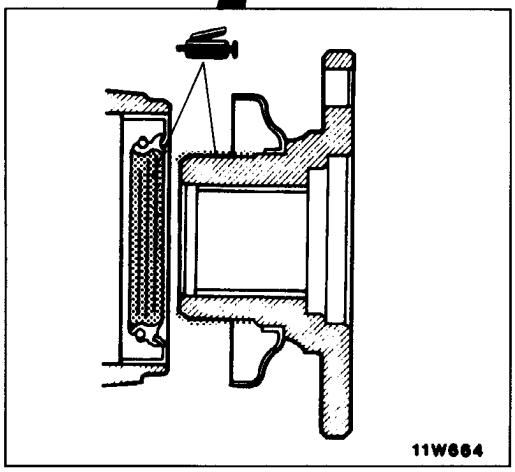


Sealant:
3M ATD Part No. 8661, 8663 or equivalent

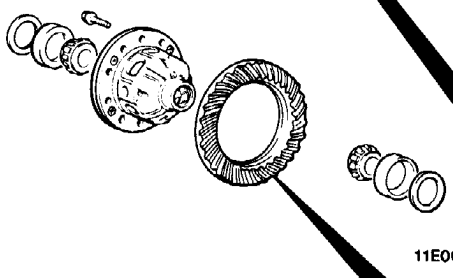


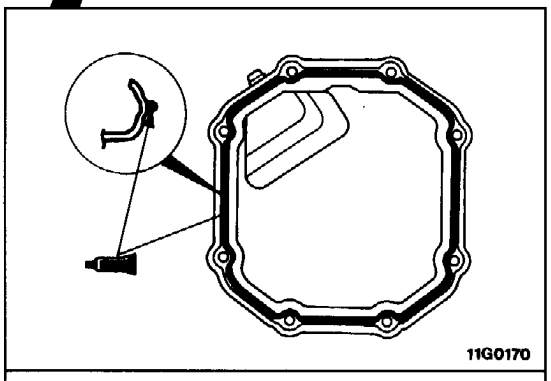
<2 pinion>



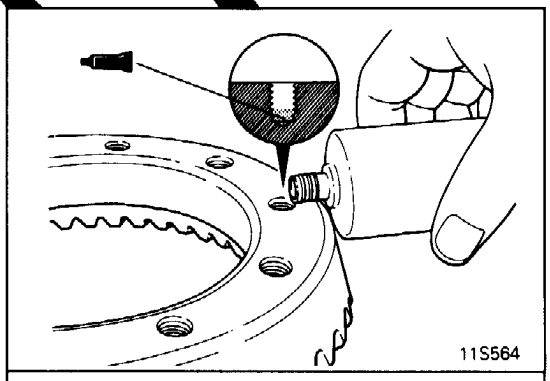


<4 pinion>





Sealant:
3M ATD Part No. 8661, 8663 or equivalent



Adhesive:
3M Stud Locking 4170 or equivalent

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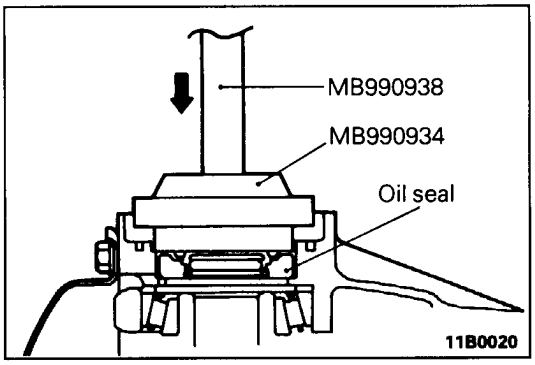
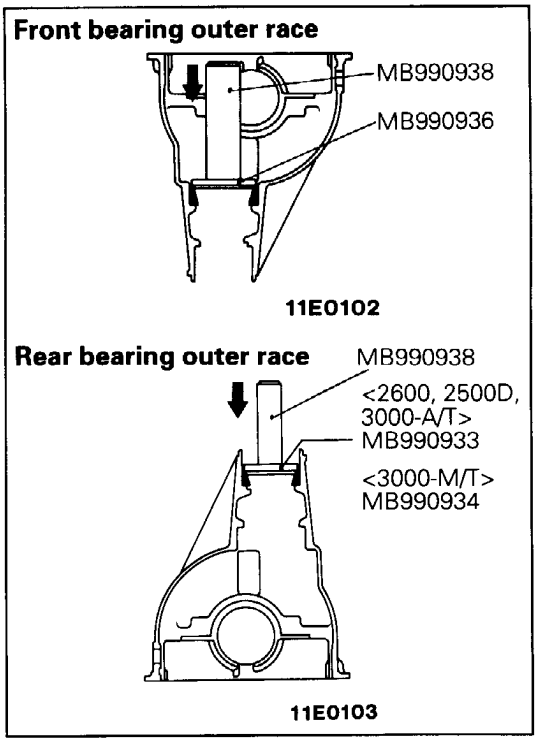


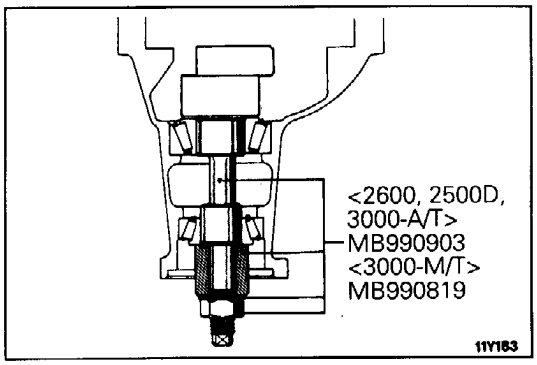
SERVICE POINTS OF REASSEMBLY E26WHAF

4. INSTALLATION OF OIL SEAL



5. INSTALLATION OF DRIVE PINION FRONT BEARING OUTER RACE/6. DRIVE PINION REAR BEARING OUTER RACE

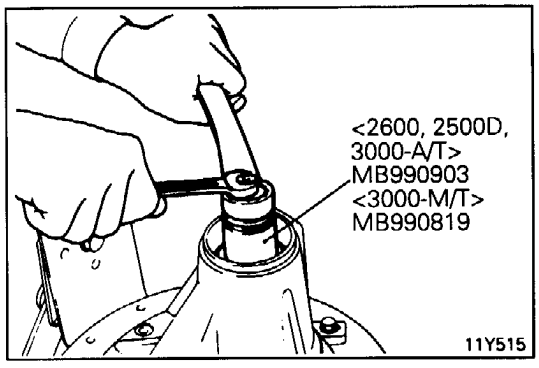
NOTE
Perform press-fitting carefully so as not to tilt the outer race.



• ADJUSTMENT OF PINION HEIGHT

Adjust the drive pinion height by the following procedures:

(1) Install special tools and drive pinion front and rear bearing inner races to the gear carrier in the sequence shown in the illustration.



(2) Tighten the nut of the special tool until the standard value of drive pinion rotation torque is obtained.

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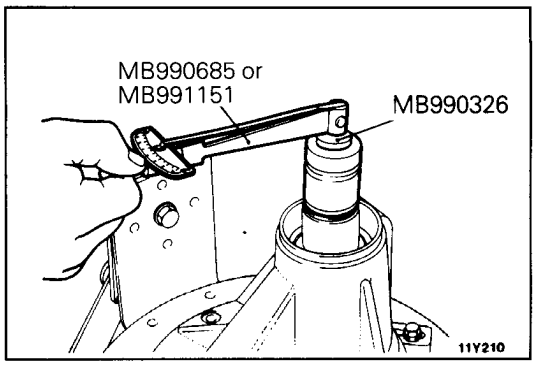

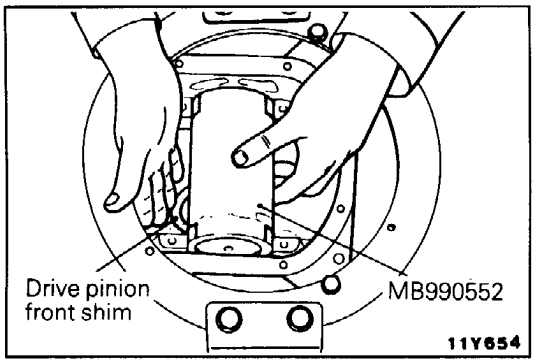

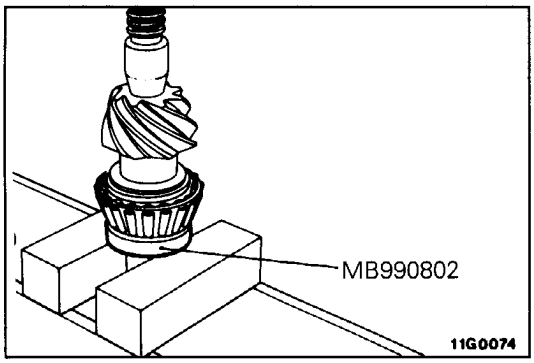

(3) Measure the drive pinion rotation torque (without the oil seal) by using the special tools.

Standard value:

Bearing division	Bearing lubrication	Rotation torque
New	None (With anti-rust agent)	0.3–0.5 Nm 3.0–5.0 kgcm 2.6–4.3 in.lbs.
New/reusing	Gear oil applied	0.15–0.25 Nm 1.5–2.5 kgcm 1.3–2.2 in.lbs.

NOTE
1. Gradually tighten the nut of the special tool while checking the drive pinion preload.
2. Because one rotation can't be made when the special tool is in contact with the gear carrier, move it a few times and, after seating the bearing, measure the rotation torque.

(4) Position the special tool in the side bearing seat of the gear carrier, and then select a drive pinion front shim of a thickness which corresponds to the gap between the special tools.

NOTE
1. Be sure to clean the side bearing seat thoroughly. When positioning the special tool, be sure that the cut-out sections of the special tool are in the position shown in the illustration, and also confirm that the special tool is in close contact with the side bearing seat.
2. When selecting the drive pinion front shims, keep the number of shims to a minimum.

(5) Fit the selected drive pinion front shim(s) to the drive pinion, and press-fit the drive pinion front bearing inner race by using the special tool.

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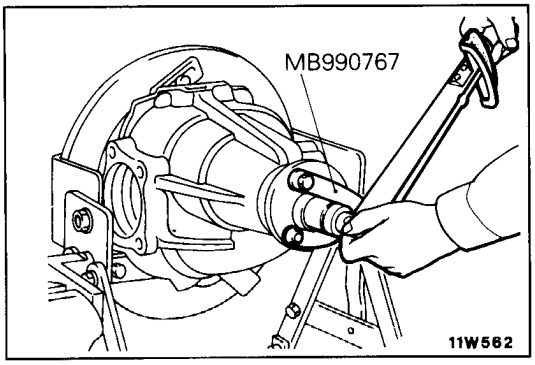


- **ADJUSTMENT OF DRIVE PINION TURNING TORQUE**

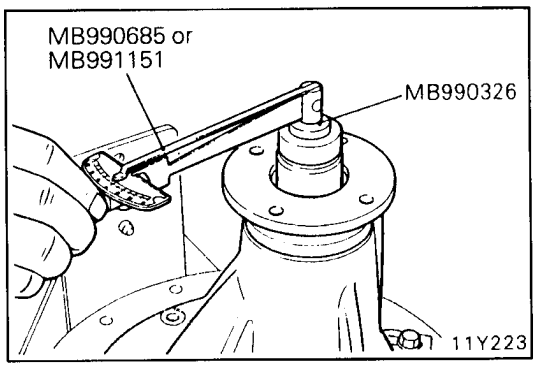
Adjust the drive pinion rotation torque by using the following procedure:

Without Oil Seal

(1) Insert the drive pinion into the gear carrier, and then install, from the front side of the carrier, the drive pinion spacer, the drive pinion rear shim, the drive pinion rear bearing inner race, and the companion flange in that order.

NOTE
Do not install the oil seal.

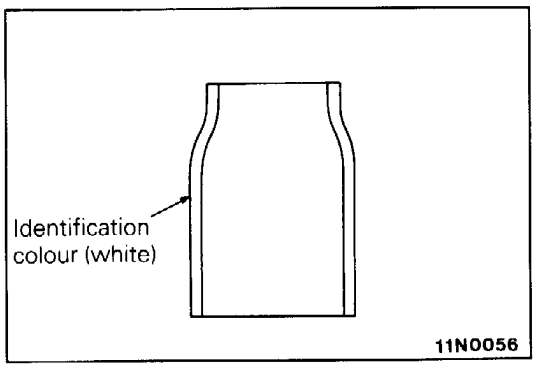
(2) Tighten the companion flange to the specified torque by using the special tool.



(3) Measure the drive pinion rotation torque (without the oil seal) by using the special tools.

Standard value:

Bearing division	Bearing lubrication	Rotation torque
New	None (With anti-rust agent)	0.3–0.5 Nm 3.0–5.0 kgcm 2.6–4.3 in.lbs.
New/reusing	Gear oil applied	0.15–0.25 Nm 1.5–2.5 kgcm 1.3–2.2 in.lbs.



(4) If the drive pinion rotation torque is not within the range of the standard value, adjust the preload by replacing the drive pinion front shim(s) or the drive pinion spacer.

NOTE
When selecting the drive pinion rear shims, if the number of shims is large, reduce the number of shims to a minimum by selecting the drive pinion spacers.
Also, select the drive pinion spacer from the following two types.

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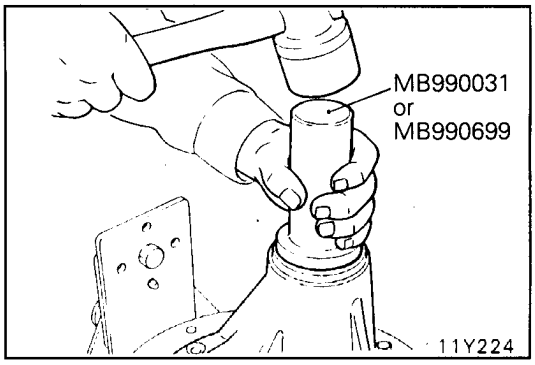

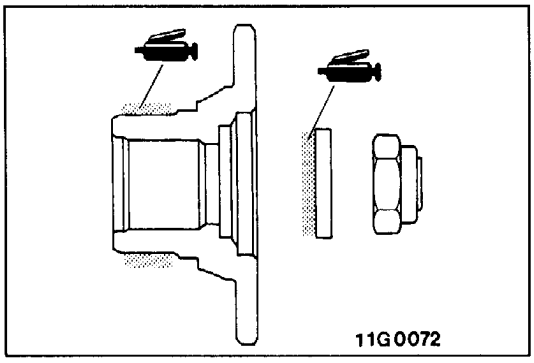

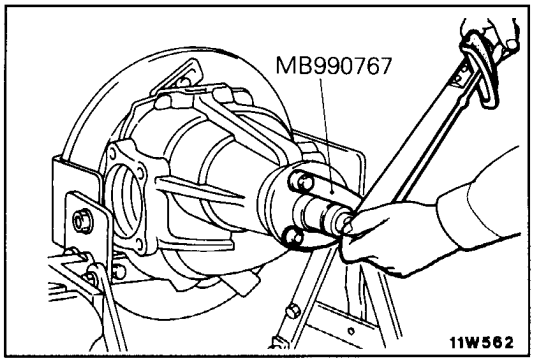

Item	<2600, 2500D, 3000-A/T>	<3000-M/T>
Height of drive pinion spacer mm (in.)	46.67 (1.837) With identification colour	56.67 (2.231) With identification colour
	47.01 (1.851) No identification colour	57.01 (2.244) No identification colour

(5) Remove the companion flange and drive pinion once again.

With Oil Seal

(1) After setting the drive pinion rear bearing inner race, drive the oil seal into the gear carrier front lip by using the special tool.
(2) Apply multi-purpose grease to the contact surfaces of the companion flange oil seal and the washer companion flange.

(3) Install the drive pinion assembly and companion flange with mating marks properly aligned, and tighten the companion flange self-locking nut to the specified torque by using the special tools.

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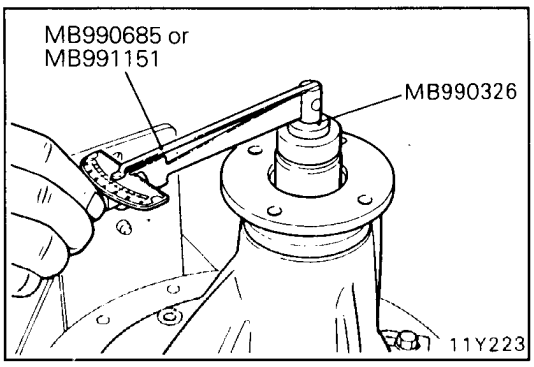
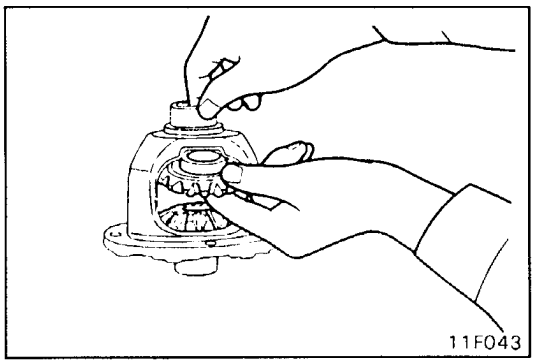


(4) Measure the drive pinion rotation torque (with oil seal) by using the special tools to verify that the drive-pinion preload complies with the standard value.

Standard value:

Bearing division	Bearing lubrication	Rotation torque
New	None (With anti-rust agent)	0.5–0.7 Nm 5.0–7.0 kgcm 4.3–6.1 in.lbs.
New/reusing	Gear oil applied	0.35–0.45 Nm 3.5–4.5 kgcm 3.1–3.9 in.lbs.

(5) If the measured value is not within the standard value range, check for faulty installation of the oil seal or faulty tightening of the self-locking nut.

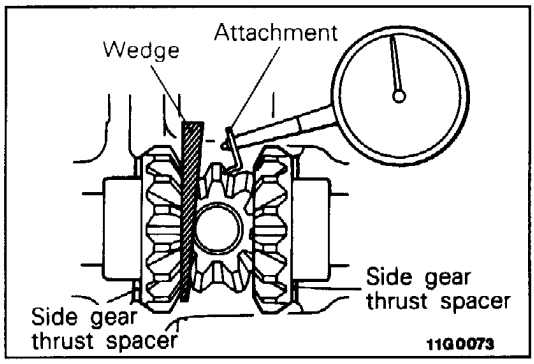


- **ADJUSTMENT OF DIFFERENTIAL GEAR BACKLASH <2 PINION>**

(1) Assemble the side gears, side gear thrust spacers, pinion gears, and pinion washers into the differential case.

(2) Temporarily install the pinion shaft.

NOTE
Do not drive in the lock pin yet.



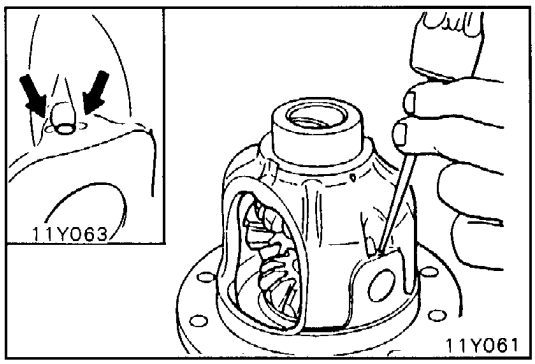
(3) Insert a wedge between the side gear and the pinion shaft to lock the side gear.

(4) Measure the differential gear backlash with a dial indicator on the pinion gear.

Standard value: 0–0.076 mm (0–0.0030 in.)
Limit: 0.2 mm (0.0079 in.)

(5) If the differential gear backlash exceeds the limit, adjust the backlash by installing thicker side gear thrust spacers.

(6) Measure the differential gear backlash once again, and confirm that it is within the limit.
If adjustment is not possible, replace the side gears and pinion gears as a set.



24. INSTALLATION OF LOCK PIN

(1) Align the pinion shaft lock pin hole with the differential case lock pin hole, and drive in the lock pin.

(2) Stake the lock pin with a punch at two points.

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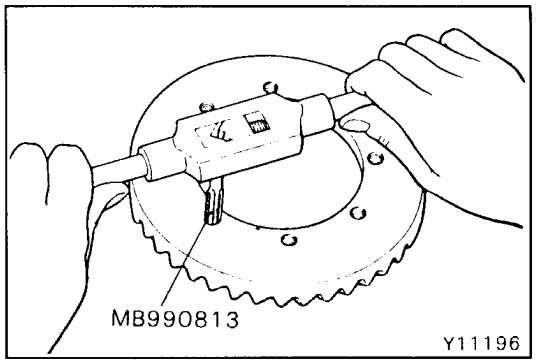
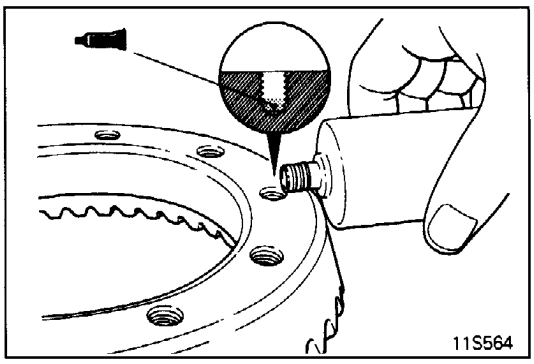


26. INSTALLATION OF DRIVE GEAR

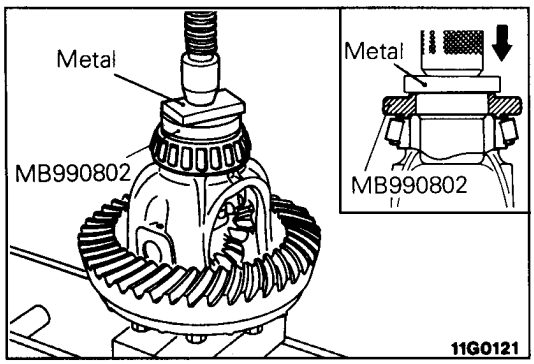
(1) Clean the drive gear attaching bolts.
(2) Remove the adhesive adhered to the threaded holes of the drive gear by turning the special tool (tap M10 × 1.25), and then clean the threaded holes by applying compressed air.



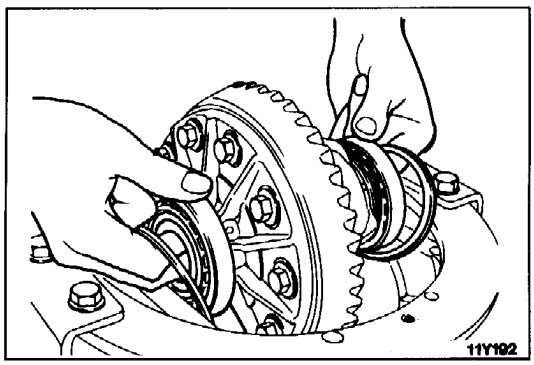
(3) Apply the specified adhesive to the threaded holes of the drive gear.

Specified adhesive: 3M Stud Locking 4170 or equivalent

(4) Install the drive gear onto the differential case with the mating marks properly aligned. Tighten the bolts to the specified torque in a diagonal sequence.



27. INSTALLATION OF SIDE BEARING INNER RACE

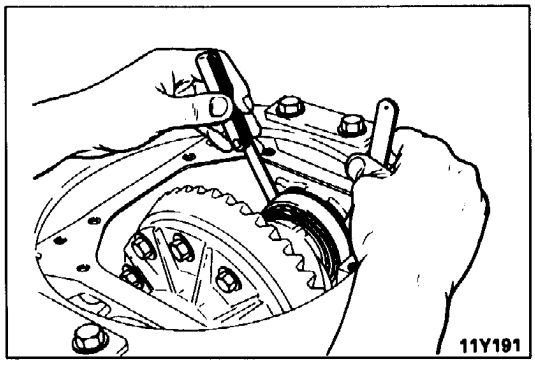


• ADJUSTMENT OF FINAL DRIVE GEAR BACKLASH

Adjust the final drive gear backlash by the following procedures:

(1) Install the side bearing spacers, which are thinner than those removed, to the side bearing outer races, and then mount the differential case assembly into the gear carrier.

NOTE
Select side bearing spacers with the same thickness for both the drive pinion side and the drive gear side.



(2) Push the differential case assembly to one side, and measure the clearance between the gear carrier and the side bearing adjusting spacer with a thickness gauge.

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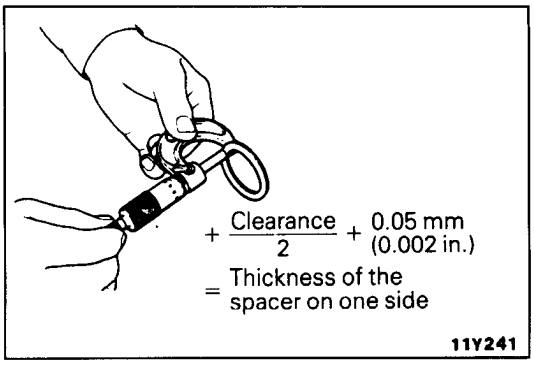
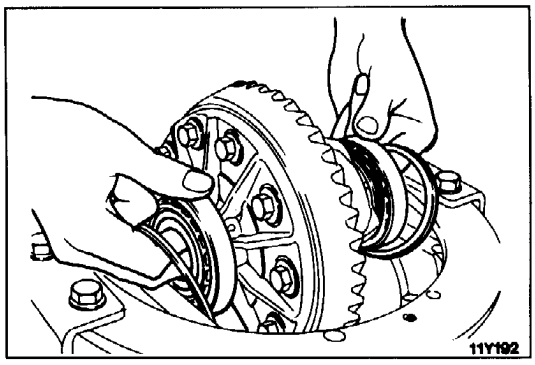
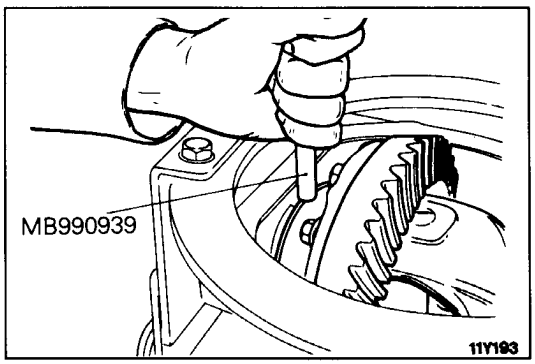


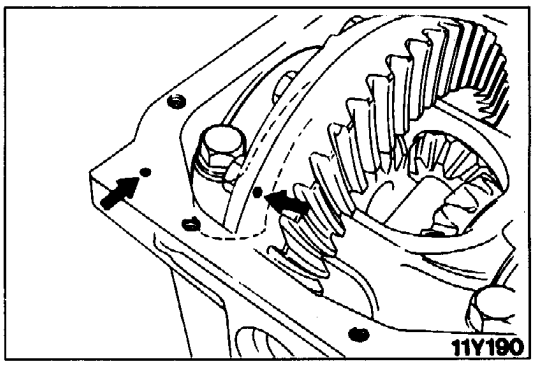
(3) Measure the thickness of the side bearing adjusting spacers on one side, select two pairs of spacers which correspond to that thickness plus one half of the clearance plus 0.05 mm (0.002 in.), and then install one pair each to the drive pinion side and the drive gear side.



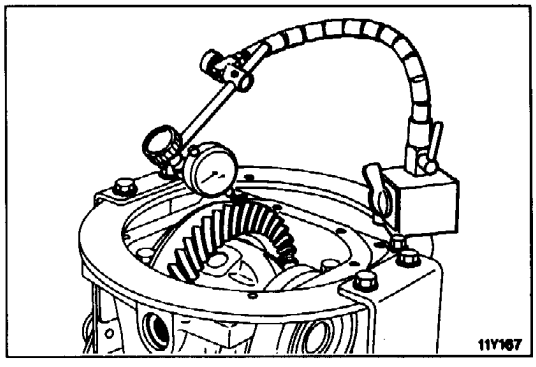
(4) Install the side bearing adjusting spacers and differential case assembly, as shown in the illustration, to the gear carrier.



(5) Tap the side bearing adjusting spacers with the special tool to fit them to the side bearing outer race.



(6) Align the mating marks on the gear carrier and the bearing cap, and then tighten the bearing cap.



(7) With the drive pinion locked in place, measure the final drive gear backlash with a dial indicator on the drive gear.

NOTE
Measure at four points or more on the circumference of the drive gear.

Standard value: 0.11–0.16 mm (0.004–0.006 in.)

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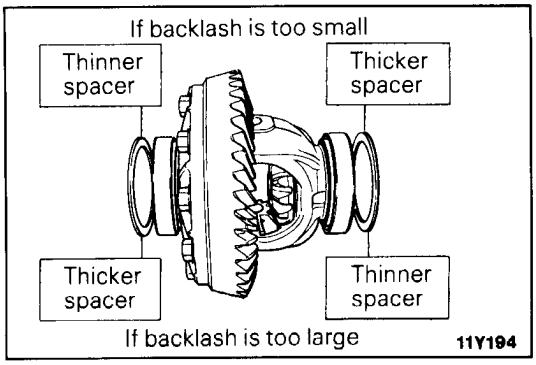
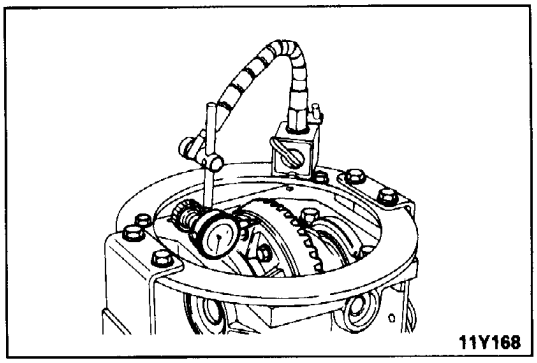




(8) Change the side bearing adjusting spacers as illustrated, and then adjust the final drive gear backlash between the drive gear and the drive pinion.

NOTE
When increasing the number of side bearing adjusting spacers, use the same number for each, and as few as possible.

(9) Check the drive gear and drive pinion for tooth contact. If poor contact is evident, make adjustment. (Refer to P.26-42)

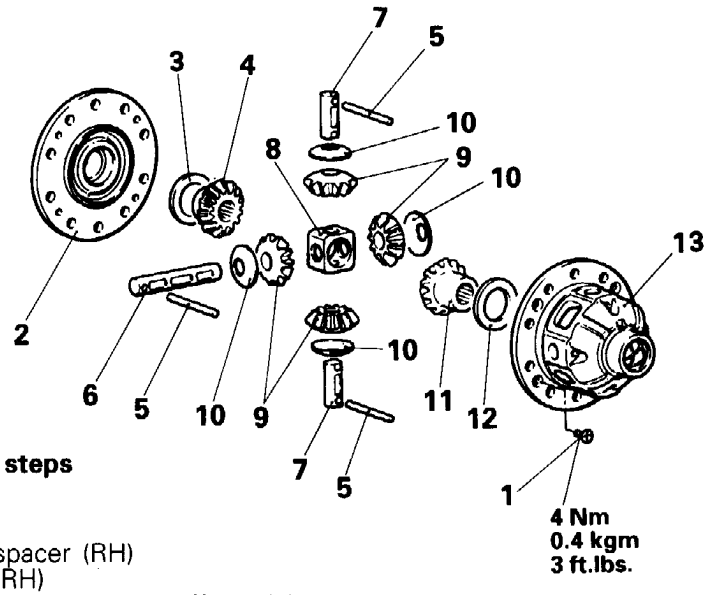
(10) Measure the drive gear runout at the shoulder on the reverse side of the drive gear.

Limit: 0.05 mm (0.0020 in.)

(11) If the drive gear runout exceeds the limit, reinstall by changing the phase of the drive gear and differential case, and remeasure.

OVERHAUL (4 PINION CASE ASSEMBLY)

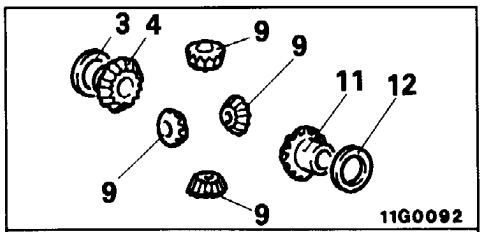
E26WK--



11G0011

Disassembly steps

- ◆◆ 1. Screw
- 2. Case A
- 3. Side gear spacer (RH)
- 4. Side gear (RH)
- ◆◆ • Backlash adjustment on differential gear case A side
- ◆◆ • Differential gear backlash check
- 5. Lock pin
- 6. Pinion shaft-A
- 7. Pinion shaft-B
- 8. Pinion shaft holder
- 9. Pinion gear
- 10. Washer
- 11. Side gear (LH)
- 12. Side gear spacer (LH)
- ◆◆ • Backlash adjustment on differential gear case B side
- 13. Case B



Differential gear set

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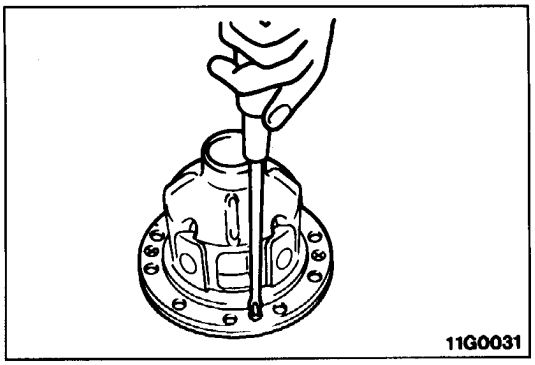
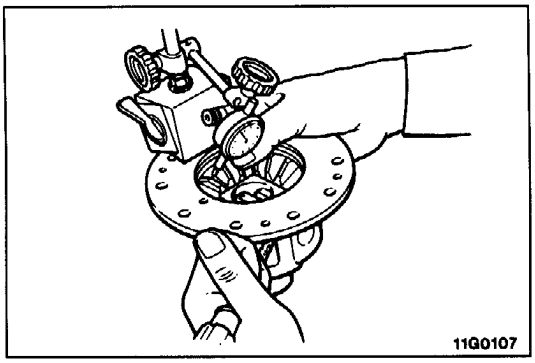




SERVICE POINTS OF DISASSEMBLY E26WLAB

1. REMOVAL OF SCREW

(1) Evenly loosen 4 screws on case A and B to remove.
(2) Set case B downward and remove case A, side gear spacer (RH) and side gear (RH).

NOTE
Check differential gear backlash to determine necessity of disassembling side gear (RH) and onward.

- **DIFFERENTIAL GEAR BACKLASH CHECK**

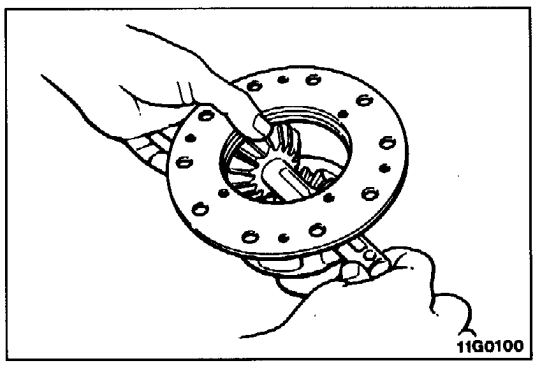
Check differential gear backlash as follows.
(1) Insert cloth wrapped screwdriver through side of case B and lock side gear (LH) and pinion gear. (one piece)
(2) Contact dial gauge on pinion gear facing the locked pinion gear and measure backlash within the standard value.

NOTE
Measure 2 pinion gears.

Standard value: 0.01–0.25 mm (0.0004–0.0098 in.)

(3) When backlash exceeds the standard value, adjust side gear spacer (LH).

NOTE
If backlash is within the standard value, assure appropriate gear spacer (RH) thickness and assemble 4 pinion case assembly. (Refer to P.26-57.)



SERVICE POINTS OF REASSEMBLY E26WNAB

- **BACKLASH ADJUSTMENT ON DIFFERENTIAL GEAR CASE B SIDE**

Adjust backlash on differential gear case B side as follows.
(1) Temporarily install side gear spacer (LH), side gear (LH), washers, 2 pinion gears and pinion shaft A on case B.

NOTE
Do not assemble pinion shaft holder, pinion shaft-B or the remaining pinion gears (2).

(2) Insert wrapped screwdriver through side of case B to lock one side of pinion gear and side gear (LH).

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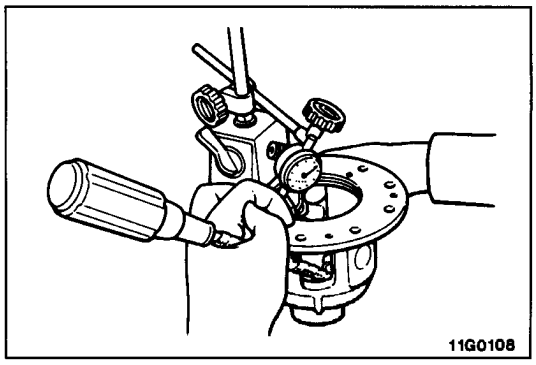
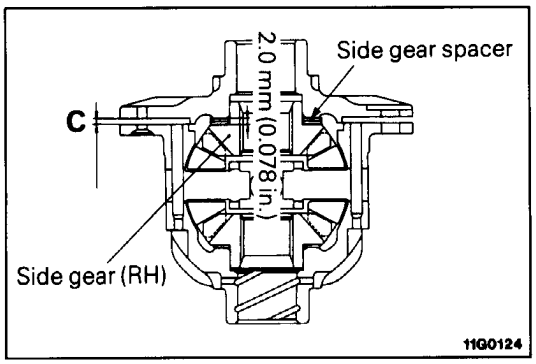


(3) Place dial gauge on unlocked pinion gear and measure differential gear backlash within the standard value.

NOTE
Measure 2 pinion gears.

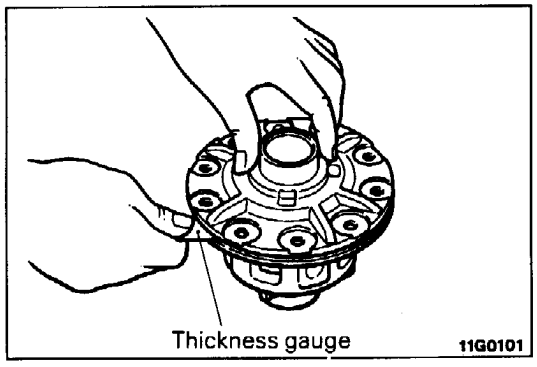
Standard value: 0.01–0.25 mm (0.0004–0.0098 in.)

(4) When backlash exceeds the standard value, adjust with selected side gear spacer (LH).
(5) Install washers, pinion gears, pinion shaft holder and pinion shaft-A and B. Lock with lock pin through case B.



- **BACKLASH ADJUSTMENT ON DIFFERENTIAL GEAR CASE A SIDE**

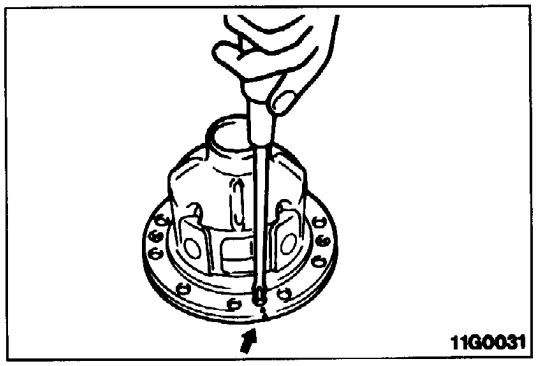
Adjust backlash as follows.
(1) Install side gear (RH) and 2 side gear spacers [1.0 mm (0.039 in.) thick]. Press differential case A to differential case B.



(2) Measure flange space (C) between differential case A and B with thickness gauge.
(3) Calculate side gear spacer (RH) thickness (D) as follows:

D=2.0 mm (0.078 in.)–[C+0.2 mm (0.008 in.)]

(4) Choose spacer with a thickness nearest D in (3) and adjust differential gear backlash on the right side.



(5) Match the match marks and assemble cases A and B.
(6) Assure smooth rotation of inner shaft.

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REAR AXLE

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E27AA--

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- Differential case 37

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SPECIFICATIONS

GENERAL SPECIFICATIONS

E27CA--

<Vehicles built up to October, 1993>

Items	2400	3000	2500D	
			Vehicles without wide fender	Vehicles with wide fender
Axle housing type	Banjo type	Banjo type	Banjo type	Banjo type
Axle shaft Supporting type	Semi-floating type	Semi-floating type	Semi-floating type	Semi-floating type
Differential Differential size 2-door models	No. 6*1 or No. 7*2	No. 7	No. 6*1 or No. 7*2	No. 6*1 or No. 7*2
4-door models	No. 7	No. 7	A/T: No. 6*1 or No. 7*2 M/T: No. 7	No. 7
Reduction gear type	Hypoid gear	Hypoid gear	Hypoid gear	Hypoid gear
Reduction ratio 2-door models	4,875	4,875	4,625	4,875
4-door models	4,875	4,875	4,875	5,285
Pinion gear type	2 pinion or 4 pinion *3	2 pinion or 4 pinion*3	2 pinion or 4 pinion*3	2 pinion or 4 pinion*3

NOTE
*1: Vehicles without rear differential lock
*2: Vehicles with rear differential lock
*3: Vehicles with limited slip differential or rear differential lock

<Vehicles built from November, 1993>

Items	2400	3000 – 12VALVE	3500
Axle housing type	Banjo type	Banjo type	Banjo type
Axle shaft Supporting type	Semi-floating type	Semi-floating type	Semi-floating type
Differential Differential size	No. 6*1 or No. 7*2	No. 7	No. 7.5
Reduction gear type	Hypoid gear	Hypoid gear	Hypoid gear
Reduction ratio	4,875	4,875	4,636
Pinion gear type	2 pinion or 4 pinion*3	2 pinion or 4 pinion*3	2 pinion*4 or 4 pinion

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Items	2500D	2800D	3000 – 24VALVE
Axle housing type	Banjo type	Banjo type	Banjo type
Axle shaft Supporting type	Semi-floating type	Semi-floating type	Semi-floating type
Differential Differential size Reduction gear type Reduction ratio 2–door models 4–door models Pinion gear type	 No. 6*1 or No. 7*2 Hypoid gear 4.625 or 4.875*5 4.875 or 5.285*5 2 pinion or 4 pinion*3	 No. 7.5 Hypoid gear 4.636 4.900 2 pinion*4 or 4 pinion	 No. 7 Hypoid gear 4.636 or 4.875*5 4.636 or 4.875*5 2 pinion or 4 pinion*3

NOTE
*1: Vehicles without rear differential lock
*2: Vehicles with rear differential lock
*3: Vehicles with limited slip differential or rear differential lock
*4: Vehicles with automatic transmission
*5: Vehicles with wide fender

SERVICE SPECIFICATIONS

Items	Vehicles with a conventional differential or rear differential lock	Vehicles with a limited slip differential
Standard value		
Axle shaft axial play mm (in.)	0.25 (0.0098)	0.25 (0.0098)
Limited slip differential preload		
Using special tool Nm (kgm, ft.lbs.)	–	12.5 (1.25, 9) or more
Without using special tool Nm (kgm, ft.lbs.)	–	25 (2.5, 18) or more
Protruding length of stabilizer bar mounting bolt mm (in.)	15–17 (0.59–0.67)	15–17 (0.59–0.67)
Press-fitting force of retainer Nm (kgm, ft.lbs.)		
Initial press-fitting force	50,000 (5,000, 11,023)	50,000 (5,000, 11,023)
Final press-fitting force	100,000–110,000 (10,000–11,000, 22,046–24,251)	100,000–110,000 (10,000–11,000, 22,046–24,251)
Clearance of snap ring and retainer mm (in.)	0–0.166 (0–0.0065)	0–0.166 (0–0.0065)
Rear differential lock air pump pressure kPa (kg/cm^2, psi)	25–40 (0.25–0.40, 4–6)	–
Final drive gear backlash mm (in.)		
No. 6 differential	0.11–0.16 (0.0043–0.0063)	0.11–0.16 (0.0043–0.0063)
No. 7 differential	0.13–0.18 (0.0051–0.0071)	0.13–0.18 (0.0051–0.0071)
No. 7.5 differential	0.13–0.18 (0.0051–0.0071) 0.12–0.18 (0.0047–0.0071)*1	0.13–0.18 (0.0051–0.0071)
Differential gear backlash mm (in.)		
No. 6 differential	0.010–0.076 (0.0004–0.0030)	–
No. 7 differential	0–0.076 (0–0.0030)	–
No. 7.5 differential	0.10–0.25 (0.004–0.01) 0.15–0.20 (0.005–0.008)*1	–
Drive pinion turning torque		
Without oil seal Nm (kgcm, in.lbs.)		
With anti-rust agent (new)	0.6–0.9 (6.0–9.0, 5.2–7.8)	0.6–0.9 (6.0–9.0, 5.2–7.8)
With gear oil applied (new or used)	0.4–0.5 (4.0–5.0, 3.5–4.3)	0.4–0.5 (4.0–5.0, 3.5–4.3)
With oil seal Nm (kgcm, in.lbs.)		
With anti-rust agent (new)	0.85–1.15 (8.5–11.5, 7.4–10.0)	0.85–1.15 (8.5–11.5, 7.4–10.0)
With gear oil applied (new or used)	0.65–0.75 (6.5–7.5, 5.6–6.5)	0.65–0.75 (6.5–7.5, 5.6–6.5)

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Items	Vehicles with a conventional differential or rear differential lock	Vehicles with a limited slip differential
Difference in total thickness between the left and right clutch plates mm (in.)		0–0.05 (0–0.020)
Clearance between spring plate and differential case mm (in.)	–	0.06–0.20 (0.0024–0.0079)
Clearance between friction disc and differential case mm (in.)	0.05–0.20 (0.0020–0.0079)*2	–
Difference between left and right dimensions from back thrust face of pressure ring to end of thrust washer mm (in.)	–	0–0.05 (0–0.020)
Clearance between thrust washer and differential case mm (in.)	–	0.05–0.20 (0.0020–0.0079)
Clutch plate preload		
When equipped with new clutch plates Nm (kgm, ft.lbs.)	–	40–75 (4.0–7.5, 29–54)
When equipped with old clutch plates Nm (kgm, ft.lbs.)	–	25–75 (2.5–7.5, 18–54)
Limit		
Rear axle total backlash mm (in.)	5 (0.20)	5 (0.20)
Drive gear runout mm (in.)	0.05 (0.0019)	0.05 (0.0019)
Differential gear backlash mm (in.)	0.2 (0.0079)	–
Friction plate and friction disc warping (flatness) mm (in.)	0.08 (0.0031)*2	0.08 (0.0031)
Friction plate and friction disc wear (difference in the thickness of the friction surfaces and the projections) mm (in.)	0.1 (0.0039)*2	0.1 (0.0039)

NOTE
*1: Vehicles with rear differential lock
*2: Vehicles with rear differential lock <3000>

LUBRICANTS

E27CD--

<Vehicles built up to October, 1993>

Items	Specified lubricant	Quantity dm^3 (U.S. qts., Imp. qts.)			
		Standard wheelbase		Long wheelbase	
		2400 2500D	3000	2500D*1	2400 3000 2500D*2
Rear axle gear oil					
Convetional differential	Hypoid gear oil API classification GL-5 or higher SAE viscosity No. 90, 80W	1.8 (1.90, 1.58)	2.6 (2.75, 2.29)	1.8 (1.90, 1.58)	2.6 (2.75, 2.29)
Limited slip differential	Hypoid gear oil MITSUBISHI Genuine Gear Oil Part No. 8149630EX, CASTROL HYPOY LS (GL-5, SAE 90), SHELL-LSD (GL-5, SAE 80W-90) or equivalent	1.8 (1.90, 1.58)	2.6 (2.75, 2.29)	1.8 (1.90, 1.58)	2.6 (2.75, 2.29)
Rear differential lock	Hypoid gear oil API classification GL-5 or higher SAE viscosity No. 90, 80W	2.6 (2.75, 2.29)	2.6 (2.75, 2.29)	2.6 (2.75, 2.29)	2.6 (2.75, 2.29)

NOTE
*1: Vehicles without wide fender–A/T.
*2: Vehicles with wide fender and vehicles without wide fender–M/T.

<Vehicles built from November, 1993>

Items	Specified lubricant	Quantity dm^3 (U.S. qts., Imp. qts.)		
		2400 2500D	3000	3500 2800D
Rear axle gear oil				
Convetional differential	Hypoid gear oil API classification GL-5 or higher SAE viscosity No. 90, 80W	1.8 (1.90, 1.58)	2.6 (2.75, 2.29)	3.2 (3.38, 2.82)
Limited slip differential	Hypoid gear oil MITSUBISHI Genuine Gear Oil Part No. 8149630EX, CASTROL HYPOY LS (GL-5, SAE 90), SHELL-LSD (GL-5, SAE 80W-90) or equivalent	1.8 (1.90, 1.58)	2.6 (2.75, 2.29)	3.2 (3.38, 2.82)
Rear differential lock	Hypoid gear oil API classification GL-5 or higher SAE viscosity No. 90, 80W	2.6 (2.75, 2.29)	2.6 (2.75, 2.29)	3.2 (3.38, 2.82)

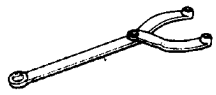
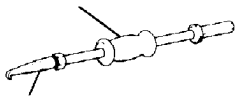
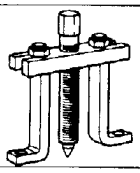
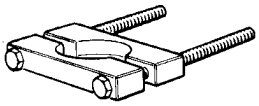
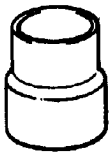
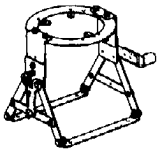
SEALANT AND ADHESIVES

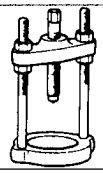
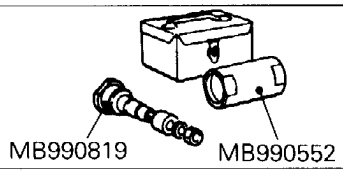
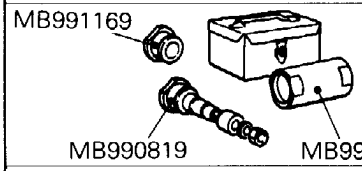
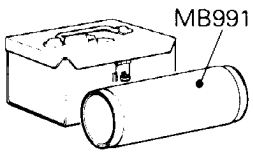
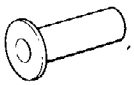
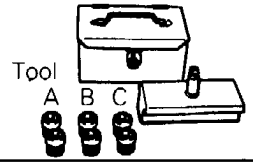
E27CE--

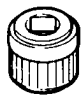
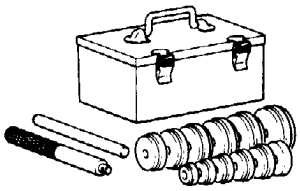
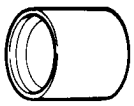
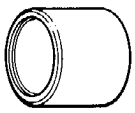
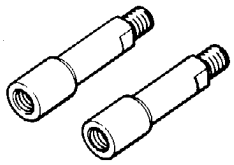
Items	Specified sealants and adhesives	Remarks
Bearing case Differential carrier mounting surface of axle housing	3M ATD Part No. 8661, 8663 or equivalent	Semi-drying sealant
Drive gear threaded hole	3M Stud Locking 4170 or equivalent	Anaerobic sealant

SPECIAL TOOLS

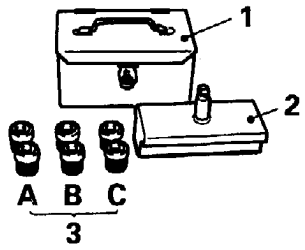
E27DA--

Tool	Number	Name	Use
	MB990767	End yoke holder	Measurement of the limited slip differential preload
MB990211  MB990212	MB990590	Sliding hammer	Removal of axle shaft (Use together with MB990241) Removal of axle housing oil seal
	MB990241	Rear axle shaft puller	Removal of axle shaft (Use together with MB990590)
	MB991552	Axle shaft bearing and case remover	Removal of the axle shaft bearing and bearing case
	MB990560	Bearing remover	Removal of bearing inner race
	MB990799	Bearing inner race installer	Press-fitting of the axle shaft bearing inner race Press-fitting of the axle shaft retainer
	MB990909	Working base	Supporting of the differential carrier
	MB990201	Side bearing adjusting special spanner	Removal and adjustment of the side bearing nut
	MB990810	Side bearing puller	Removal of the side bearing inner race
	MB990811	Side bearing cup	
	MB990850	End yoke holder	Removal of the companion flange

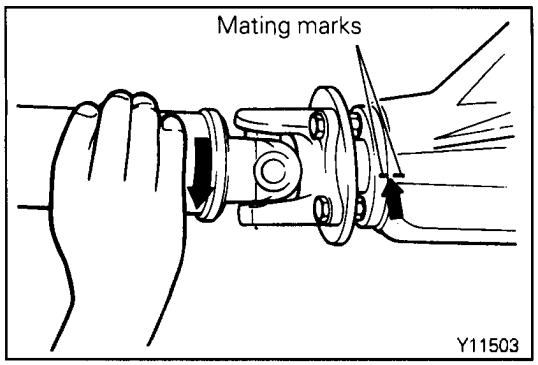
Tool	Number	Name	Use
	MB990339	Bearing puller	Removal of the drive pinion rear bearing inner race
	MB990648	Bearing remover	
	MB990818	Pinion height gauge set	Measurement of the pinion height <No. 6 differential>
	MB991171	Pinion height gauge set	Measurement of the pinion height <No. 7 differential>
	MB991542	Cylinder gauge set	Measurement of the pinion height <No. 7.5 differential> (Use together with MB990819 and MB991169)
	MB9901151 or MB990685	Torque wrench	Measurement of the starting torque of drive pinion
	MB990326	Preload socket	
	MB991168	Drive pinion oil seal installer	Press-fitting of the drive pinion oil seal
	MB990813	Tap	Removal of sealant
	MB990802	Bearing installer	Press-fitting of the drive pinion rear bearing inner race Press-fitting of the side bearing inner race
	MB990988	Side gear holding tool set	Measurement of the clutch plate preload <No. 6 differential and No. 7 differential>

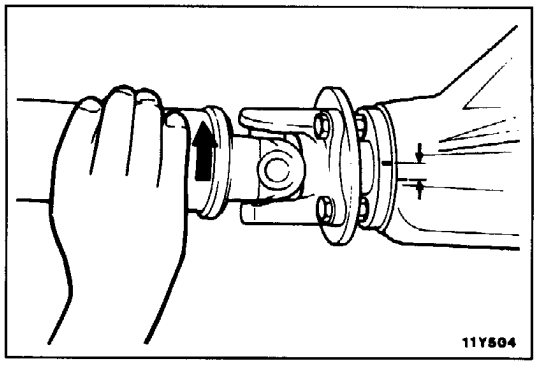
Tool	Number	Name	Use
	MB991535	Side gear holding tool	Measurement of the clutch plate preload <No. 7.5 differential> (Use together with MB990989)
	MB990925	Bearing and oil seal installer set	Press-fitting of the axle housing oil seal MB990938, MB990932 Press-fitting of the axle shaft oil seal MB990938, MB990936 Driving-out of the drive pinion bearing outer race MB990939 Press-fitting of the drive pinion rear bearing outer race No. 6 differential: MB990938, MB990936 No. 7 differential: MB990938, MB990937 Press-fitting of the drive pinion front bearing outer race MB990938, MB990934 (Refer to GROUP 26)
	MB991388	Bushing remover base	Installation of rotor assembly <Vehicles with ABS>
	MB990890 or MB990891	Rear suspension bushing base	Installation of bearing outer race
	MB991601	Extension bar	Removal of the axle shaft bearing and bearing case (Use together with MB991552)

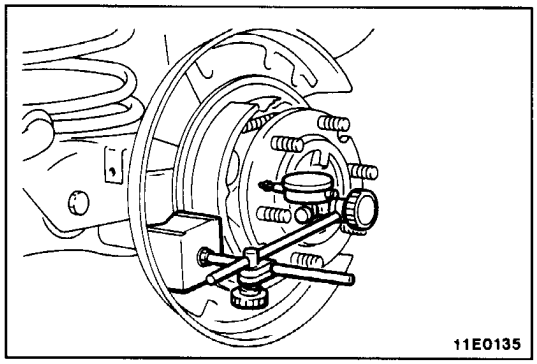
MB990988

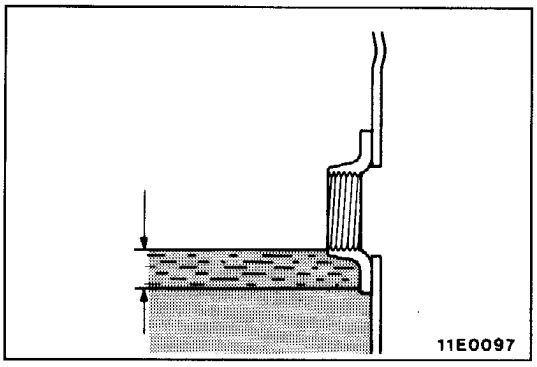


Tool number		Name	O.D. mm (in.)
1	MB990551	Box	–
2	MB990989	Base	–
3	(MB990990)	Tool A	25 (0.98)
	(MB990991)	Tool B	28 (1.10)
	(MB990992)	Tool C	31 (1.22)









SERVICE ADJUSTMENT PROCEDURES

REAR AXLE TOTAL BACKLASH CHECK E27FCAF

If the vehicle vibrates and produces a booming sound due to the unbalance of the driving system, measure the rear axle total backlash by the following procedures to see if the differential carrier assembly requires removal.

(1) Park the vehicles on a flat, level surface.
(2) Place the transmission control lever to the neutral position, and place the transfer control lever to the neutral position. Then pull the parking brake lever and raise the vehicle on a jack.
(3) Turn the companion flange clockwise as far as it will go. Make the mating mark on the dust cover of the companion flange and on the differential carrier.
(4) Turn the companion flange anti-clockwise as far as it will go, and measure the amount of distance through which the mating marks moved. If the backlash exceeds the limit, remove the differential carrier assembly and adjust the backlash.

Limit: 5 mm (0.20 in.)

AXLE SHAFT AXIAL PLAY CHECK E27FEAA

Measure the axle shaft axial play by using a dial indicator.

Standard value: 0.25 mm (0.0098 in.)

If the axle shaft axial play exceeds the standard value, replace the bearing with new one.

GEAR OIL LEVEL CHECK E27FGAA

Remove the filler plug, and check the oil level.
Check that gear oil level is not 8 mm (0.3 in.) below the bottom of filler plug hole.

Specified gear oil: dm^3 (U.S. qts, Imp.qts.)

Conventional differential

Hypoid gear oil API classification GL-5 or higher
SAE viscosity No. 90, 80W

<Vehicles built up to October, 1993>

Standard wheelbase	
2400, 2500D	**1.8 (1.90, 1.58)**
3000	**2.6 (2.75, 2.29)**
Long wheelbase	
2500D*[1]	**1.8 (1.90, 1.58)**
2400, 3000, 2500D*[2]	**2.6 (2.75, 2.29)**

<Vehicles built from November, 1993>

2400, 2500D	**1.8 (1.90, 1.58)**
3000	**2.6 (2.75, 2.29)**
3500, 2800D	**3.2 (3.38, 2.82)**

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Limited slip differential
Hypoid gear oil MITSUBISHI Genuine Gear Oil Part No. 8149630 EX, CASTROL HYPOY LS (GL-5, SAE 90), SHELL-LSD (GL-5, SAE 80W-90) or equivalent

<Vehicles built up to October, 1993>

Standard wheelbase	
2400, 2500D	**1.8 (1.90, 1.58)**
3000	**2.6 (2.75, 2.29)**
Long wheelbase	
2500D*1	**1.8 (1.90, 1.58)**
2400, 3000, 2500D*2	**2.6 (2.75, 2.29)**

<Vehicles built from November, 1993>

2400, 2500D	**1.8 (1.90, 1.58)**
3000	**2.6 (2.75, 2.29)**
3500, 2800D	**3.2 (3.38, 2.82)**

Rear differential lock
Hypoid gear oil API classification GL-5 or higher SAE viscosity No. 90, 80W

<Vehicles built up to October, 1993>

2400, 3000, 2500D	**2.6 (2.75, 2.29)**

<Vehicles built from November, 1993>

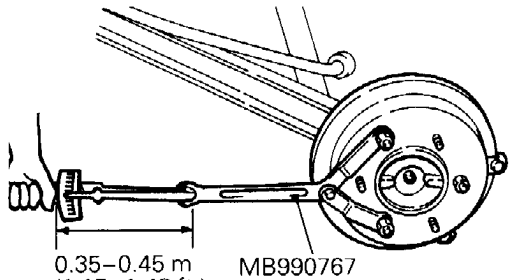
2400, 3000, 2500D	**2.6 (2.75, 2.29)**
3500, 2800D	**3.2 (3.38, 2.82)**

NOTE
*1: Vehicles without wide fender–A/T.
*2: Vehicles with wide fender and vehicles without wide fender–M/T.

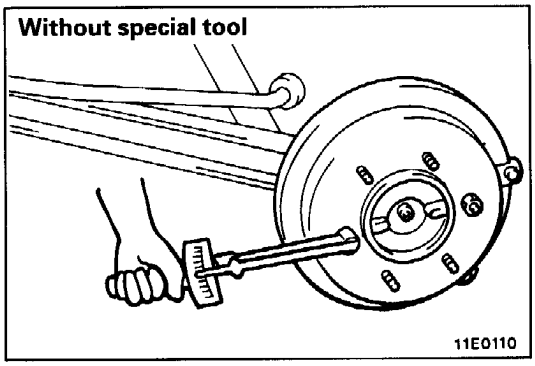
LIMITED SLIP DIFFERENTIAL PRELOAD MEASUREMENT E27FIAA

To measure the preload of the limited slip differential, set the shift lever of the transmission to the neutral position, lock the front wheels, and fully release the parking brake. One of the rear wheels should be maintained in contact with the ground surface, and the other should be raised up.
Measure the starting torque at the side on which the wheel is in the raised position by using the following procedures.

Using the special tool



Without special tool



(1) Remove the wheel.
(2) Mount the special tool to the hub bolts by using the hub nuts.
(3) Find the limited slip differential preload by measuring the axle shaft starting torque in the forward direction with a torque wrench.

Standard value: Using the special tool
12.5 Nm (1.25 kgm, 9 ft.lbs.) or more
Without using the special tool
25 Nm (2.5 kgm, 18 ft. lbs.) or more

(4) If the torque is less than the standard value, remove the limited slip differential from the vehicle and disassemble it.

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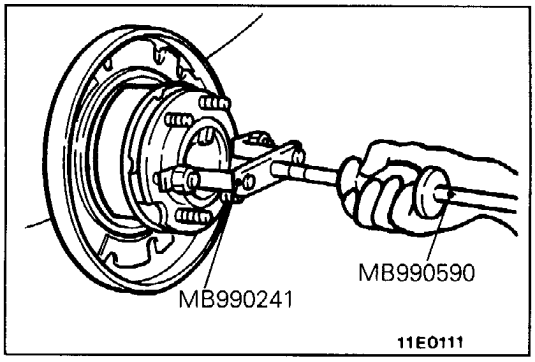
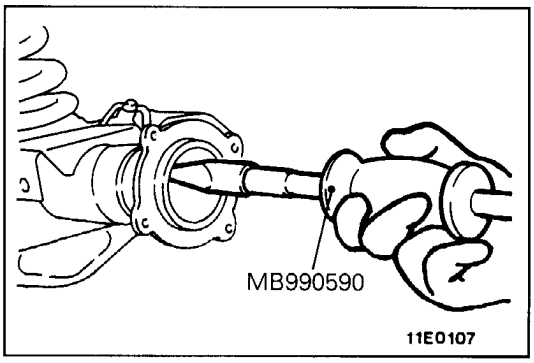
AXLE HOUSING OIL SEAL REPLACEMENT E27FKAD

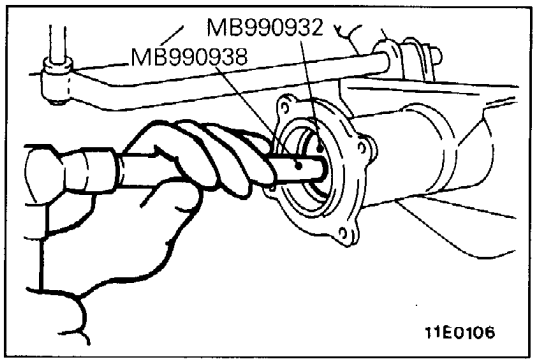
1. Release coupling between parking brake cable and backing plate.
2. Before disconnecting the brake pipe, drain the brake fluid from the bleeder screw.
3. Remove the nuts securing the backing plate to the axle housing.



4. Pull the rear axle shaft from axle housing. If the rear axle shaft is hard to remove, use the special tools.

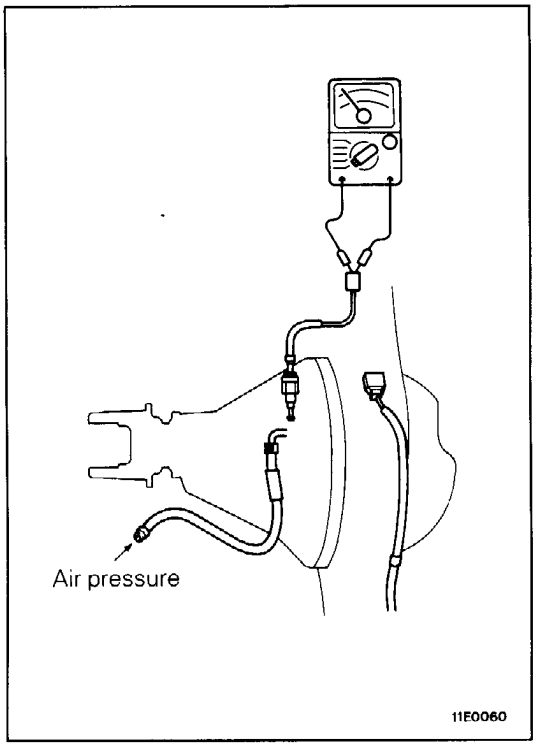


5. Use special tools with hook attached to remove the oil seal.
6. Apply multipurpose grease to the oil seal fitting area of the rear axle housing.



7. Drive the new oil seal into the rear axle housing end by using the special tool.
8. Apply multipurpose grease to the oil seal lip.

9. Install the rear axle shaft.
10. Install the brake tube and perform air bleeding of the brake system from the air bleeder. (Refer to GROUP 35 – Service Adjustment Procedures.)
11. Install the parking brake cable and adjust the parking brake lever stroke. (Refer to GROUP 36 – Service Adjustment Procedures.)



REAR DIFFERENTIAL LOCK DETECTION SWITCH CHECK

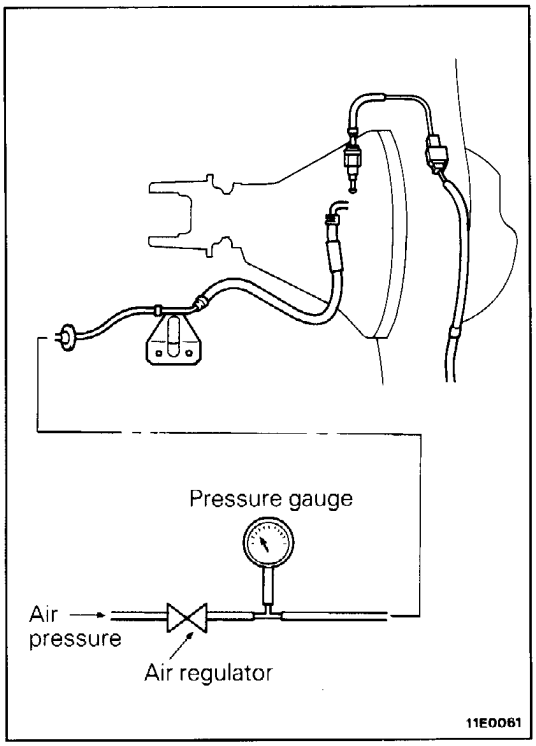
E27F0AA

1. Jack up the vehicle.
2. Remove the air pipe and air hose connections.
3. Connect a pressure gauge and air regulator, for adjusting the outside air pressure, to the air hose.
4. Adjust the outside air pressure with the air regulator until the pressure gauge shows a pressure of approx. 25 kPa (0.25 kg/cm^2, 4 psi.).

   Caution
   Do not apply a higher pressure.
5. Lock the wheel on one side of the vehicle, and slowly turn the wheel on the other side.
6. Check for continuity in the rear differential lock detection switch.

When air is supplied	Continuity
When air is released	No continuity

7. If the detection switch is defective, it cannot be removed by itself, first remove the differential carrier to remove the detection switch.



REAR DIFFERENTIAL LOCK SYSTEM AIR LEAKAGE CHECK

E27F0AA

1. Remove the rear differential lock air pump and remove the air hose from the air pump. (Refer to P.27-26.)
2. Connect a pressure gauge and air regulator, for adjusting the outside air pressure to the air hose.
3. Adjust the outside air pressure with the air regulator until the pressure gauge shows a pressure of approx. 35 kPa (0.35 kg/cm^2, 5 psi.).

   Caution
   Do not apply a higher pressure.
4. If after approximately 10 minutes have passed, the pressure has dropped not more than approximately 10 kPa (0.1 kg/cm^2, 1 psi.), it can be concluded that there is no leaking of air from the air hose, etc.

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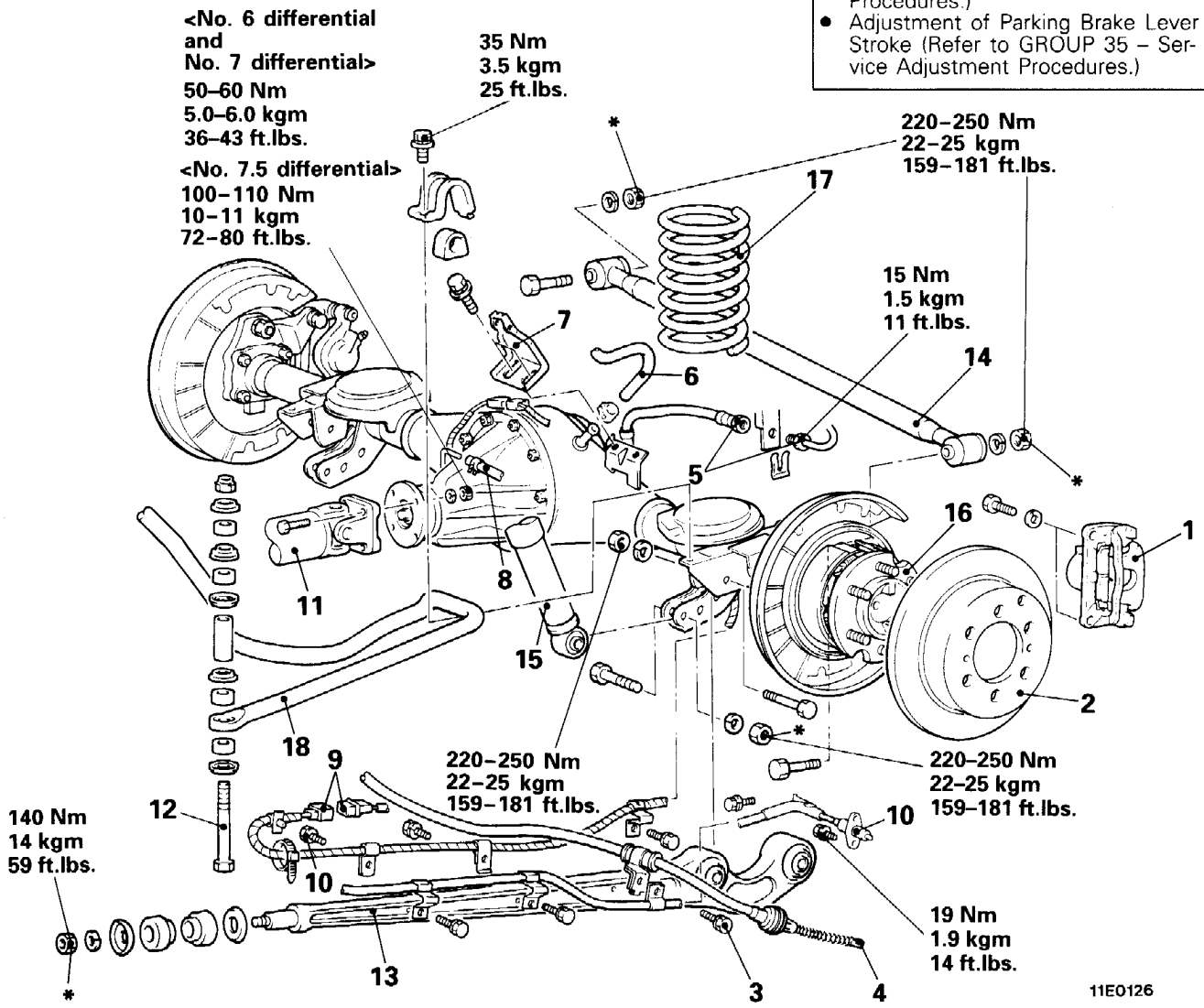
AXLE ASSEMBLY

REMOVAL AND INSTALLATION

E27JA--

Caution
***: Indicates part which should be temporarily tightened, and then fully tightened with the vehicle on the ground in the unladen condition.**

Post-installation Operation
- Air Bleeding from Brake Lines (Refer to GROUP 35 – Service Adjustment Procedures.)
- Checking and Adjustment of Load Sensing Spring Length (Refer to GROUP 35 – Service Adjustment Procedures.)
- Adjustment of Parking Brake Lever Stroke (Refer to GROUP 35 – Service Adjustment Procedures.)



Removal steps

1. Rear brake assembly
2. Brake disc
3. Parking brake cable or speed sensor attaching bolt
4. Connection for parking brake cable end
5. Brake hose connection
6. Breather hose connection
7. Spring support for load sensing proportioning valve
8. Hose connection <Vehicles with rear differential lock>
9. Rear differential lock position harness connector <Vehicles with rear differential lock>
10. Speed sensor <Vehicles with ABS> (Refer to GROUP 35 – Wheel Speed Sensor)
11. Rear propeller shaft
12. Stabilizer bar installation bolt
13. Lower arm
14. Lateral rod
15. Shock absorber connection (lower part only)
16. Axle assembly
17. Coil spring
18. Stabilizer bar

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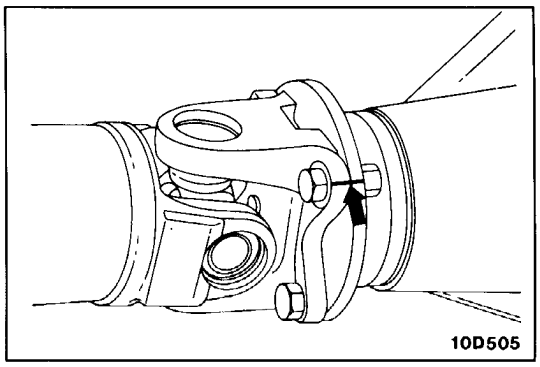
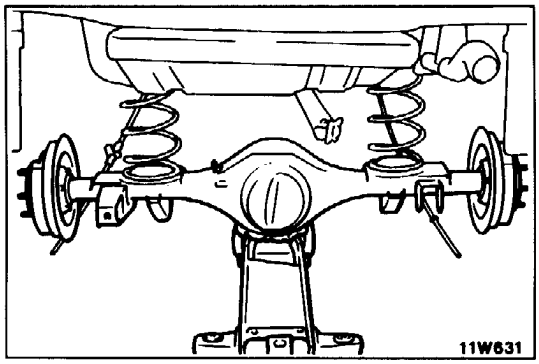


SERVICE POINTS OF REMOVAL E27JBAE

11. REMOVAL OF REAR PROPELLER SHAFT

Make the mating marks on the flange yoke of the rear propeller shaft and the companion flange of the differential case.



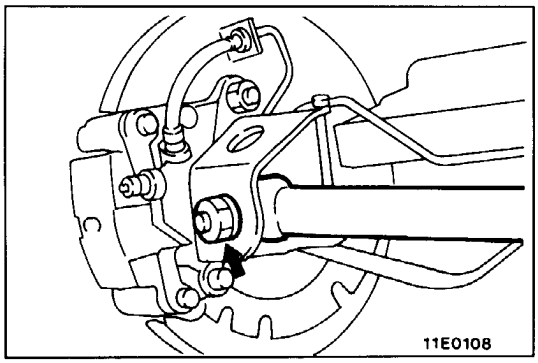
13. REMOVAL OF LOWER ARM

After supporting the axle assembly by floor jacks, remove the lower arm.

16. REMOVAL OF AXLE ASSEMBLY

Draw out the axle assembly toward the rear of the vehicle.

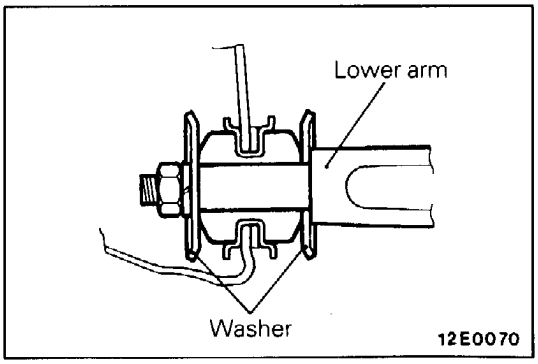
Caution
The axle assembly is unsuitable on the jack; be careful not to allow it to fall.



SERVICE POINTS OF INSTALLATION E27JDBB

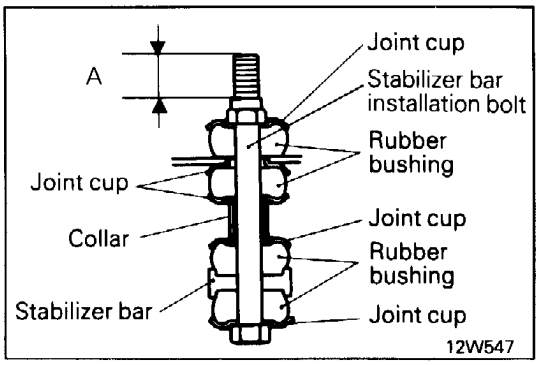
14. INSTALLATION OF LATERAL ROD

Install the lateral rod from the axle housing side.



13. INSTALLATION OF LOWER ARM

Install the washers (facing as shown in the figure) to the lower arm.



12. INSTALLATION OF STABILIZER BAR INSTALLATION BOLT

When installing the stabilizer bar to the stabilizer bar bracket, check that the amount of projection of the stabilizer bar installation bolt is within the standard value range.

Standard value (A): 15–17 mm (0.59–0.67 in.)

11. INSTALLATION OF REAR PROPELLER SHAFT

Align the mating marks on the flange yoke and the companion flange to install the rear propeller shaft.

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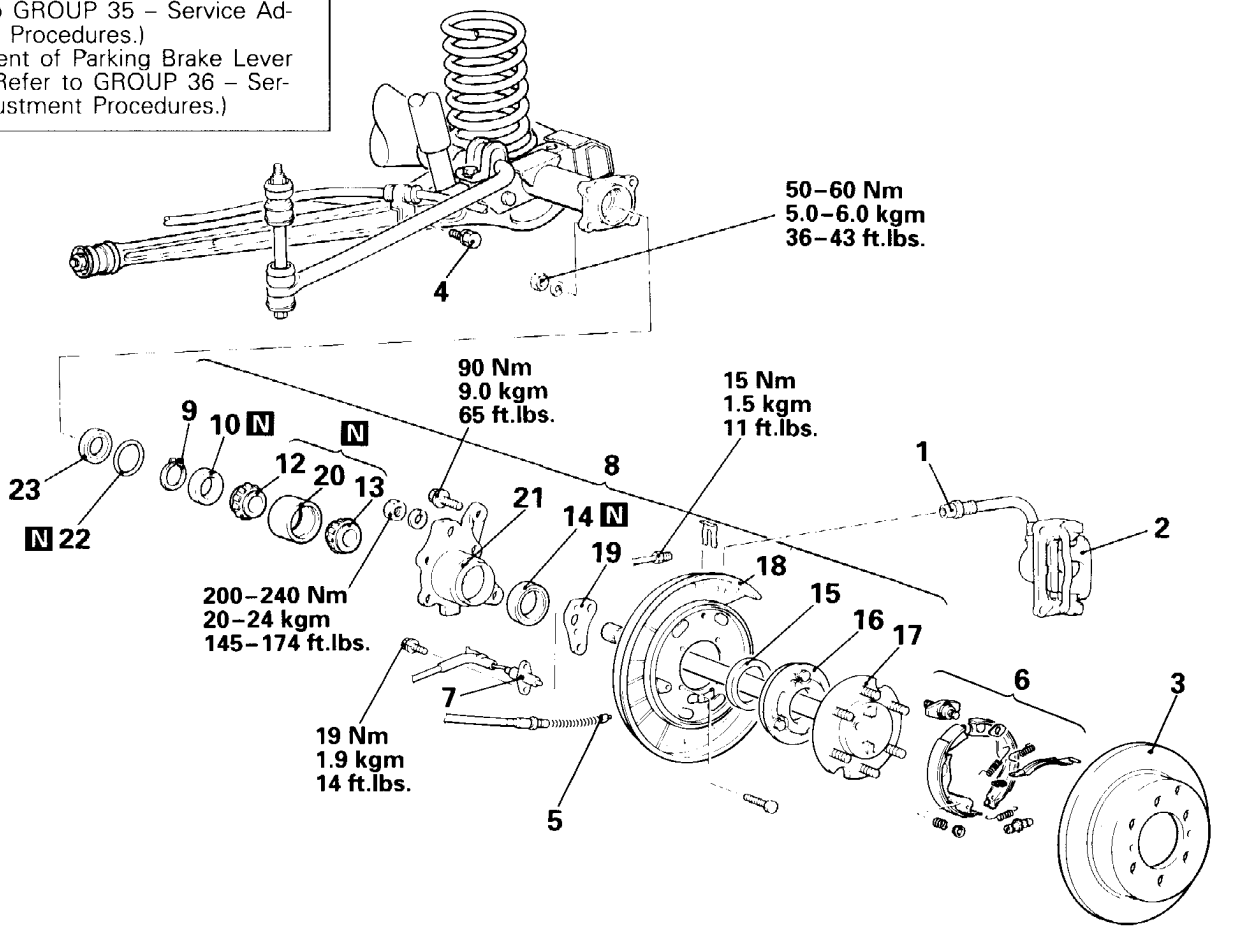
AXLE SHAFT

REMOVAL AND INSTALLATION

E27HA--

Post-installation Operation
- Air Bleeding from Brake Lines (Refer to GROUP 35 – Service Adjustment Procedures.)
- Adjustment of Parking Brake Lever Stroke (Refer to GROUP 36 – Service Adjustment Procedures.)



11E0180

Removal steps

1. Connection for brake pipe
2. Rear brake assembly
3. Brake disc
4. Parking brake cable attaching bolt
5. Parking cable end
6. Parking brake assembly
7. Speed sensor <Vehicles with ABS>
8. ◆◆ Axle shaft assembly
9. ◆◆ Snap ring
10. ◆◆ Retainer
11. ◆◆ Axle shaft sub assembly (Parts from step 13 to step 17)
12. Bearing inner race (inner)
13. ◆◆ Bearing inner race (outer)
14. Oil seal
15. Dust cover <Vehicles without ABS>
16. ◆◆ Rotor assembly <Vehicles with ABS>
17. Axle shaft
18. Backing plate
19. Speed sensor bracket <Vehicles with ABS>
20. ◆◆ Bearing outer race
21. Bearing case
22. O-ring
23. ◆◆ Oil seal

Installation steps

23. ◆◆ Oil seal
22. O-ring
21. Bearing case
20. ◆◆ Bearing outer race
19. Speed sensor bracket <Vehicles with ABS>
18. Backing plate
17. Axle shaft
16. ◆◆ Rotor assembly <Vehicles with ABS>
15. Dust cover <Vehicles without ABS>
13. Bearing inner race (outer)
14. ◆◆ Oil seal
12. ◆◆ Bearing inner race (inner)
10. ◆◆ Retainer
9. ◆◆ Snap ring
8. Axle shaft assembly
7. Speed sensor <Vehicles with ABS> (Refer to GROUP 35 – Wheel Speed Sensor.)
6. Parking brake assembly (Refer to GROUP 36 – Parking Brake Drum.)
5. Parking cable end
4. Parking brake cable attaching bolt
3. Brake disc
2. Rear brake assembly
1. Connection for brake pipe

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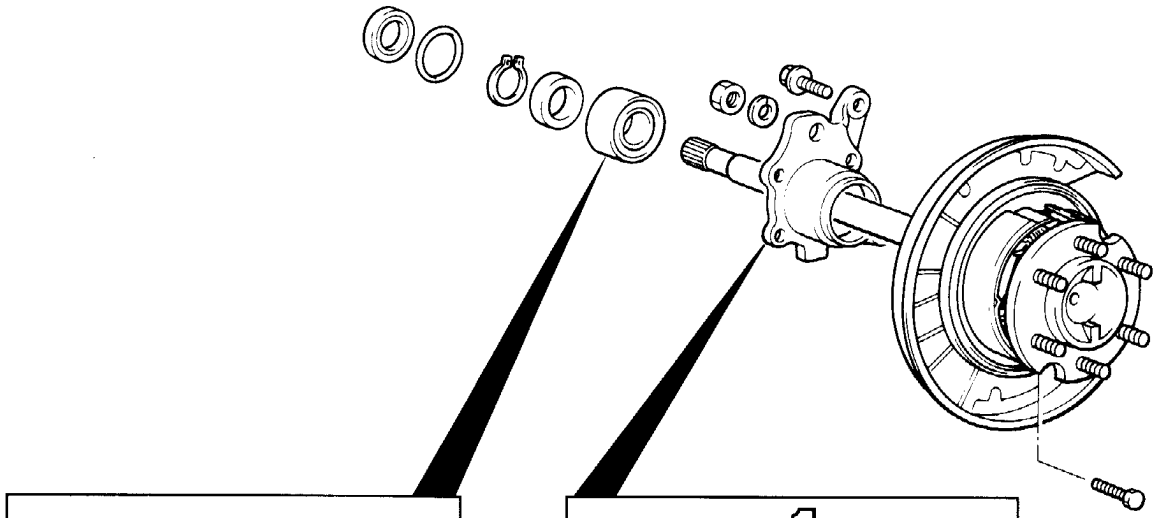
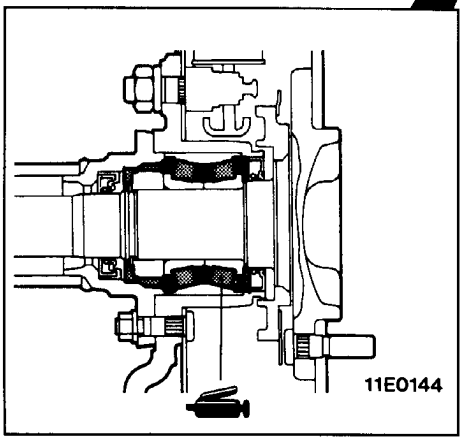
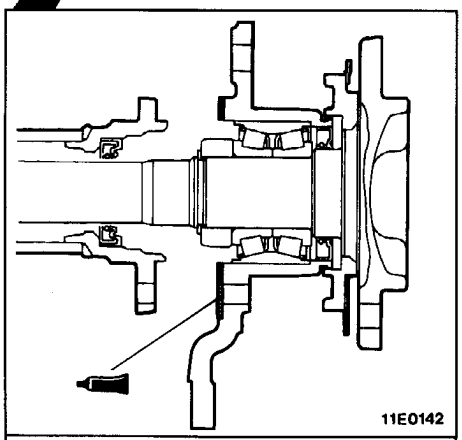
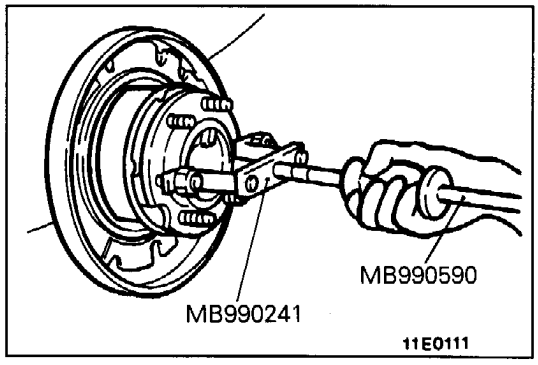
LUBRICATION AND SEALING POINTS







Sealant:
3M ATD Part. No.8661, 8663 or equivalent

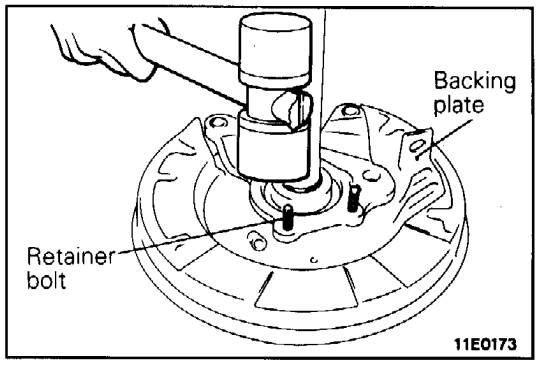


SERVICE POINTS OF REMOVAL E27HBAH

8. REMOVAL OF AXLE SHAFT ASSEMBLY

Pull the rear axle shaft. If the rear axle shaft is difficult to remove, use the special tools.

NOTE
Do not damage the oil seal during its removal.



10. REMOVAL OF RETAINER

(1) Remove one retainer bolt from the backing plate.

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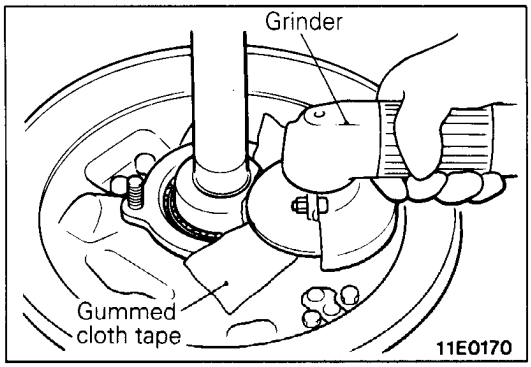
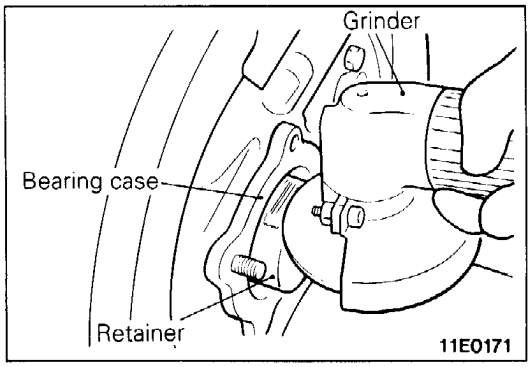


(2) Apply gummed cloth tape around the edge of the bearing case for protection.

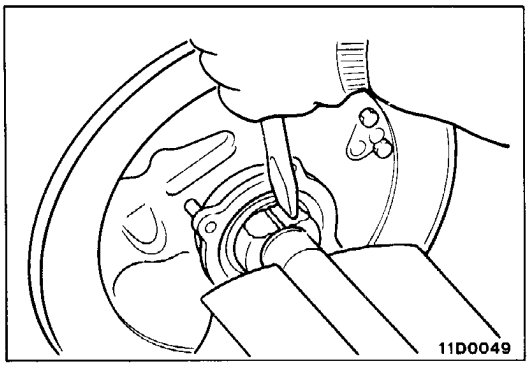
(3) As shown in the figure, fix the axle shaft and shave off with grinder a point of its circumference locally until the wall thickness on the side of axle shaft of retainer and the side of bearing become approximately 1.0–2.0 mm (0.04–0.06 in.) and 2.0 mm (0.08 in.) respectively.

Caution
Be careful not to damage the bearing case and the axle shaft.



(4) Fix the axle shaft and shave off the remaining 2.0 mm (0.08 in.) on the side of the bearing of the retainer.

Caution
Be careful not to damage the bearing case and the axle shaft.



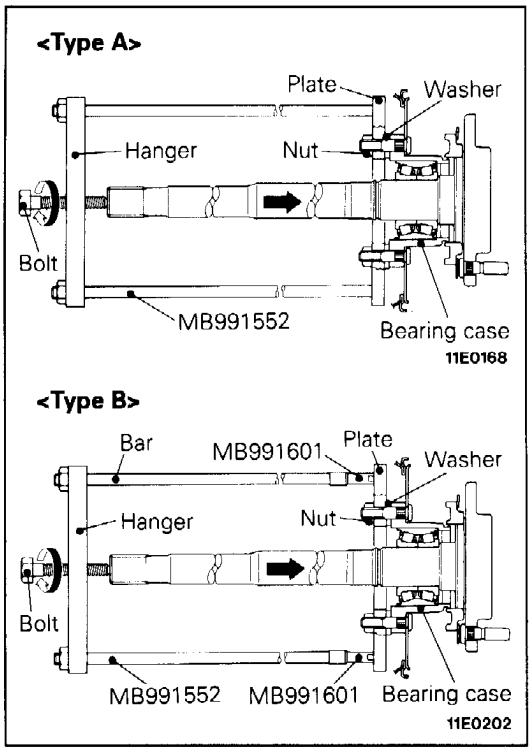
(5) Cut in with a chisel the place where the retainer ring has been shaven and remove the retainer ring.

Caution
Be careful not to damage the axle shaft.

11. REMOVAL OF AXLE SHAFT SUB ASSEMBLY

(1) Adjust the height of the hanger and secure the washers, plate and nuts in that order.

NOTE
1. If the axle shaft is type B, install the extension bar (MB991601) to the special tool bar (MB991552).
2. The washers are used to eliminate the difference in height of the bearing case so that the plate and the bearing case are parallel.



Type A	Other than the below
Type B	Right side axle shaft of: • Vehicles with rear differential lock • Vehicles with 6G74 • Vehicles with 4M40

(2) Place the end of the bolt against the centre of the axle shaft, and then tighten the nuts to remove the axle shaft from the bearing case assembly.

Caution
The hanger and plate must be placed so that they are parallel.

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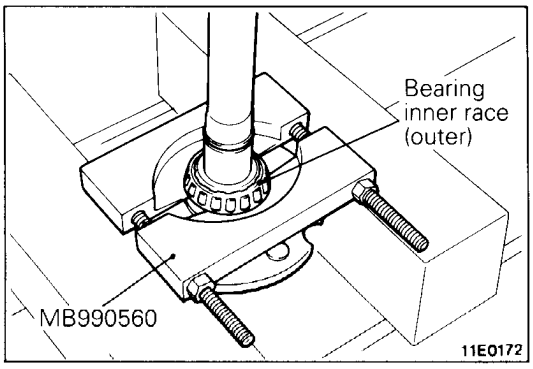
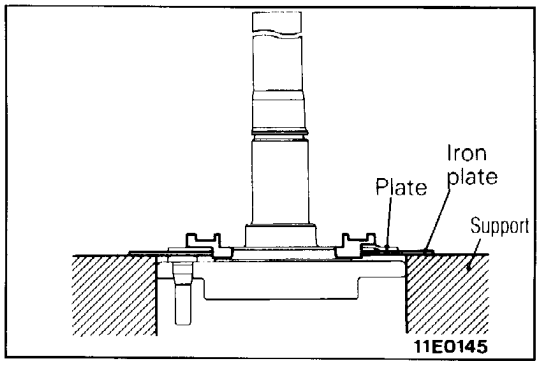


13. REMOVAL OF BEARING INNER RACE (OUTER)

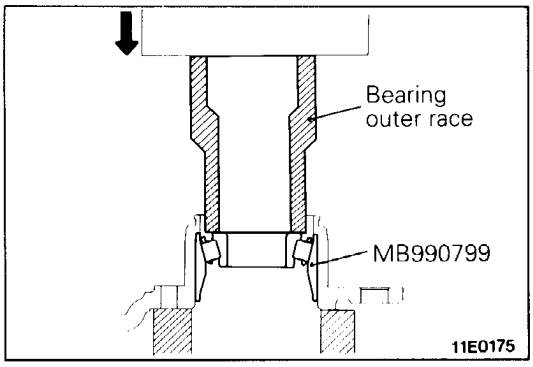
Install the special tool as shown in the illustration, and then use a press to remove the bearing inner race (outer) from the axle shaft.



16. REMOVAL OF ROTOR ASSEMBLY

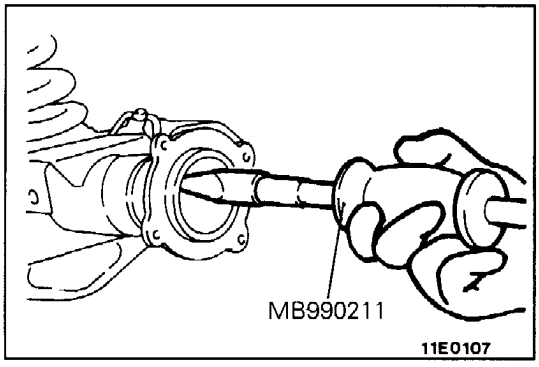
Insert an iron plate of approximately 1 mm (0.04 in.) width between the rotor assembly and the axle shaft, and use a press to remove the rotor assembly.

Caution
In order not to bend the rotor assembly plate, place the support in contact with the axle shaft when using the press.



20. REMOVAL OF BEARING OUTER RACE

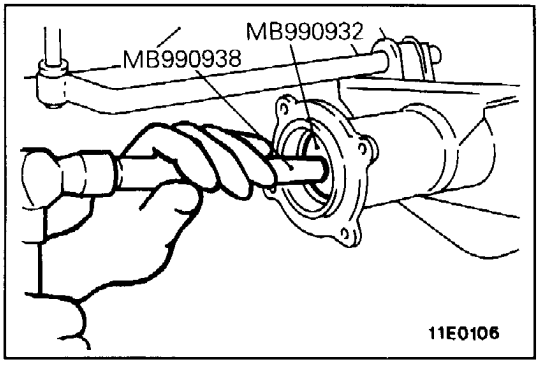
Reinstall the bearing inner race that was removed previously, and then use the special tool and a press to remove the bearing outer race.



23. REMOVAL OF OIL SEAL E27HCAA

INSPECTION

- Check the dust cover for deformation and damage.
- Check the oil seal for damage.
- Check the inner and outer bearings for seizure, discoloration and rough raceway surface.
- Check the axle shaft for cracks, wear and damage.



SERVICE POINTS OF INSTALLATION E27HDAJ

23. INSTALLATION OF OIL SEAL

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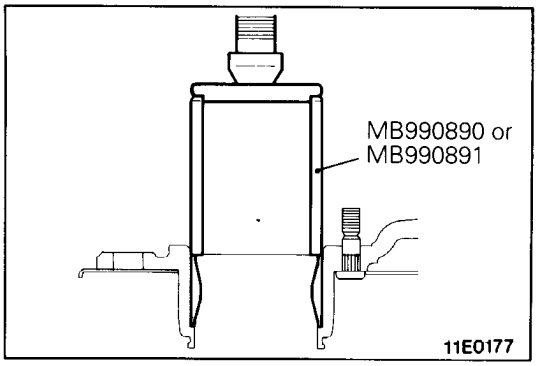
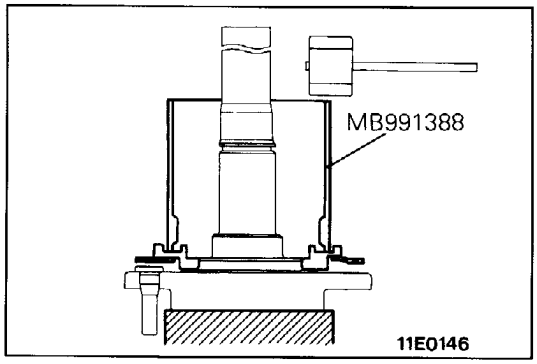
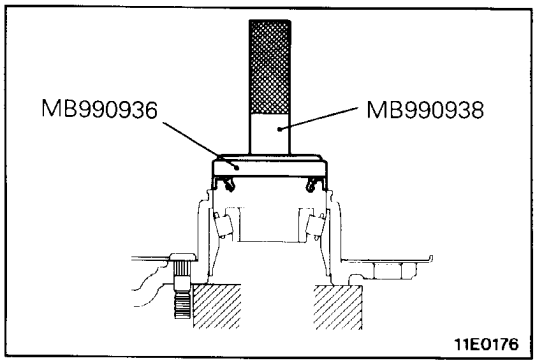


20. INSTALLATION OF BEARING OUTER RACE

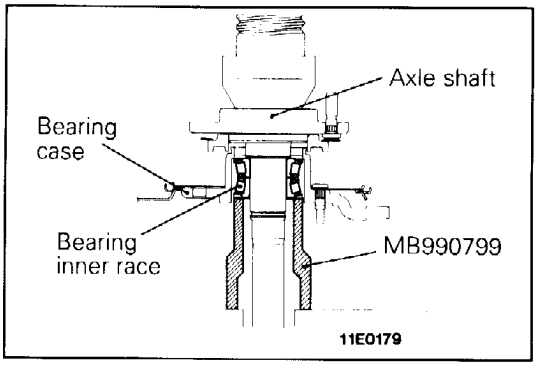


16. INSTALLATION OF ROTOR ASSEMBLY



14. INSTALLATION OF OIL SEAL

(1) Apply multi-purpose grease to the outside of the oil seal.
(2) Use the special tools to press-fit the oil seal until it is flush with the end of the bearing case.
(3) Apply multi-purpose grease to the lip of the oil seal.

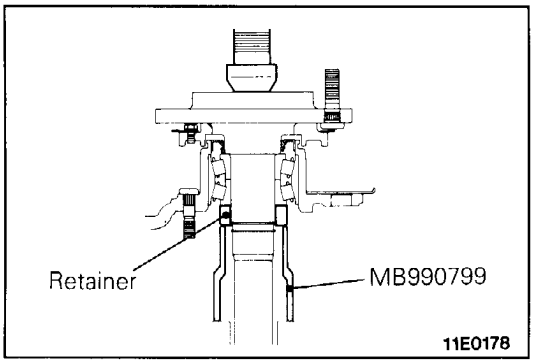


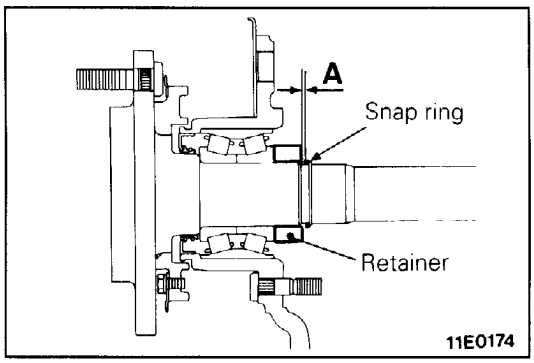
12. INSTALLATION OF BEARING INNER RACE (INNER)

(1) Pass the axle shaft through the bearing case and bearing inner race (inner).
(2) Use the special tool to press-fit the bearing inner race to the axle shaft.

Caution

1. **Both bearing inner race sets should be press-fitted together.**
2. **The left and right lengths of the axle shaft are different [approx. 7 mm (0.28 in.)] in vehicles with rear differential lock. The right side is longer, so be careful when installing.**





10. PRESS-FITTING OF RETAINER

Use the special tool to press-fit the retainer to the axle shaft, while checking that the press-fitting force is at the standard value.
If the initial press-fitting force is less that the standard value, replace the axle shaft.

Standard value:
Initial press-fitting force
50,000 N (5,000 kg, 11,023 lbs.) or more
Final press-fitting force
100,000–110,000 N (10,000–11,000 kg, 22,046–24,251 lbs.)

9. INSTALLATION OF SNAP RING

(1) After installing the snap ring, measure the clearance (A) between the snap ring and the retainer with a thickness gauge, and check that it is within the standard values.

Standard value (A): 0–0.166 mm (0–0.0065 in.)

(2) If the clearance exceeds the standard value, change the snap ring so that the clearance is at the standard value.

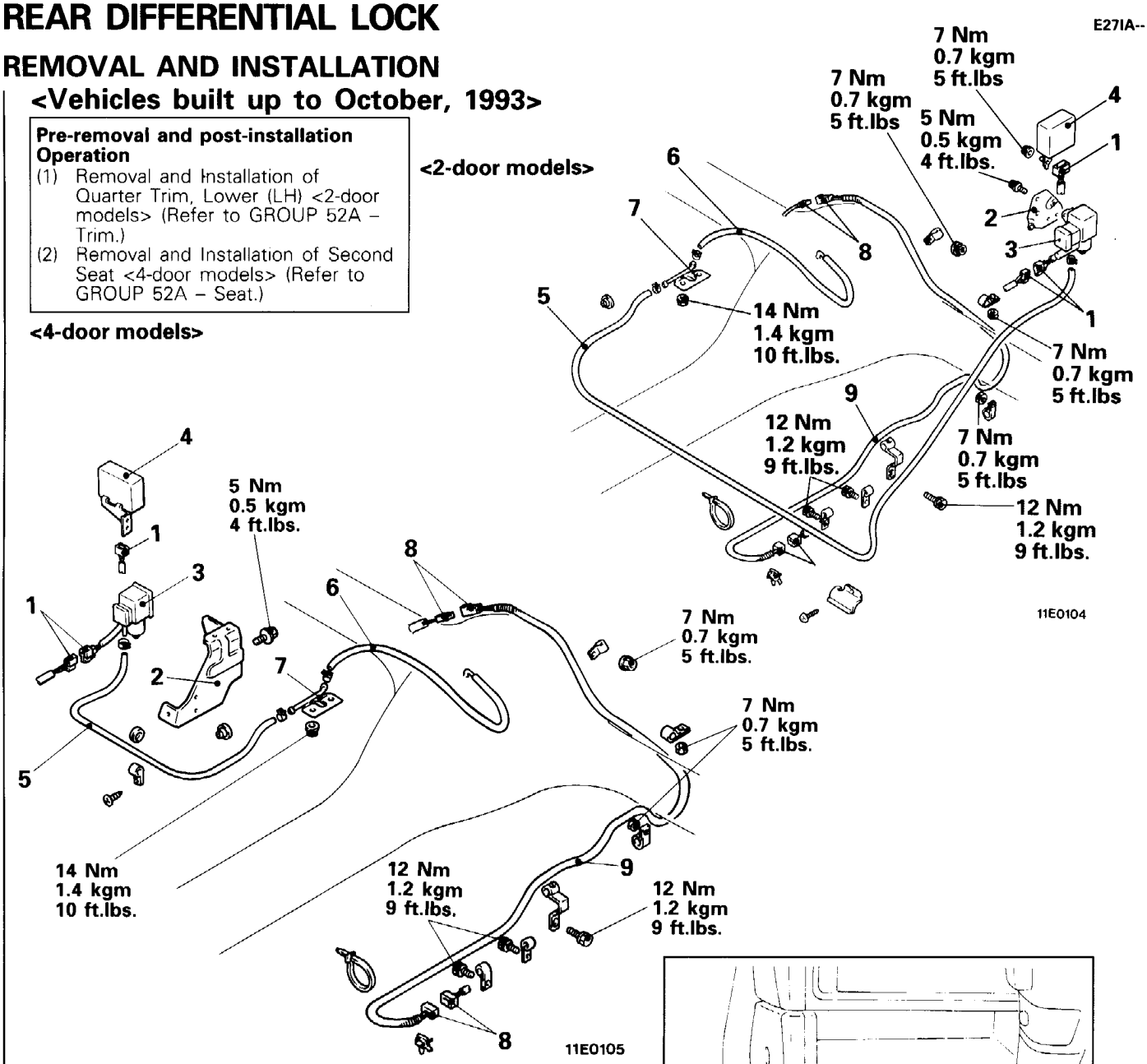
Thickness of snap ring mm (in.)	Identification colour
2.17 (0.0854)	–
2.01 (0.0791)	Yellow
1.85 (0.0728)	Blue
1.69 (0.0665)	Purple
1.53 (0.0602)	Red

REAR DIFFERENTIAL LOCK

REMOVAL AND INSTALLATION

<Vehicles built up to October, 1993>

Pre-removal and post-installation Operation
(1) Removal and Installation of Quarter Trim, Lower (LH) <2-door models> (Refer to GROUP 52A – Trim.)
(2) Removal and Installation of Second Seat <4-door models> (Refer to GROUP 52A – Seat.)



Removal steps of rear differential lock air pump and control unit

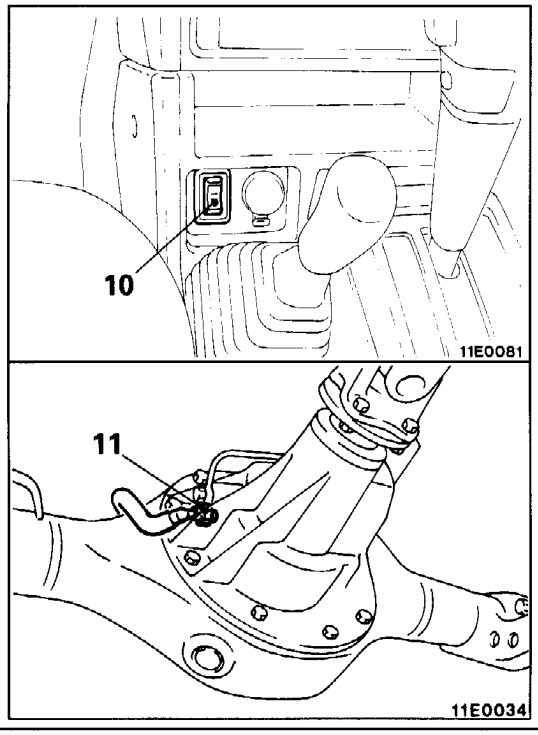
1. Harness connector
2. Bracket
3. Rear differential lock air pump
4. Rear differential lock control unit
5. Air hose
6. Air hose
7. Hose bracket
8. Harness connector
9. Position harness

Removal steps of rear differential lock switch

10. Rear differential lock switch

Removal steps of rear differential lock detection switch

11. Rear differential lock detection switch (Refer to P.27-26.)

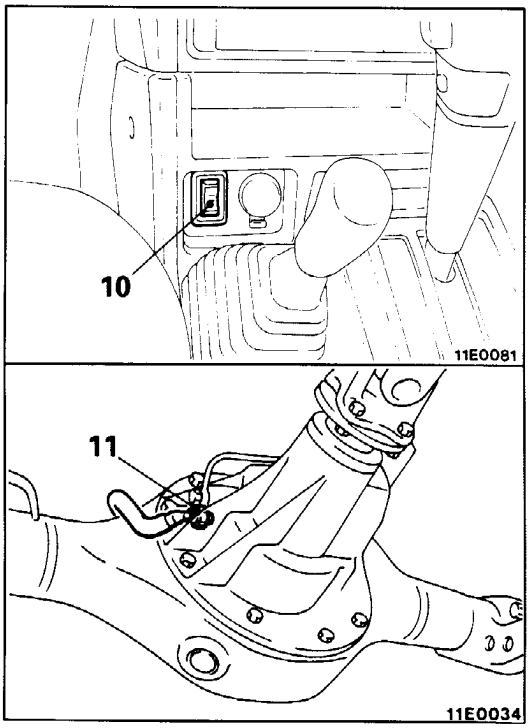


<Vehicles built from November, 1993>

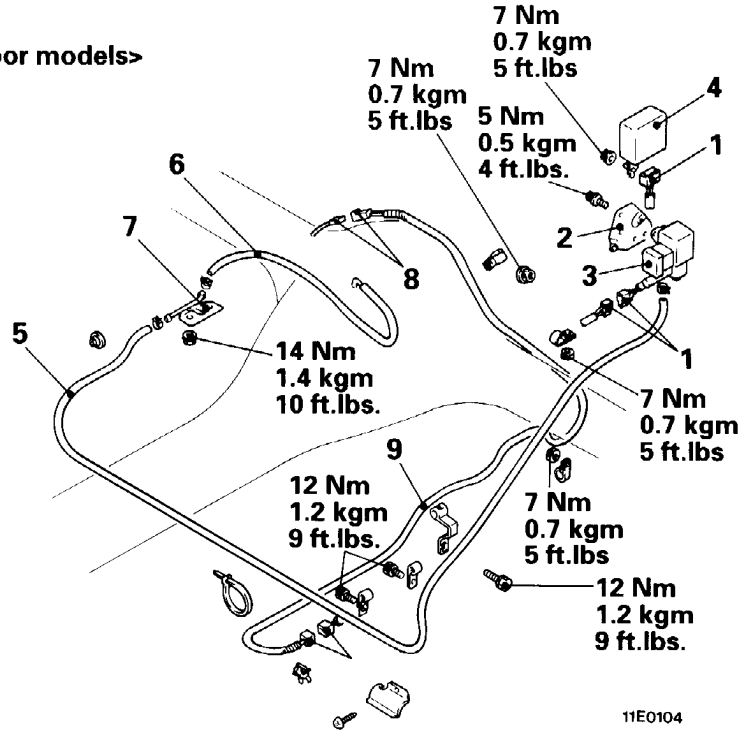
Pre-removal and post-installation Operation

(1) Removal and Installation of Quarter Trim, Lower (LH) (Refer to GROUP 52A – Trim.)

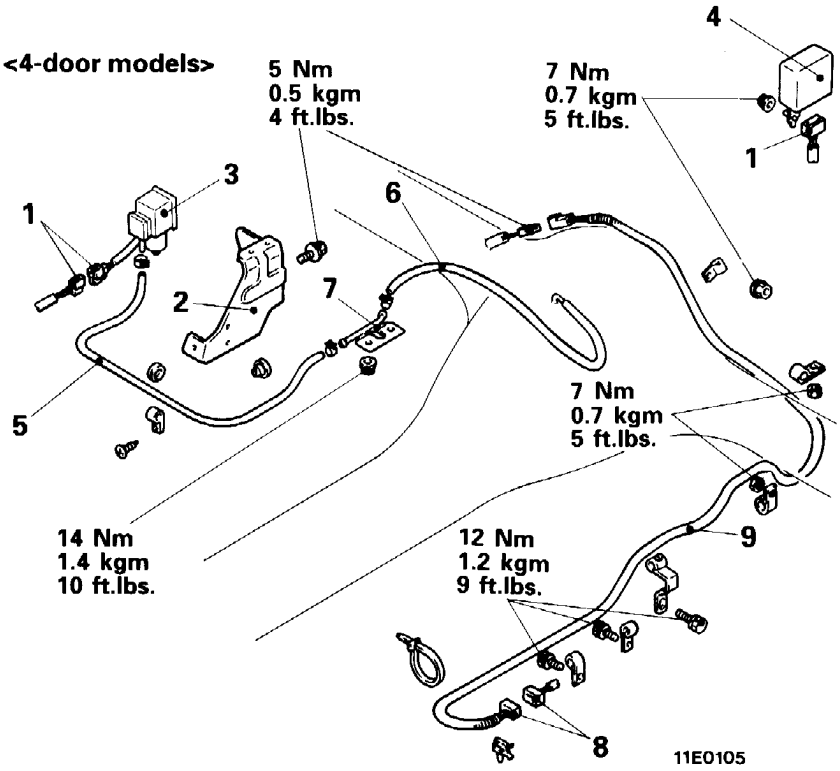
(2) Removal and Installation of Second Seat <4-door models> (Refer to GROUP 52A – Seat.)



<2-door models>



<4-door models>



Removal steps of rear differential lock air pump and control unit

1. Harness connector
2. Bracket
3. Rear differential lock air pump
4. Rear differential lock control unit
5. Air hose
6. Air hose
7. Hose bracket
8. Harness connector
9. Position harness

Removal of rear differential lock switch

10. Rear differential lock switch

Removal of rear differential lock detection switch

11. Rear differential lock detection switch (Refer to P.27-26.)

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NOTES

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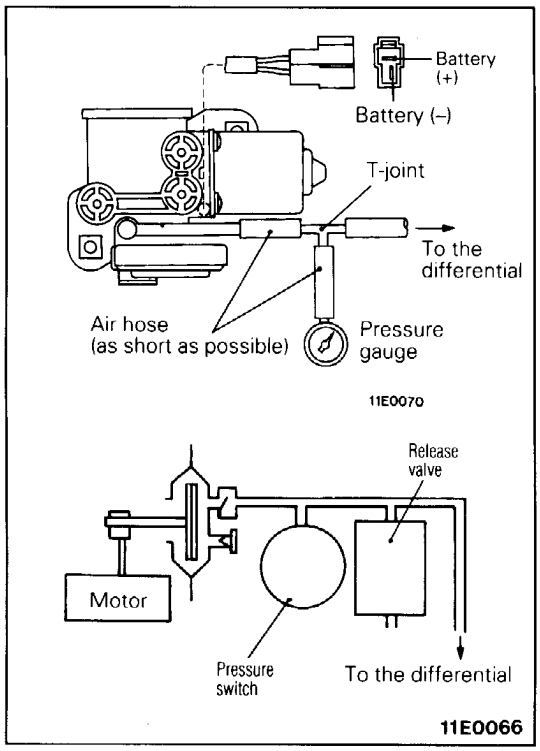


INSPECTION

E27ICAA

REAR DIFFERENTIAL LOCK AIR PUMP

1. Install air hose to the differential.
2. Connect the pressure gauge to the air pump discharge outlet nozzle, via the air hose and T-joint.
3. Apply battery voltage to the air pump connector.
4. Measure the time between when the pump starts and stops operating, and if it stops within 5 seconds, the pressure switch inside the pump is normal.
5. Measure the pressure 10–20 seconds after the pump has stopped.

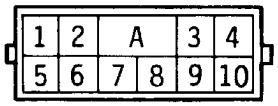
   Standard value: 25–40 kPa (0.25–0.40 kg/cm², 4–6 psi.)

   If the pressure is within the standard value, the release valve inside the pump is normal.
6. Check that the pump does not begin operating for 5 minutes after it has stopped.
7. If the inspection for 4–6 is normal, then the pump is fully operational.

REAR DIFFERENTIAL LOCK CONTROL UNIT

TYPE A (10 terminals connector)

1. Measure the terminal voltages under each condition.
2. With the control unit connected to the harness and the probe inserted into the rear of the harness connector, carry out the voltage measurements between terminal ⑥ (earth terminal) and each other terminal.

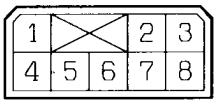


11E0068

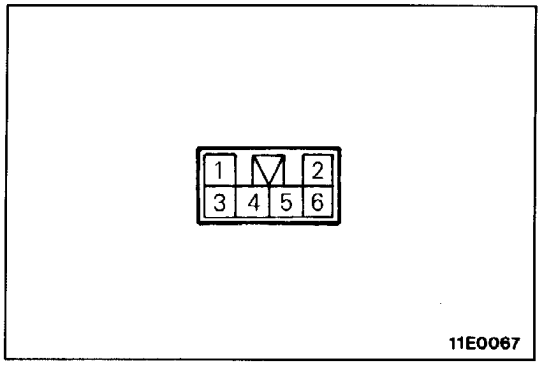
Terminal No.	Inspection Item		Condition		Terminal Voltage
3	Ignition switch (IG1)		Ignition switch (IG1)	OFF	0 V
				ON	System voltage
9	Rear differential lock switch	ON side	Ignition switch: ON	ON side or OFF side	0 V
1		OFF side		When in neutral	System voltage
10	Rear differential lock indicator lamp		Ignition switch: ON	Rear differential is locked	0 V
				Rear differential is free	System voltage
2	Vehicle speed reed switch		Select "D" or "1" (1st gear) and drive forward slowly.		5 V
8	Rear differential lock detection switch		Ignition switch: ON	Rear differential is locked	0 V
				Rear differential is free	System voltage
4	Rear differential lock air pump		Ignition switch: ON	When filling or holding	System voltage
				When releasing	0 V
5	Centre differential lock switch		Ignition switch: ON	Centre differential is free	System voltage
				Centre differential is locked	0 V

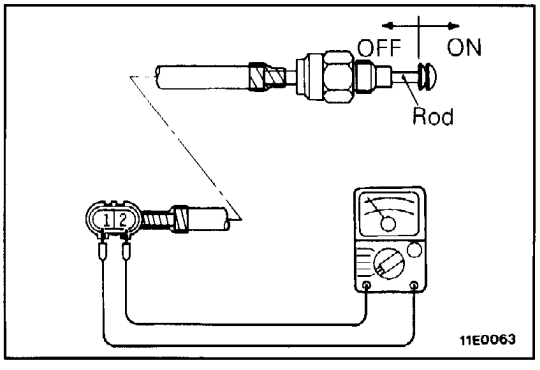
TYPE B (8 terminals connector)

1. Measure the terminal voltages under each condition.
2. With the control unit connected to the harness and the probe inserted into the rear of the harness connector, carry out the voltage measurements between terminal ④ (earth terminal) and each other terminal.



Terminal No.	Inspection Item	Condition		Terminal Voltage
2	Ignition switch (IG1)	Ignition switch (IG1)	OFF	0 V
			ON	System voltage
7	Rear differential lock switch	Ignition switch: ON	ON	0 V
			OFF	System voltage
8	Rear differential lock indicator lamp	Ignition switch: ON	Rear differential is locked	0 V
			Rear differential is free	System voltage
1	Vehicle speed reed switch	Select "D" or "1" (1st gear) and drive forward slowly.		5 V
6	Rear differential lock detection switch	Ignition switch: ON	Rear differential is locked	0 V
			Rear differential is free	System voltage
3	Rear differential lock air pump	Ignition switch: ON	When filling or holding	System voltage
			When releasing	0 V





REAR DIFFERENTIAL LOCK SWITCH CONTINUITY

TYPE A (Without indicator lamp)

Switch position \ Terminal	5	3	2	6	1
ON	○	—	○	○—(ILL)—○	
OFF		○	○		

TYPE B (With indicator lamp)

Switch position \ Terminal	6	2	5	1	3
ON	○	○	(IND) ○	○—(ILL)—○	
OFF					

NOTE
• ○—○ indicates that there is continuity between the terminals.

REAR DIFFERENTIAL LOCK DETECTION SWITCH

1. Connect an ohmmeter to the detection switch connector.
2. The rear differential lock detection switch is in good condition when the rod of the detection switch is pulled, there should be continuity, and when it is returned to its normal position, no continuity.

NOTE
Remove the differential carrier in order to replace the rear differential lock detection switch (Refer to P.27-26).

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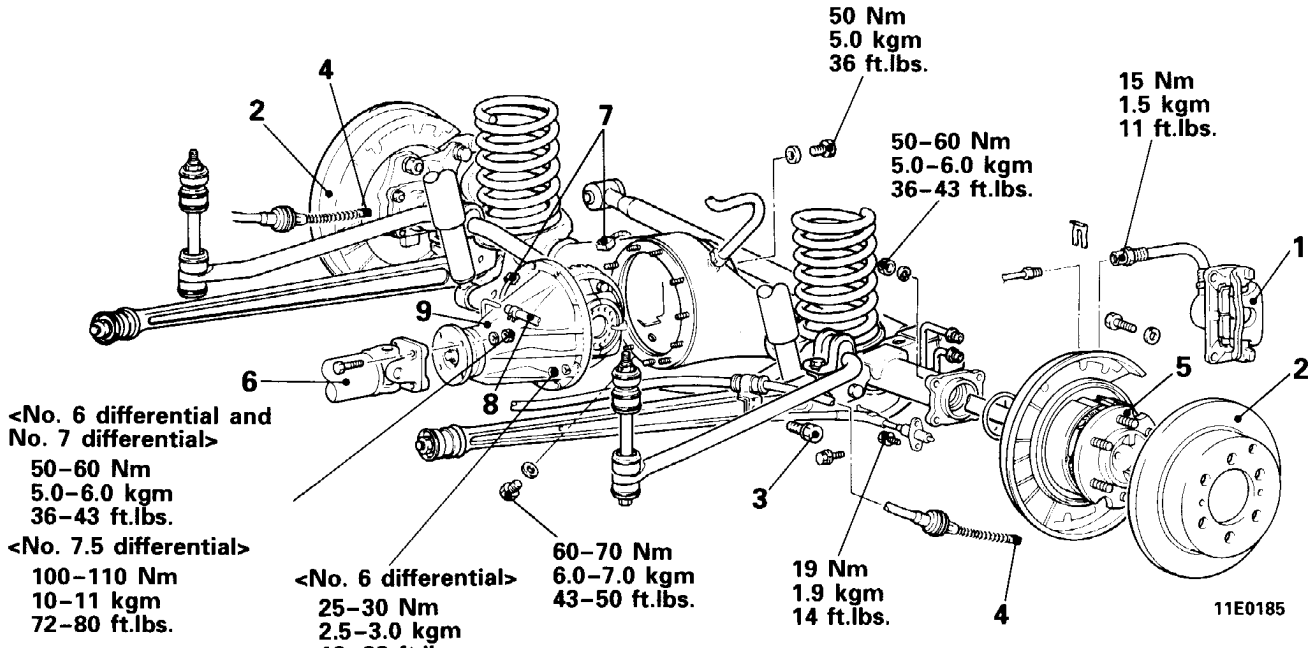
DIFFERENTIAL CARRIER

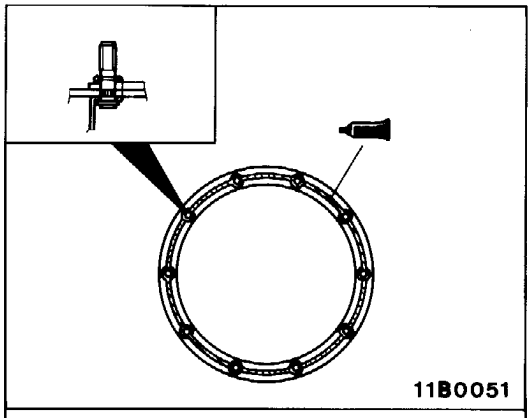
REMOVAL AND INSTALLATION

E27QA--

Pre-removal Operation
- Draining of Differential Gear Oil

Post-installation Operation
- Air Bleeding from Brake Lines (Refer to GROUP 35 – Service Adjustment Procedures.)
- Adjustment of Parking Brake Lever Stroke (Refer to GROUP 36 – Service Adjustment Procedures.)
- Filling of Differential Gear Oil (Refer to P.27-8.)



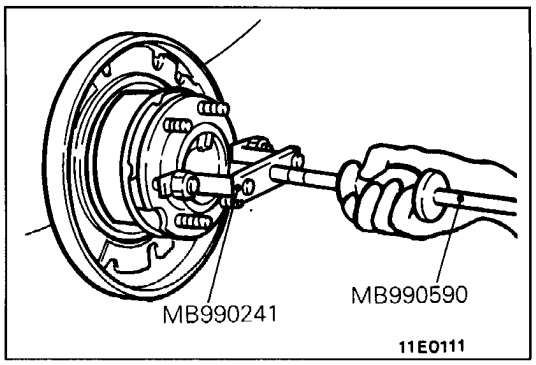


Sealant:
3M ATD Part No. 8661, 8663 or equivalent

NOTE
Apply the specified sealant to the differential carrier mounting surface of the axle housing as shown in the illustration.

Removal steps

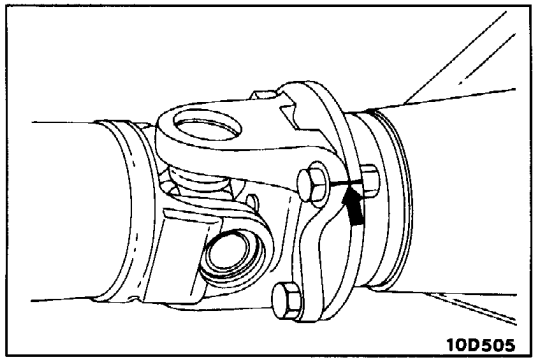
1. Rear brake assembly
2. Brake disc
3. Parking brake cable attaching nut
4. Parking brake cable end
5. Rear axle shaft assembly
6. Rear propeller shaft
7. Rear differential lock position harness connector
8. Hose connection <Vehicles with rear differential lock>
9. Differential carrier



SERVICE POINTS OF REMOVAL E27QBAI

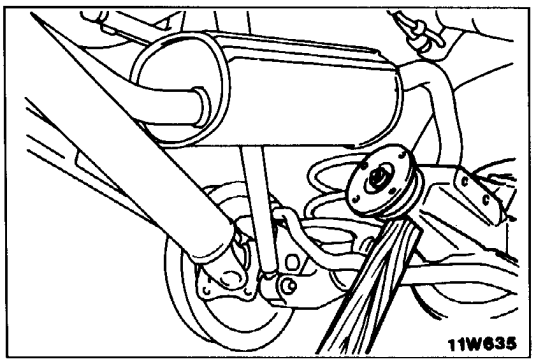
5. REMOVAL OF REAR AXLE SHAFT ASSEMBLY

Pull out the right and left axle shafts by about 70 mm (3 in.). If it is difficult to pull out, use the special tools.



6. REMOVAL OF REAR PROPELLER SHAFT

Make the mating marks on the flange yoke of the rear propeller shaft and the companion flange of the differential case.

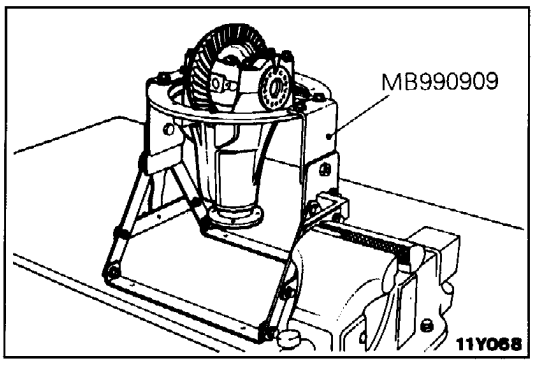


9. REMOVAL OF DIFFERENTIAL CARRIER

Remove the attaching nuts and strike the lower part of differential carrier assembly with a piece of timber several times to loosen, then remove the assembly.

Caution

1. **Do not remove the uppermost nut but keep it loosened all the way to the stud bolt end.**
2. **Use care not to strike the companion flange.**



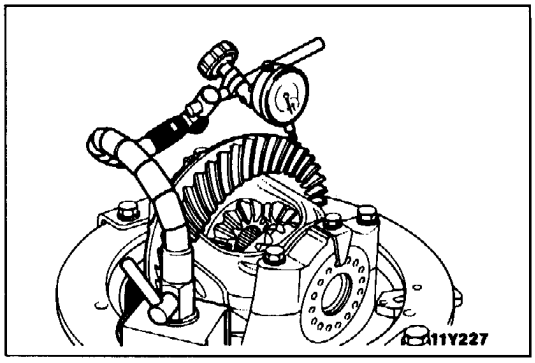
SERVICE POINTS OF INSTALLATION E27QBAK

6. INSTALLATION OF REAR PROPELLER SHAFT

Align the mating marks on the flange yoke and the companion flange to install the rear propeller shaft.

INSPECTION BEFORE DISASSEMBLY E27QDAA

Hold the special tool in a vice, and install the differential carrier to the special tool.



FINAL DRIVE GEAR BACKLASH

With the drive pinion locked in place, measure the final drive gear backlash with a dial indicator on the drive gear.

NOTE
Measure at four points or more on the circumference of the drive gear.

Standard value: **<No. 6 differential>**
0.11–0.16 mm (0.0043–0.0063 in.)
<No. 7 differential and No. 7.5 differential (except rear differential lock)>
0.13–0.18 mm (0.0051–0.0071 in.)
<No. 7.5 differential (rear differential lock)>
0.12–0.18 mm (0.0047–0.0071 in.)

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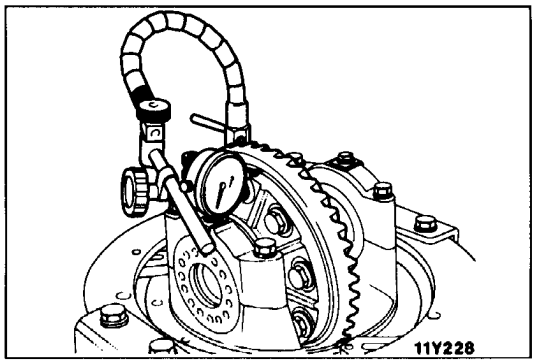
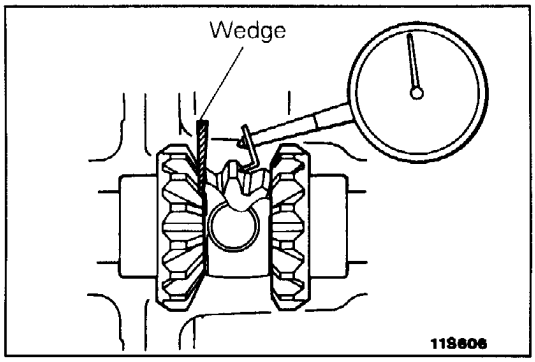


DRIVE GEAR RUNOUT

Measure the drive gear runout at the shoulder on the reverse side of the drive gear.

Limit: 0.05 mm (0.0019 in.)



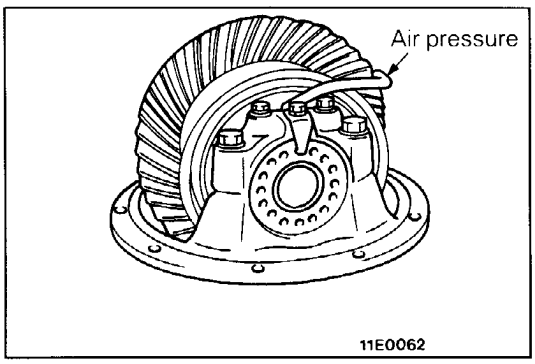
DIFFERENTIAL GEAR BACKLASH (No. 6 conventional differential and No. 7 conventional differential)

While locking the side gear with the wedge, measure the differential gear backlash with a indicator on the pinion gear.

Standard value: <No. 6 differential>
0.010–0.076 mm (0.0004–0.0030 in.)
<No. 7 differential>
0–0.076 mm (0–0.0030 in.)
Limit: 0.2 mm (0.0079 in.)

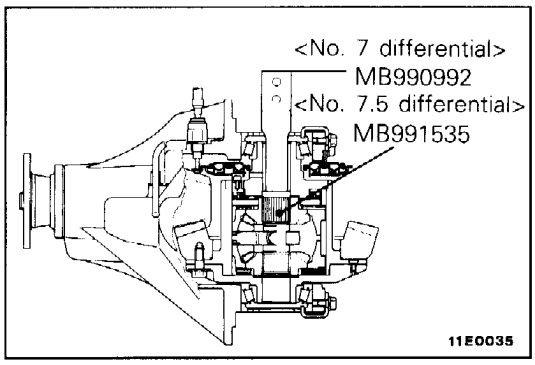
FINAL DRIVE GEAR TOOTH CONTACT

Refer to GROUP 26 – Differential Carrier.



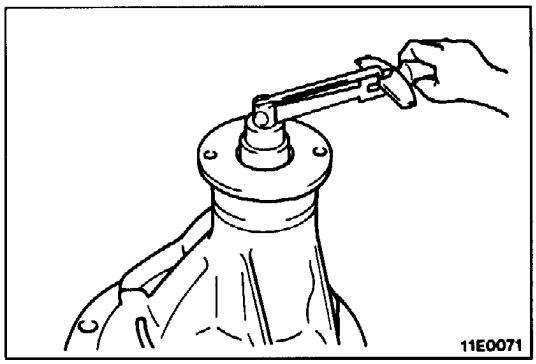
REAR DIFFERENTIAL LOCK

1. Connect an air hose, pressure gauge and air regulator, for adjusting the outside air pressure, to the actuator pipe.
2. Adjust the outside air pressure with the air regulator until the pressure gauge shows a pressure of approx. 25 kPa (0.25 kg/cm^2, 4 psi.).



3. Use the special tool to gently turn only the side gear of one side of the axle 1/4–1/2 turns.

   NOTE
   1. The lock will not operate straight away, even when air pressure is supplied, so the side gear on one side of the axle is turned so that the clutch will mesh (lock).
   2. To unlock, stop the supply of air pressure, and gently turn the side gear on one side of the axle 1/4–1/2 turns.



4. Measure the rotation torque of the companion flange, and check the lock condition and free condition of the rear differential.

Rear differential operation	Companion flange Nm (kgm, ft.lbs.) [N (kg, lbs)]
Locked	Doesn't turn at 50 (5, 36) [1,111 (111, 248)]
Free	Turns at less than 50 (5, 36) [1,111 (111, 248)]

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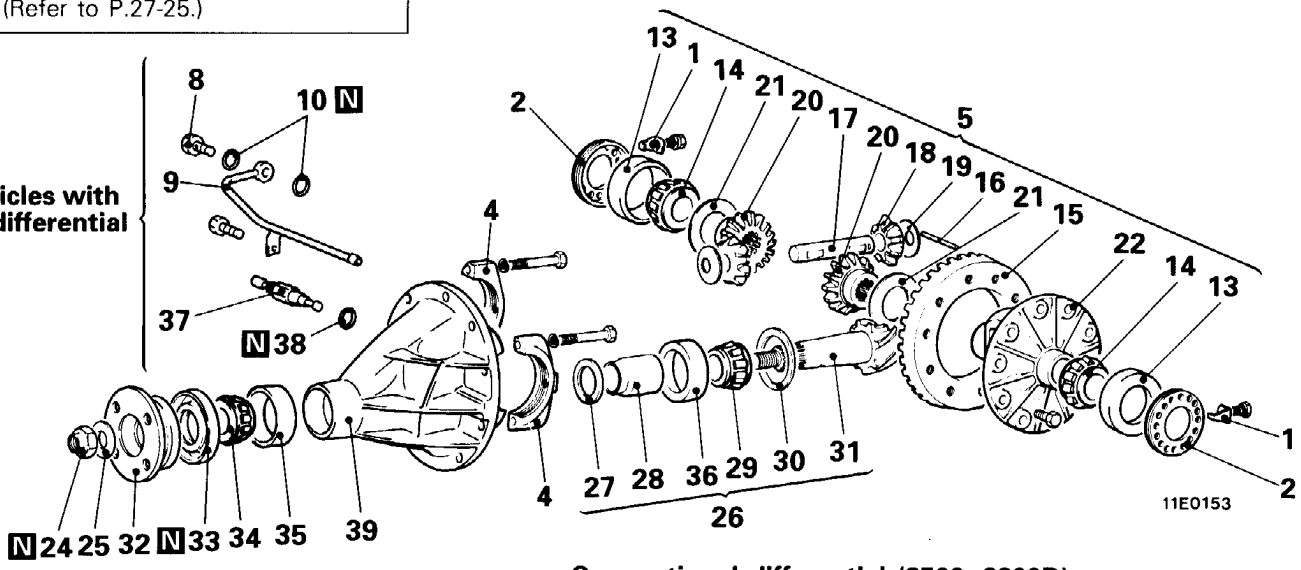
DISASSEMBLY

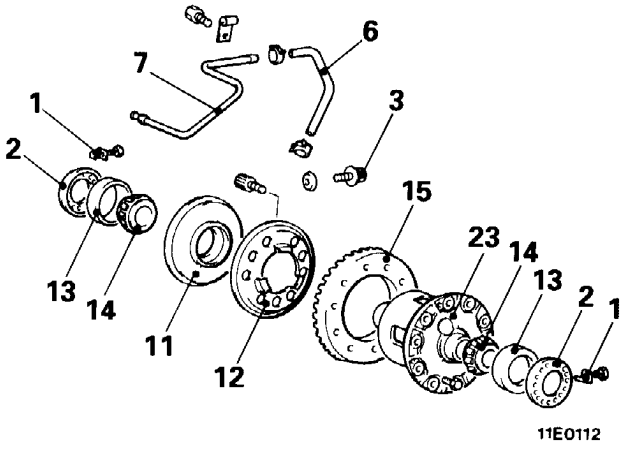
E27QI--

Inspection Before Disassembly
(1) Inspection of Final Drive Gear Inspection
(Refer to P.27-24.)
(2) Inspection of Drive Gear Run-out
(Refer to P.27-25.)
(3) Inspection of Differential Gear Backlash (Refer to P.27-25.)
(4) Inspection of Final Drive Gear Tooth Contact
(Refer to P.27-25.)

<Conventional differential (2400, 3000, 2500D)>

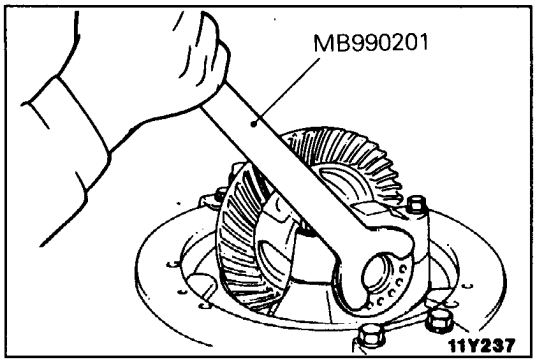


<Conventional differential (3500, 2800D), limited slip differential and rear differential lock>



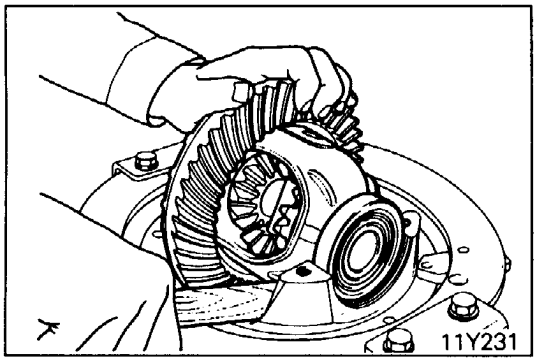
Disassembly steps

- 1. Lock plate
- ◆◆ 2. Side bearing nut
- 3. Bolt
- 4. Bearing cap
- ◆◆ 5. Differential case assembly
- 6. Hose
- 7. Air pipe assembly (A) } <Vehicles with rear differential lock>
- 8. Eye bolt } <Vehicles with rear differential lock>
- 9. Air pipe assembly (B) } <Vehicles with rear differential lock>
- 10. Gasket } <Vehicles with rear differential lock>
- 11. Actuator assembly } <Vehicles with rear differential lock>
- 12. Pressure plate } <Vehicles with rear differential lock>
- 13. Side bearing outer race
- ◆◆ 14. Side bearing inner race
- ◆◆ 15. Drive gear
- ◆◆ 16. Lock pin
- 17. Pinion shaft
- 18. Pinion gear
- 19. Pinion washer
- 20. Side gear
- 21. Side gear spacer
- 22. Differential case
- 23. Differential case (Refer to P. 27-37)
- ◆◆ 24. Self-locking nut
- 25. Washer
- ◆◆ 26. Drive pinion assembly
- 27. Drive pinion front shim (For adjusting preload of drive pinion)
- 28. Drive pinion spacer
- ◆◆ 29. Drive pinion rear bearing inner race
- 30. Drive pinion rear shim (For adjusting drive pinion height)
- 31. Drive pinion
- 32. Companion flange
- ◆◆ 33. Oil seal
- ◆◆ 34. Drive pinion front bearing inner race
- ◆◆ 35. Drive pinion front bearing outer race
- ◆◆ 36. Drive pinion rear bearing outer race
- 37. Rear differential lock detection switch } <Vehicles with rear differential lock>
- 38. Gasket } <Vehicles with rear differential lock>
- 39. Differential carrier



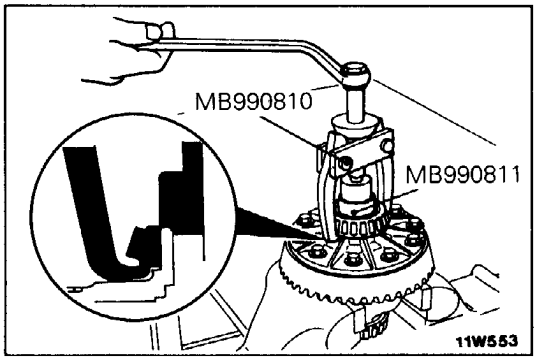
SERVICE POINTS OF DISASSEMBLY E27QFAE

2. REMOVAL OF SIDE BEARING NUT



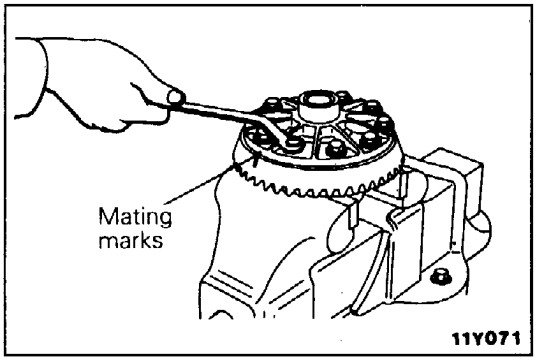
5. REMOVAL OF DIFFERENTIAL CASE ASSEMBLY

NOTE
Keep the right and left side bearings and side bearing nuts separate, so that they do not become mixed at the time of reassembly.



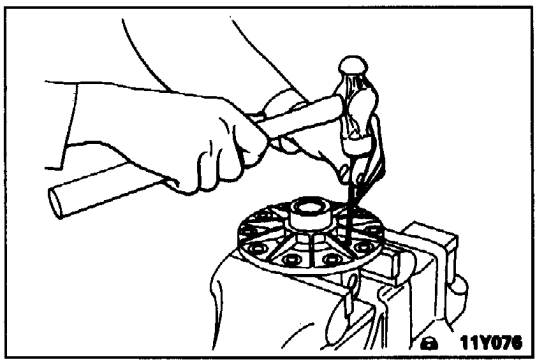
14. REMOVAL OF SIDE BEARING INNER RACE

NOTE
Attach the prongs of the special tool to the inner race of the side bearing through the openings in the differential case.



15. REMOVAL OF DRIVE GEAR

(1) Make the mating marks to the differential case and the drive gear.
(2) Loosen the drive gear attaching bolts in diagonal sequence to remove the drive gear.



16. REMOVAL OF LOCK PIN

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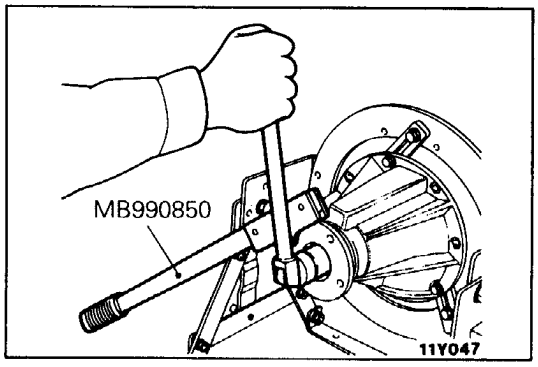
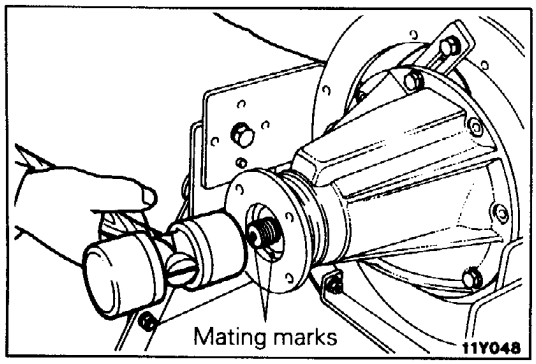


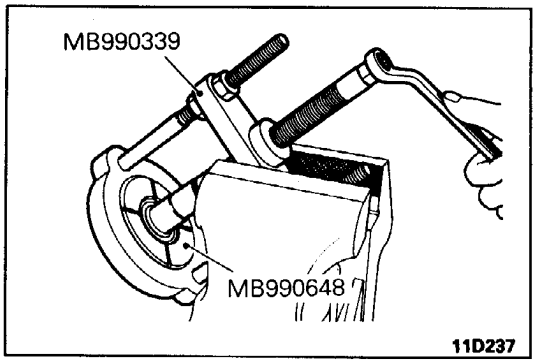
24. REMOVAL OF SELF-LOCKING NUT



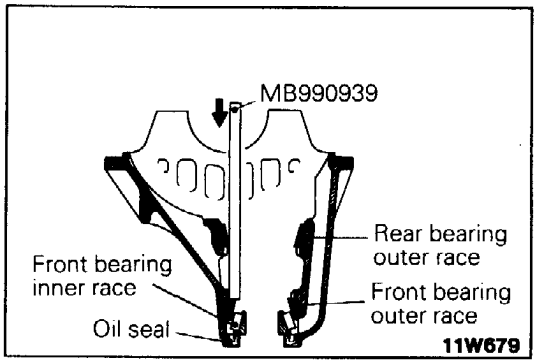
26. REMOVAL OF DRIVE PINION ASSEMBLY

(1) Make the mating marks to the drive pinion and companion flange.
(2) Drive out the drive pinion together with the drive pinion spacer and drive pinion front shims.

Caution
Do not make mating marks on the contact surfaces of the companion flange and propeller shaft.



29. REMOVAL OF DRIVE PINION REAR BEARING INNER RACE



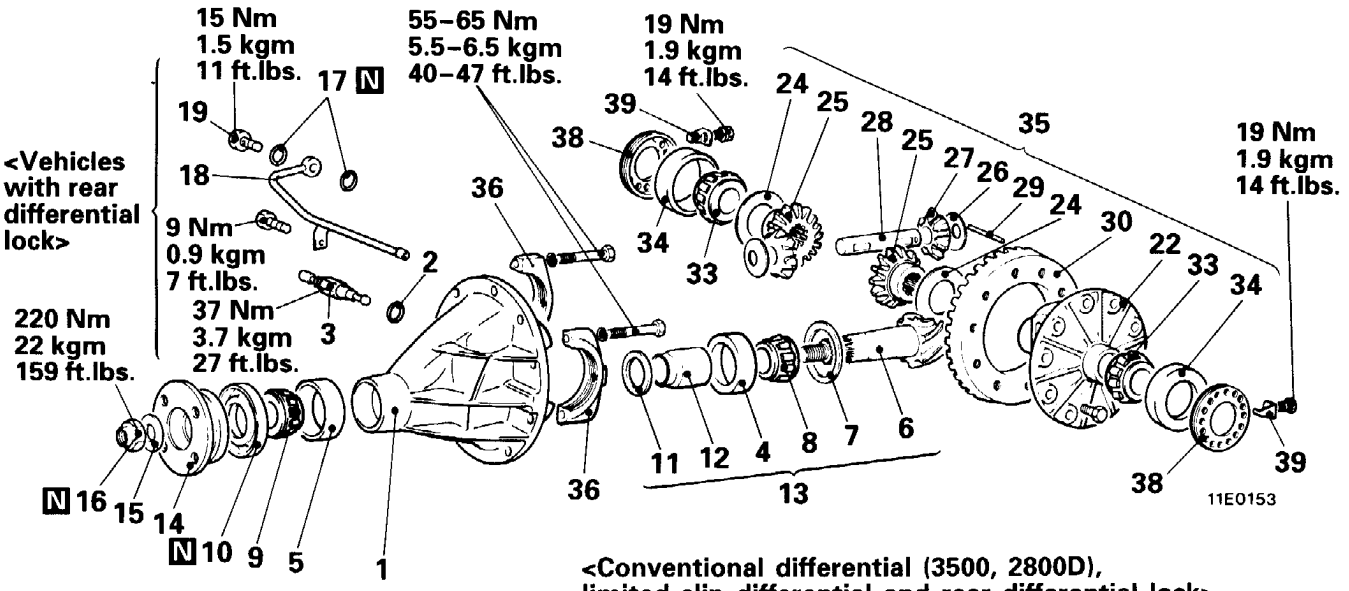
33. REMOVAL OF OIL SEAL/34. DRIVE PINION FRONT BEARING INNER RACE/35. DRIVE PINION FRONT BEARING OUTER RACE/36. DRIVE PINION REAR BEARING OUTER RACE

(1) Using the special tool, drive out the drive pinion front bearing outer race with drive pinion front bearing inner race and oil seal from the gear carrier.
(2) Drive out the drive pinion rear bearing outer race in the same manner.

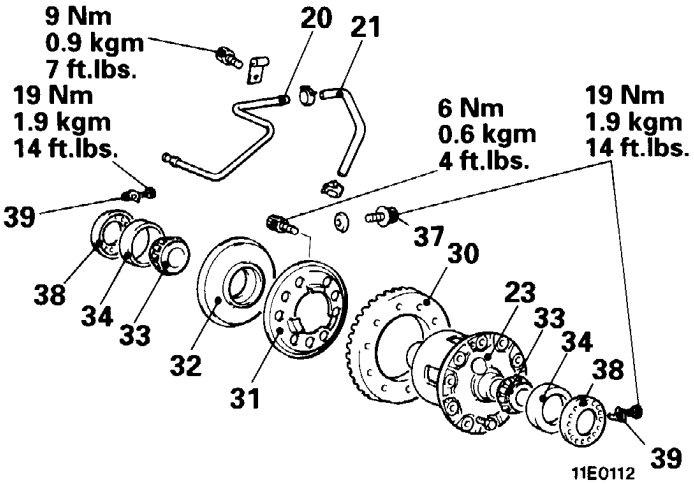
REASSEMBLY

E27QJ--

<Conventional differential (2400, 3000, 2500D)>

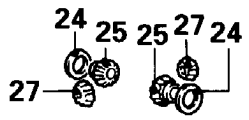
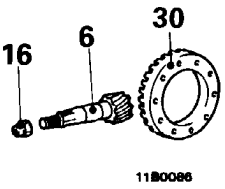


<Conventional differential (3500, 2800D), limited slip differential and rear differential lock>

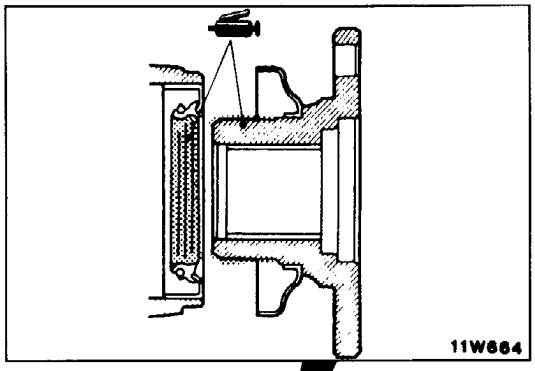


Reassembly steps

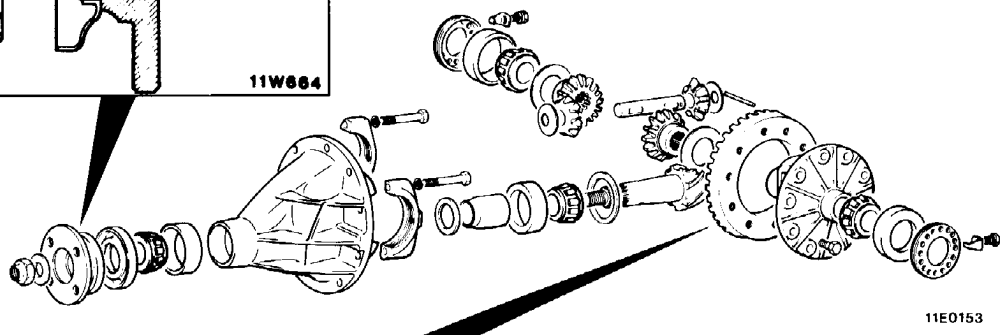
1. Differential carrier
2. Gasket
3. Rear differential lock detection switch
4. ➡◀ Drive pinion rear bearing outer race
5. ➡◀ Drive pinion front bearing outer race
6. ➡◀ • Adjustment of drive pinion height
7. Drive pinion
8. Drive pinion rear shim (For adjusting drive pinion height)
9. Drive pinion rear bearing inner race
10. Drive pinion front bearing inner race
11. Oil seal
12. Drive pinion front shim (For adjusting drive pinion preload)
13. Drive pinion spacer
14. ➡◀ • Adjustment of drive pinion preload
15. Drive pinion assembly
16. Companion flange
17. Washer
18. Self-locking nut
19. Gasket
20. Air pipe assembly (B)
21. Eye bolt
22. Air pipe assembly (A) | <Vehicles with rear
23. Hose | differential lock>
24. Differential case
25. Differential case (Refer to P.27-37)
26. Side gear spacer
27. Side gear
28. Pinion washer
29. Pinion gear
30. ➡◀ • Adjustment of differential gear backlash
31. Pinion shaft
32. ➡◀ Lock pin
33. ➡◀ Drive gear
34. Pressure plate | <Vehicles with rear
35. Actuator assembly | differential lock>
36. ➡◀ Side bearing inner race
37. Side bearing outer race
38. Differential case assembly
39. ➡◀ Bearing cap
40. ➡◀ • Adjustment of final drive gear backlash
41. Bolt
42. Side bearing nut
43. Lock plate

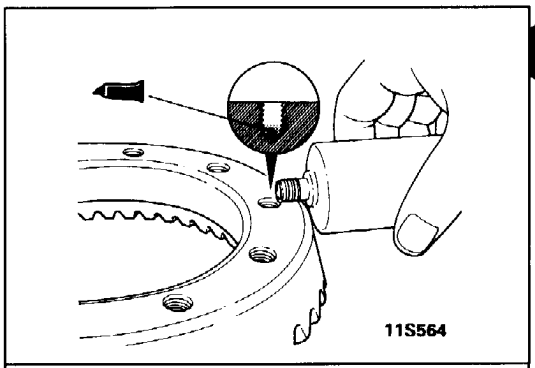
<Conventional differential (2400, 3000, 2500D)>	
	
Differential gear set	Final drive gear set

LUBRICATION AND ADHESIVE POINTS



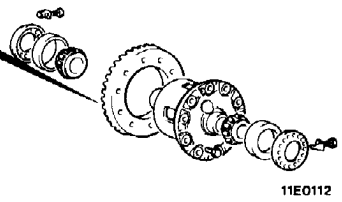
<Conventional differential (2400, 3000, 2500D)>

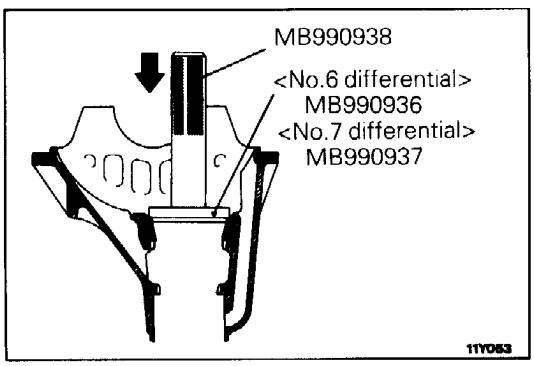




Adhesive:
3M Stud Locking 4170 or equivalent

<Conventional differential (3500, 2800D), limited slip differential and rear differential lock>





SERVICE POINTS OF REASSEMBLY E27QHAH

4. PRESS-FITTING OF DRIVE PINION REAR BEARING OUTER RACE

Caution
Bearing outer race must be fitted by a press to avoid tilt and distortion.

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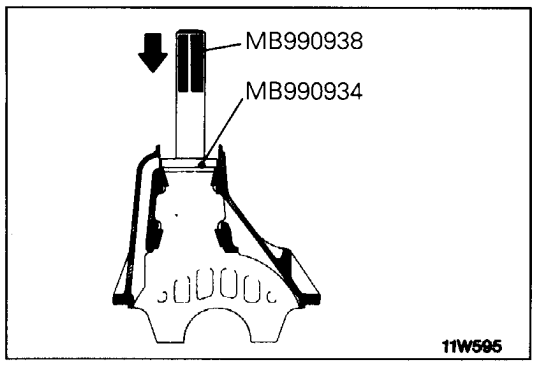
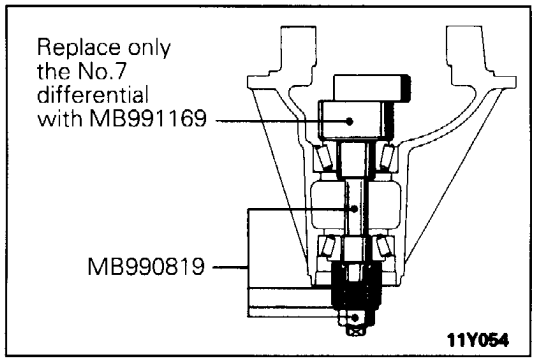


5. INSTALLATION OF DRIVE PINION FRONT BEARING OUTER RACE

Caution
Bearing outer race must be fitted by a press to avoid tilt and distortion

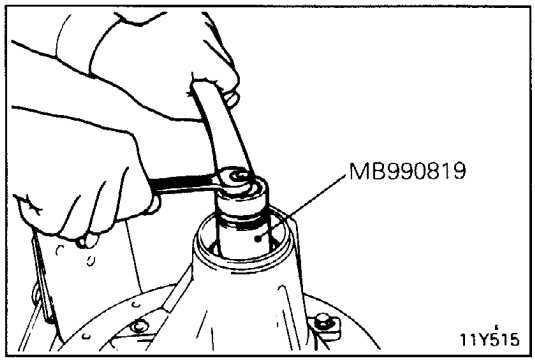


- **ADJUSTMENT OF DRIVE PINION HEIGHT**

Adjust the drive pinion height by the following procedures:

(1) Install special tools and drive pinion front and rear bearing inner races to the gear carrier in the sequence shown in the illustration.

NOTE
For the No. 7 differential, the MB990819 head part should be replaced by the MB991169 (attachment).

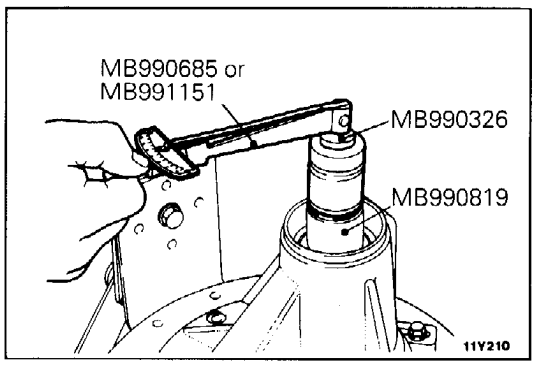


(2) Tighten the nut on the special tool until standard value of drive pinion turning torque is obtained.

(3) Measure the drive pinion turning torque (without the oil seal).

Standard value:

Bearing division	Bearing lubrication	Rotation torque
New	None (With anti-rust agent)	0.6–0.9 Nm 6.0–9.0 kgcm 5.2–7.8 in.lbs.
New/reusing	Gear oil applied	0.4–0.5 Nm 4.0–5.0 kgcm 3.5–4.3 in.lbs.



NOTE
1. Gradually tighten the nut of the special tool while checking the drive pinion turning torque.
2. With small type differentials, one complete rotation cannot be given to the special tool. Rotate tool several times within the possible range to run in the bearing, and then measure the torque.

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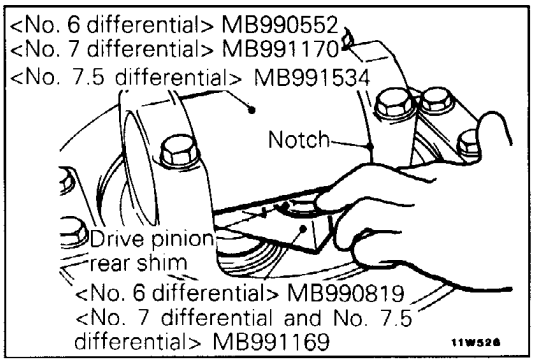

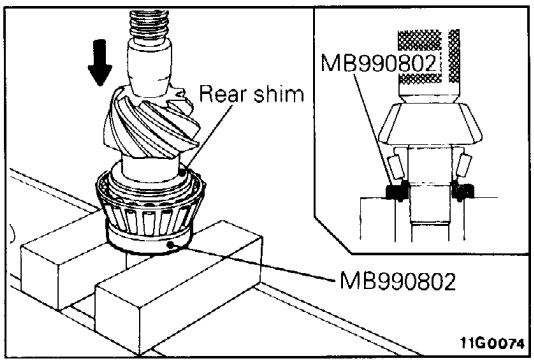

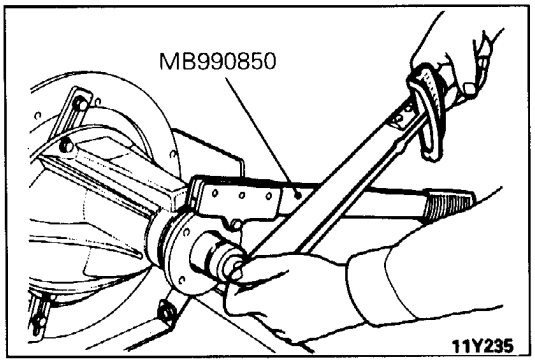

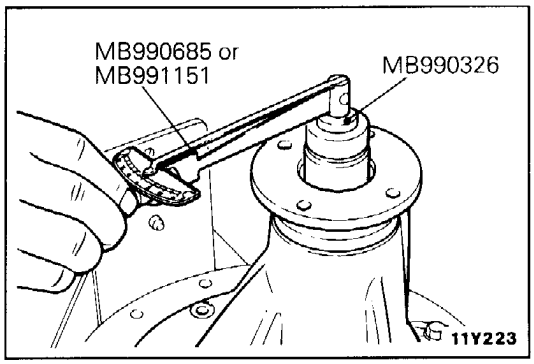

(4) Position the special tool in the side bearing seat of the gear carrier, then select a drive pinion rear shim of a thickness which corresponds to the gap between the special tools.

NOTE
Thoroughly clean the side bearing seat.
When positioning the special tool, be sure that the cutout sections of the special tool are in the position shown in the illustration, and also confirm that the special tool is in close contact with the side bearing seat.
When selecting the drive pinion rear shims, keep the number of shims to a minimum.

(5) Fit the selected drive pinion rear shim(s) to the drive pinion, and press-fit the drive pinion rear bearing inner race by using the special tool.

- **ADJUSTMENT OF DRIVE PINION PRELOAD**

Adjust the drive pinion turning torque by using the following procedure:

Without oil seal

(1) Fit the drive pinion front shim(s) between the drive pinion spacer and the drive pinion front bearing inner race.
(2) Tighten the companion flange to the specified torque by using the special tools.

NOTE
Do not install the oil seal.

(3) Measure the drive pinion turning torque. (without the oil seal)

Standard value:

Bearing division	Bearing lubrication	Rotation torque
New	None (With anti-rust agent)	0.6–0.9 Nm 6.0–9.0 kgcm 5.2–7.8 in.lbs.
New/reusing	Gear oil applied	0.4–0.5 Nm 4.0–5.0 kgcm 3.5–4.3 in.lbs.

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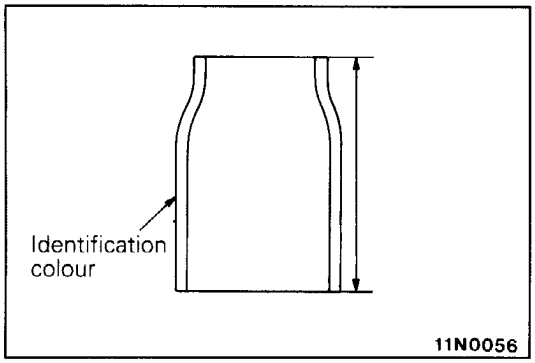

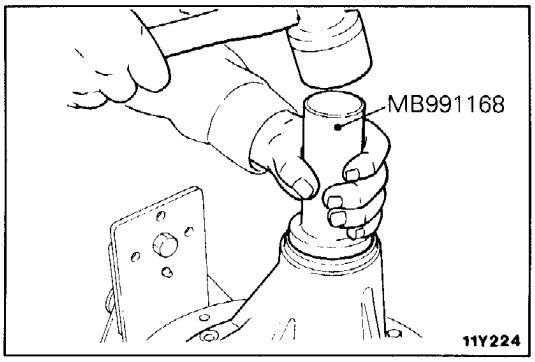

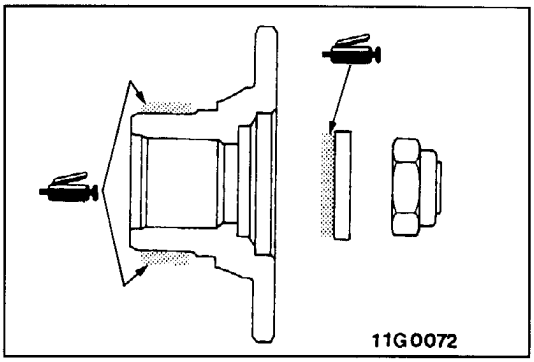

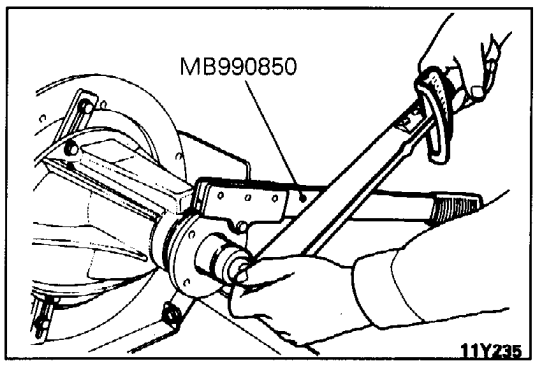

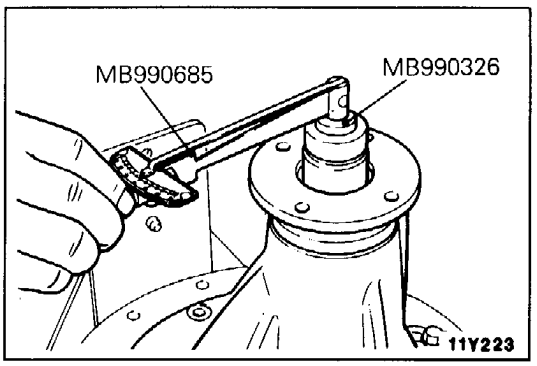

(4) If the drive pinion turning torque is not within the range of the standard value, adjust the turning torque by replacing the drive pinion front shim(s) or the drive pinion spacer.

NOTE
When selecting the drive pinion front shims, if the number of shims is large, reduce the number of shims to a minimum by selecting the drive pinion spacers.
Also, select the drive pinion spacer from the following two types.

	Height of drive pinion spacer mm (in.)	Identification colour
2400, 3000 2500D	56.67 (2.231)	—
	57.01 (2.244)	White
3500, 2800D	52.50 (2.067)	Yellow
	52.84 (2.080)	Red

(5) Remove the companion flange and drive pinion once again.

With oil seal

(1) After setting the drive pinion front bearing inner race, drive the oil seal into the gear carrier front lip by using the special tool.

(2) Apply a thin coat of multipurpose grease to the companion flange contacting surface of the washer and oil seal contacting surface before installing drive pinion assembly.

(3) Install the drive pinion assembly and companion flange with mating marks properly aligned, and tighten the companion flange self-locking nut to the specified torque by using the special tools.

(4) Measure the drive pinion turning torque (with oil seal) to verify that the drive pinion turning torque complies with the standard value.

Standard value:

Bearing division	Bearing lubrication	Rotation torque
New	None (With anti-rust agent)	0.85–1.15 Nm 8.5–11.5 kgcm 7.4–10.0 in.lbs.
New/reusing	Gear oil applied	0.65–0.75 Nm 6.5–7.5 kgcm 5.6–6.5 in.lbs.

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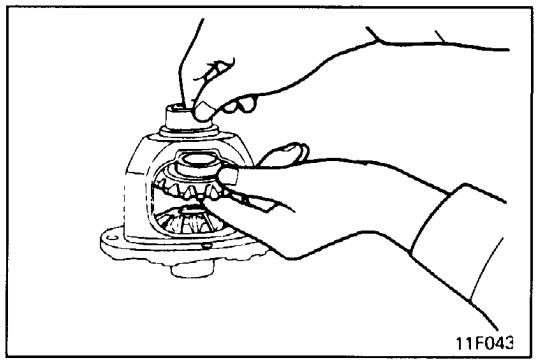
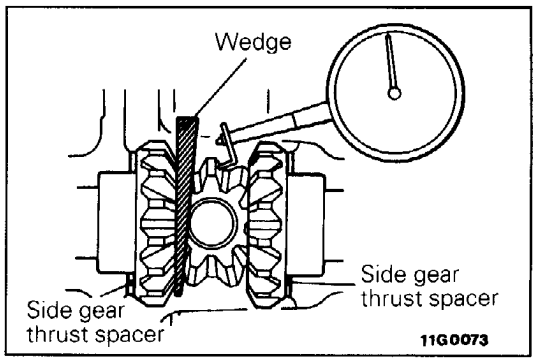




- **ADJUSTMENT OF DIFFERENTIAL GEAR BACKLASH <Conventional differential (2400, 3000, 2500D)>**

Adjust the differential gear backlash by the following procedure.

(1) Assemble the side gears, side gear thrust spacers, pinion gears, and pinion washers into the differential case.

(2) Temporarily install the pinion shaft.

NOTE
Do not assemble the thrust block and lock pin yet.

(3) Insert a wedge between the side gear and the pinion shaft to lock the side gear.

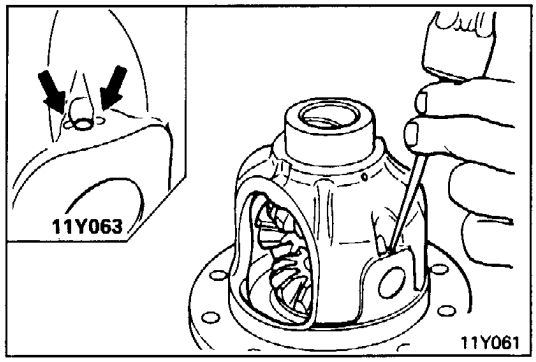
(4) While locking the side gear with the wedge, measure the differential gear backlash with a dial indicator on the pinion gear.

Standard value:
<No.6 differential>
0.010–0.076 mm (0.0004–0.0030 in.)
<No. 7 differential>
0–0.076 mm (0–0.0030 in.)
Limit: 0.2 mm (0.0079 in.)

NOTE
Measure both pinion gears.

(5) If the differential gear backlash exceeds the limit, adjust the backlash by installing thicker side gear thrust spacers.

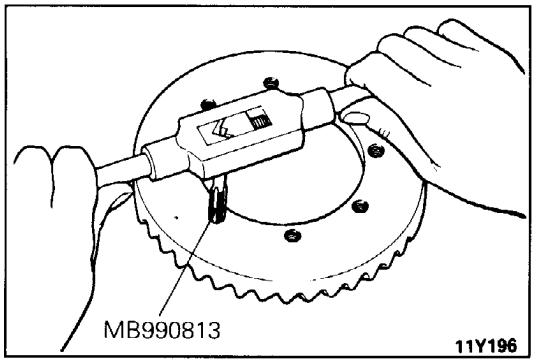
(6) Measure the differential gear backlash once again, and confirm that it is within the limit.
If adjustment is not possible, replace the side gears and pinion gears as a set.



29. INSTALLATION OF LOCK PIN

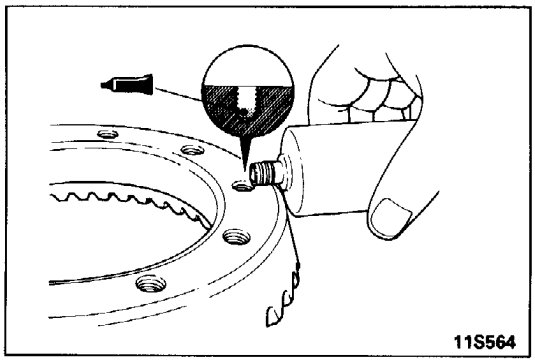
(1) Align the pinion shaft lock pin hole with the differential case lock pin hole, and drive in the lock pin.

(2) Stake the lock pin with a punch at two points.



30. INSTALLATION OF DRIVE GEAR

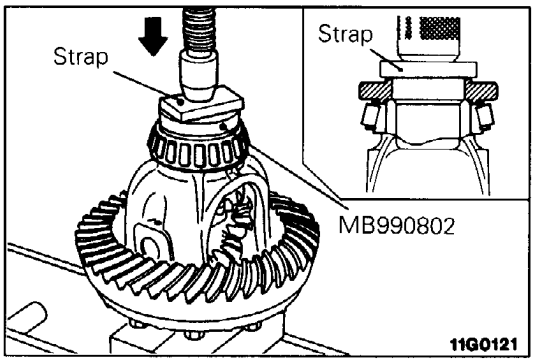
(1) Clean the drive gear attaching bolts.
(2) Remove the adhesive adhered to the threaded holes of the drive gear by turning the special tool (tap M10 × 1.25), and then clean the threaded holes by applying compressed air.



(3) Apply the specified adhesive to the threaded holes of the drive gear

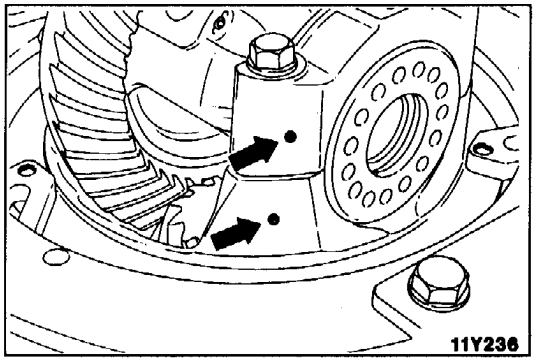
Specified adhesive: 3M Stud Locking 4170 or equivalent

(4) Install the drive gear onto the differential case with the mating marks properly aligned. Tighten the bolts to the specified torque in a diagonal sequence.



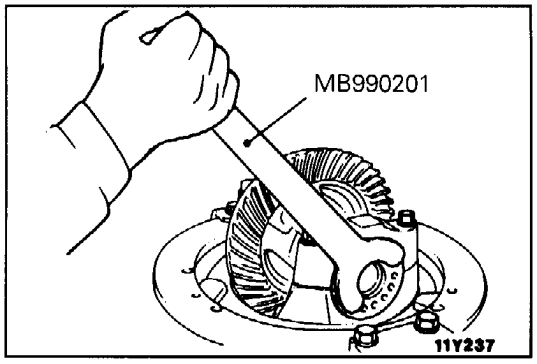
33. PRESS-FIT OF SIDE BEARING INNER RACE

Caution
When only one side bearing inner race is installed, only place load on the differential case.



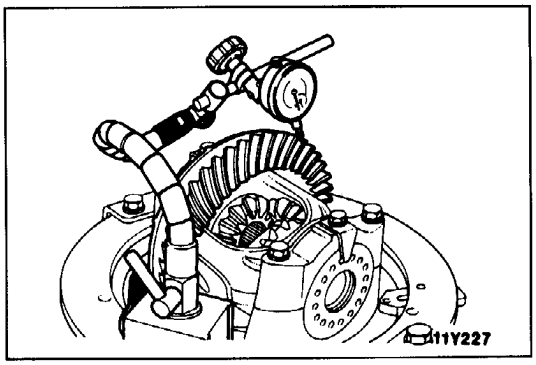
36. INSTALLATION OF BEARING CAP

Align the mating marks on the gear carrier and the bearing cap, and then tighten the bearing cap.



• ADJUSTMENT OF FINAL DRIVE GEAR BACKLASH

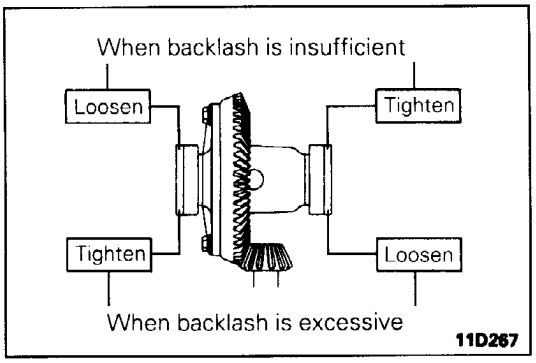
Adjust final drive gear backlash as follows:
(1) Using the special tool, temporarily tighten the side bearing nut until it is in the state just before preloading of the side bearing.



(2) Measure the final drive gear backlash.

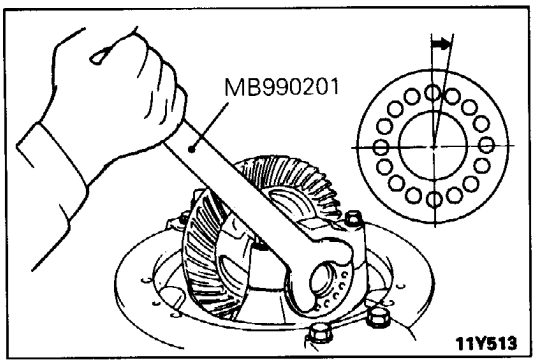
Standard value: <No. 6 differential>
0.11–0.16 mm (0.0043–0.0063 in.)
<No. 7 differential and No. 7.5 differential (except rear differential lock)>
0.13–0.18 mm (0.0051–0.0071 in.)
<No. 7.5 differential (rear differential lock)>
0.12–0.18 mm (0.0047–0.0071 in.)

NOTE
Measure at least 4 points on the drive gear periphery.

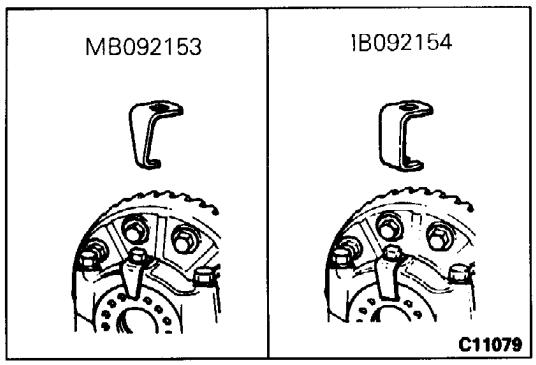


(3) Using the special tool (MB990201), adjust the backlash to standard value by moving the side bearing nut as shown.

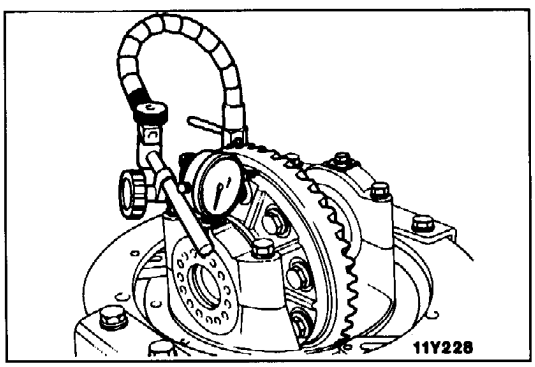
NOTE
First turn the side bearing nut for loosening, and then turn (by the same amount) the side bearing nut for tightening.



(4) Using the special tool, to apply the preload, turn down both right and left side bearing nuts on half the distance between centres of two neighbouring holes.



(5) Choose and install the lock plate (two kinds).
(6) Check the final drive gear tooth contact. If poor contact is evident, make adjustment. (Refer to GROUP 26-Differential Carrier.)



(7) Measure the drive gear runout.

Limit: 0.05 mm (0.0020 in.)

(8) When drive gear runout exceeds the limit, remove the differential case and then the drive gears, moving them to different positions and reinstall them.

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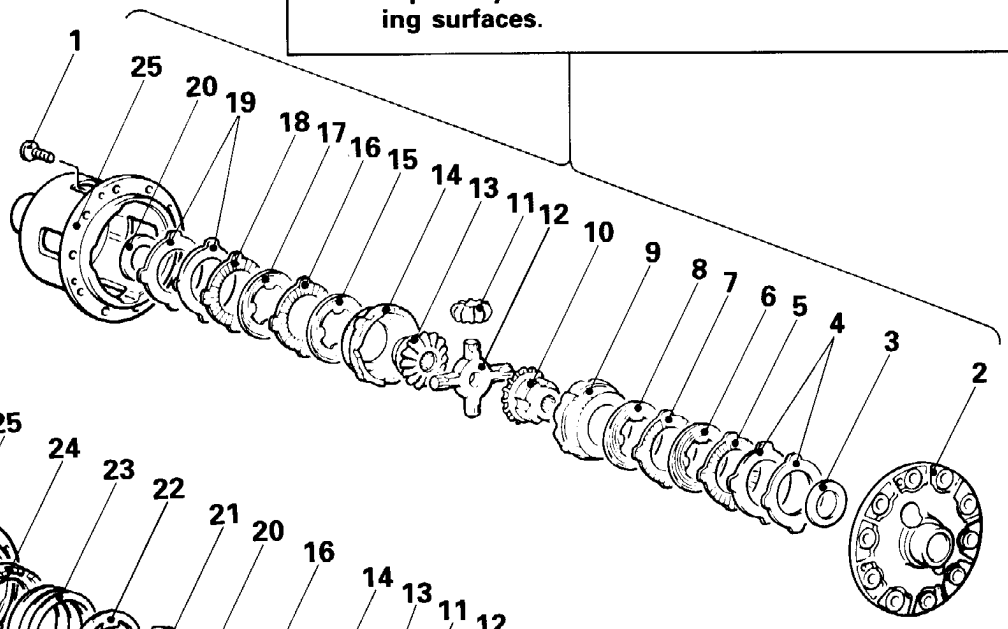
E27TI--

DIFFERENTIAL CASE DISASSEMBLY AND REASSEMBLY <Limited slip differential (All models) and Rear differential lock (2400, 3000, 2500D)>

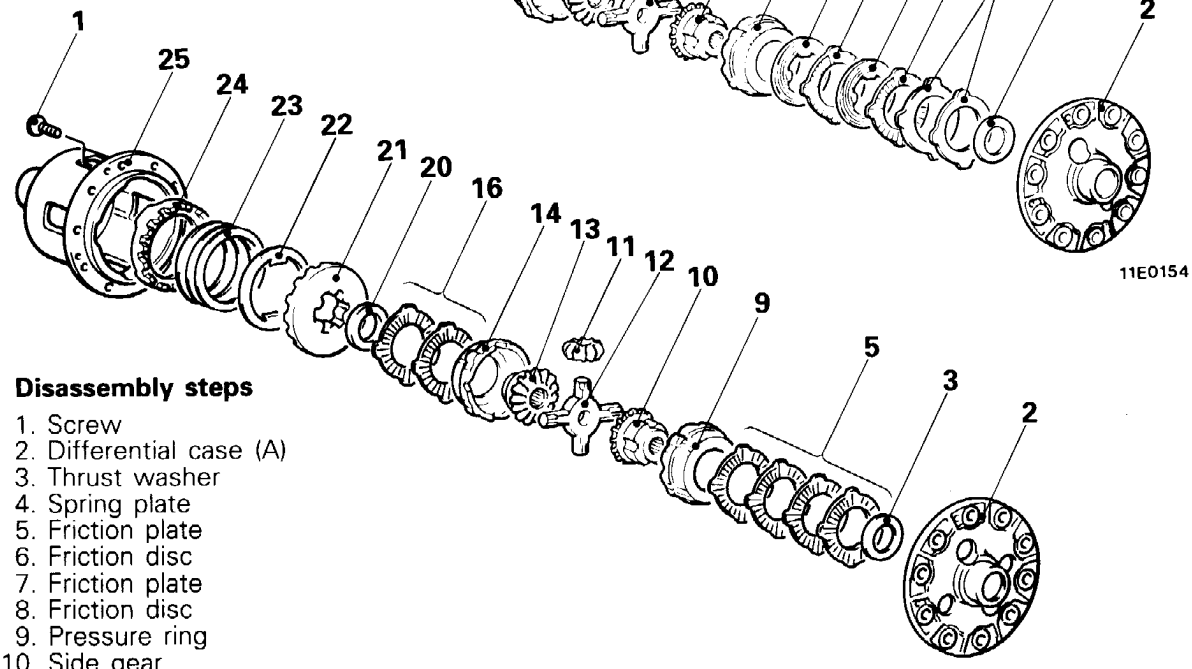
Gear oil:
MITSUBISHI Genuine Gear Oil Part No. 8149630EX, CASTROL HYPOY LS (GL-5, SAE 90), SHELL-LSD (GL-5, SAE 80W-90) or equivalent

Caution
Apply the specified gear oil to each component especially careful to coat contact surfaces and sliding surfaces.

<Vehicles with limited slip differential>



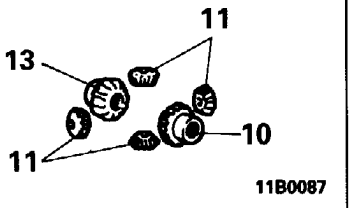
<Vehicles with rear differential lock>



11E0154

Disassembly steps

◆◆ ◆◆ 1. Screw
2. Differential case (A)
3. Thrust washer
4. Spring plate
5. Friction plate
6. Friction disc
7. Friction plate
8. Friction disc
9. Pressure ring
10. Side gear
11. Differential pinion gear
12. Differential pinion shaft
13. Side gear
14. Pressure ring
15. Friction disc
16. Friction plate
17. Friction disc
18. Friction plate
19. Spring plate
20. Thrust washer
21. Driven cam
22. Spring washer
23. Spring
24. Drive cam
◆◆ ◆◆ Adjustment of clutch plate friction force
25. Differential case (B)



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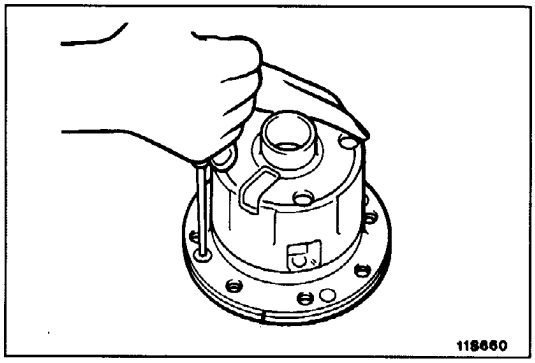
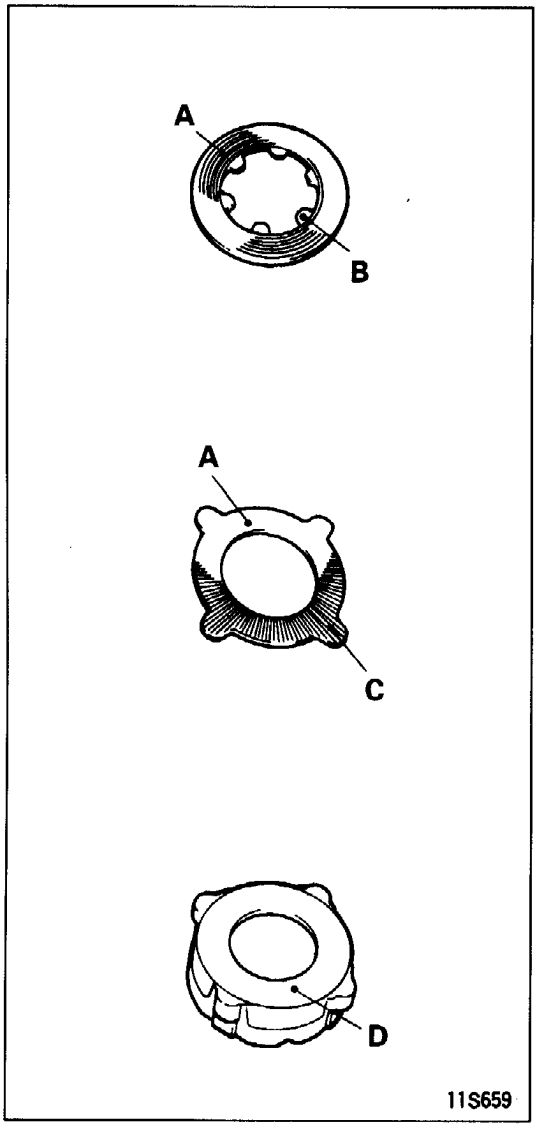
Differential gear set





SERVICE POINTS OF DISASSEMBLY E27TJAD

1. REMOVAL OF SCREW

(1) Loosen screws of the differential cases (A) and (B) uniformly a little at a time.
(2) Separate differential case (A) from differential case (B).
(3) Remove the components from differential case (B).

NOTE
Keep the right and left thrust washers, spring plates, spring discs, friction plates, and friction discs separate in order to be able to distinguish them for reassembly.

INSPECTION E27TKAE

CONTACT AND SLIDING SURFACES OF PARTS

(1) Inspect the friction plate, friction disc, spring plate and pressure ring.

A. The friction surfaces of the friction plate, friction disc, spring plate.
If there are any signs of seizure, severe friction, or colour change from the heat, it will adversely affect the locking performance; replace the part with a new one.

NOTE
The strong contact on the inner circumference of the friction surfaces is because of the spring plate; this wear is not abnormal.

B. The six projections on the inner circumference of the friction disc.
If there are nicks and dents, it will cause abnormalities in the clutch pressure.
Repair the parts by using an oil stone; if the parts cannot be repaired, replace them.

C. The four projections on the outer circumference of the friction disc.
If there are nicks and dents, it will cause abnormalities in the clutch pressure.
Repair the parts by using an oil stone; if the parts cannot be repaired, replace them.

D. The friction surface of the friction disc of the pressure ring. If there are nicks or scratches, repair the part by first grinding with an oil stone and then polishing with rubbing compound on a surface plate.

NOTE
The strong contact on the inner circumference of the friction surface is because of the spring plate; this wear is not abnormal.

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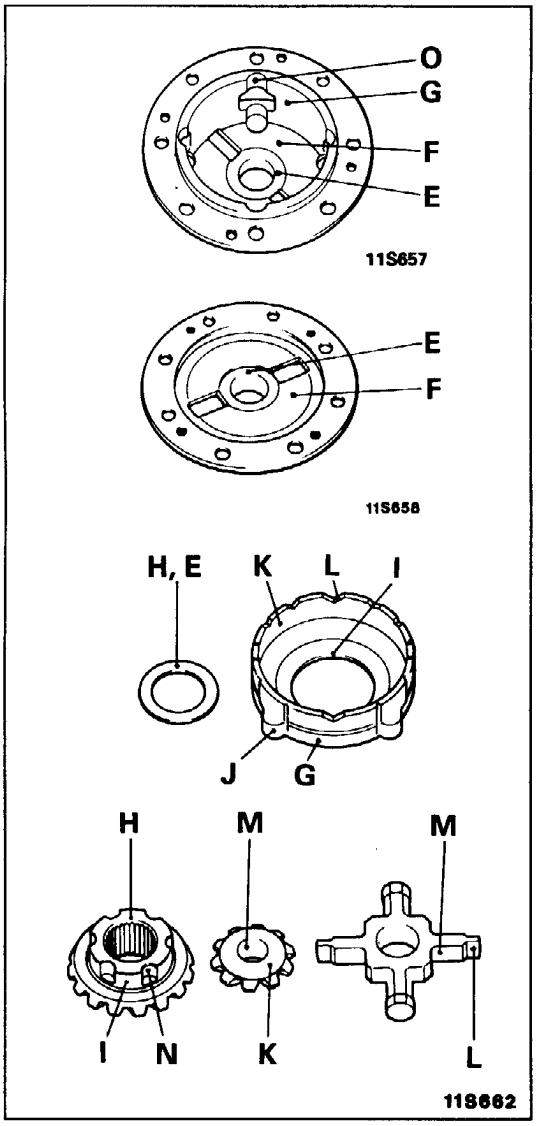
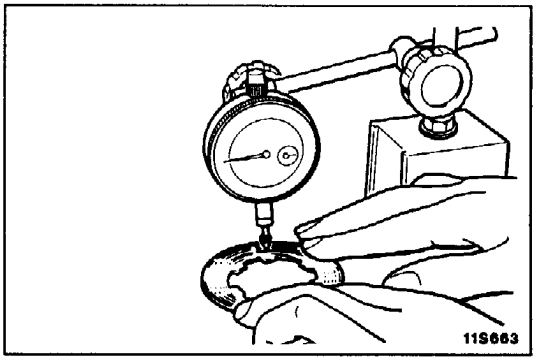


(2) Inspect the contact and sliding surfaces listed below, and repair any nicks and burrs by using an oil stone.

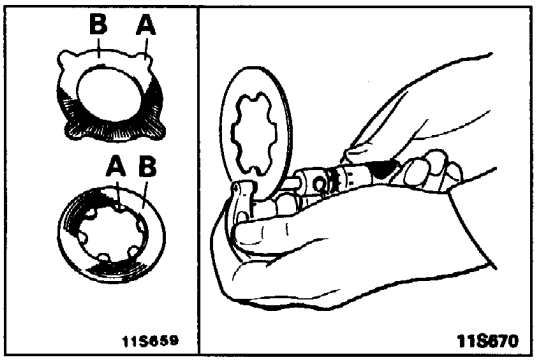
E. The sliding surfaces of the thrust washer and the case.
F. The spring contacting surface of the differential case.
G. The contact surfaces of the outer circumference of the pressure ring and the inner circumference of the differential case.
H. The sliding surface of the side gear and thrust washer.
I. The sliding surfaces of the hole in the pressure ring and the outer circumference of the side gear.
J. The projection on the outer circumference of the pressure ring.
K. The spherical surface of the differential pinion gear and the inner diameter of the pressure ring.
L. The V-shaped groove in the pressure ring, and the V-shaped part in the pinion shaft.
M. The outer diameter of the pinion shaft and the hole of the differential pinion gear.
N. The outer circumference groove of the side gear.
O. The inner circumference groove of the differential case.



WARPING OF THE FRICTION PLATE AND FRICTION DISC

Using a dial indicator, measure the amount of warping (the flatness) of the friction plate and the friction disc on a surface plate by turning the friction plate or disc.

Limit: 0.08 mm (0.0031 in.)



WEAR OF THE FRICTION PLATE AND FRICTION DISC

(1) In order to measure the wear, measure the thickness of the friction surfaces and projections of the friction disc and plate, and then find the difference.

Limit: 0.1 mm (0.0039 in.)

NOTE
Make the measurement at several different points.

(2) If the parts are worn beyond the allowable limit, replace them with new parts.

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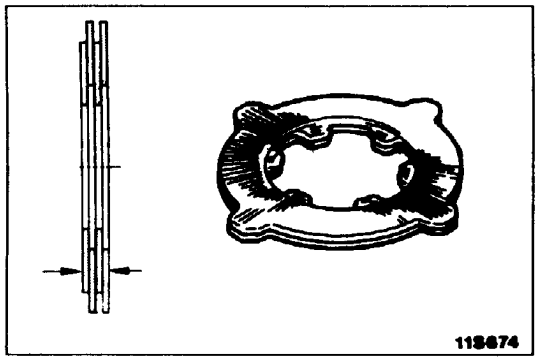
SERVICE POINTS OF REASSEMBLY E27TLAE

• ADJUSTMENT OF CLUTCH PLATE FRICTION FORCE

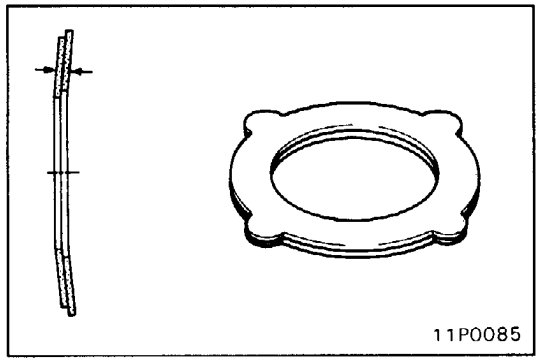
Before assembly, use the following method to adjust the clearance between the spring plates and differential cases (for adjustment of the clutch plate friction force), and to adjust the end play of the side gear when installing the internal components into the differential case.



(1) Arrange the two (each) friction discs and friction plates for each side, one on top of another, as shown in the figure, combining them so that the difference in thickness between the left and the right is the standard value.

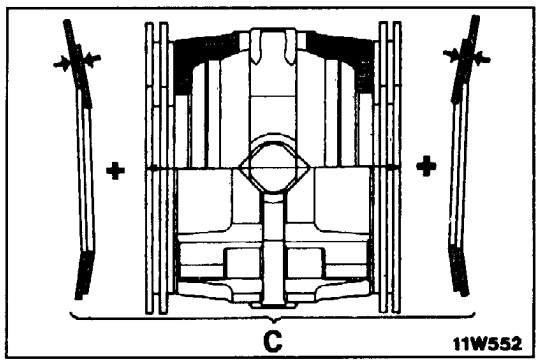
Standard value: 0–0.05 mm (0–0.0020 in.)

NOTE
For new ones, there is one type of friction plate: 1.75 mm (0.0689 in.); there are two types of friction disc: 1.75 mm (0.0689 in.) and 1.85 mm (0.0728 in.).



(2) Arrange the two spring plates for each side one on top of the other, as shown in the illustration, so that the difference between the left and the right thickness is minimized.

NOTE
For new ones, there is one type of spring disc and spring plate: 1.75 mm (0.0689 in.).



(3) Assemble the pressure ring's internal components (differential pinion shaft and pressure ring) and the friction discs and friction plates, and then as shown in the figure, measure the overall width.
(4) Calculate the total value (C) of the thickness of the 2 sets of spring plate plus the value measured in (3) above.

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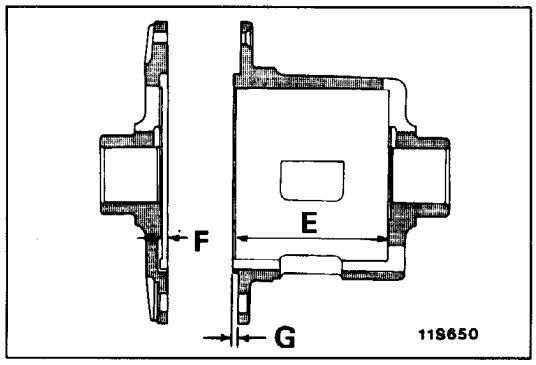
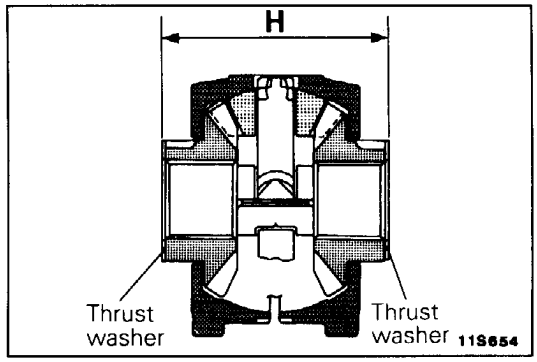
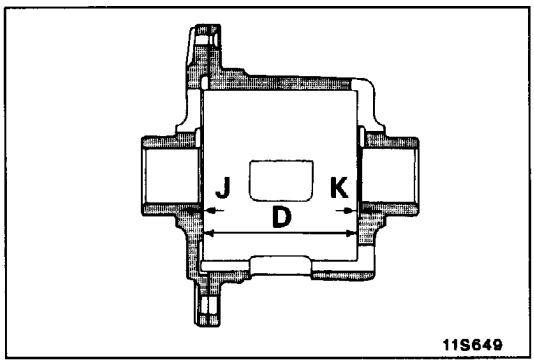


(5) Obtain the dimension (D) between the spring plate contact surfaces when differential cases (A) and (B) are combined.
(D = E + F – G)
(6) Change the thickness of the friction disc so that the clearance (D – C) between the differential case and the spring plate (vehicles with limited slip differential) or friction disc (vehicles with rear differential lock) becomes the standard value.

Standard value:
<Vehicles with limited slip differential>
0.06–0.20 mm (0.0024–0.0079 in.)
<Vehicles with rear differential lock>
0.05–0.20 mm (0.0020–0.0079 in.)



(7) Remove the spring plates, spring discs, friction plates and friction disc.
(8) Measure the dimension (H) from the thrust washer end surface to end surface.



(9) Obtain the dimension (I) between the thrust washer contact surfaces when differential cases (A) and (B) are combined.
(I = D + J + K)

NOTE
Dimension (D) is the distance between the spring plate contact surfaces when differential cases (A) and (B) are combined. (Refer to P.27-40.)

(10)Change the thickness of the thrust washer so that the clearance (I – H) between the thrust washer and the differential case is the standard value.

Standard value: 0.05–0.20 mm (0.0020–0.0079 in.)

NOTE
There are three sizes of new thrust washers: 1.50 mm (0.0591 in.), 1.60 mm (0.0630 in.), and 1.70 mm (0.0670 in.).

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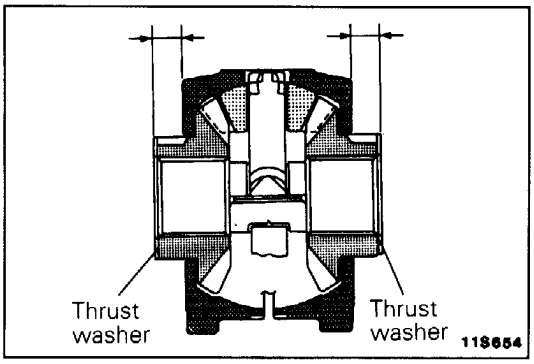
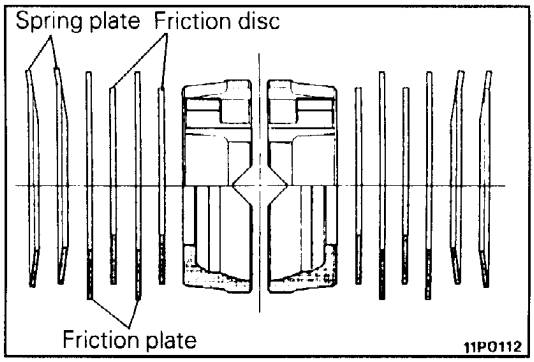


(11)Install the thrust washer as shown in the figure, and then select a thrust washer so that the difference between the left and right dimensions from the pressure ring rear face to the thrust washer end face is the standard value.

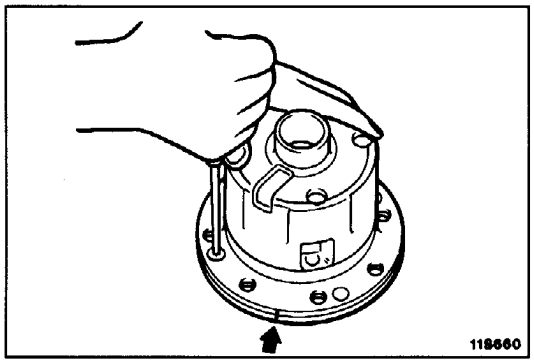
Standard value: 0–0.05 mm (0–0.0020 in.)

NOTE
Measure the distance while squeezing the V-shaped groove manually.



(12)Place the each part in the differential case (B) as directions shown in the figure.

NOTE
Be careful not to insert the friction plates and friction discs in the incorrect order and to install the spring plates in incorrect direction.

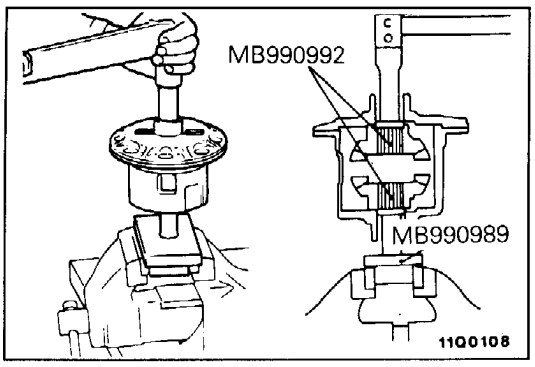


1. INSTALLATION OF SCREW

(1) Align the mating marks (the same numeral on each case) of differential case (A) and differential case (B).

(2) Turning the screwdriver slowly several times, tighten the screw so that the cases are in close contact.

NOTE
If, even though the screw is tightened, the end surfaces of case (A) and case (B) do not come into close contact, probably the thrust washer and spring plate are not fit correctly into the groove, so make the assembly again.



(3) After assembly, in order to check the frictional force of the clutch plate, use the special tools to measure the starting torque.

Standard value:
When a new clutch plate is used
40–75 Nm (4.0–7.5 kgm, 29–54 ft.lbs.)
When an old clutch plate is used
25–75 Nm (2.5–7.5 kgm, 18–54 ft.lbs.)

NOTE
Measure the starting torque after rotating slightly. When measuring the torque, do so at the beginning of movement.

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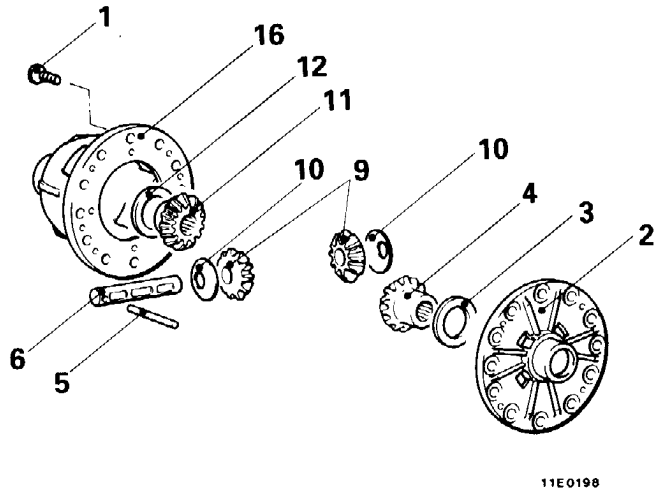
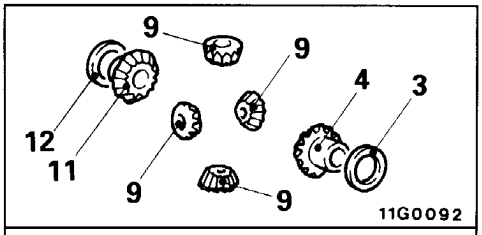
DISASSEMBLY AND REASSEMBLY
<Conventional differential (3500, 2800D) and Rear differential lock (3500, 2800D)>

<Vehicles with conventional differential – A/T>

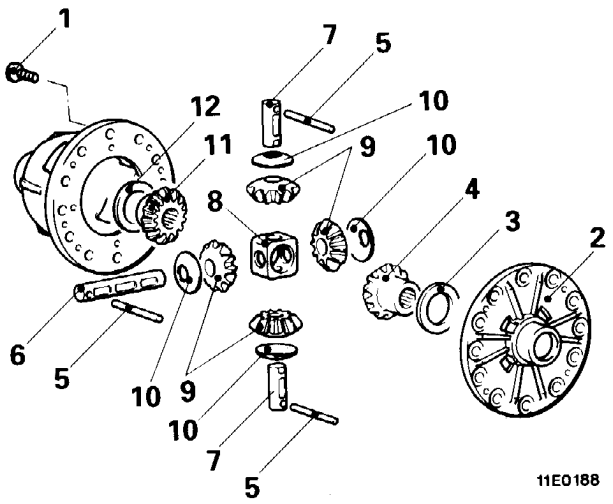


11E0198



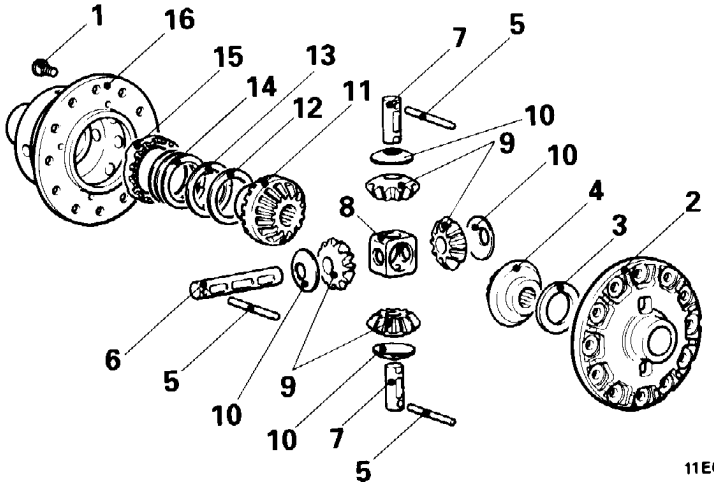
Differential gear set

<Vehicles with conventional differential – M/T>



11E0188

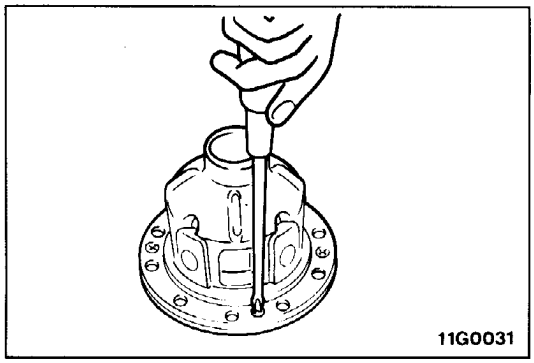
<Vehicles with rear differential lock>

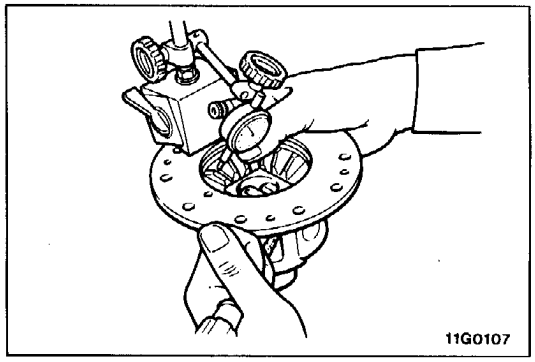


11E0189

Disassembly steps

- 1. Screw
- 2. Case A
- 3. Side gear spacer (RH)
- 4. Side gear (RH)
- • Backlash adjustment on differential gear case A side
- • Differential gear backlash check
- 5. Lock pin
- 6. Pinion shaft-A
- 7. Pinion shaft-B
- 8. Pinion shaft holder
- 9. Pinion gear
- 10. Washer
- 11. Side gear (LH)
- 12. Side gear spacer (LH)
- 13. Spring washer
- 14. Spring
- 15. Drive cam
- • Backlash adjustment on differential gear case B side
- 16. Case B





SERVICE POINTS OF DISASSEMBLY E26WLAB

1. REMOVAL OF SCREW

(1) Evenly loosen 4 screws on case A and B to remove.
(2) Set case B downward and remove case A, side gear spacer (RH) and side gear (RH).

NOTE
Check differential gear backlash to determine necessity of disassembling side gear (RH) and onward.

• DIFFERENTIAL GEAR BACKLASH CHECK

Check differential gear backlash as follows.
(1) Insert cloth wrapped screwdriver through side of case B and lock side gear (LH) and pinion gear. (one piece)
(2) Contact dial gauge on pinion gear facing the locked pinion gear and measure backlash within the standard value.

NOTE
Measure 2 pinion gears.

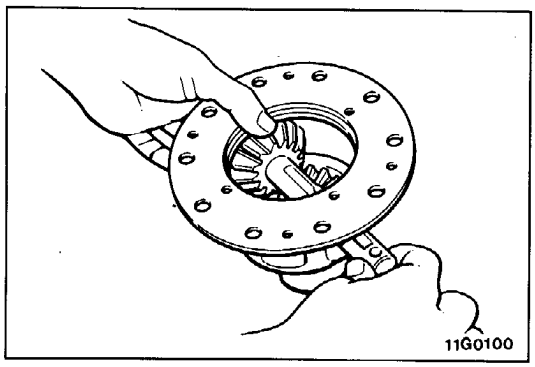
Standard value:
Conventional differential
0.10–0.25 mm (0.004–0.01 in.)
Vehicles with rear differential lock
0.15–0.20 mm (0.005–0.008 in.)

(3) When backlash exceeds the standard value, adjust side gear spacer (LH).

NOTE
If backlash is within the standard value, assure appropriate gear spacer (RH) thickness and assemble differential case assembly.

INSPECTION M27IHAC

Wash the disassembled parts in cleaning solvent, dry them using compressed air, and then check the following areas:
- Check the side gears, pinion gears and pinion shaft for wear or damage.
- Check the side gear spline for wear or damage.



SERVICE POINTS OF REASSEMBLY E26WNAB

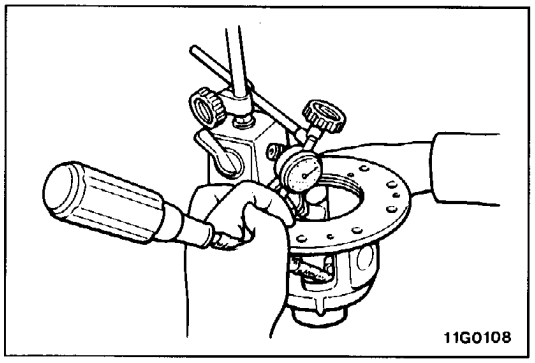
- **BACKLASH ADJUSTMENT ON DIFFERENTIAL GEAR CASE B SIDE**

Adjust backlash on differential gear case B side as follows.

(1) Temporarily install side gear spacer (LH), side gear (LH), washers, 2 pinion gears and pinion shaft A on case B.

NOTE
Do not assemble pinion shaft holder, pinion shaft-B or the remaining pinion gears (2).

(2) Insert wrapped screwdriver through side of case B to lock one side of pinion gear and side gear (LH).



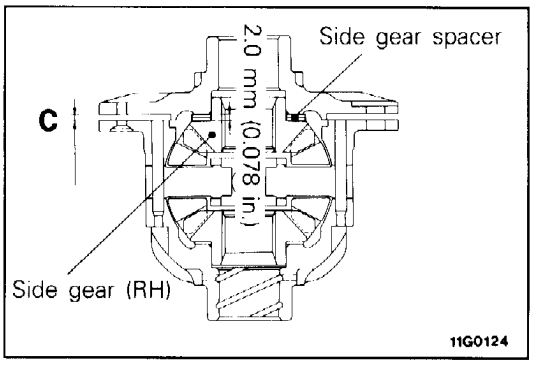
(3) Place dial gauge on unlocked pinion gear and measure differential gear backlash within the standard value.

NOTE
Measure 2 pinion gears.

Standard value:
Conventional differential
0.10–0.25 mm (0.004–0.01 in.)
Vehicles with rear differential lock
0.15–0.20 mm (0.005–0.008 in.)

(4) When backlash exceeds the standard value, adjust with selected side gear spacer (LH).

(5) Install washers, pinion gears, pinion shaft holder and pinion shaft-A and B. Lock with lock pin through case B.



- **BACKLASH ADJUSTMENT ON DIFFERENTIAL GEAR CASE A SIDE**

Adjust backlash as follows.

(1) Install side gear (RH) and 2 side gear spacers [1.0 mm (0.039 in.) thick]. Press differential case A to differential case B.

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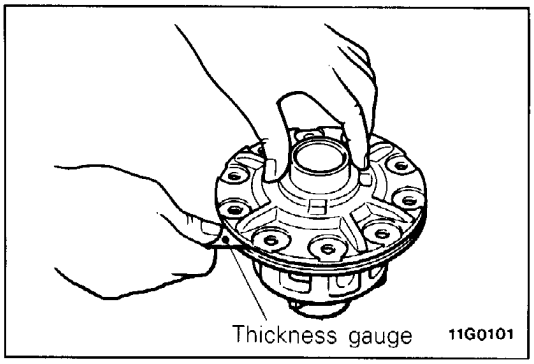
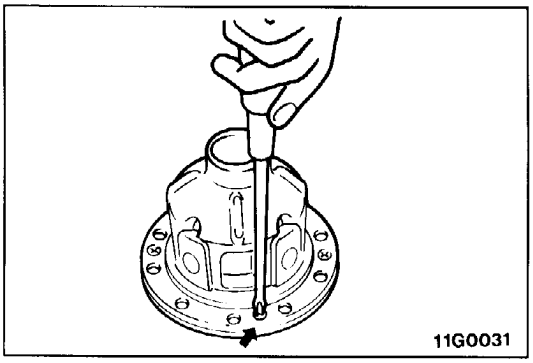


(2) Measure flange space (C) between differential case A and B with thickness gauge.
(3) Calculate side gear spacer (RH) thickness (D) as follows:

D=2.0 mm (0.078 in.)–[C+0.2 mm (0.008 in.)]

(4) Choose spacer with a thickness nearest D in (3) and adjust differential gear backlash on the right side.



(5) Match the match marks and assemble cases A and B.
(6) Assure smooth rotation of inner shaft.

WHEEL AND TYRE

CONTENTS

E31AA--

SPECIFICATIONS **2**
Service Specifications 2

TROUBLESHOOTING **3**

SERVICE ADJUSTMENT PROCEDURES **4**
Tyre Inflation Pressure Check 4
Tyre Wear Check 4
Wheel Runout Check 4

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SPECIFICATIONS

SERVICE SPECIFICATIONS

E31CB--

Items		Specifications
Standard		
Wheel nut tightening torque	Nm (kgm, ft.lbs.)	100–120 (10–12, 72–87)
Limit		
Wheel runout	mm (in.)	
Radial		
Aluminum wheels		1.0 (0.039)
Steel wheels		1.2 (0.047)
Lateral		
Aluminum wheels		1.0 (0.039)
Steel wheels		1.2 (0.047)
Tread depth of tyre	mm (in.)	1.6 (0.06)

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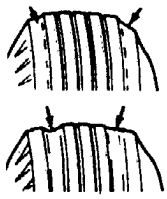
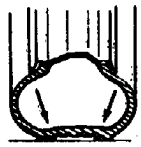
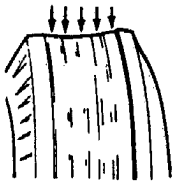
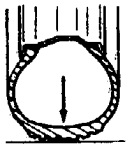
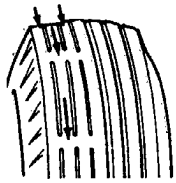
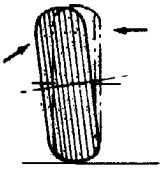
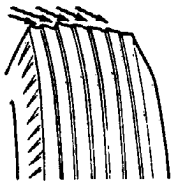
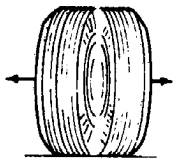
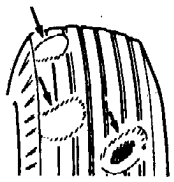
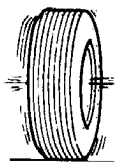
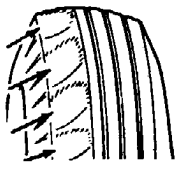
TROUBLESHOOTING

E31EA--

Symptom	Probable cause	Remedy	Reference page
Rapid wear at shoulders 	Under-inflation or lack of rotation 	Adjust the tyre pressure	Refer to P.31-2
Rapid wear at centre 	Over-inflation or lack of rotation 		
Cracked treads	Under-inflation		
Wear on one side 	Excessive camber 	Inspect the camber	Refer to GROUP 33 – Service Adjustment Procedures
Feathered edge 	Incorrect toe-in 	Adjust the toe-in	
Bald spots 	Unbalanced wheel 	Adjust the imbalanced wheels	—
Scalloped wear 	Lack of rotation of tyres or worn or out-of-alignment suspension	Rotate the tyres Inspect the front suspension alignment	Refer to GROUP 33 – Service Adjustment Procedures

11U0047

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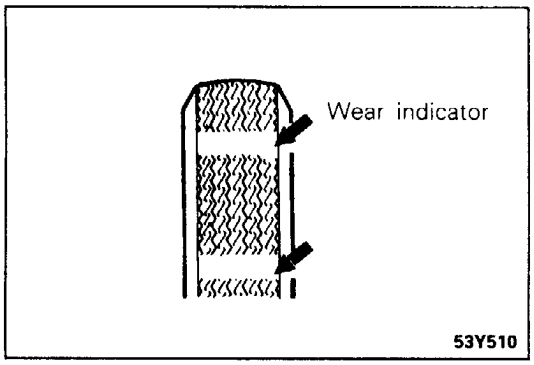
SERVICE ADJUSTMENT PROCEDURES

E31FAAA

TYRE INFLATION PRESSURE CHECK

Check the inflation pressure of the tyres. If it is not within the standard value, make the necessary adjustment.



TYRE WEAR CHECK

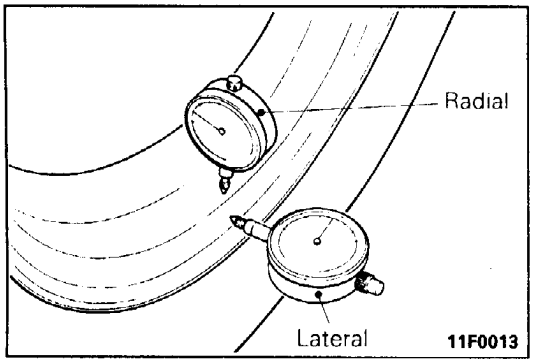
E31FBAA

Measure the tread depth of tyres.

Limit: 1.6 mm (0.06 in.)

If the remaining tread depth is less than the limit, replace the tyre.

NOTE
When the tread depth of tyres is reduced to 1.6 mm (0.06 in.) or less, wear indicators appear.



WHEEL RUNOUT CHECK

E31FCAA

Jack up the vehicle so that the wheels are clear of the floor. While slowly turning the wheel, measure wheel runout with a dial indicator.

Limit:

	Aluminum wheels	Steel wheels
Radial	1.0 mm (0.039 in.)	1.2 mm (0.047 in.)
Lateral	1.0 mm (0.039 in.)	1.2 mm (0.047 in.)

If wheel runout exceeds the limit, replace the wheel.

POWER PLANT MOUNT

CONTENTS

E32AA--

ENGINE MOUNTING 2
FRONT DIFFERENTIAL MOUNTING 4

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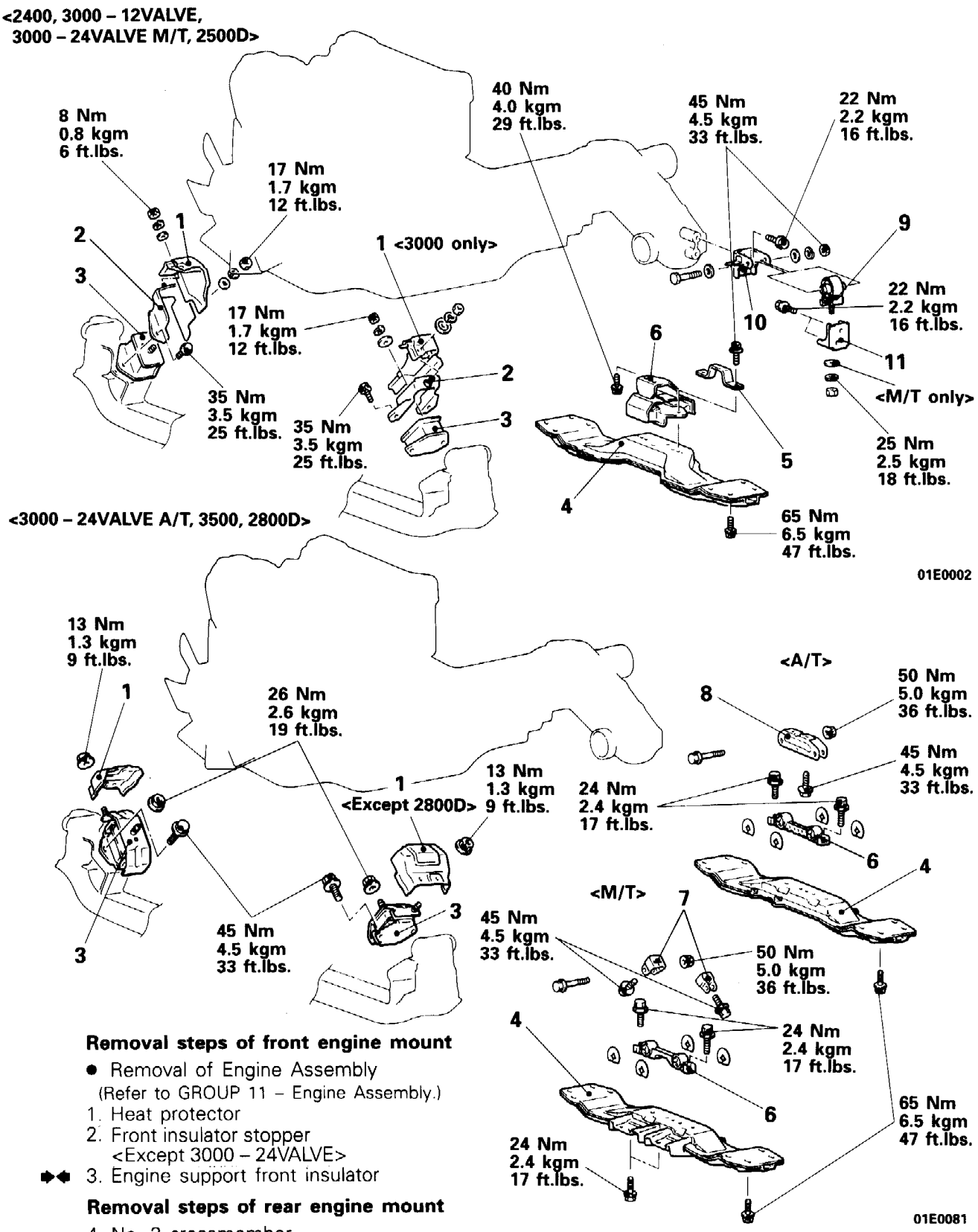
ENGINE MOUNTING

REMOVAL AND INSTALLATION

E32JA..



Removal steps of front engine mount

- Removal of Engine Assembly
  (Refer to GROUP 11 – Engine Assembly.)
1. Heat protector
2. Front insulator stopper
   <Except 3000 – 24VALVE>
3. Engine support front insulator

Removal steps of rear engine mount

4. No. 2 crossmember
5. Stopper
6. Engine support rear insulator
7. Rear engine mount bracket <M/T>
8. Rear engine mount bracket <A/T>

Removal steps of transfer role stopper

9. Transfer support insulator
10. Transfer mounting bracket
11. Transfer support bracket

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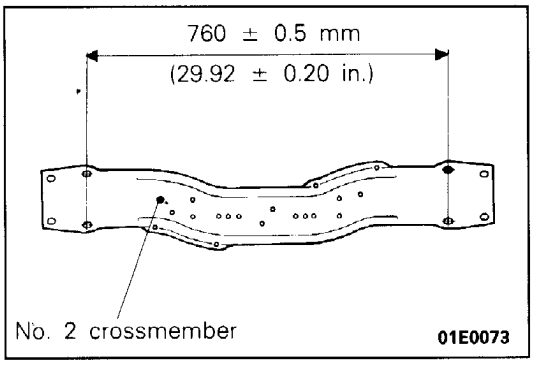
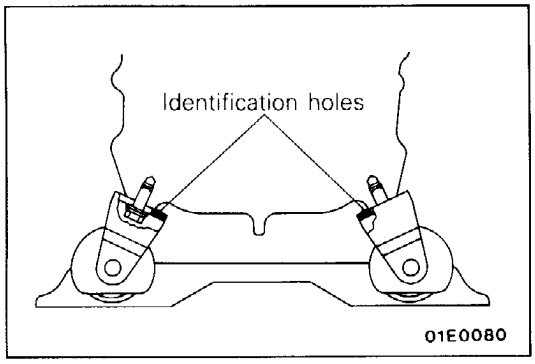


INSPECTION

E32TCBC

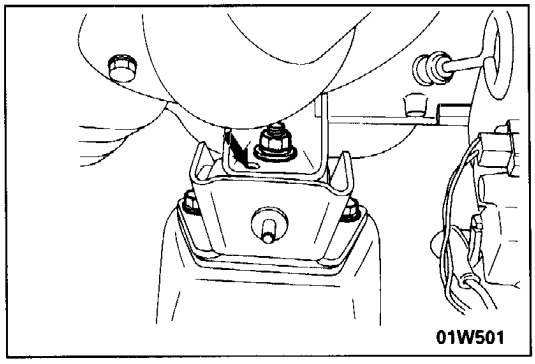
- Check insulators for cracks, separation or deformation.
- Check the front insulator stoppers for deformations.
- Check insulators for cracks, separation or deformation.
- Check transfer mounting bracket for deformation or corrosion.
- Check transfer support bracket for deformation or corrosion.
- Check No. 2 crossmember for deformation or corrosion.
- Check No. 2 crossmember as illustrated for dimension.



SERVICE POINTS OF INSTALLATION

7. INSTALLATION OF ENGINE REAR MOUNT BRACKET

Install the engine mount bracket so that the identification holes are facing towards the inside of the vehicle.



3. INSTALLATION OF ENGINE SUPPORT FRONT INSULATOR

make sure that the locating boss and hole are in alignment.

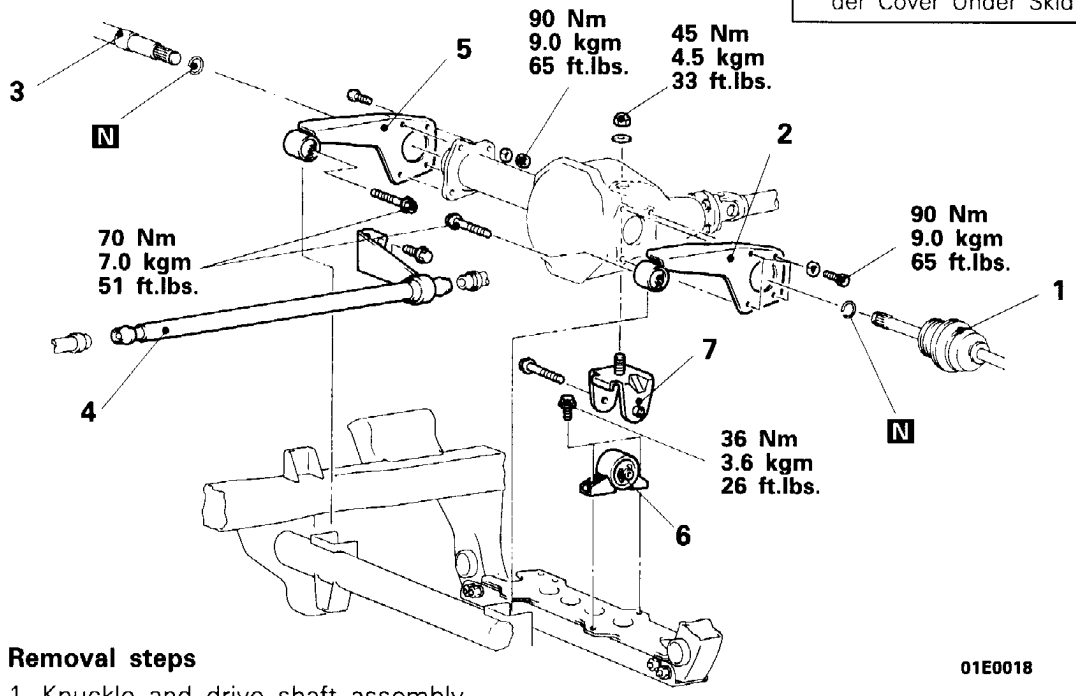
Caution
Do not distort rubber portions, and never stain rubber portions with fuel or oil.

FRONT DIFFERENTIAL MOUNTING

E32LA--

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Removal and Installation of the Air Guide Plate <3000, 3500>
- Removal and Installation of the Under Cover Under Skid Plate.



01E0018

Removal steps

1. Knuckle and drive shaft assembly (Refer to GROUP 26 – Knuckle, Drive Shaft.)
2. Differential mounting bracket (L.H.)
3. Inner shaft (Refer to GROUP 26 – Inner Shaft.)
4. Winch drive shaft (front) <Vehicles with mechanical winch>
5. Differential mounting bracket (R.H.)
6. Differential mounting bracket
7. Differential support bracket

SERVICE POINTS OF REMOVAL

E32LBAC

2. REMOVAL OF DIFFERENTIAL MOUNTING BRACKET (L.H.)/5. DIFFERENTIAL MOUNTING BRACKET (R.H.)/6. DIFFERENTIAL MOUNTING BRACKET

While supporting the differential carrier with a jack, remove the differential mounting bracket.

NOTE
Support the differential carrier with a jack until installing the differential mounting bracket.

INSPECTION

E32LCAC

- Check the differential mounting brackets for deformation and damage.
- Check the differential support bracket for deformation and damage.
- Check insulators for cracks, separation or deformation.

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FRONT SUSPENSION

CONTENTS

E33AA--

SPECIFICATIONS **2**
- General Specifications 2
- Service Specifications 2
- Sealants and Adhesives 3

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- Ball Joint Dust Cover Replacement 15

LOWER ARM **16**
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TORSION BAR **19**

STABILIZER BAR **21**

SHOCK ABSORBER CONTROL SWITCH **24**

SHOCK ABSORBER CONTROL UNIT **24**

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SPECIFICATIONS

GENERAL SPECIFICATIONS

E33CA--

Items	Standard specifications	Optional specifications
Suspension system	Independent, double wishbone with torsion bar and telescopic shock absorber	Independent, double wishbone with torsion bar and telescopic shock absorber
Torsion bar Length × O.D. mm (in.)		
<2400, 3000 – 12VALVE, 2500D>	1277.5 × 26.2 (50.295 × 1.031)	1277.5 × 27.0 (50.295 × 1.062)
<3000 – 24VALVE, 3500, 2800D>	1307.5 × 26.4 (51.476 × 1.039)	1307.5 × 27.2 (51.476 × 1.071)
Spring constant (wheel position) N/mm (kg/mm, lbs./in.)	25 (2.5, 140)	28 (2.8, 157)
Front shock absorbers Type	Hydraulic, cylindrical, double-acting type	Hydraulic, cylindrical, double-acting type with low-pressure nitrogen gas
Max. length mm (in.)	345 (13.6)	345 (13.6)
Min. length mm (in.)	225 (8.9)	230 (9.1)
Stroke mm (in.)	115 (4.5)	115 (4.5)
Damping force [at 0.3 m/sec (0.9 ft./sec.)] Expansion N (kg, lbs.)	2,450 (245, 540)	Hard: 3,150 (315, 694) Medium: 2,350 (235, 518) Soft: 1,700 (170, 375)
Contraction N (kg, lbs.)	1,500 (150, 331)	Hard: 1,600 (160, 353) Medium: 1,250 (125, 276) Soft: 850 (85, 187)

SERVICE SPECIFICATIONS

E33CB--

Items	Specifications
Standard value Toe-in	
At the centre of tyre tread mm (in.)	3.5 ± 3.5 (0.14 ± 0.14)
At the rim of disc wheel mm (in.)	1.8 ± 1.8 (0.07 ± 0.07)
Toe-in angle (per wheel)	0°–0°17′
Toe-out angle on turn (inner wheel when outer wheel is at 20°)	21° 56′

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Items		Specifications
Camber		0°40′ ± 30′
Caster		3°00′ ± 1°00′
Kingpin inclination		14°52′
Upper ball joint starting torque	Nm (kgcm, in.lbs.)	0.8–3.5 (8–35, 7–30)
Shock absorber attaching dimension	mm (in.)	
Normal shock absorber		1–2 (0.04–0.08)
Remote-controlled variable shock absorber		1.5–2.5 (0.06–0.10)
Anchor arm attaching dimension	mm (in.)	138 (5.43)
Clearance between bump stopper and bump stopper bracket	mm (in.)	21–23 (0.83–0.91)
Stabilizer attaching bolt end attaching dimension	mm (in.)	6–7 (0.24–0.28)
Stabilizer link ball joint starting torque	Nm (kgcm, in.lbs.)	1.7–3.2 (17–32, 15–28)
Limit		
Lower ball joint end play	mm (in.)	0.3 (0.012)

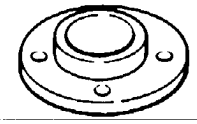
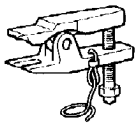
SEALANTS AND ADHESIVES

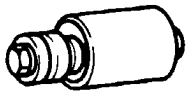
E33CE--

Items	Specified sealant
Upper ball joint dust cover to upper ball joint groove	3M ATD Part No. 8661 or equivalent

SPECIAL TOOLS

E33DA--

Tool	Number	Name	Use
	MB991034	Gauge attachment	Measurement of the wheel alignment
	MB991406	Steering linkage puller	Removal of ball joints and knuckle
	MB990685 or MB990968	Torque wrench	Measurement of the upper ball joint starting torque
	MB990326	Preload socket	Measurement of the upper ball joint starting torque

Tool	Number	Name	Use
	MB991522	Torsion bar bushing remover and installer base	Removal and press-fitting of the lower arm bushing (A)
	MB990883	Arbor	Removal and press-fitting of the lower arm bushing (B).
	MB990957	Lower arm bushing remover and installer	

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TROUBLESHOOTING
<Remote controlled variable shock absorbers>

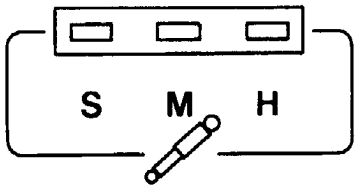
E33EAAF

SELECTION OF THE TROUBLESHOOTING CHART

Check the malfunction symptoms according to the following flow chart, and inspect according to the inspection chart.

Inspect with the engine idling

When the shock absorber control switch position is changed, do the indicators operate normally?



12E0025

No → Refer to Troubleshooting Chart [1] (malfunctions related to the indicators) (P.33-5).

Yes

When the control switch position is changed while the vehicle is being rocked up and down, does the damping force change? (Carry out at the 4 locations at front and rear, left and right)

No → Refer to Troubleshooting Chart [2] (malfunctions related to the dampers) (P.33-6).

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CHART CLASSIFIED BY THE MALFUNCTION SYMPTOM

TROUBLESHOOTING [1] (MALFUNCTIONS RELATED TO THE INDICATORS)

Trouble Symptom	Inspection	Diagnosis		Probable cause
		Normal	Problem	
Even when switched to S (soft) mode, the indicator does not illuminate.	(1) Remove the shock absorber control switch connector and earth the harness connector No. 4 terminal.	The indicator illuminates	The indicator remains off	• Broken wire in fuse No.11 in the junction block • Light-emitting diode is defective • Broken harness wire between the combination meter and either the junction block or the shock absorber control switch
	(2) Remove the shock absorber control switch connector and check for continuity between switch connector terminals No. 4 and No. 2 when the switch is set to S (soft).	Continuity	No continuity	• Shock absorber control switch is defective
	(3) When the results of inspection items (1) and (2) are normal.	–	–	• Broken harness wire between the control switch and the earth • Earth connection is defective
Even when switched to M (medium) mode, the indicator does not illuminate.	(1) Remove the shock absorber control switch connector and earth the harness connector No. 5 terminal.	The indicator illuminates	The indicator remains off	• Broken wire in fuse No. 11 in the junction block • Light-emitting diode is defective • Broken harness wire between the combination meter and either the junction block or the shock absorber control switch
	(2) Remove the shock absorber control switch connector and check for continuity between switch connector terminals No. 5 and No. 2 when the switch is set to M (medium).	Continuity	No continuity	• Shock absorber control switch is defective
	(3) When the results of inspection items (1) and (2) are normal.	–	–	• Broken harness wire between the shock absorber control switch and the earth • Earth connection is defective

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Trouble Symptom	Inspection	Diagnosis		Probable cause
		Normal	Problem	
Even when switched to H (hard) mode, the indicator does not illuminate.	(1) Remove the shock absorber control switch connector and earth the harness connector No. 6 terminal.	The indicator illuminates	The indicator remains off	• Broken wire in fuse No. 11 in the junction block • Light-emitting diode is defective • Broken harness wire between the combination meter and either the junction block or the shock absorber control switch
	(2) Remove the shock absorber control switch connector and check for continuity between switch connector terminals No. 6 and No. 2 when the switch is set to H (hard).	Continuity	No continuity	• Shock absorber control switch is defective
	(3) When the results of inspection items (1) and (2) are normal.	–	–	• Broken harness wire between the shock absorber control switch and the earth • Earth connection is defective

TROUBLESHOOTING CHART [2] (MALFUNCTION RELATED TO THE DAMPERS)

A Part of the damping force does not change.

NOTE
When the front or rear left and right mutual damping forces do not change, the problem is probably a broken harness wire between the actuator and either the shock absorber control unit or the shock absorber control switch, so the harness should be checked first.

Swap the actuators in the left and right wheels and check that the damping force is changed over by operation of the shock absorber control switch.

Has the malfunction disappeared?

No (The malfunction appears at the other wheel) → Actuator is defective

No → The malfunction remains on the initial wheel.

Remove the malfunctioning actuator.

Does the control rod inside the piston rod turn easily?

No → Shock absorber assembly is defective

Yes → Broken harness wire or short between the actuator and either the shock absorber control unit or the shock absorber control switch

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B Damping force for all wheels does not change over.

Remove the shock absorber control unit connector.

Yes ↓

When the ignition switch is turned to ON, does a voltage of approximately 12 V show between the harness connector terminal No. 4 of the shock absorber control unit and the earth?

No → Broken harness wire between the shock absorber control unit and the junction block

Yes ↓

Is there continuity between the harness connector No. 1 terminal of the shock absorber control unit and the earth?

No → Broken harness wire between the shock absorber control unit and the earth

Yes ↓

Is there normal continuity between the shock absorber control unit harness connector terminal No. 3 and the earth, No. 7 and the earth, and No. 2 and the earth?

<When normal>

Terminal \ Mode	S (soft)	M (medium)	H (hard)
No. 3	Continuity	No continuity	No continuity
No. 7	No continuity	Continuity	No continuity
No. 2	No continuity	No continuity	Continuity

No → Broken harness wire between the shcok absorber control unit and the shcok absorber control switch

Yes ↓

When 12 V is applied to the harness connector No. 6 terminal of the shock absorber control unit, does the damping force change over?

No → Broken harness wire or short between the actuator and either the shock absorber control unit or the shock absorber control switch

Yes → Shock absorber control unit connection is defective, or the shock absorber control unit is defective

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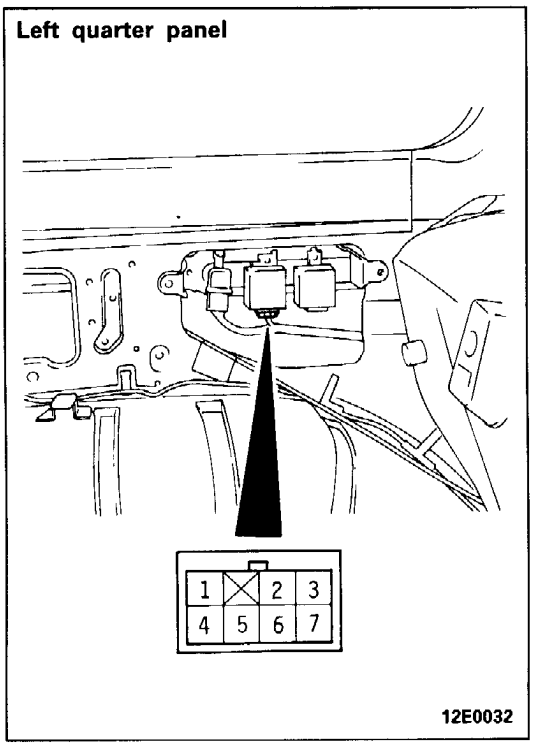

SHOCK ABSORBER CONTROL UNIT SIGNAL CIRCUIT INSPECTION

(1) Remove the shock absorber control unit connector, and inspect the harness-side connector.

BV: Battery Voltage

Terminal No.	Connection destination	Measure-ment	Tester connection	Check condition		Standard
1	Earth	Continuity	1 – Earth	Constantly		Continuity
2	Shcok absorber control switch (Hard)	Continuity	2 – Earth	Shcok absorber control switch condition	S (Soft mode)	No continuity
					M (Medium mode)	No continuity
					H (Hard mode)	Continuity
7	Shcok absorber control switch (Medium)	Continuity	7 – Earth	Shcok absorber control switch condition	S (Soft mode)	No continuity
					M (Medium mode)	Continuity
					H (Hard mode)	No continuity
3	Shcok absorber control switch (Soft)	Continuity	3 – Earth	Shcok absorber control switch condition	S (Soft mode)	Continuity
					M (Medium mode)	No continuity
					H (Hard mode)	No continuity
4	Power supply	Voltage	4 – Earth	Ignition switch	OFF	0 V
					ON	BV

(2) Connect the shock absorber control unit and inspect.

Terminal No.	Connection destination	Measure-ment	Tester connection	Check condition	Standard
6	Shock absorber actuator	Voltage	6 – Earth	5 seconds after operating the shock absorber control switch	Approx. 12 V
				Conditions except for above	0 V

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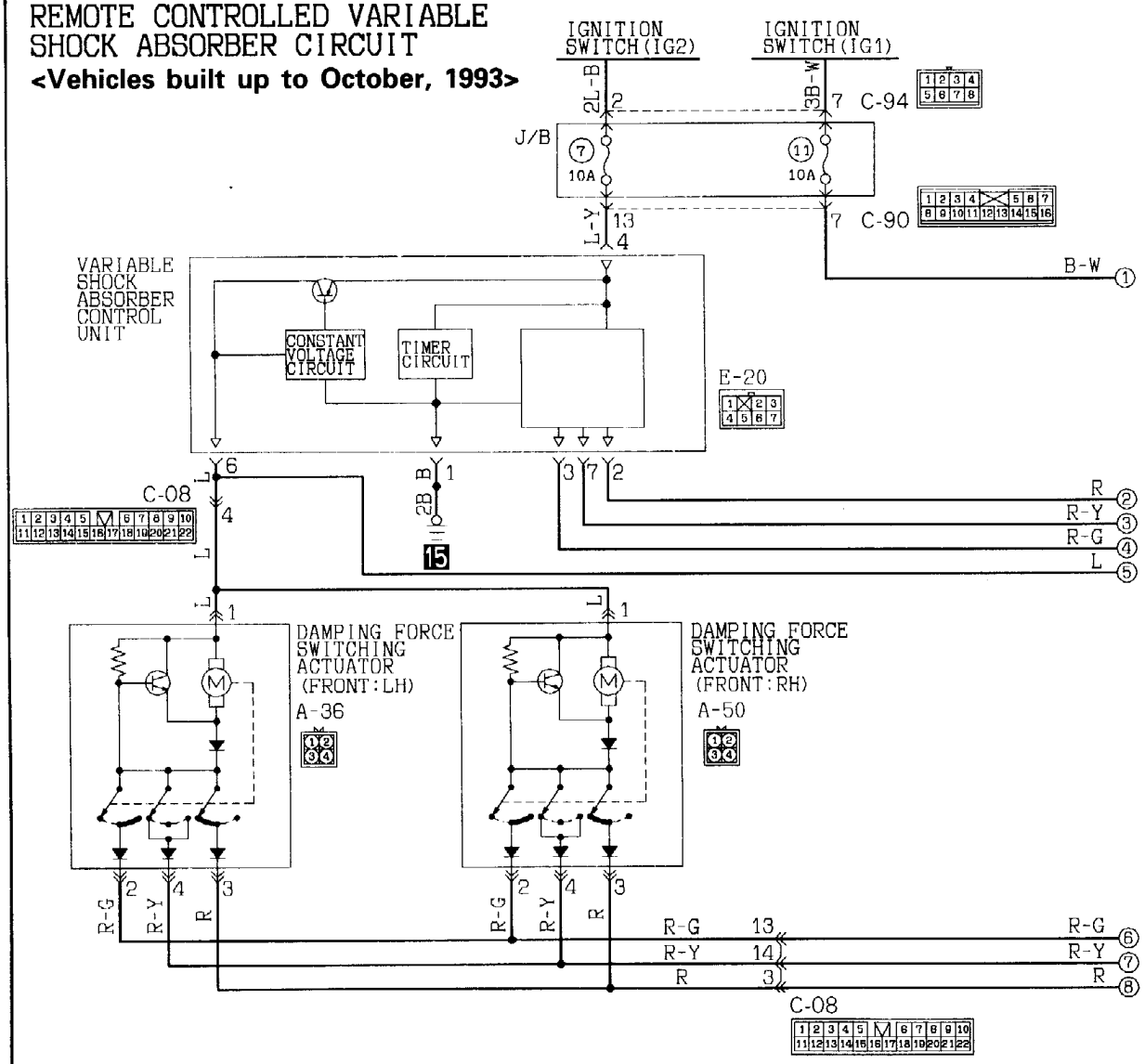
REMOTE CONTROLLED VARIABLE SHOCK ABSORBER CIRCUIT

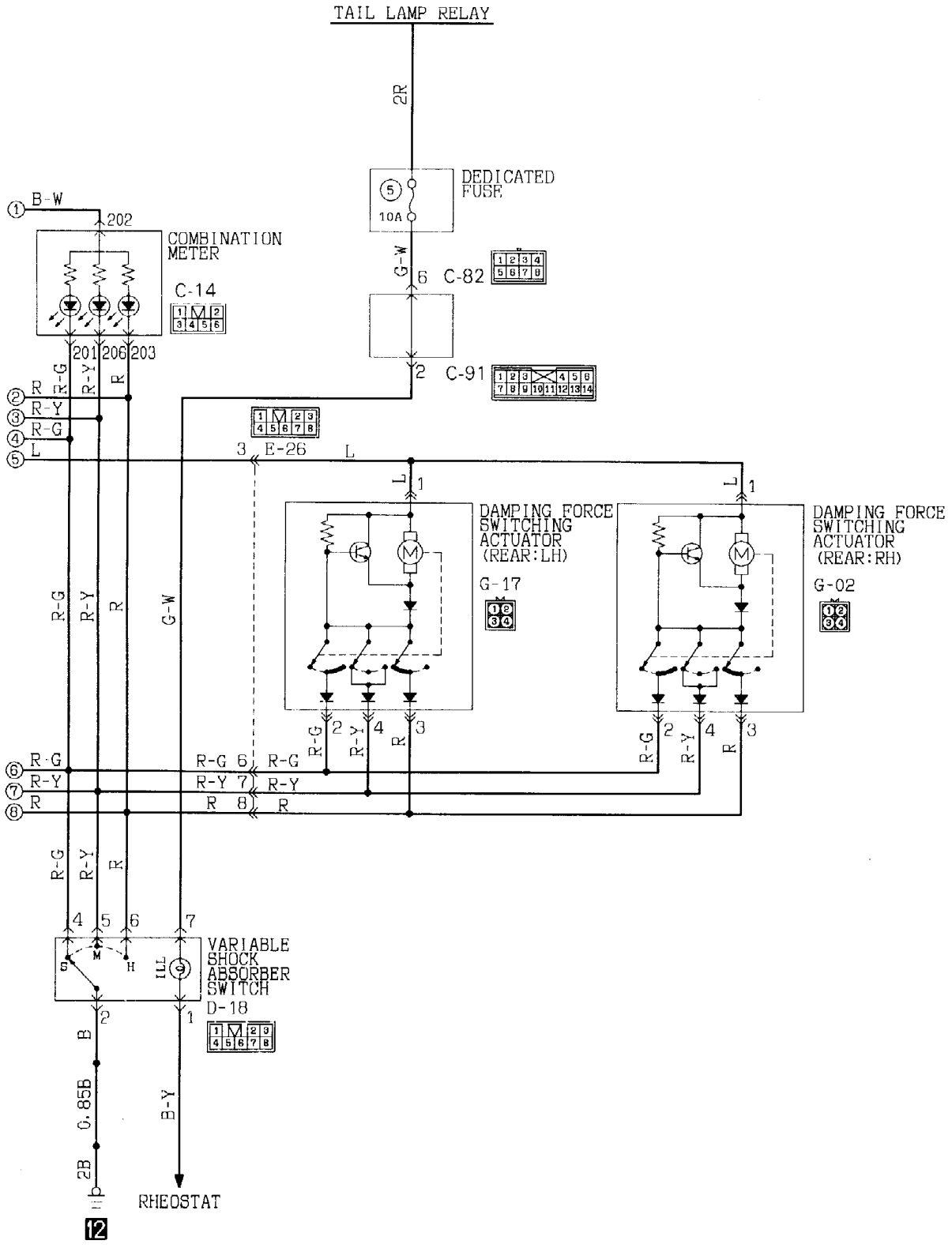
<Vehicles built up to October, 1993>



Wire colour code

B:Black	LG:Light green	G:Green	L:Blue	W:White	Y:Yellow	SB:Sky blue
BR:Brown	O:Orange	GR:Gray	R:Red	P:Pink	V:Violet	

KX35-AC-Q1504-EC


TAIL LAMP RELAY
2R
DEDICATED FUSE
10A
G-W
6 C-82
2 C-91
B-W
202
COMBINATION METER
C-14
201 206 203
R
R-G
R-Y
L
3 E-26
DAMPING FORCE SWITCHING ACTUATOR (REAR:LH)
G-17
DAMPING FORCE SWITCHING ACTUATOR (REAR:RH)
G-02
R-G 6
R-Y 7
R 8
VARIABLE SHOCK ABSORBER SWITCH
D-18
B
0.85B
2B
B-Y
RHEOSTAT
12

REMOTE CONTROLLED VARIABLE SHOCK ABSORBER CIRCUIT

<Vehicles built from November, 1993>

Refer to REMOTE CONTROLLED VARIABLE SHOCK ABSORBER SYSTEM of '94 PAJERO Workshop Manual Electrical Wiring (Pub No. PHJE 9026).

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NOTES

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SERVICE ADJUSTMENT PROCEDURES

FRONT WHEEL ALIGNMENT INSPECTION AND ADJUSTMENT

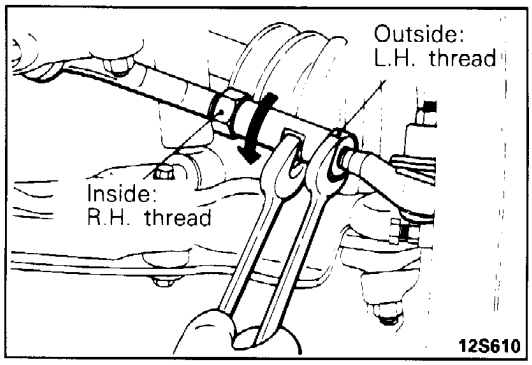
E33FAAW

TOE-IN

1. Measure the toe-in.

Standard value:

At the centre of tyre tread	**3.5 ± 3.5 mm (0.14 ± 0.14 in.)**
At the rim of disc wheel	**1.8 ± 1.8 mm (0.07 ± 0.07 in.)**
Toe angle (per wheel)	**0°–0°17′**



2. If the toe-in is not within the standard value, adjust the toe-in by turning the left and right tie rod turnbuckles by the same amount (in opposite directions).

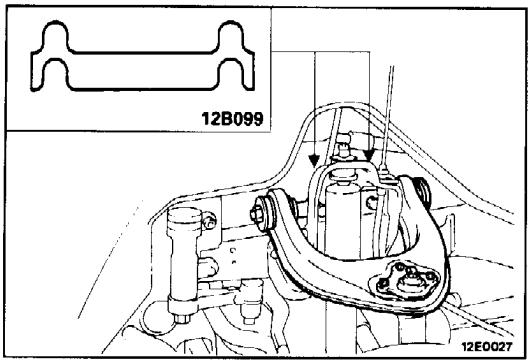
Caution
The difference between the left and right tie rods shall not exceed 5 mm (0.2 in.).

3. After making the adjustments, use a turning radius gauge to confirm that the steering wheel turning angle is within the standard value range. (Refer to GROUP 37.)

TOE-OUT ANGLE ON TURNS

To check the steering linkage, especially after the vehicle has been involved in an accident or if an accident is presumed, it is advisable to check the toe-out angle on turns in addition to the wheel alignment.
Conduct this test on the left turn as well as on the right turn.

Standard value: **21°56′ (inner wheel when outer wheel at 20°)**



CAMBER

Standard value:
CAMBER
0°40′ ± 30′
(Left/right deviation within 30′)

1. Make adjustment of the camber by increasing or decreasing the thickness of the adjusting shim provided between the upper arm shaft and the crossmember.

NOTE
- Standard thickness of the shim is 4 mm (0.16 in.).
- Number of shims is three or less.

Camber adjustment shim (yellow plating)

Part number	Thinkness mm (in.)
MB176288 MB176289	1.0 (0.039) 2.0 (0.079)

CASTER

Standard value: 3°00′±1°
(Left/right deviation within 30′)

NOTE
1. Caster is pre-set at the factory and cannot be adjusted.
2. If caster is not within the standard value, replace bent or damaged parts.

KINGPIN INCLINATION

Standard value: 14°52′

SIDE SLIP

Measure the side slip with a side slip tester.

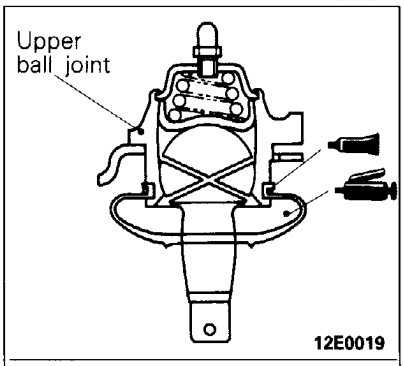
Standard value: 0±3 mm (0±0.12 in.)

SHOCK ABSORBER AND UPPER ARM

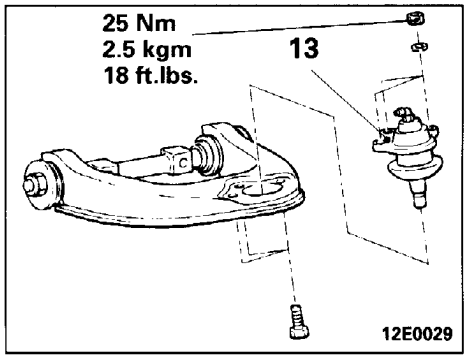
E33GA--

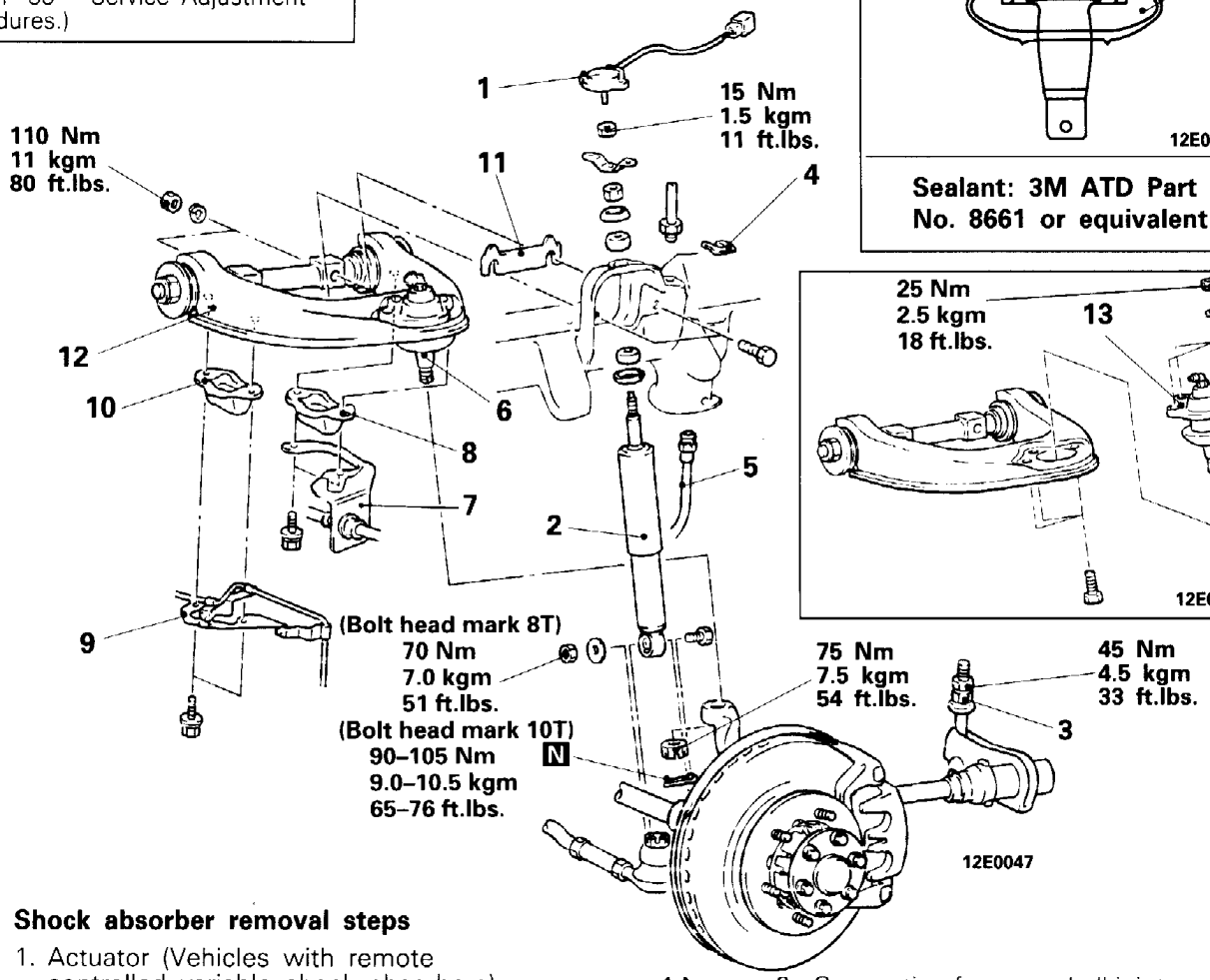
REMOVAL AND INSTALLATION

Post-installation Operation
- Inspection and Adjustment of Wheel Alignment (Refer to P.33-12.)
- Brake line Bleeding (Refer to GROUP 35 – Service Adjustment Procedures.)



Sealant: 3M ATD Part No. 8661 or equivalent

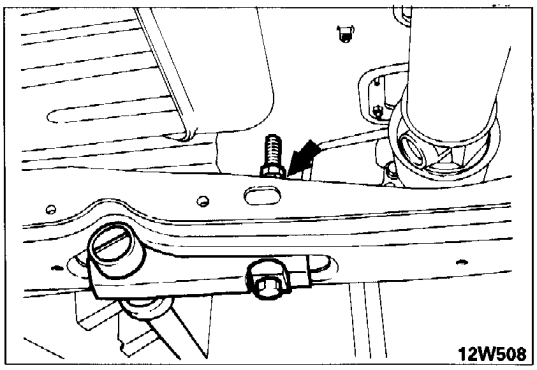




Shock absorber removal steps
- ◆◆ 1. Actuator (Vehicles with remote controlled variable shock absorbers)
- ◆◆ 2. Shock absorber

Upper arm removal steps

Adjustment of clearance between bump stopper and bump stopper bracket (Refer to P.33-20).
- ◆◆ 3. Anchor arm assembly adjusting nut
- 4. Hose clip
- 5. Brake hose connection
- ◆◆ 6. Connection for upper ball joint and knuckle
- 7. Brake hose support
- 8. Rebound stopper
- 9. Speed sensor bracket (Vehicles with A.B.S.)
- 10. Rebound stopper
- 11. Shim
- ◆◆ 12. Upper arm
- 13. Upper ball joint



SERVICE POINTS OF REMOVAL

E33GBAE

3. LOOSENING OF ANCHOR ARM ASSEMBLY ADJUSTING NUT

Loosen the anchor bolt of the torsion bar all the way.

NOTE
When the anchor arm assembly adjusting nut is loosened, use a jack to support the lower arm of the side to be loosened, thus the work easier.

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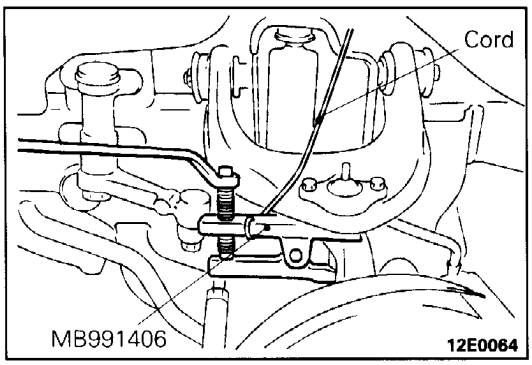
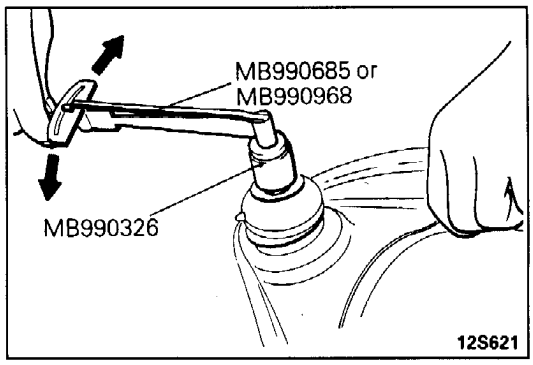


6. DISCONNECTION OF UPPER BALL JOINT AND KNUCKLE

Using the special tool, disconnect the upper arm ball joint from the knuckle.

Caution

1. **Be sure to tie the cord of the special tool to the nearby part.**
2. **Loosen the nut but do not remove it.**



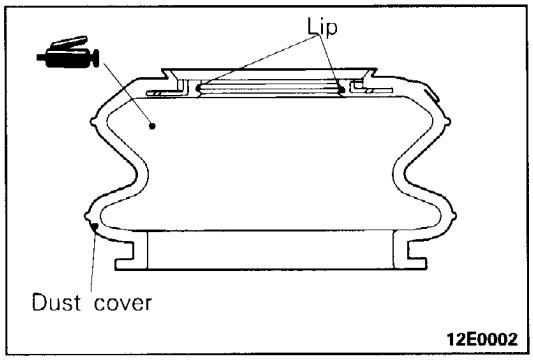
INSPECTION E33GCAE

UPPER BALL JOINT STARTING TORQUE CHECK

1. Measure the upper ball joint starting torque by using special tools.

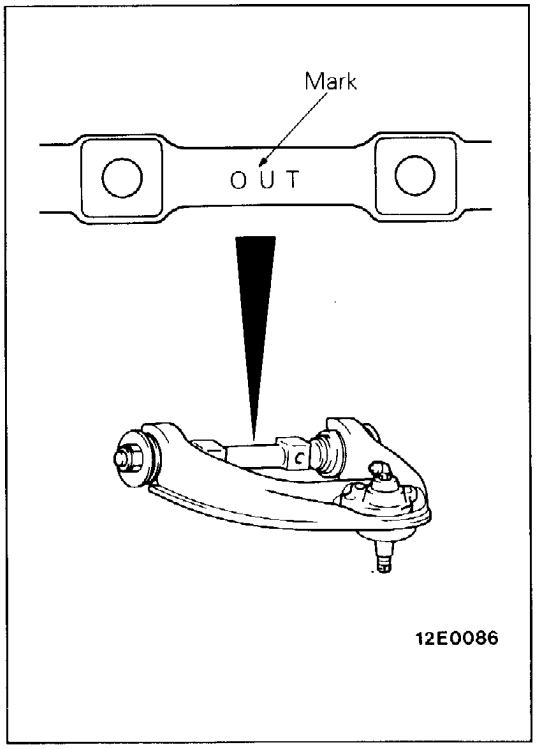
   Standard value: 0.8–3.5 Nm (8–35 kgcm, 7–30 in.lbs.)

2. If the upper ball joint starting torque is out of specification, replace the upper ball joint.



BALL JOINT DUST COVER REPLACEMENT

1. Remove the dust cover.
2. Apply multipurpose grease to both the interior of dust cover and the upper ball joint.



SERVICE POINT OF INSTALLATION E33GEAF

12. INSTALLATION OF UPPER ARM <Vehicles built from November, 1993>

Install the upper arm so that the OUT mark on the upper arm shaft is facing towards the outside of the vehicle.

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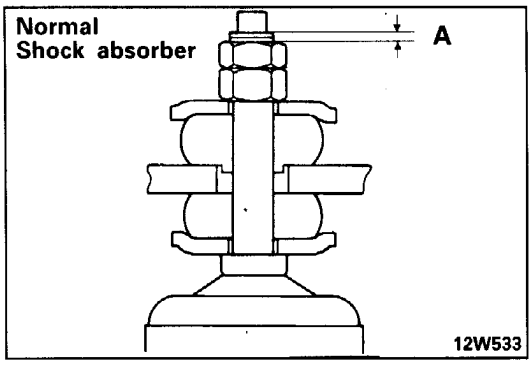

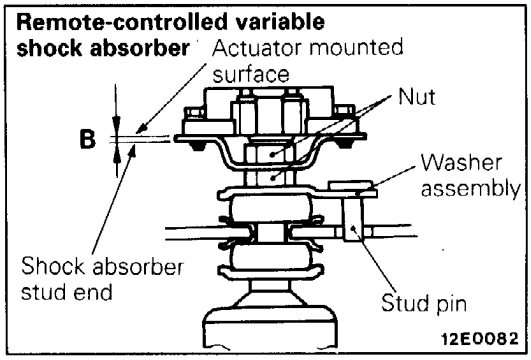

2. INSTALLATION OF SHOCK ABSORBER/1. ACTUATOR (VEHICLES WITH REMOTE-CONTROLLED VARIABLE SHOCK ABSORBER)

Tighten the shock absorber installation nut so that the dimension shown in the figure (A and B) is the standard value.

Standard value A: 1–2 mm (0.04–0.08 in.)
B: 1.5–2.5 mm (0.06–0.10 in.)

Caution
When tightening the nut, be careful not to bend the stud pin of the washer assembly.

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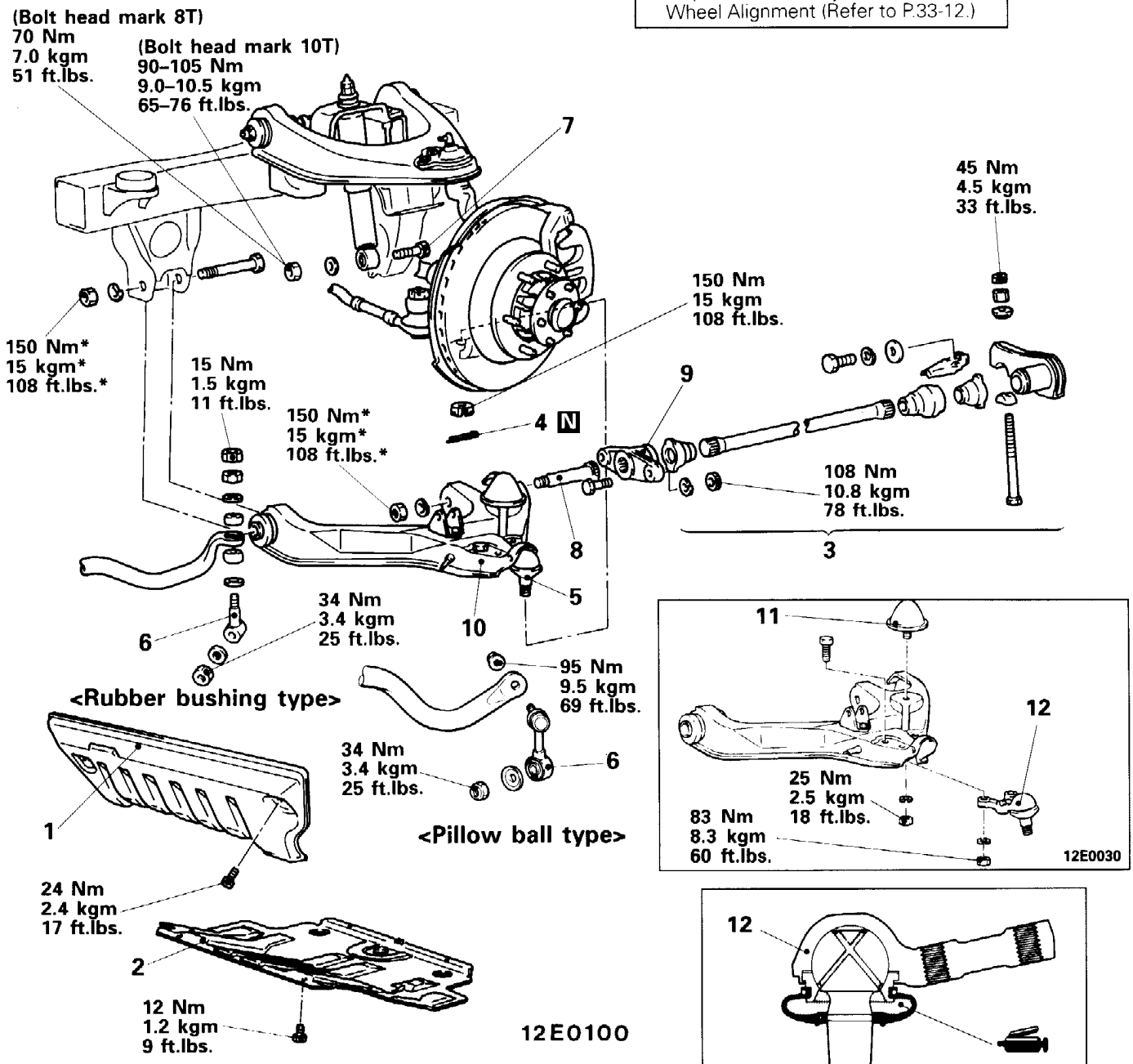
NOTES

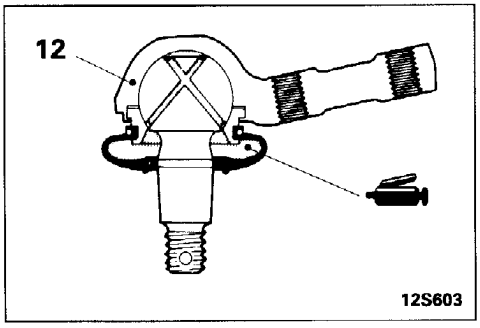
LOWER ARM

E33HA--

REMOVAL AND INSTALLATION

Post-installation Operation
- Inspection and Adjustment of Wheel Alignment (Refer to P.33-12.)



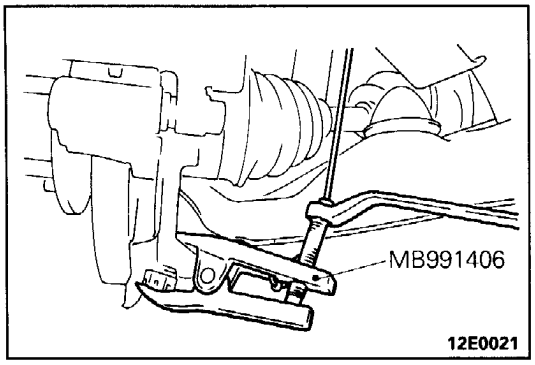


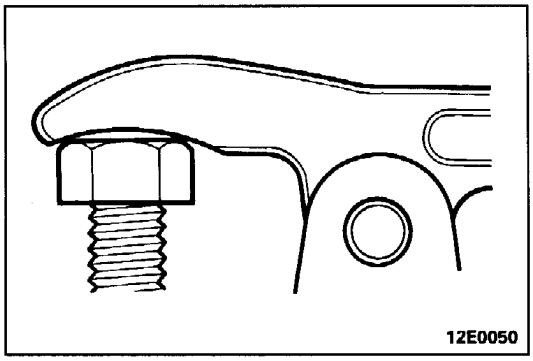
Removal steps

1. Under skid plate
2. Under cover
   Adjustment of clearance between bump stopper and bump stopper bracket (Refer to P.33-20.)
3. Torsion bar (Refer to P.33-19.)
4. Split pin
5. ◀▶ Connection for lower ball joint and knuckle
6. ▶◀ Stabilizer link assembly (Refer to P.33-21.)
7. Shock absorber mounting bolts
8. Lower arm shaft
9. Anchor arm B
10. Lower arm
11. Bump stopper
12. Lower ball joint

Caution

***: Indicates part which should be temporarily tightened, and then fully tightened with the vehicle on the ground in the unladen condition.**





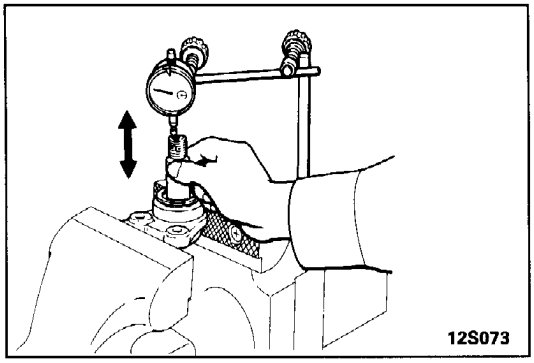
SERVICE POINT OF REMOVAL E33HBAD

5. DISCONNECTION OF LOWER BALL JOINT AND KNUCKLE

Using the special tool, disconnect the lower arm ball joint from the knuckle.

Caution

1. **Be sure to tie the cord of the special tool to the nearby part.**
2. **Loosen the nut but do not remove it.**
3. **Insert the special tool securely.**

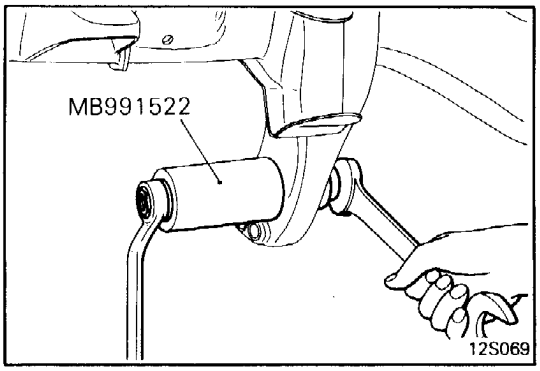


INSPECTION E33HCAE

LOWER BALL JOINT END PLAY

Check the lower ball joint end play by following the steps below.

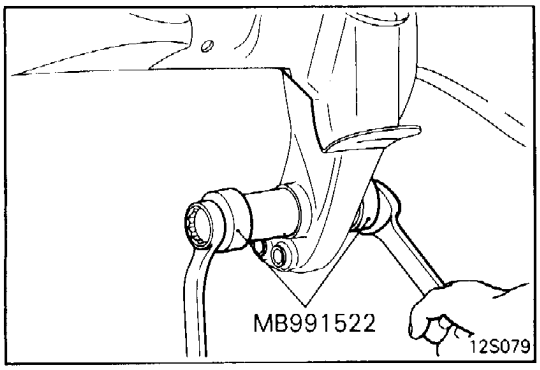
1. Measure the lower ball joint end play with a dial indicator.
   Limit: 0.3 mm (0.012 in.)
2. If the lower ball joint end play exceeds the service limit, replace the lower ball joint.



LOWER ARM BUSHING (A) REPLACEMENT

1. Using the special tool, remove the bushing A from the bracket.

   NOTE
   When removing the left hand bushing A, detach the differential carrier. (Refer to Group 26.)



2. Using the special tool, press-fit the bushing A into the bracket.

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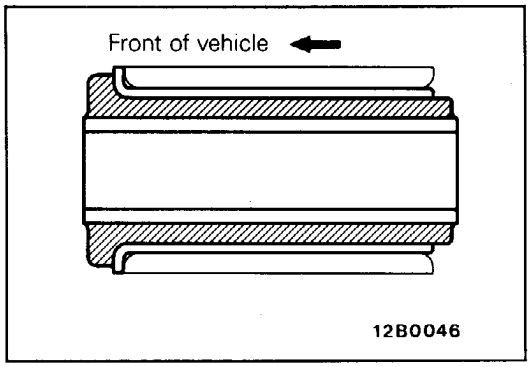
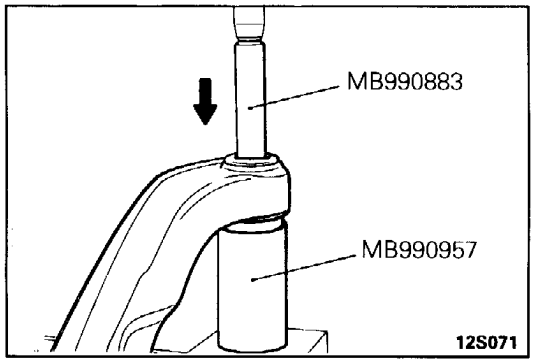
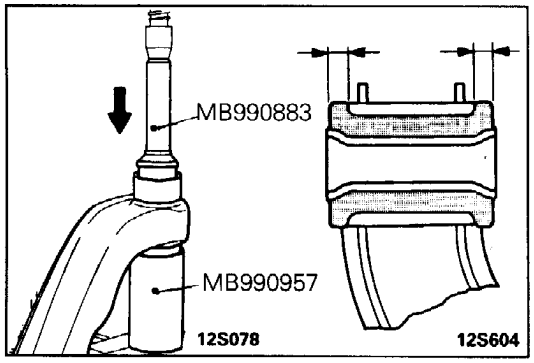


NOTE
Install the bushing A in a arrow direction.



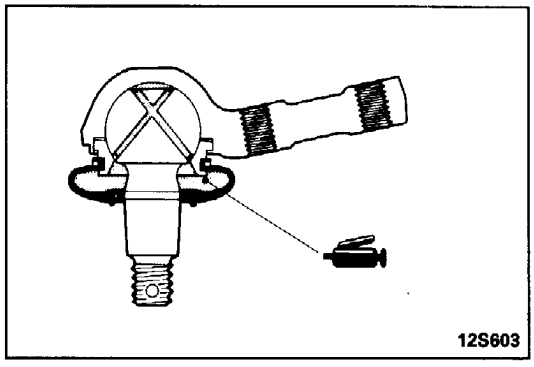
LOWER ARM BUSHING (B) REPLACEMENT E33HDAF

1. Remove the bushing B from the lower arm by using special tools.



2. Coat the bushing B and the lower arm with soap solution and press-fit the bushing B into the lower arm by using special tools and taking care not to twist or tilt the bushing B.

   NOTE
   Press-fit the bushing again from the opposite side to equalize bushing projections at both ends.



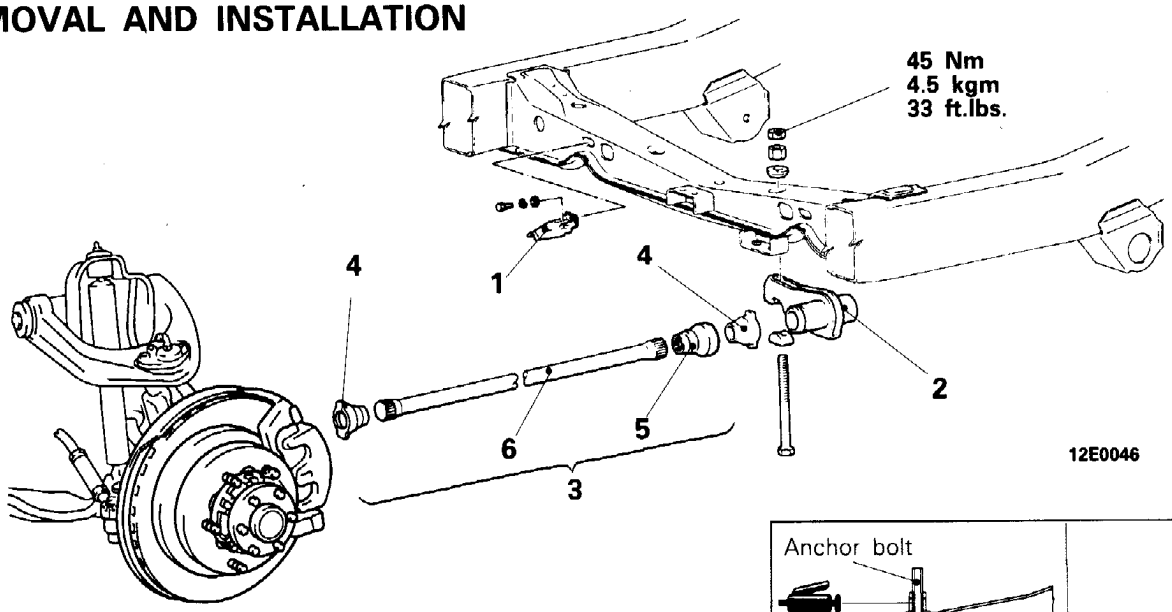
LOWER BALL JOINT DUST COVER REPLACEMENT E33HEAE

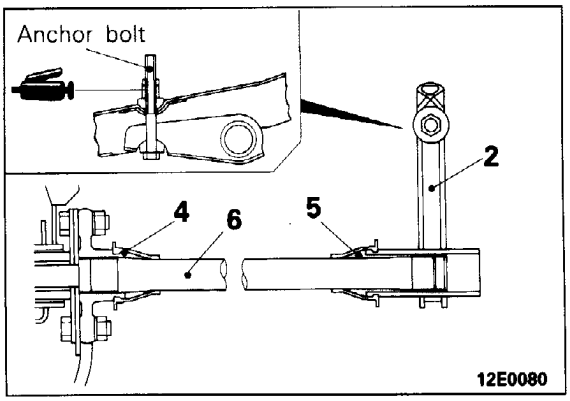
1. Apply multipurpose grease to the interior of the dust cover and the lower ball joint.
2. Secure the dust cover to the lower ball joint with a ring.

TORSION BAR

E331A--

REMOVAL AND INSTALLATION





Removal steps

1. Heat protector (right side only)
- ◆◆ • Adjustment of clearance between bump stopper and bump stopper bracket
2. Anchor arm assembly
- ◆◆ 3. Torsion bar assembly
4. Dust covers
5. Heat cover (right side only)
6. Torsion bar

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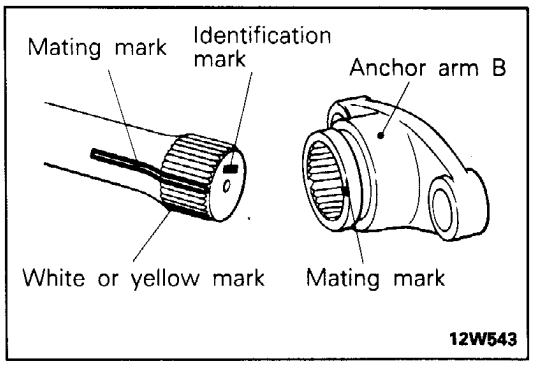
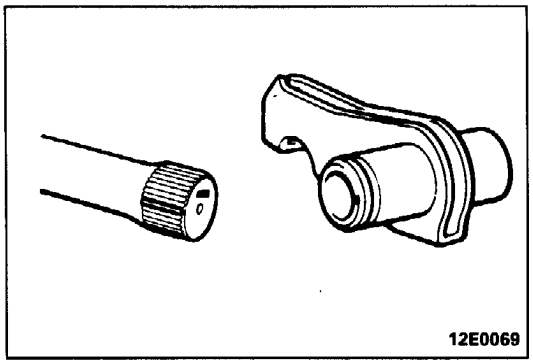


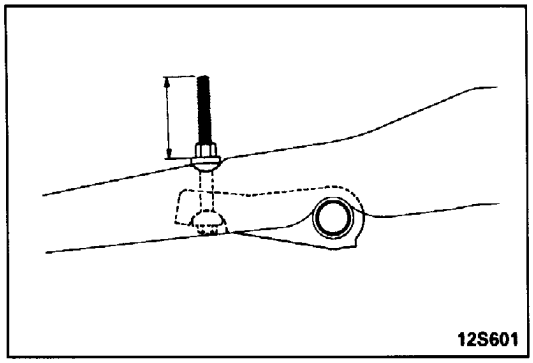
SERVICE PPOINTS OF INSTALLATION E33IDAG

3. INSTALLATION OF TORSION BAR ASSEMBLY

(1) Check the identification marks at the end of the left and right shock absorbers.
R →for right side
L →for left side

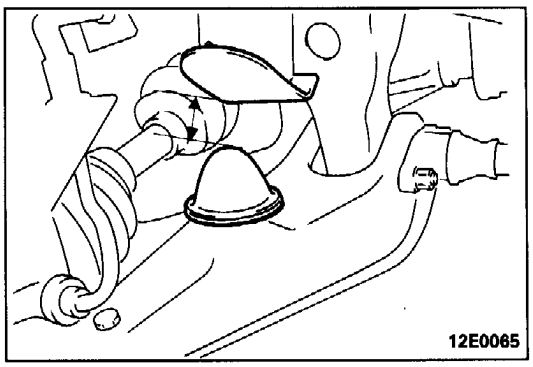


(2) When installing the torsion bar, align the white mark on the serrated section of the torsion bar with the mating mark on the anchor arm.



- **ADJUSTMENT OF CLEARANCE BETWEEN BUMP STOPPER AND BUMP STOPPER BRACKET**

(1) Tighten the adjusting nut until the protruding length of the anchor bolt is 80 mm (3.15 in.) or less.



(2) With the vehicle in an unladen condition, measure the distance from the bump stopper to the bump stopper bracket to check if it is at the standard value.

Standard value: 21–23 mm (0.83–0.91 in.)

(3) If outside the standard value, adjust the anchor bolt with the adjusting nut.

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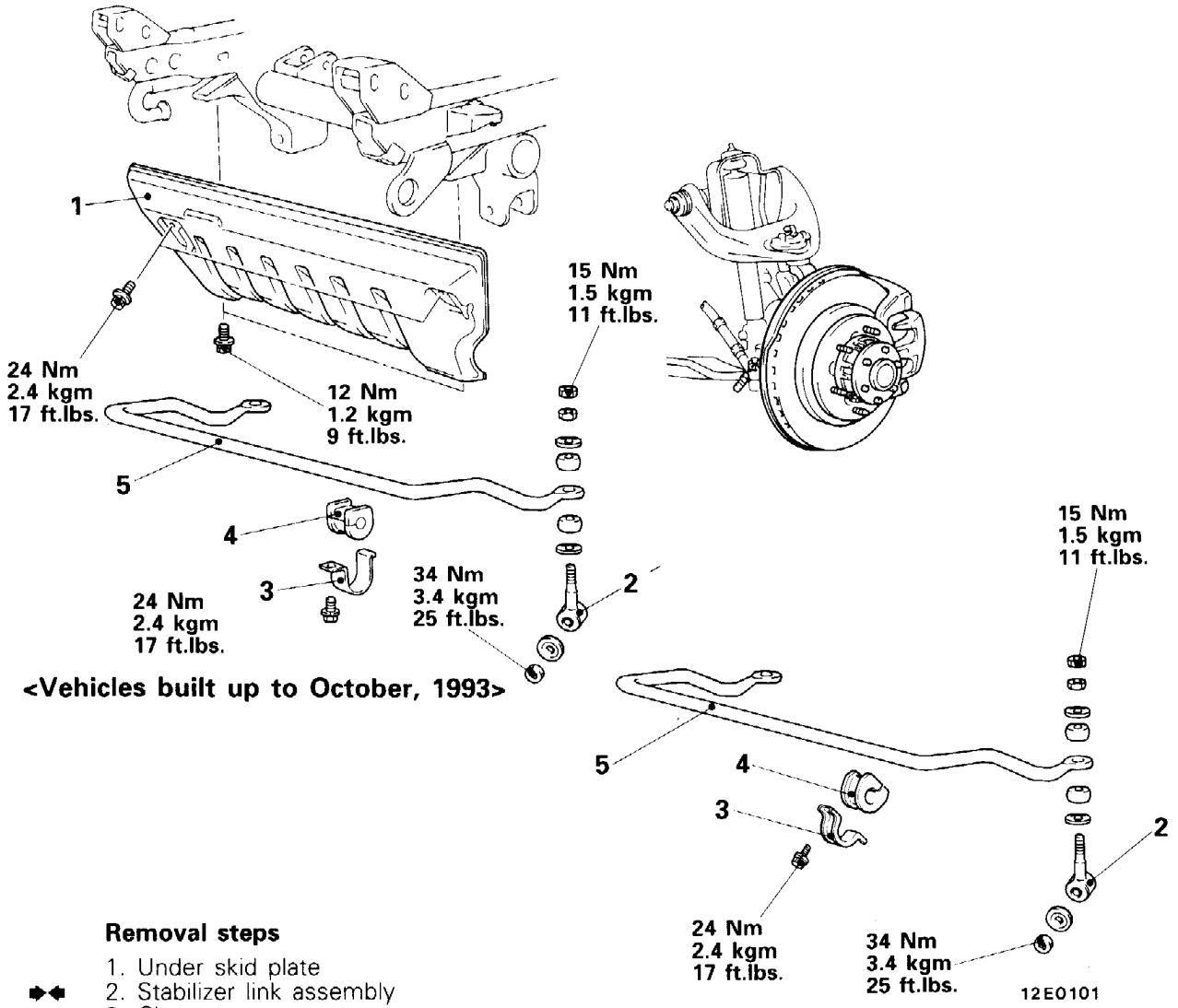
STABILIZER BAR

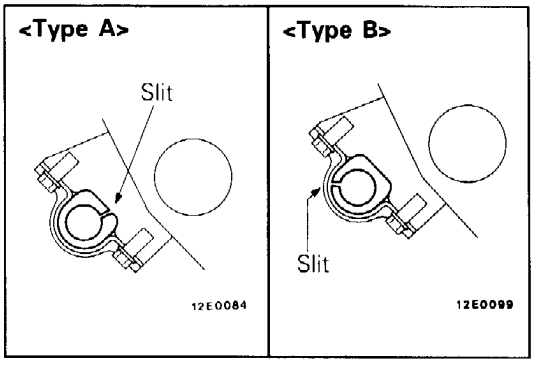
E33KA--

<RUBBER BUSHING TYPE>
REMOVAL AND INSTALLATION



Removal steps

1. Under skid plate
2. Stabilizer link assembly
3. Clamp
4. Bushing
5. Stabilizer bar



SERVICE POINTS OF INSTALLATION

E33KDAE

4. INSTALLATION OF BUSHING
<Vehicles built from November, 1993>

Check which type of busing is being used by the position of the slit, and then install the bushing so that the slit is in the position shown in the illustration.

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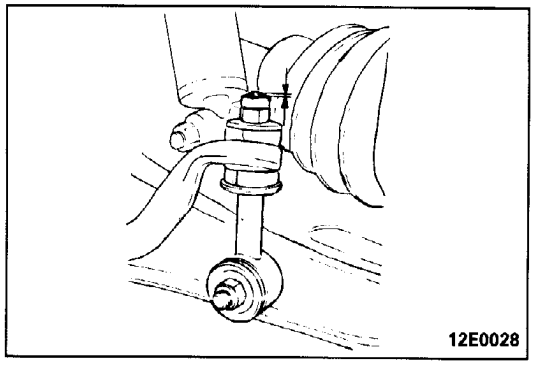
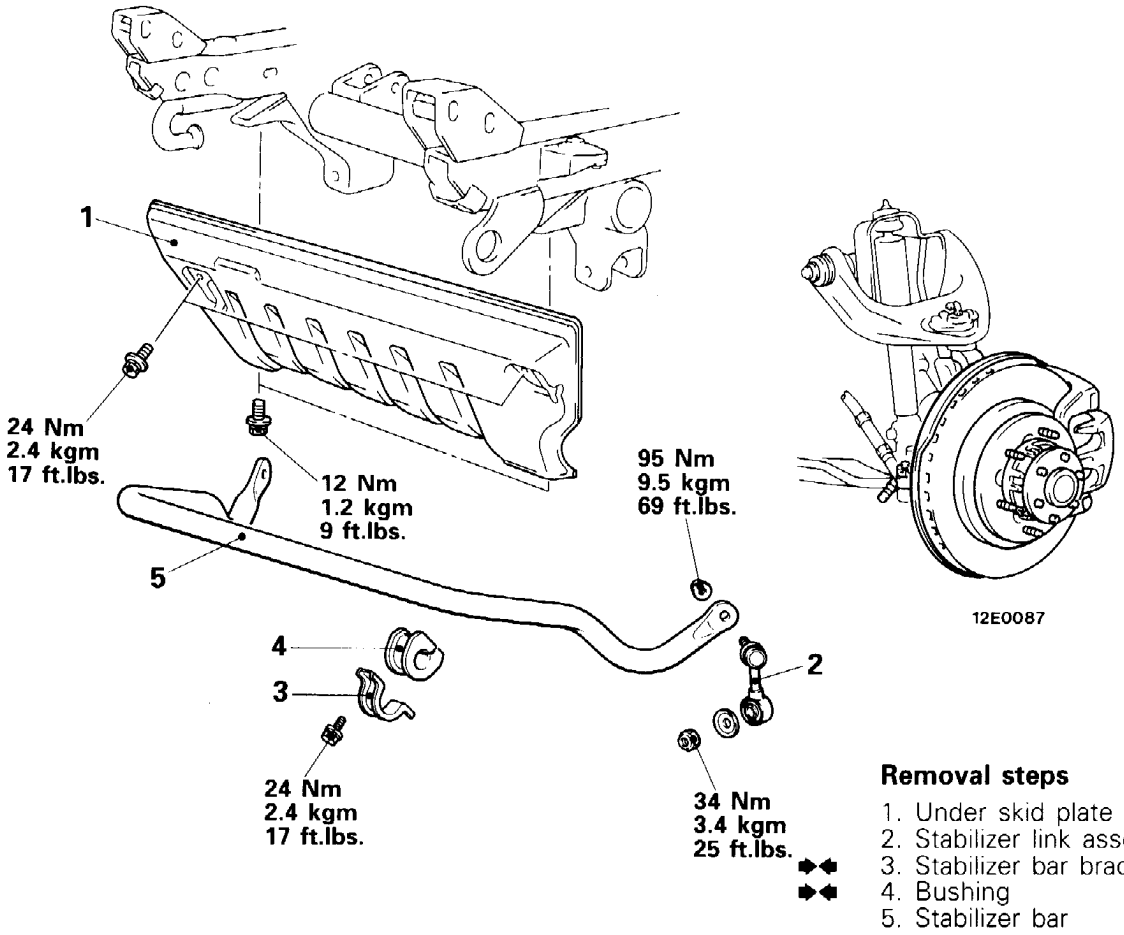


2. INSTALLATION OF STABILIZER LINK ASSEMBLY

Tighten the adjusting nut so that the dimensions shown in the figure are at the standard value.

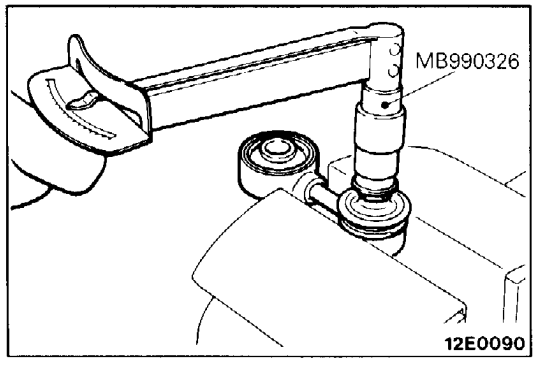
Standard value: 6–7 mm (0.24–0.28 in.)

<PILLOW BALL TYPE> REMOVAL AND INSTALLATION



Removal steps

1. Under skid plate
2. Stabilizer link assembly
3. Stabilizer bar bracket
4. Bushing
5. Stabilizer bar



INSPECTION

STABILIZER LINK BALL JOINT FOR STARTING TORQUE CHECK

Standard value: 1.7–3.2 Nm (17–32 kgcm, 15–28 in.lbs.)

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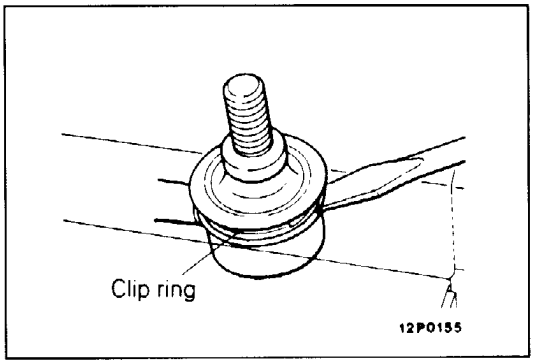
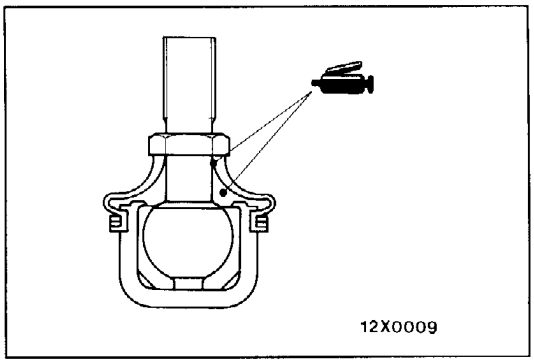
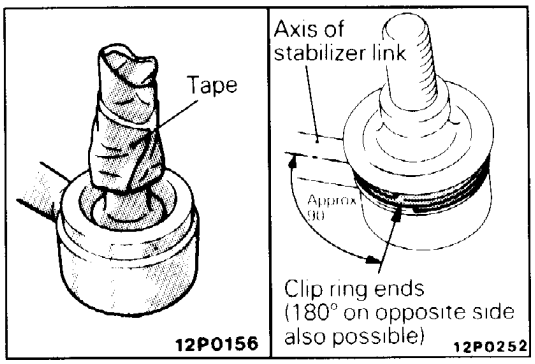
BALL JOINT DUST COVER REPLACEMENT



(1) Remove the clip ring and the dust cover.



(2) Apply multi-purpose grease to the lip and inside of the dust cover.

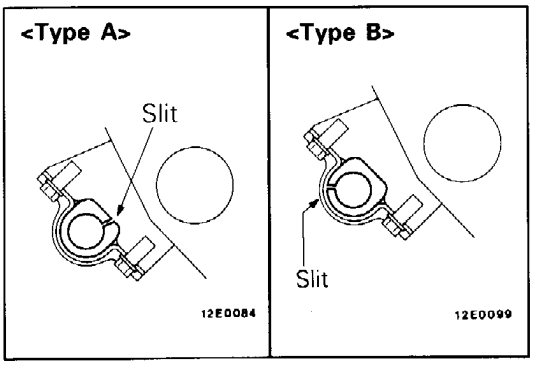


(3) Use vinyl tape to tape the stabilizer link where shown in the illustration, and then install the dust cover to the stabilizer link.
(4) Secure the dust cover with the clip ring.

NOTE
When installing the clip ring, align it so that its ends are located at a 90° angle from the axis of the stabilizer link.

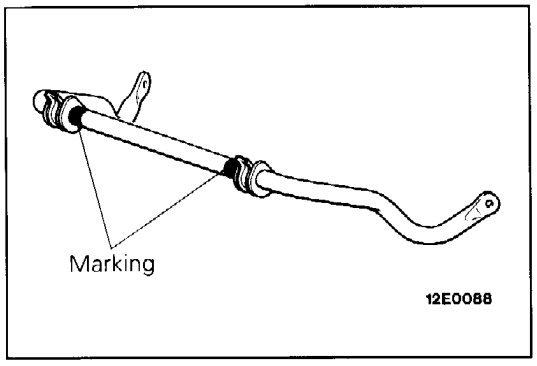
SERVICE POINTS OF INSTALLATION

4. INSTALLATION OF BUSHING



Check which type of busing is being used by the position of the slit, and then install the bushing so that the slit is in the position shown in the illustration.

3. INSTALLATION OF STABILIZER BAR BRACKET



Position the stabilizer bar so that the marking on the stabilizer bar and the edge of the bracket becomes the reference value, and then tighten the stabilizer bar bracket mounting bolt.

Reference value: Approx. 10 mm (0.4 in.)

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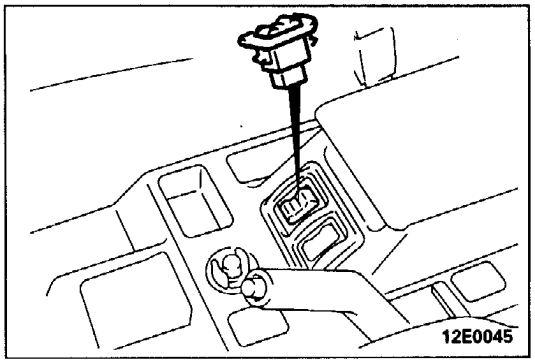
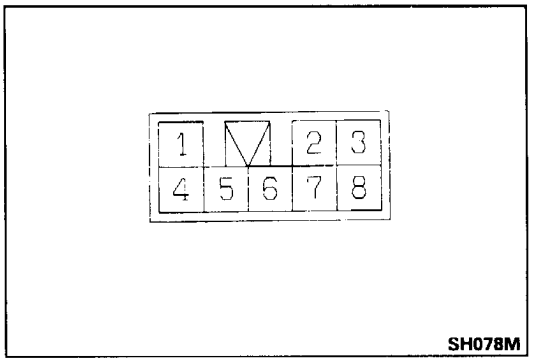


SHOCK ABSORBER CONTROL SWITCH

E33UA--

REMOVAL AND INSTALLATION



INSPECTION

E33UABA

Operate the switch to check for continuity between terminals.

Switch position \ Terminal	4	5	6	2	7	1
H (Hard)			○	○		
M (Medium)		○		○		○
S (Soft)	○			○		

NOTE
○–○ indicates that there is continuity between the terminals.

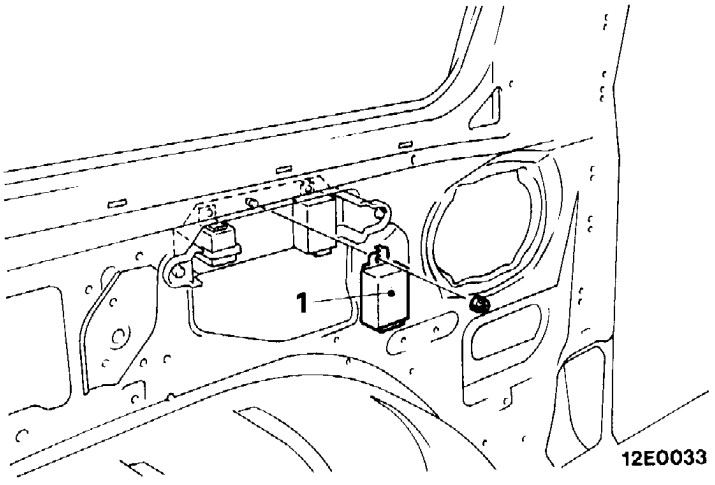
SHOCK ABSORBER CONTROL UNIT

E33UB--

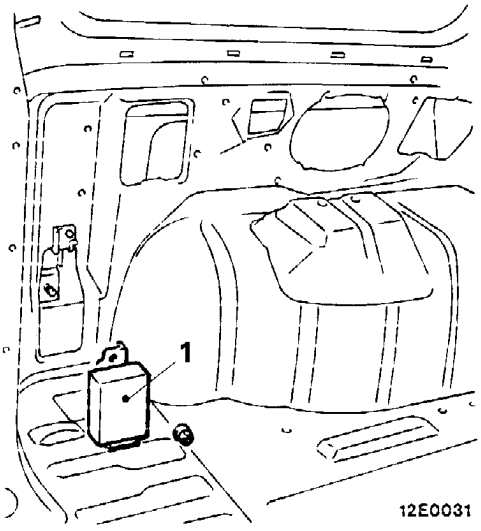
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Removal and Installation of Quarter Trim Lower (Refer to GROUP 52 – Trims.)

<Standard wheelbase>



<Long wheelbase>



1. Shock absorber control unit

INSPECTION

E33UBBA

Refer to TROUBLESHOOTING.

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REAR SUSPENSION

CONTENTS

E34AA--

SPECIFICATIONS **2**
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SPECIAL TOOLS **3**
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SERVICE ADJUSTMENT PROCEDURES **3-1**
Rear Wheel Alignment 3-1
LOWER ARM **4**
Lower Arm Rear Bushing Replacement 4
SHOCK ABSORBER AND LATERAL ROD **6**
Lateral Rod Bushing Replacement 7
COIL SPRING AND AXLE BUMPER **8**
STABILIZER BAR **9**

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SPECIFICATIONS

GENERAL SPECIFICATIONS

<Vehicles built up to October, 1993>

E34CA--

Items	V21C, V24C	V21W, V23C, V23W, V24W	V41W, V43W, V44W
Suspension system	Coil spring type 3-link rigid axle suspension	Coil spring type 3-link rigid axle suspension	Coil spring type 3-link rigid axle suspension
Coil spring			
Wire dia. × O.D. × free length mm (in.)	13.4–14.5 x 159.4–160.5 x 422.5 (0.53–0.57 x 6.28–6.32 x 16.63) [13.4–15.0 x 159.4–161 x 391 (0.53–0.59 x 6.28–6.34 x 15.39)]	13.4–14.5 x 159.4–160.5 x 435.5 or *424 (0.53–0.57 x 6.28–6.32 x 17.15 or *16.70) [13.4–15.0 x 159.4–161 x 401.5 or *390.5 (0.53–0.59 x 6.28–6.34 x 15.81 or *15.37)]	14.2–15.8 x 160.2–161.8 x 404.5 (0.56–0.62 x 6.31–6.37 x 15.93) [11.8–16.0 x 157.8–162 x 396.5 (0.46–0.63 x 6.21–6.38 x 15.61)]
Coil spring identification colour	Orange x 1 [Pink x 1]	Orange x 2 [Pink x 2]	Green x 1 [Light Blue x 1]
Spring constant N/mm (kg/mm, lbs./in.)	18–30 (1.8–3.0, 101–168) [22–40 (2.2–4.0, 123–224)]	18–30 (1.8–3.0, 101–168) [22–40 (2.2–4.0, 123–224)]	27–39 (2.7–3.9, 151–218) [27–45 (2.7–4.5, 151–252)]
Shock absorber			
Max. length mm (in.)	457 (18.0)	457 (18.0)	
Min. length mm (in.)	297 (11.7)	297 (11.7)	
Stroke mm (in.)	160 (6.3)	160 (6.3)	
Damping force [at 0.3 m/sec. (0.9 ft./sec.)]			
Expansion N (kg, lbs.)	2,450 (245, 540)	2,450 (245, 540) Hard: 3,350 (335, 739) Medium: 2,450 (245, 540) Soft: 1,750 (175, 386)	
Contraction N (kg, lbs.)	1,300 (130, 287)	1,300 (130, 287) Hard: 1,650 (165, 364) Medium: 1,300 (130, 287) Soft: 900 (90, 198)	

NOTE
[ ] indicates option specifications.
* : Diesel-powered vehicles for Switzerland and Finland built from July, 1993.

<Vehicles built from November, 1993>

Items	V24C
Suspension system	Coil spring type 3-link rigid axle suspension
Coil spring	
Wire dia: × O.D. × free length mm (in.)	13.4–14.5 × 159.4–160.5 × 411 (0.53–0.57 × 6.28–6.32 × 16.18) [13.4–15.0 × 159.4–161 × 380 (0.53–0.59 × 6.28–6.34 × 14.96)]
Coil spring identification colour	Yellow-green × 2 [Brown × 2]
Spring constant N/mm (kg/mm, lbs./in.)	18–30 (1.8–3.0, 101–168) [22–40 (2.2–4.0, 123–224)]
Shock absorber	
Max. length mm (in.)	457 (18.0)
Min. length mm (in.)	297 (11.7)
Stroke mm (in.)	160 (6.3)
Damping force [at 0.3 m/sec. (0.9 ft./sec.)]	
Expansion N (kg, lbs.)	2,450 (245, 540)
Contraction N (kg, lbs.)	1,300 (130, 287)

Items	V21W, V23C, V23W, V25W
Suspension system	Coil spring type 3-link rigid axle suspension
Coil spring	
Wire dia. × O.D. × free length mm (in.)	13.4–14.5 × 159.4–160.5 × 435.5 (0.53–0.57 × 6.28–6.32 × 17.15) [13.4–15.0 × 159.4–161 × 401.5 (0.53–0.59 × 6.28–6.34 × 15.81)]
Coil spring identification colour	Orange × 2 [Pink × 2]
Spring constant N/mm (kg/mm, lbs./in.)	18–30 (1.8–3.0, 101–168) [22–40 (2.2–4.0, 123–224)]
Shock absorber	
Max. length mm (in.)	457 (18.0)
Min. length mm (in.)	297 (11.7)
Stroke mm (in.)	160 (6.3)
Damping force [at 0.3 m/sec. (0.9 ft./sec.)]	
Expansion N (kg, lbs.)	2,450 (245, 540) Hard: 3,350 (335, 739) Medium: 2,450 (245, 540) Soft: 1,750 (175, 386)
Contraction N (kg, lbs.)	1,300 (130, 287) Hard: 1,650 (165, 364) Medium: 1,300 (130, 287) Soft: 900 (90, 198)

NOTE
[ ] indicates option specifications.

Items	V24W, V26W
Suspension system	Coil spring type 3-link rigid axle suspension
Coil spring	
Wire dia. × O.D. × free length mm (in.)	13.4–14.5 × 159.4–160.5 × 424 (0.53–0.57 × 6.28–6.32 × 16.70) [13.4–15.0 × 159.4–161 × 390.5 (0.53–0.59 × 6.28–6.34 × 15.37)]
Coil spring identification colour	Yellow-green × 1 [Brown × 1]
Spring constant N/mm (kg/mm, lbs./in.)	18–30 (1.8–3.0, 101–168) [22–40 (2.0–4.0, 123–224)]
Shock absorber	
Max. length mm (in.)	457 (18.0)
Min. length mm (in.)	297 (11.7)
Stroke mm (in.)	160 (6.3)
Damping force [at 0.3 m/sec. (0.9 ft./sec.)]	
Expansion N (kg, lbs.)	2,450 (245, 540) Hard: 3,350 (335, 739) Medium: 2,450 (245, 540) Soft: 1,750 (175, 386)
Contraction N (kg, lbs.)	1,300 (130, 287) Hard: 1,650 (165, 364) Medium: 1,300 (130, 287) Soft: 900 (90, 198)

Items	V44W, V43W, V45W, V46W
Suspension system	Coil spring type 3-link rigid axle suspension
Coil spring	
Wire dia. × O.D. × free length mm (in.)	14.2–15.8 × 160.2–161.8 × 404.5 (0.56–0.62 × 6.31–6.37 × 15.93) [11.8–16.0 × 157.8–162 × 396.5 (0.46–0.63 × 6.21–6.38 × 15.61)] 10.5–15.7 × 156.5–161.7 × 418 (0.41–0.62 × 6.16–6.37 × 16.46)* [10.7–16.2 × 156.5–162.2 × 399 (0.42–0.64 × 6.16–6.39 × 15.71)]*
Coil spring identification colour	Green × 1 [Light Blue × 1], Creme × 1 [Creme × 2]*
Spring constant N/mm (kg/mm, lbs./in.)	27–39 (2.7–3.9, 151–218) [27–45 (2.7–45, 151–252)] 18–42 (1.8–4.2, 101–235) [20–50 (2.0–5.0, 112–280)]*
Shock absorber	
Max. length mm (in.)	457 (18.0)
Min. length mm (in.)	297 (11.7)
Stroke mm (in.)	160 (6.3)
Damping force [at 0.3 m/sec. (0.9 ft./sec.)]	
Expansion N (kg, lbs.)	2,450 (245, 540) Hard: 3,350 (335, 739) Medium: 2,450 (245, 540) Soft: 1,750 (175, 386)
Contraction N (kg, lbs.)	1,300 (130, 287) Hard: 1,650 (165, 364) Medium: 1,300 (130, 287) Soft: 900 (90, 198)

NOTE
[ ] indicates option specifications.
*: V44WNDFCL6, V46WNDFCL6, V46WNAFCL6 (built up to May, 1994)

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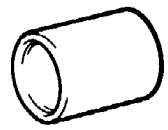
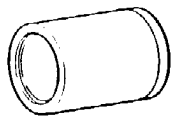
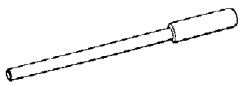
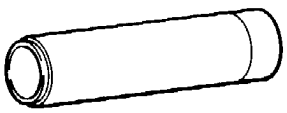
SERVICE SPECIFICATIONS

E34CB--

Items		Specifications
Standard value		
Toe-in	mm (in.)	0 (Non-adjustable)
Camber		0° (Non-adjustable)
Protruding length of stabilizer bar mounting bolt	mm (in.)	15–17 (0.59–0.67)
Protruding length of shock absorber mounting bolt	mm (in.)	1–2 (0.04–0.08)
Distance between actuator mounting surface and shock absorber stud end	mm (in.)	1.5–2.5 (0.06–0.10)

SPECIAL TOOLS

E34DA--

Tool	Number	Name	Use
	MB991293	Rear suspension bushing ardor	Removal and installation of lower arm rear bushing
	MB990891	Bushing remover/installer base	
	MB990971	Rear wheel bearing and hub installer joint	
	MB991318	Lower arm bushing arbor	
	MB991411	Rear wheel bearing and hub installer joint	
	MB990650	Lower arm bushing ardor	Removal and installation of lateral rod bushing

TROUBLESHOOTING

E34EAAC

Refer to GROUP 33 – Troubleshooting.

SERVICE ADJUSTMENT PROCEDURES

E34FAAN

REAR WHEEL ALIGNMENT

The rear suspension assembly must be free of worn, loose or damaged parts prior to measurement of rear wheel alignment.

Standard value:

Toe-in	**0mm (0 in.)**
Camber	**0°**

NOTE
Toe-in and camber are set at the factory and cannot be adjusted.

NOTES

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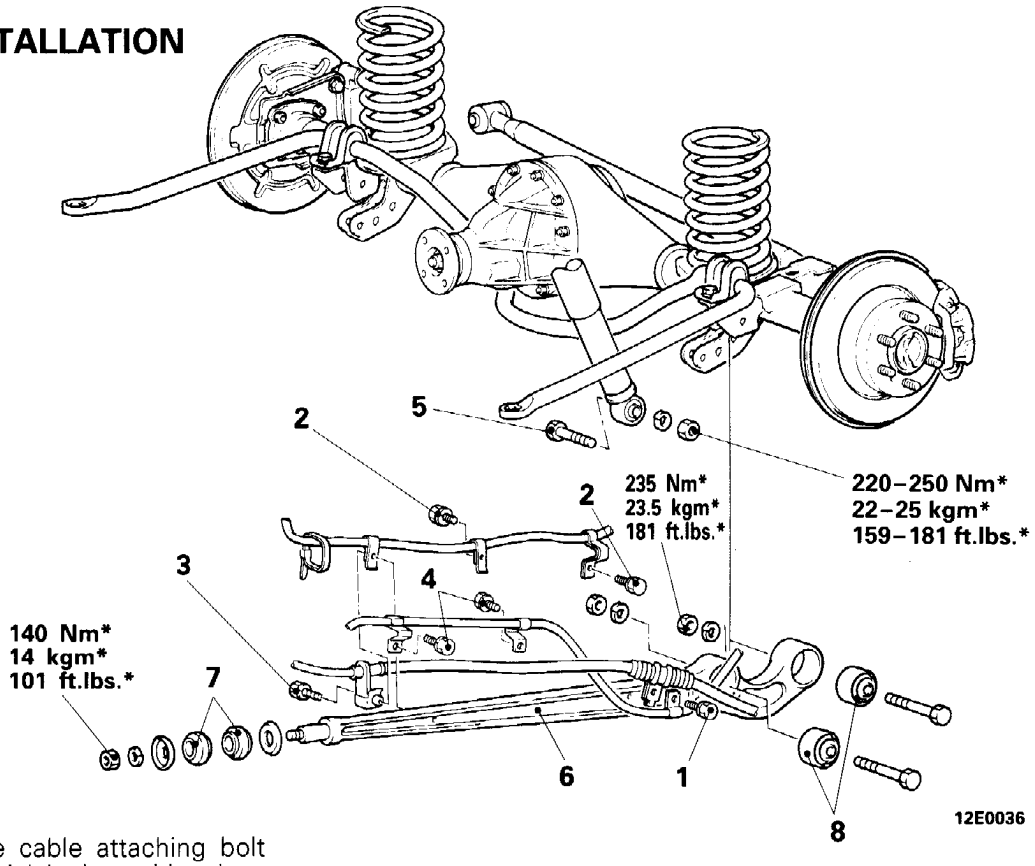
LOWER ARM

E34IA--

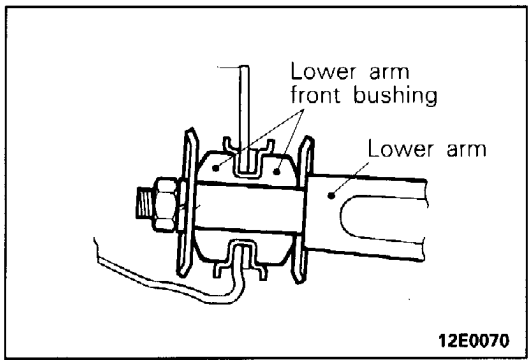
REMOVAL AND INSTALLATION



Removal steps

1. Parking brake cable attaching bolt
2. Rear differential lock position harness attaching bolt
3. Parking brake cable attaching bolt (Long wheelbase)
4. Rear sensor attaching bolt (Vehicles with A.B.S.)
5. Shock absorber mounting bolts (lower side)
6. Lower arm
7. Lower arm front bushing
8. Lower arm rear bushing

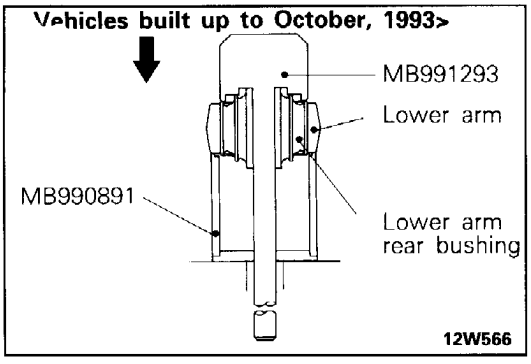
Caution
***: Indicates part which should be temporarily tightened, and then fully tightened with the vehicle on the ground in the unladen condition.**



SERVICE POINT OF INSTALLATION E34IEAC

7. INSTALLATION OF LOWER ARM FRONT BUSHING

Install the lower arm front bushing so that its direction will be as shown in the figure.



LOWER ARM REAR BUSHING REPLACEMENT

E34IDAH

(1) Drive out the bushing by using the special tools.

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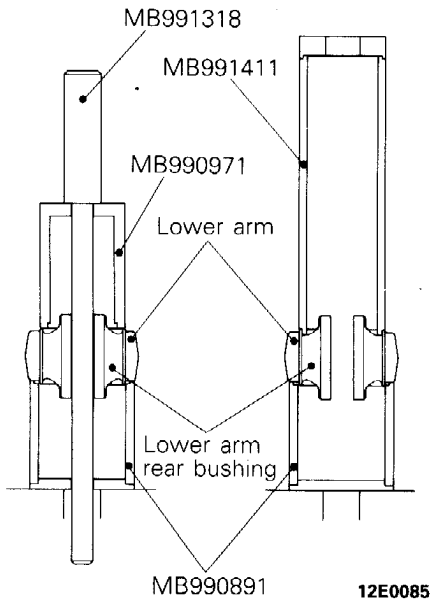
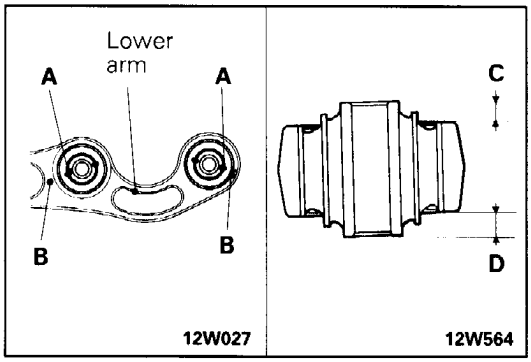
<Vehicles built from November, 1993>

[During removal] [During press-fitting]



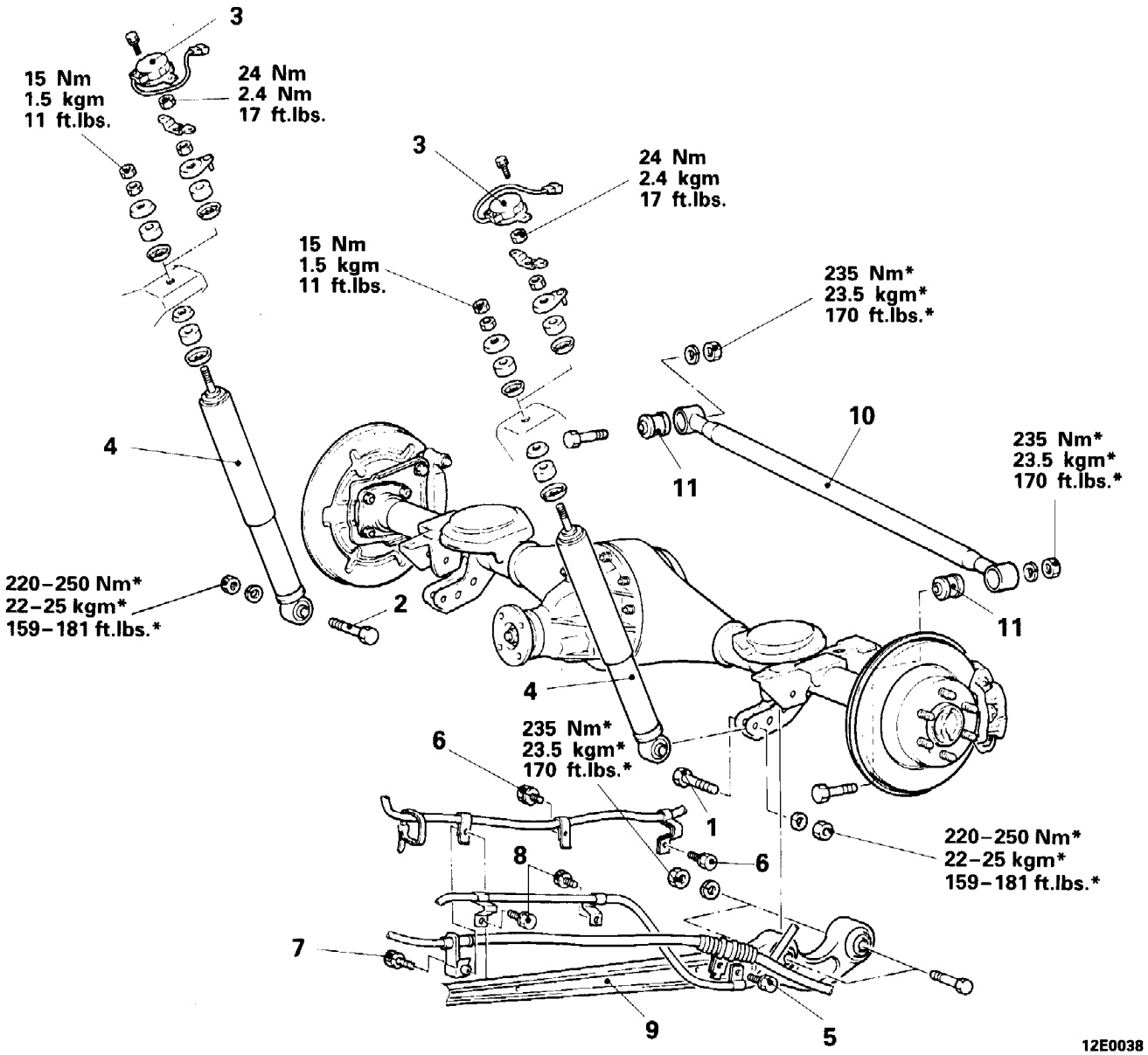


(2) Align, as shown in the figure, the marked location (B) of the lower arm and the hole part (A) of the lower arm rear bushing, and then, by using the special tool, press the lower arm rear bushing onto the lower arm.
Be sure that the difference between the projecting lengths (C – D) should be within 1 mm (0.04 in.)

SHOCK ABSORBER AND LATERAL ROD

E34HA--

REMOVAL AND INSTALLATION



Removal steps of shock absorber

1. Shock absorber mounting bolt (lower left side)
2. Shock absorber mounting bolt (lower right side)
- ◆◆ 3. Actuator (Vehicles with remote-controlled variable shock absorbers)
- ◆◆ 4. Shock absorber

Removal steps of lateral rod

1. Shock absorber mounting bolt (lower left side)
5. Parking brake cable attaching bolt (LH side)
6. Rear differential lock position harness attaching bolt
7. Parking brake cable attaching bolt (Long wheelbase–LH side)
8. Rear sensor attaching bolt (Vehicles with A.B.S.)
9. Lower arm
10. Lateral rod
11. Lateral rod bushing

Caution

***: Indicates part which should be temporarily tightened, and then fully tightened with the vehicle on the ground in the unladen condition.**

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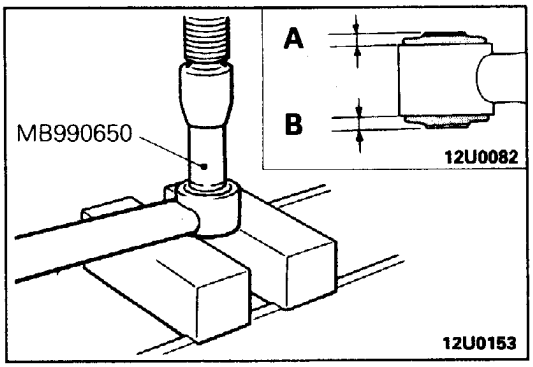
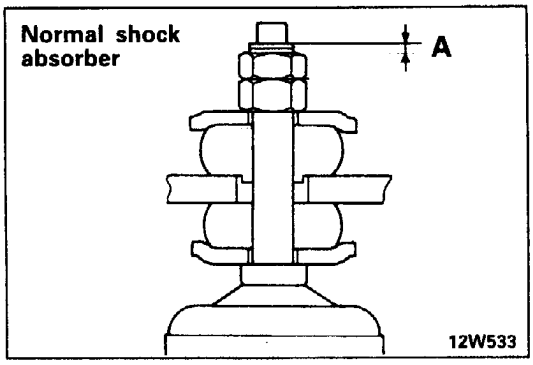
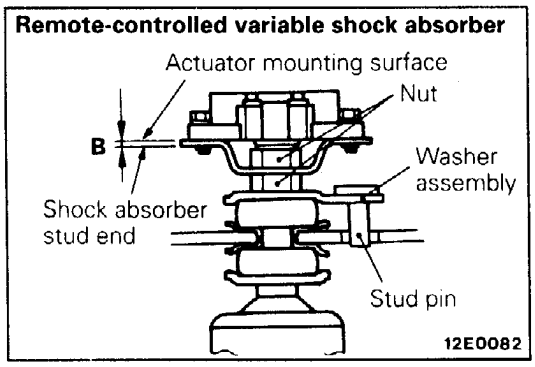






LATERAL ROD BUSHING REPLACEMENT E34HEAD

(1) Use the special tool to drive out and press in the lateral rod bushing.
(2) Be careful that the difference (A – B) in bushing projection distances does not exceed the following value.

A – B = 0 ± 1.0 mm (0 ± 0.04 in.)

Caution
When pressing in the bushing, apply a sufficient amount of liquid soap to the inside of the lateral rod eyes and the rubber area of the bushing.

SERVICE POINTS OF INSTALLATION E34HDAE

4. INSTALLATION OF SHOCK ABSORBER/3. ACTUATOR (VEHICLES WITH REMOTE-CONTROLLED VARIABLE SHOCK ABSORBERS)

Tighten the nut so that the values shown in the figure (A and B) are at the standard value.

Standard value A: 1–2 mm (0.04–0.08 in.)
B: 1.5–2.5 mm (0.06–0.10 in.)

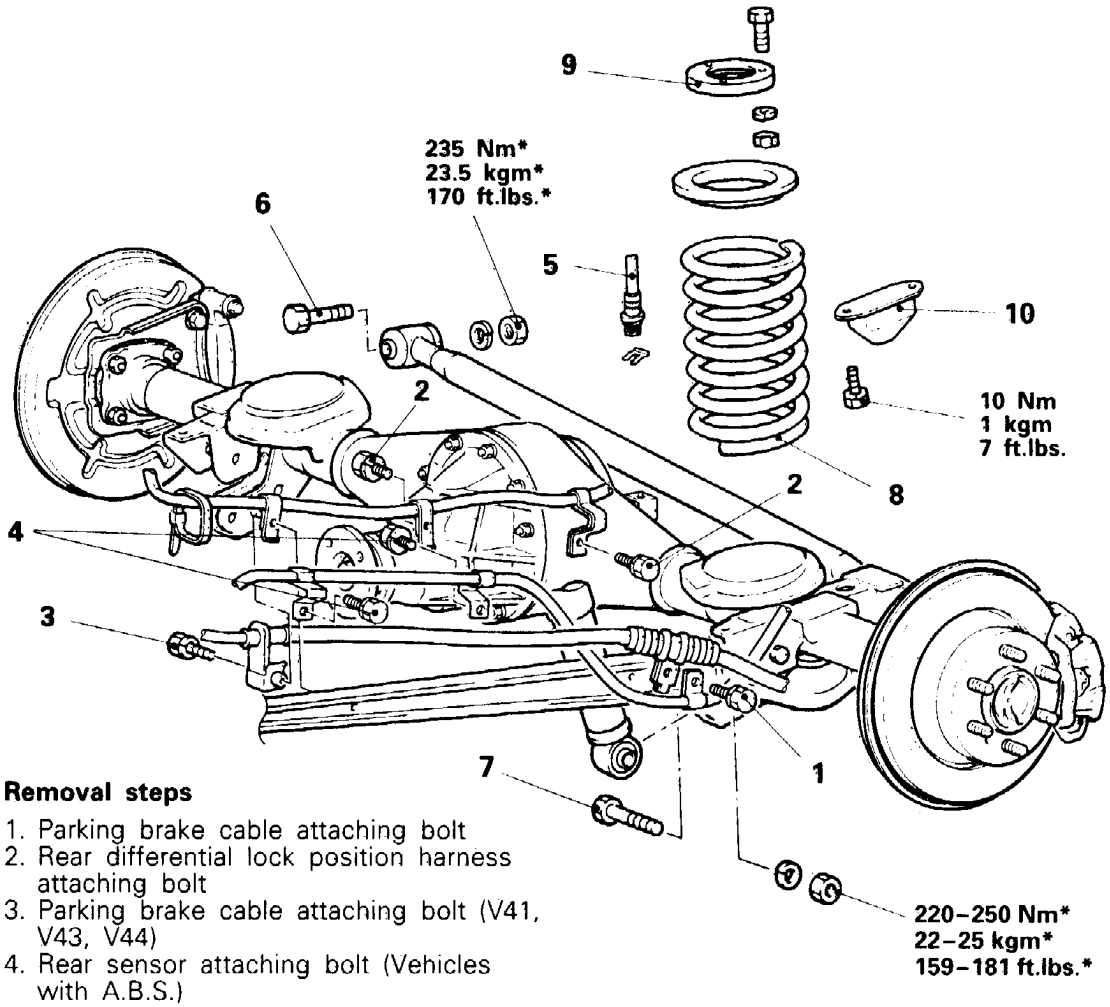
Caution
When tightening the nut, be careful not to bend the stud pin of the washer assembly.

COIL SPRING AND AXLE BUMPER

E34PA--

REMOVAL AND INSTALLATION

Post-installation Operation
- Filling of Brake Fluid and Air Bleeding (Refer to GROUP 35 Service Adjustment Procedures.)



Removal steps

1. Parking brake cable attaching bolt
2. Rear differential lock position harness attaching bolt
3. Parking brake cable attaching bolt (V41, V43, V44)
4. Rear sensor attaching bolt (Vehicles with A.B.S.)
5. Brake hose connection
6. Lateral rod mounting bolt (body side only)
7. Shock absorber mounting bolt (lower side only)

◆■◆ 8. Coil spring
9. Rear spring pad
10. Helper rubber

NOTE

*: Indicates part which should be temporarily tightened, and then fully tightened with the vehicle in the unladen condition.

SERVICE POINT OF REMOVAL

E34PBAB

8. REMOVAL OF COIL SPRING

Slowly lower the jack supporting the axle housing, and remove the coil spring and rear spring pad.

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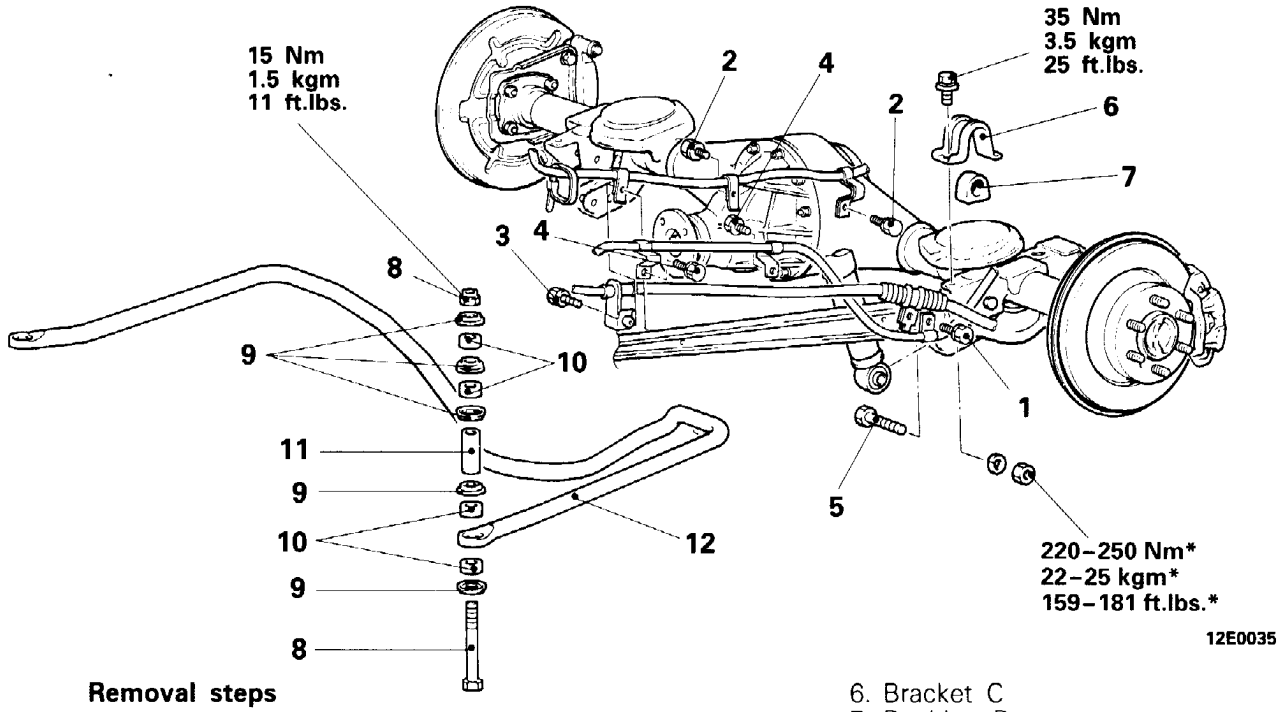
STABILIZER BAR

E34KA--

<Vehicles built up to October, 1993>

REMOVAL AND INSTALLATION



Removal steps

1. Parking brake cable attaching bolt
2. Rear differential lock position harness attaching bolt
3. Parking brake cable attaching bolt (Long wheelbase)
4. Rear sensor attaching bolt (Vehicles with A.B.S.)
5. Shock absorber mounting bolts (lower side)
6. Bracket C
7. Bushing B

◆◆ 8. Stabilizer bar mounting bolt and nut

9. Joint cup
10. Rubber bushing
11. Collar

◆◆ 12. Stabilizer bar

Caution

***: Indicates part which should be temporarily tightened, and then fully tightened with the vehicle on the ground in the unladen condition.**

SERVICE POINT OF REMOVAL

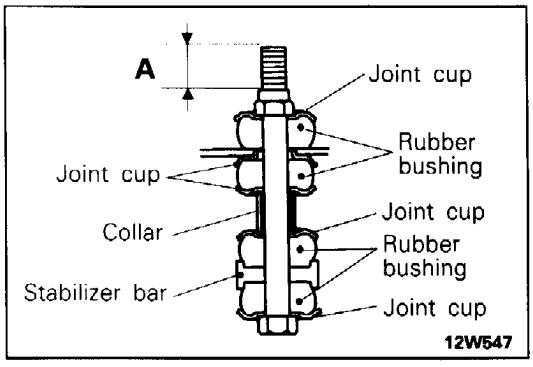
E34KBAC

12. REMOVAL OF STABILIZER BAR

Slowly lower the jack and remove the stabilizer bar to the vehicle right side.

Caution

When lowering the jack, take care not to damage the rear brake pipe between the main brake pipe and the rear axle housing.



SERVICE POINT OF INSTALLATION

E34KDAH

8. INSTALLATION OF STABILIZER BAR MOUNTING BOLT AND NUT

(1) To install the stabilizer bar, assemble the joint cups and rubber bushings by the order and the certain direction as shown in the figure.

(2) Install the nut on the stabilizer bar mounting bolt to the specified dimensions.

Standard value (A): 15–17 mm (0.59–0.67 in.)

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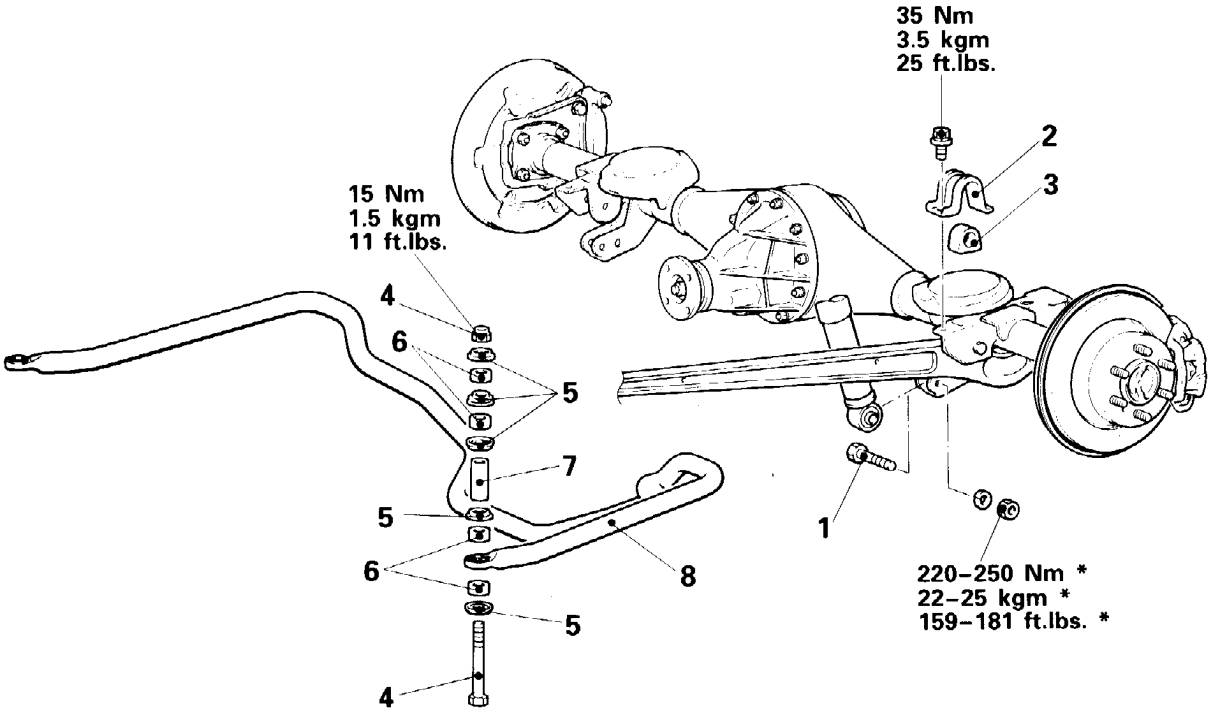
<Vehicles built from November, 1993>

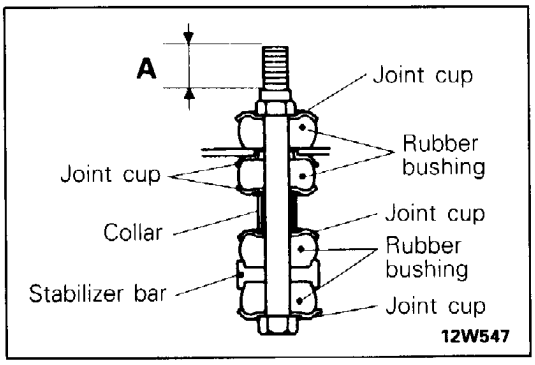
REMOVAL AND INSTALLATION



Removal steps

1. Shock absorber mounting bolts (lower side)
2. Bracket C
3. Bushing B
- ◆◆ 4. Stabilizer bar mounting bolt and nut
5. Joint cup
6. Rubber bushing
7. Collar
8. Stabilizer bar

Caution
***: Indicates part which should be temporarily tightened, and then fully tightened with the vehicle on the ground in the unladen condition.**



SERVICE POINT OF INSTALLATION E34KDAH

4. INSTALLATION OF STABILIZER BAR MOUNTING BOLT AND NUT

(1) To install the stabilizer bar, assemble the joint cups and rubber bushings by the order and the certain direction as shown in the figure.
(2) Install the nut on the stabilizer bar mounting bolt to the specified dimensions.
Standard value (A): 15–17 mm (0.59–0.67 in.)

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SERVICE BRAKES

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SPECIFICATIONS

GENERAL SPECIFICATIONS

E35CA--

Items	2400, 3000, 3500	2500D, 2800D
Master cylinder		
Type	Tandem Type (with level sensor)	Tandem type (with level sensor)
I.D. mm (in.)	23.8 (15/16)	23.8 (15/16)
Brake booster		
Type	Vacuum Type, tandem	Vacuum Type, tandem
Effective dia. of power cylinder mm (in.)	205 + 230 (8 + 9)	180 + 205 (7 + 8)
Boosting ratio	6.0	6.0
Proportioning valve type	Load sensing proportioning type	Load sensing proporting type
Front brakes		
Type	Floating caliper, double pistons, ventilated disc (M-R57W)	Floating caliper, double pistons, ventilated disc (M-R57W)
Disc effective dia. x thickness mm (in.)	228 x 24 (8.98 x 0.94) <2400, 3000> 228 x 27 (8.98 x 1.06) <3500>	228 x 24 (8.98 x 0.94)
Wheel cylinder I.D. mm (in.)	42.8 (1 11/16) x 2	42.8 (1 11/16) x 2
Lining thickness mm (in.)	10 (0.39)	10 (0.39)
Clearance adjustment	Automatic	Automatic
Rear brakes		
Type	Floating caliper, single piston, solid disc (M-R59S)	Floating caliper, single piston, solid disc (M-R59S)
Disc effective dia. x thickness mm (in.)	272 x 18 (10.71 x 0.71)	272 x 18 (10.71 x 0.71)
Wheel cylinder I.D. mm (in.)	42.8 (1 11/16)	42.8 (1 11/16)
Lining thickness mm (in.)	9 (0.354)	9 (0.354)
Clearance adjustment	Automatic	Automatic
ABS		
Rotor teeth		
<Vehicles built up to May, 1994>		
front	110	110
rear	110	110
<Vehicles built from June, 1994>		
front	47	47
rear	47	47
Speed sensor type	Magnet coil type	Magnet coil type

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SERVICE SPECIFICATIONS

E35CB--

Items	Specifications
Standard value	
Brake pedal height mm (in.)	186–191 (7.3–7.5)
Brake pedal to toeboard clearance mm (in.)	100 (3.94) or more
Brake pedal free play mm (in.)	3–8 (0.12–0.32)
Load sensing spring length mm (in.)	224–228 (8.8–9.0)
Load sensing proportioning valve output pressure MPa (kg/cm^2, psi)	
2-door models	
When load sensing spring length is 227.5 mm (9.0 in.)	
Input pressure MPa (kg/cm^2, psi)	
at 10 (100, 1422)	5.37–6.27 (53.7–62.7, 763.8–891.8)
at 18 (180, 2560)	7.17–8.47 (71.7–84.7, 1019.8–1204.7)
When load sensing spring length is 255.6 mm (10.1 in.)	
Input pressure MPa (kg/cm^2, psi)	
at 18 (180, 2560)	10.4–12.4 (104–124, 1479.2–1763.7)
4-door models	
When load sensing spring length is 226.7 mm (8.9 in.)	
Input pressure MPa (kg/cm^2, psi)	
at 10 (100, 1422)	6.14–7.04 (61.4–70.4, 873.3–1001.3)
at 18 (180, 2560)	7.94–9.24 (79.4–92.4, 1129.3–1314.2)
When load sensing spring length is 257.7 mm (10.1 in.)	
Input pressure MPa (kg/cm^2, psi)	
at 18 (180, 2560)	13.1–15.1 (131–151, 1863.3–2147.7)
Booster push rod to master cylinder piston clearance mm (in.)	
7 + 8 inch tandem brake booster	0.85–1.10 (0.033–0.043)
8 + 9 inch tandem brake booster	0.65–0.90 (0.026–0.035)
Brake dragging force N (kg, lbs.)	57 (5.7, 13) or less
[Brake dragging torque] Nm (kgm, ft.lbs.)	[4 (0.4, 3)] or less
Pad thickness mm (in.)	
Front	10.0 (0.39)
Rear	9.0 (0.35)
Disc thickness mm (in.)	
Front	24 (0.94) <Except 3500> 27 (1.06) <3500>
Rear	18 (0.71)
Lining thickness mm (in.)	6.5 (0.256)
Brake drum inside diameter mm (in.)	197 (7.76)

Items		Specifications
Limit		
Pad thickness	mm (in.)	2.0 (0.079)
Disc thickness	mm (in.)	
Front		22.4 (0.882) <Except 3500> 25.4 (1.0) <3500>
Rear		16.4 (0.646)
Brake disc runout	mm (in.)	
Front		0.1 (0.0039)
Rear		0.08 (0.0031)
Hub axial play	mm (in.)	0.25 (0.0098)
Lining thickness	mm (in.)	4.5 (0.177)
Brake drum inside diameter	mm (in.)	198 (7.8)

LUBRICANTS

E35CD--

Items	Specified lubricant	Quantity
Brake fluid	DOT3 or DOT4	As required
Brake piston boot inner surfaces Lock pin boot inner surfaces Guide pin boot inner surfaces	Repair kit grease	As required

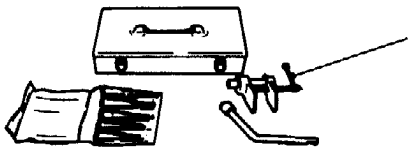
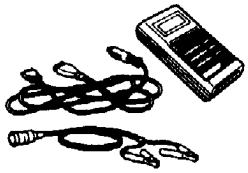
SEALANTS

E35CE--

Items	Specified sealants	Remarks
Thread part of vacuum switch	3M ATD Part No. 8659 or equivalent	Non-drying sealant
Thread part of fitting	3M ATD Part No. 8663, 8661 or equivalent	Semi-drying sealant

SPECIAL TOOLS

E35DA--

Tool	Number	Name	Use
	MB990964 MB990520	Brake tool set	Pushing-in of the front disc brake piston MB990520
	MB991341	Multi-use tester assembly	Vehicles built up to October, 1993 For checking of A.B.S.
	MB991419	ROM pack	

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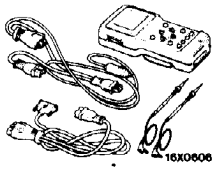
Tool	Number	Name	Use
	MB991502	MUT-II sub assembly	All models For checking of A.B.S.
16X0607		ROM pack	
	MB991529	Diagnosis code check harness	For checking of ABS with a voltmeter

NOTES

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ABS TROUBLESHOOTING <Vehicles built up to May, 1994>

E35EC--

PARTICULAR PHENOMENA OF THE ANTI-LOCK BRAKE SYSTEM

Models equipped with the anti-lock brake system (A.B.S.) may exhibit one or more of the following phenomena from time to time, but none of these are abnormal.

(1) A pulsing feeling in the brake pedal, or vibration of the body or the steering wheel, when the anti-lock brake system is activated by sudden braking or by braking on a slippery road surface. Actually, this phenomenon is an indication that the A.B.S. is functioning normally.
(2) When the vehicle speed reaches approximately 8 km/h (5 mph) after the engine is started and the vehicle starts off (for the first time), a whining motor noise may be heard from the engine compartment if the vehicle is traveling in a quiet place, but this noise is simply the result of a self-check being made of the A.B.S. operation.

TROUBLESHOOTING METHODS

Problems related to the A.B.S. can be classified into two general categories: problems in the electrical system and those in the hydraulic system.

For problems in the electrical system the selfdiagnosis function is built into the electronic control unit (E.C.U.), causing the A.B.S. warning lamp to illuminate as a warning to the driver. In this instance, checks can be made by using the multi-use tester and osciloscope.

Problems in the hydraulic system (poor braking, etc.) can be located in the same way as for ordinary brakes. There is, however, the necessity to check to determine whether the problem is related to ordinary brake components or to the components related to the A.B.S. To make this check, use the multi-use tester.

HOW TO USE THE TROUBLESHOOTING FLOW CHART

(1) Following the flow chart, first refer to the illumination pattern of the ABS warning lamp, and next note the diagnosis code and inspect the brake operation.
(2) Follow the inspection charts listed in the "Remedy" column to carry out an inspection. In each inspection chart, [Comment] and (Hint) are listed for troubleshooting reference.

NOTE
ECU: Electronic control unit

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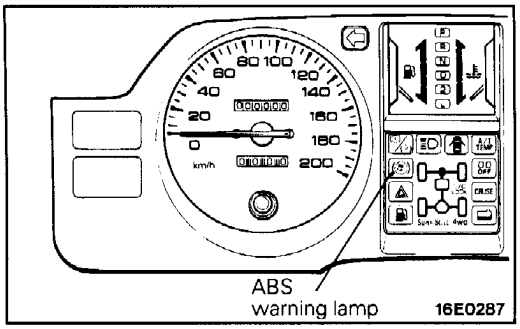
Check the trouble symptoms by the following procedure, and inspect according to the instructions.

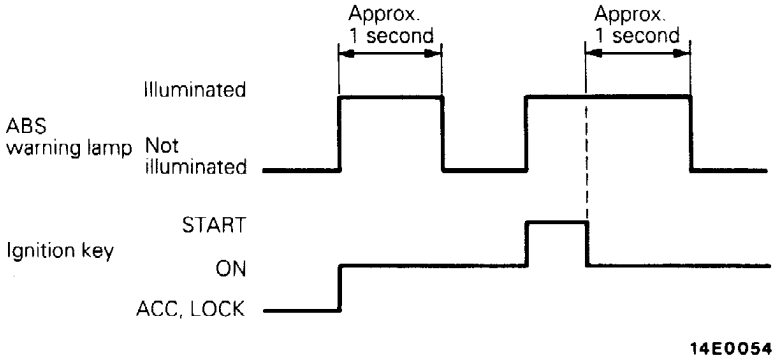
Before the engine starts, does the ABS warning lamp illuminate?

(1) With the ignition key in the "ON" position, the ABS-ECU causes the ABS warning lamp to illuminate for approximately 1 second (during this time, the initial check is carried out), and then the lamp switches off.

(2) With the ignition key in the "START" position, power to the ABS-ECU is cut, and because the valve relay turns OFF, the ABS warning lamp remains illuminated.

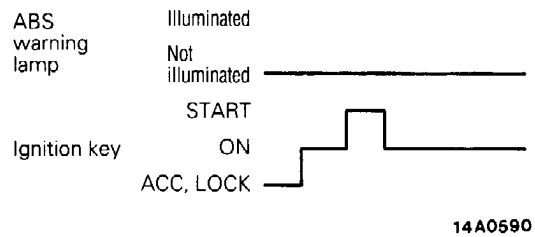
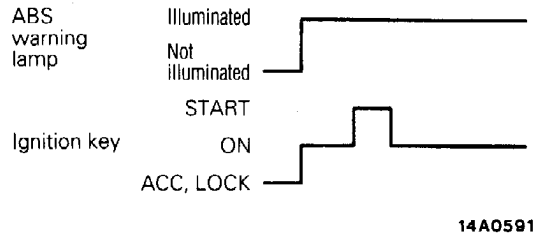
(3) When the ignition key is turned from the "START" position back to the "ON" position, the ABS warning lamp illuminates for approximately 1 second (during this time, the initial check is carried out once more), and then the lamp switches off.

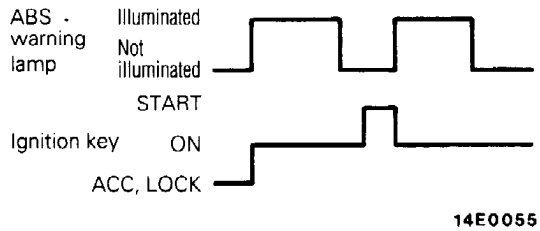
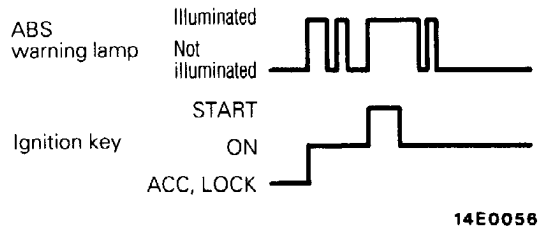


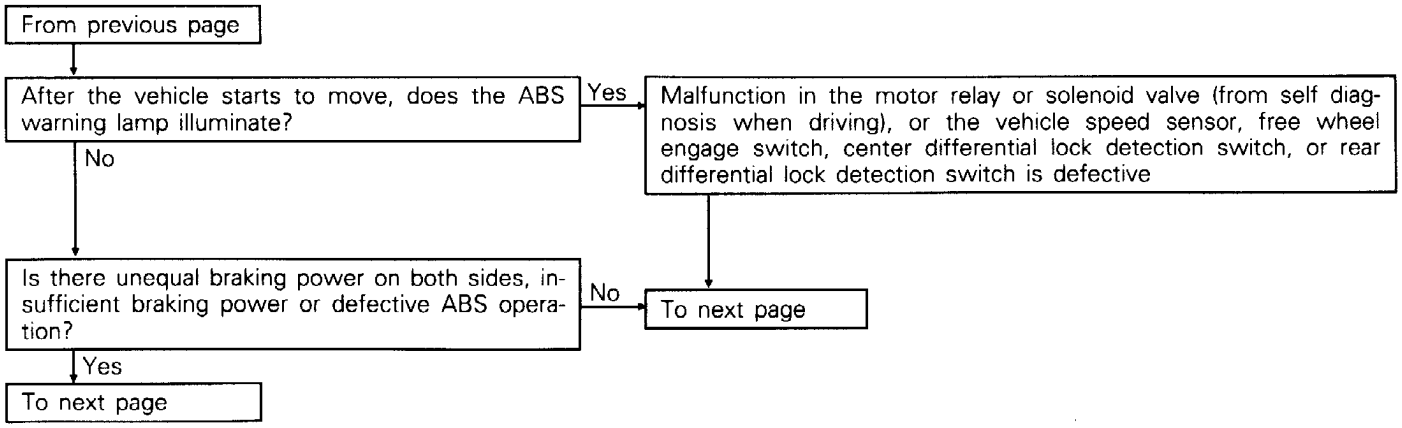


Yes → To next page

No ↓

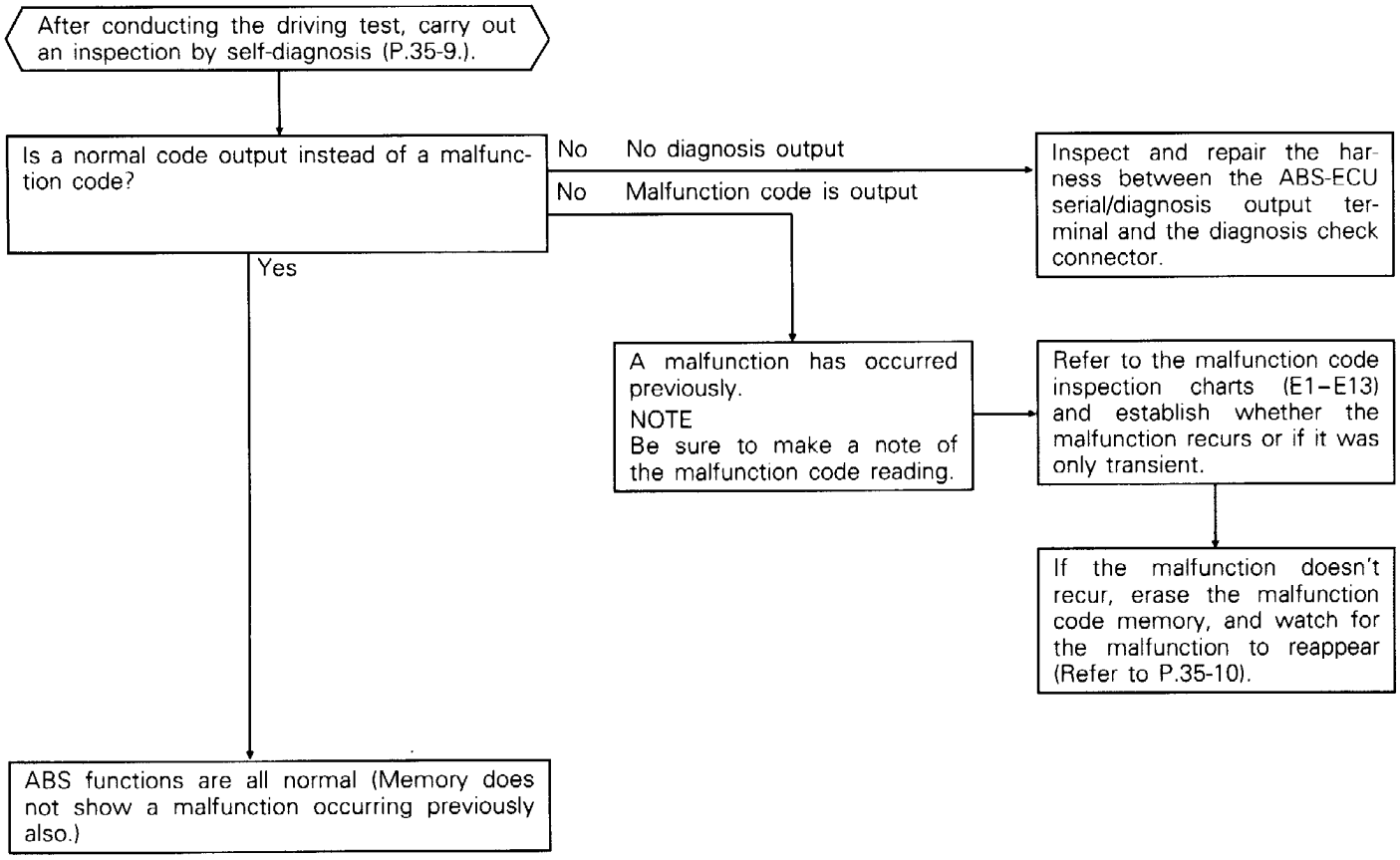
No.	Trouble symptom	Main cause	Remedy
1	The ABS warning lamp does not illuminate at all. 	• ABS warning lamp bulb failure. • Broken wire in the ABS warning lamp power circuit (including blown fuse).	Inspect according to Flow Chart A (Refer to P.35-13).
2	When the ignition key is turned to "ON", the ABS warning lamp remains illuminated. 	• Fail safe function is operated by the ABS-ECU self-diagnosis. • Short in the ABS-ECU warning lamp drive circuit • ABS-ECU is defective	Inspect according to Flow Chart B (Refer to P.35-16).

No.	Trouble symptom	Main cause	Remedy
3	When the ignition key is turned to "START", the ABS warning lamp does not illuminate. 	• Valve relay is defective • Broken harness wire between the ABS warning lamp and the hydraulic unit • Broken harness wire between the hydraulic unit and the earth	Inspect according to Flow Chart C (Refer to P.35-18).
4	After the ignition key is turned to "ON", the ABS warning lamp blinks twice, and when turned to "START", it illuminates. When returned to "ON", the lamp flashes once, and then switches off. (The blinking when the key is turned to "ON" occurs simultaneously with the operation noise from the valve relay) 	• Broken harness wire in the ABS-ECU warning lamp drive circuit • ABS-ECU is defective	Inspect according to Flow Chart D (Refer to P.35-19).



From previous page

Trouble symptom	Main cause	Remedy
Unequal braking power Insufficient braking power	• Blocked pressure circuit inside the hydraulic unit. • Mechanical lock in the hydraulic unit solenoid valve.	Follow the hydraulic unit operation inspection (refer to P.35-50) and replace the hydraulic unit if necessary. If the hydraulic unit is normal, inspect the components of the normal brake.
Decline in ABS function	• Blocked pressure circuit inside the hydraulic unit. • Operation of the hydraulic unit solenoid valve is defective.	
	• Operation of the idle-up system during ABS operation when vehicle speed is approx. 24 km/h (15 mph) or more is defective <2500D-M/T>	Inspect the operation of the idle-up system (Refer to GROUP 13 – Service Adjustment Procedures <4D56>)
ABS operates even when not carrying out sudden braking (ABS operating vibration starts to be felt).	• Insufficient wheel speed sensor output voltage (sensor is defective, excessive clearance between the sensor and rotor, or rotor is chipped). • ABS-ECU is defective	Inspect the wheel speed sensor (refer to P.35-48), and replace the sensor or adjust the sensor clearance if necessary. If the problem occurs frequently even though the sensor is normal, then replace the ABS-ECU.



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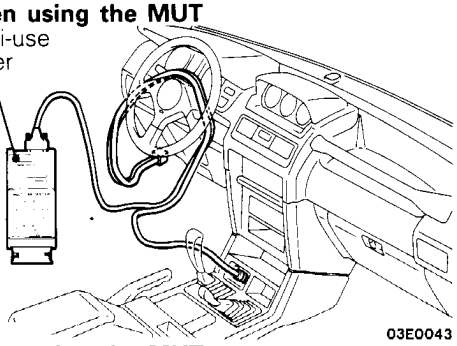
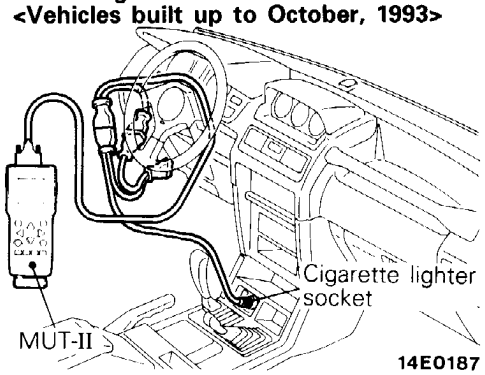
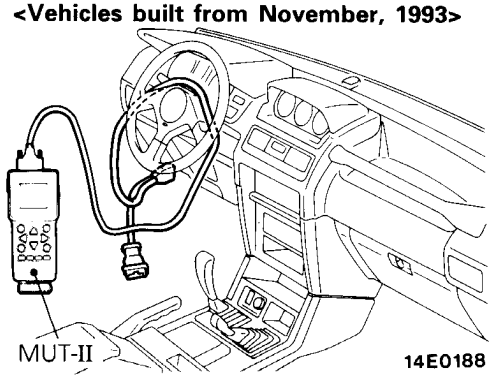
When using the MUT



When using the MUT-II
<Vehicles built up to October, 1993>



<Vehicles built from November, 1993>



INSPECTION BY SELF-DIAGNOSIS

1. Turn the ignition key to ACC and connect the multi-use tester or MUT-II as shown in the illustration.

   Caution
   Turn off the ignition switch before disconnecting or connecting MUT or the MUT-II.

2. Start the engine, and select the ABS system.
3. Read and make a note of the diagnosis output codes.
   If the ABS-ECU and multi-use tester cannot communicate, inspect the harness between diagnosis connector and the ABS-ECU power circuit or the ABS-ECU.
4. Momentarily erase the diagnosis code memory. (Refer to P.35-10.)
   If the memory cannot be erased, the function is being stopped by a malfunction that is currently displaying a malfunction code. If the memory can be erased, then the malfunction was only temporary, or it is a malfunction that can only be detected while driving.
5. If the malfunction code is not erased, or if the ABS function is stopped by a repeated driving test and a malfunction code is output, inspect according to the malfunction code inspection charts (E-1–E-13).

   NOTE
   The codes below are output as diagnosis codes according to the vehicle's condition, even when the ABS system is normal. These codes are output only for a current malfunction, and if the vehicle's condition returns to normal, malfunction code will be erased automatically.

METHOD OF ERASING THE DIAGNOSIS CODE MEMORY

Caution
When repairs are completed, the diagnosis code memory should be erased. When the ABS-ECU function is stopped, the malfunction code memory cannot be erased, so the function should be continuing while inspection and repair is being carried out.

1. Erase the memory with the multi-use tester or MUT-II.
   NOTE
   After erasing the memory, a command cannot be received from the multi-use tester or MUT-II. When checking diagnosis codes, momentarily stop and restart the engine, and then reactivate the multi-use tester or MUT-II.
2. Check the diagnosis codes to check that the memory has been erased.

DIAGNOSIS CODE REFERENCE TABLE

Diagnosis code no.	Name of inspection chart or remedy	Reference page	Diagnosis code no.	Name of inspection chart or remedy	Reference page
11	E–1	P.35-20	27	E–7	P.35-28
12			31	E–8	P.35-29
13			32	E–9	P.35-30
14			33	E–10	P.35-33
15	E–2	P.35-21	41	E–11	P.35-34
16	E–4	P.35-24	43		
21	E–3	P.35-22	45		
22			51	E–12	P.35-35
23			53	E–13	P.35-36
24			63	Replace the ABS-ECU	—
25	E–5	P.35-25	64		
26	E–6	P.35-26			

DIAGNOSIS CODE DISPLAY METHOD

All problem codes that are in memory are displayed.

NOTE

(1) Diagnosis code no. 16 (abnormally low or abnormally high voltage) is only displayed when there is a current problem. (Past occurrences are not recorded in memory.)
(2) Even if identical codes are output continuously, the code is only displayed one time.

SERVICE DATA INSPECTION TABLE

The following items can be read by the multi-use tester or MUT-II from the ABC-ECU input data.

Service data item		Display units
No.	Item	
11	Front right wheel speed	km/H
12	Front left wheel speed	km/H
13	Rear right wheel speed	km/H
14	Rear left wheel speed	km/H
16	ABS-ECU power voltage	V
25	ON/OFF condition of free wheel engage switch	ON/OFF
26	ON/OFF condition of centre differential lock detection switch	ON/OFF
27	ON/OFF condition of rear differential lock detection switch	ON/OFF
32	G sensor output voltage	V
33	ON/OFF condition of stop lamp switch	ON/OFF

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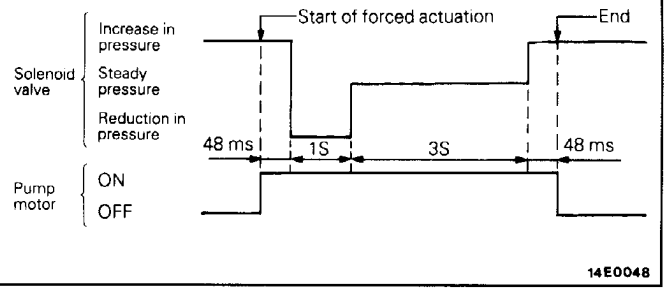
ACTUATOR TEST FUNCTION

By using the multi-use tester or MUT-II, the following force-activation of the actuator can be performed.
By using this function, function checking of the hydraulic unit can be done without the need for special devices such as a hydraulic unit checker (MB991131).

NOTE
(1) When the ABS-ECU function is stopped, actuator testing cannot be carried out.
(2) Actuator testing can be carried out only when the vehicle is stopped.
(3) During actuator testing, if the maximum vehicle wheel speed reaches 10 km/h (6 mph), the test will be cancelled.
(4) During actuator testing, the ABS warning lamp illuminates, and ABS control is interrupted.

ACTUATOR TEST SPECIFICATIONS

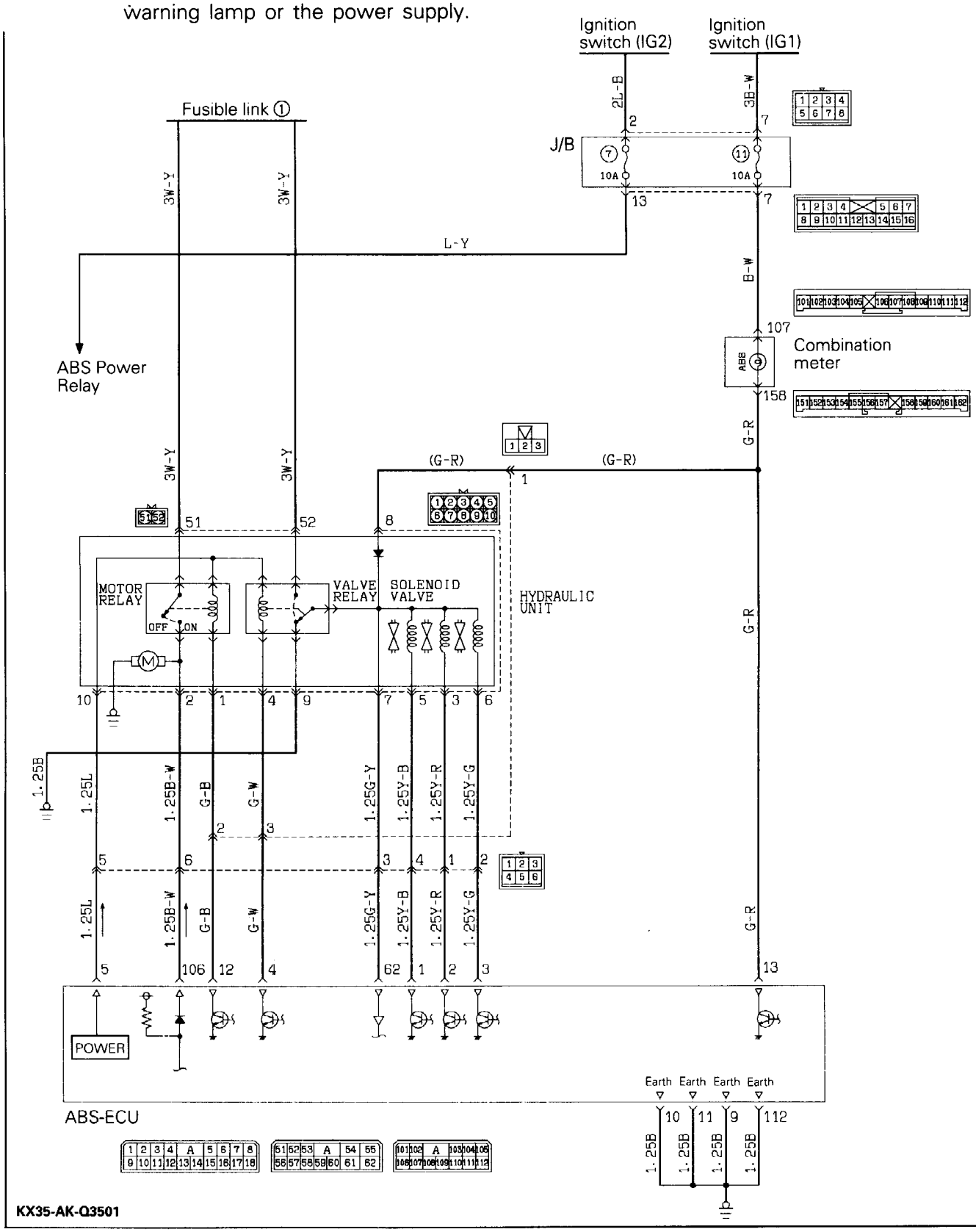
No.	Driving objective		Driving pattern
01	Solenoid valves and pump motors for each corresponding channel in the hydraulic unit	Solenoid valve for front left wheel	
02		Solenoid valve for front right wheel	
03		Solenoid valve for rear wheels	

A ABS warning lamp does not illuminate at all

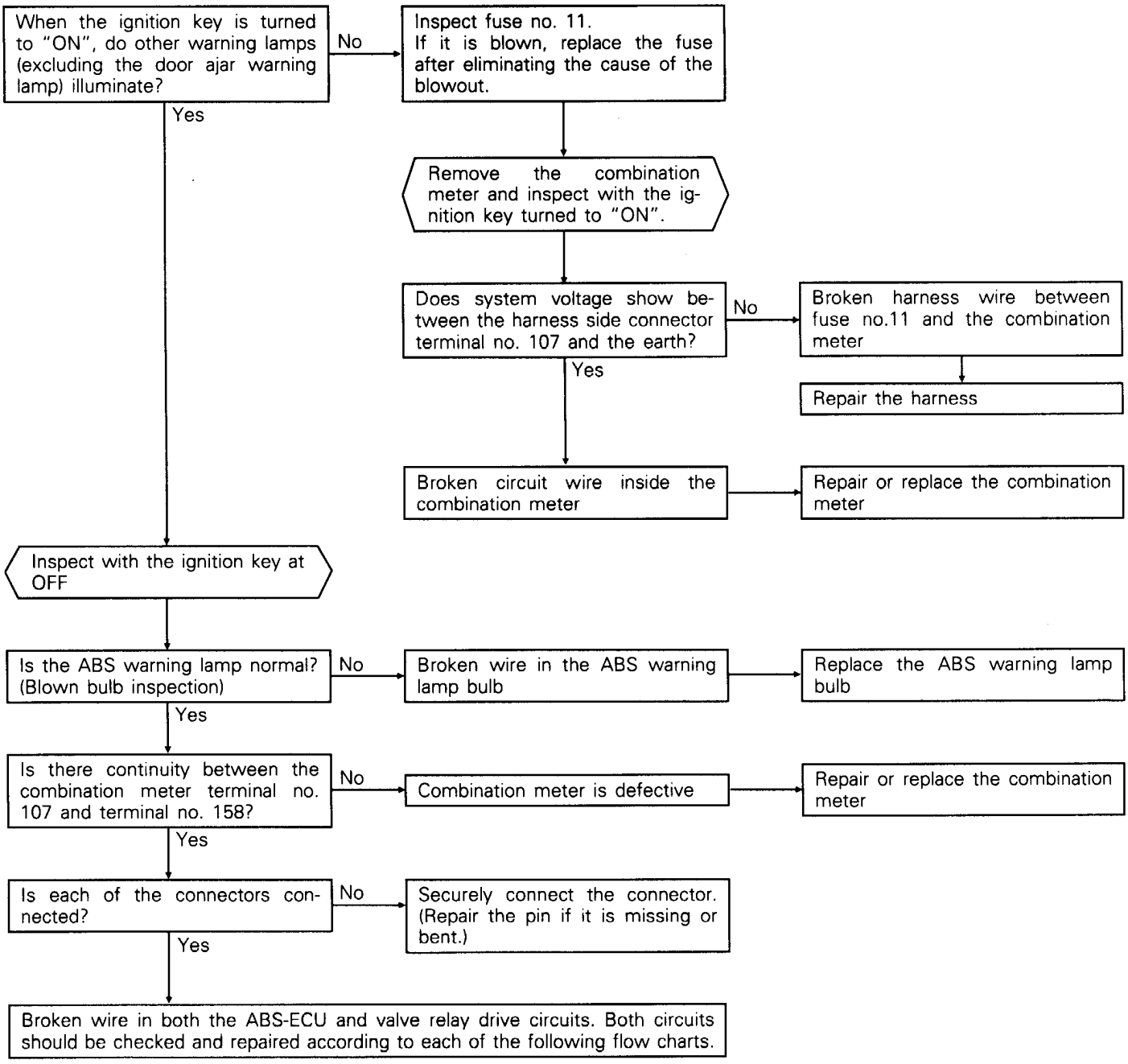
<Vehicles built up to October, 1993>

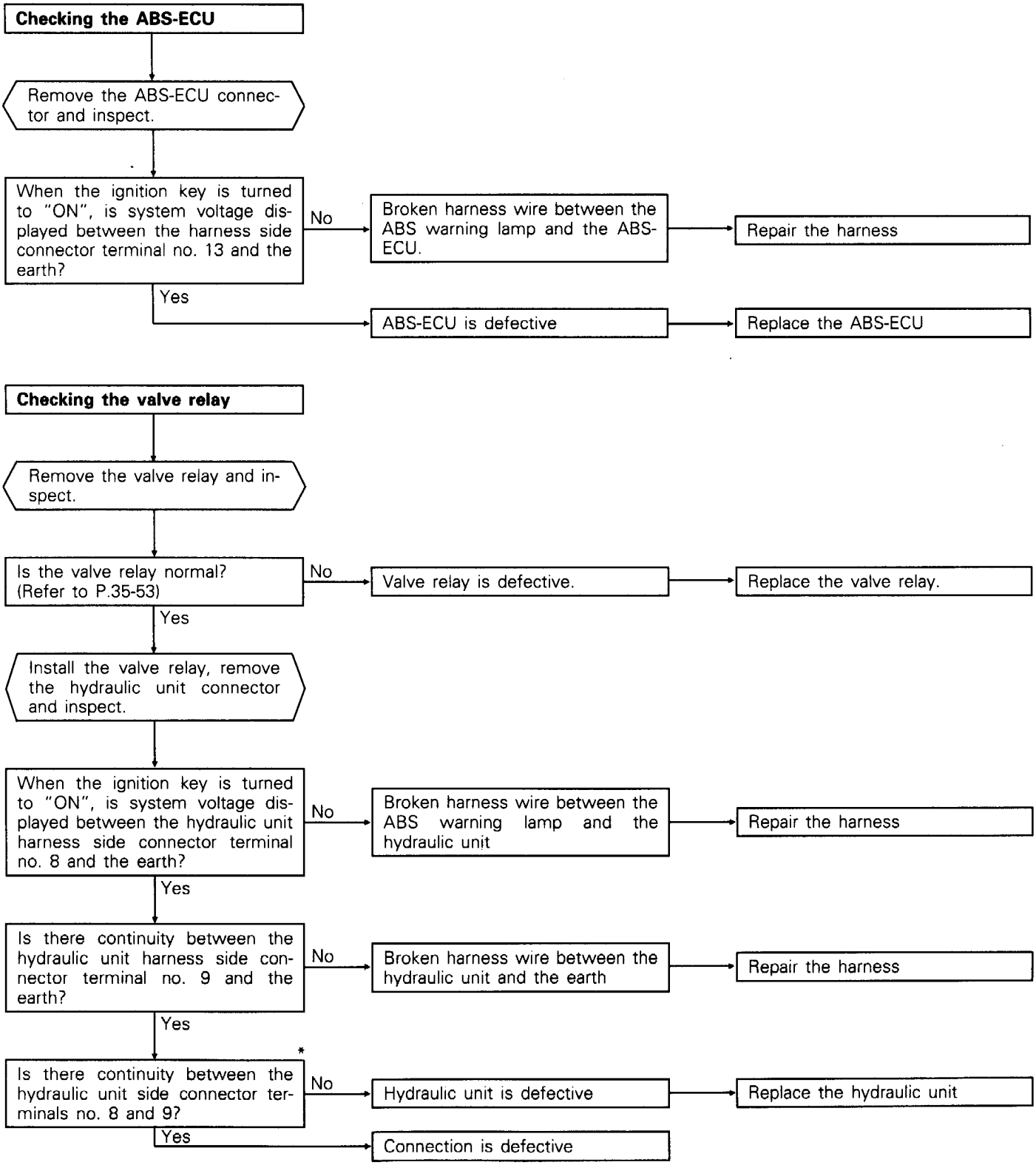
[Comment] When the lamp does not illuminate at all, there is a strong possibility that there is a malfunction of the ABS warning lamp or the power supply.

(Hint) If other warning lamps also do not illuminate, it is probably a blown fuse.



KX35-AK-Q3501


When the ignition key is turned to "ON", do other warning lamps (excluding the door ajar warning lamp) illuminate?
No
Inspect fuse no. 11. If it is blown, replace the fuse after eliminating the cause of the blowout.
Yes
Remove the combination meter and inspect with the ignition key turned to "ON".
Does system voltage show between the harness side connector terminal no. 107 and the earth?
No
Broken harness wire between fuse no.11 and the combination meter
Repair the harness
Yes
Broken circuit wire inside the combination meter
Repair or replace the combination meter
Inspect with the ignition key at OFF
Is the ABS warning lamp normal? (Blown bulb inspection)
No
Broken wire in the ABS warning lamp bulb
Replace the ABS warning lamp bulb
Yes
Is there continuity between the combination meter terminal no. 107 and terminal no. 158?
No
Combination meter is defective
Repair or replace the combination meter
Yes
Is each of the connectors connected?
No
Securely connect the connector. (Repair the pin if it is missing or bent.)
Yes
Broken wire in both the ABS-ECU and valve relay drive circuits. Both circuits should be checked and repaired according to each of the following flow charts.

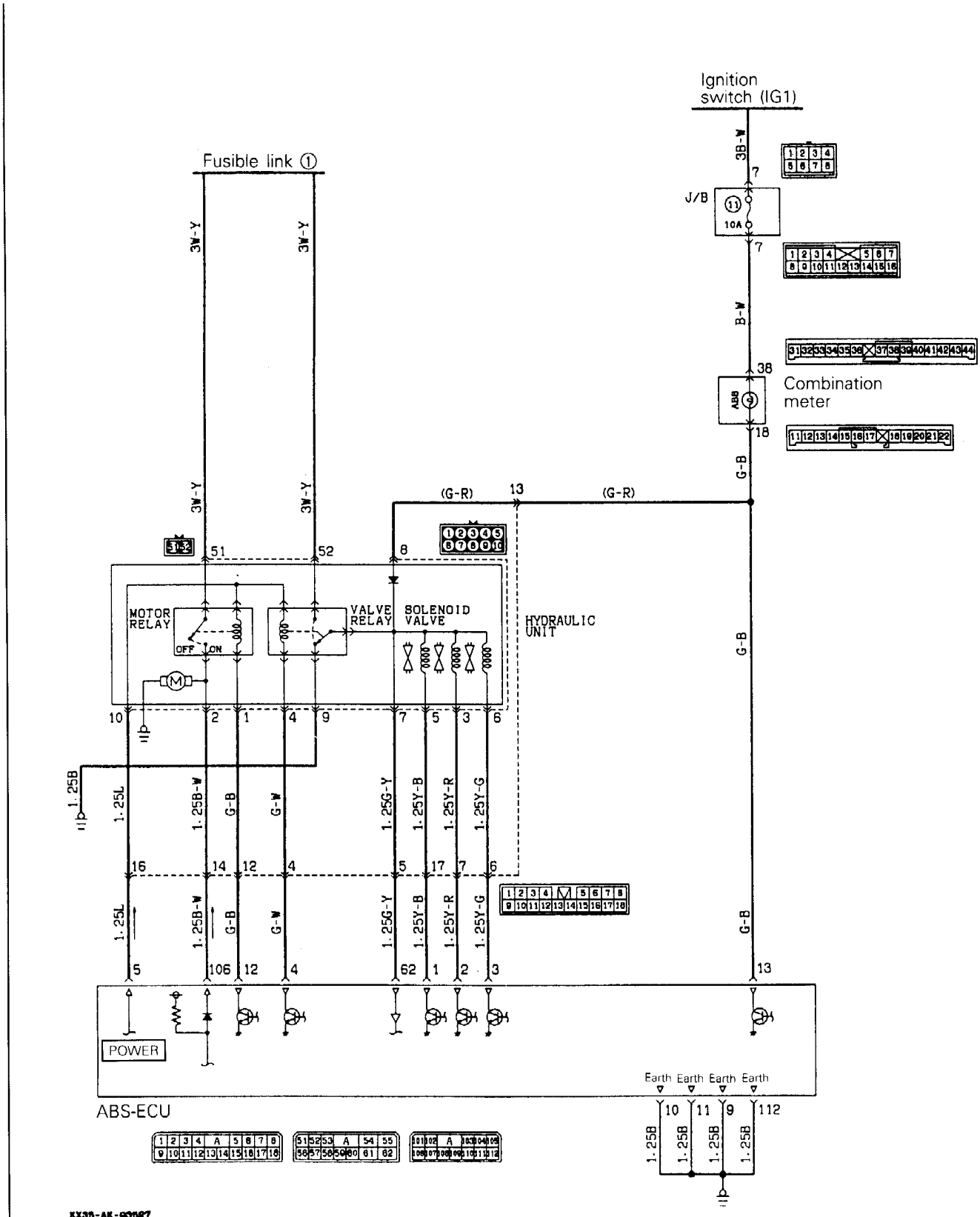


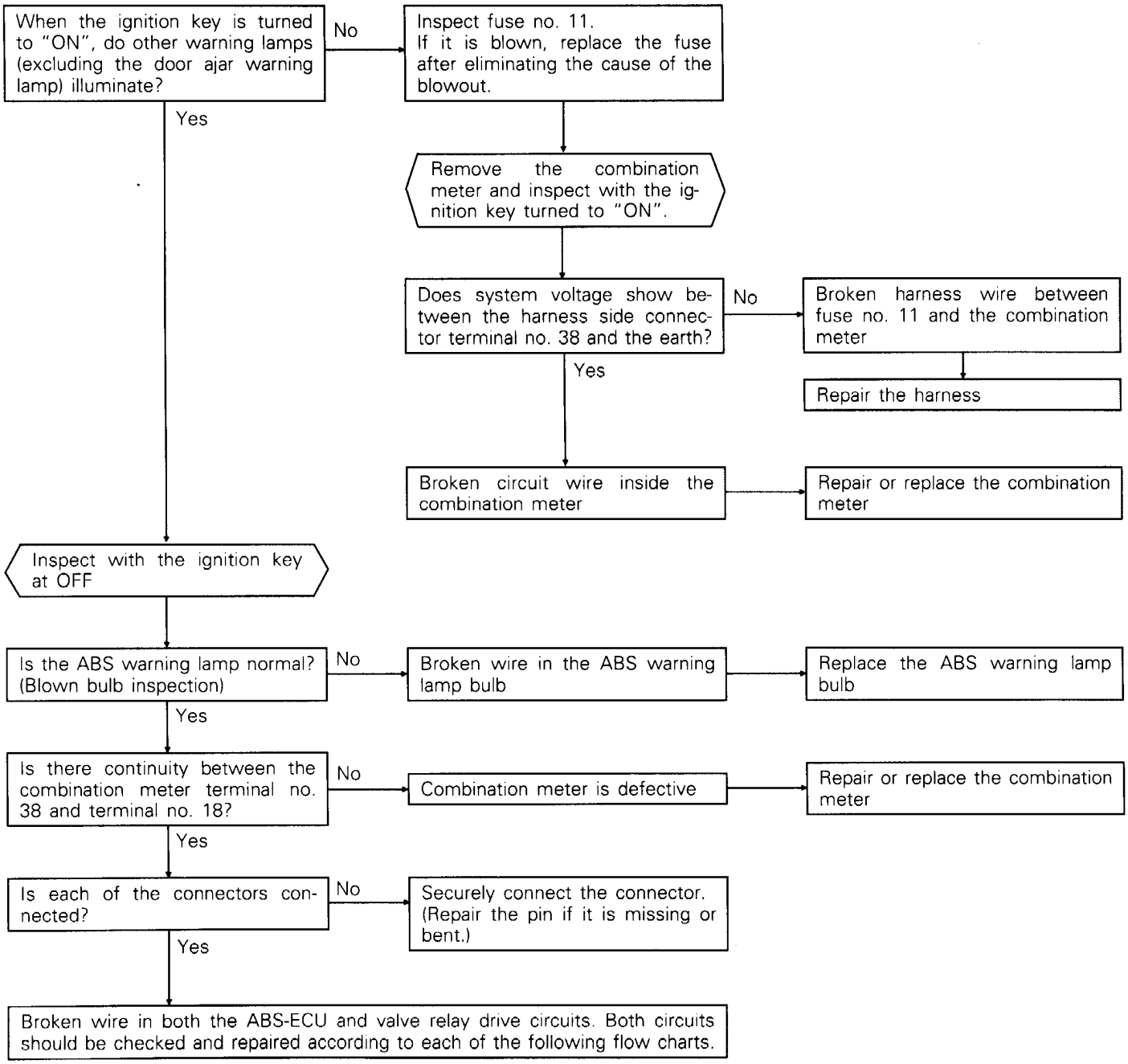
NOTE
For inspection sections marked by *, pay attention to the polarity of the diodes. (Refer to the circuit diagram on P.35-13.)

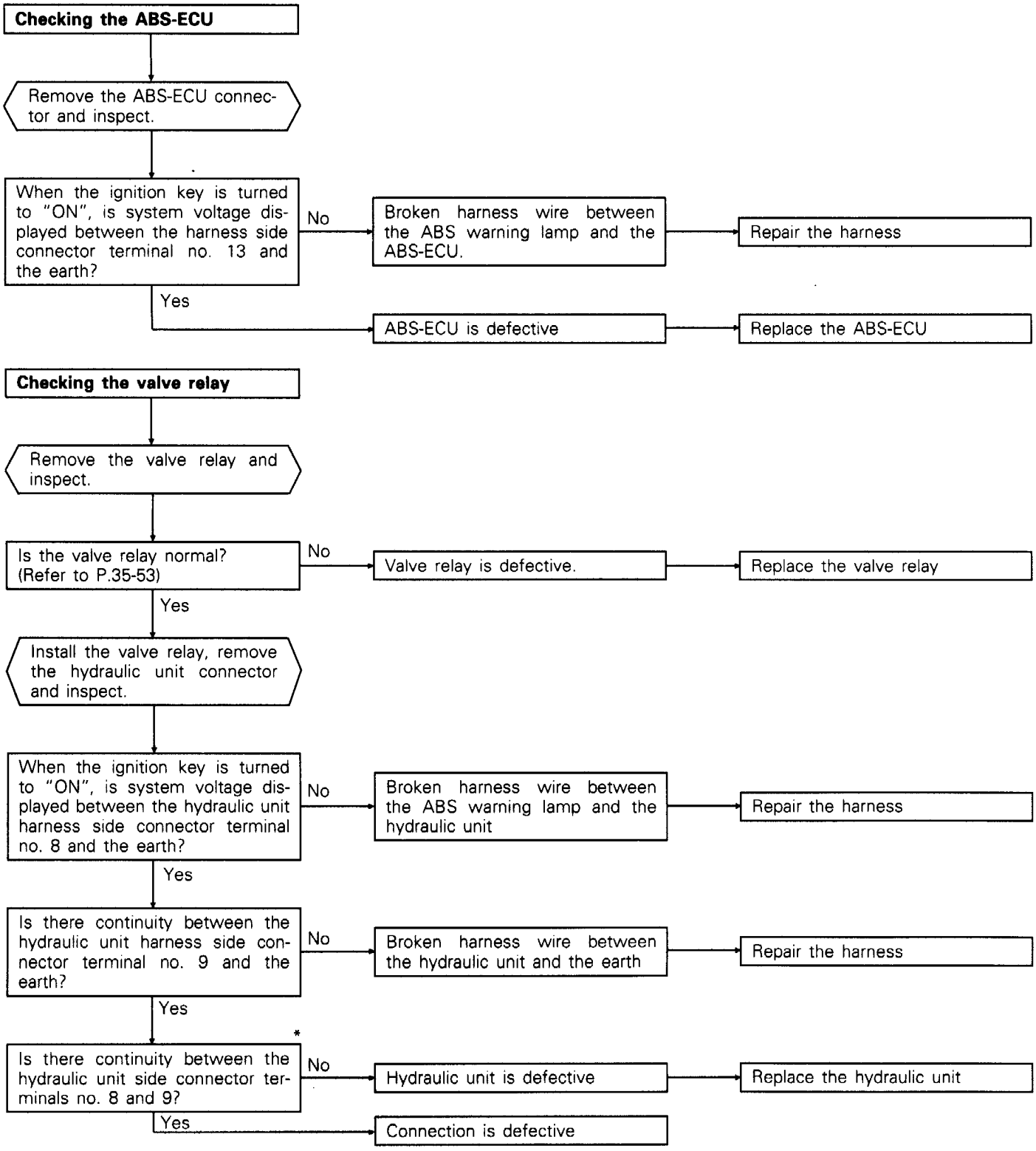
<Vehicles built from November, 1993>

[Comment] When the lamp does not illuminate at all, there is a strong possibility that there is a malfunction of the ABS warning lamp or the power supply.

(Hint) If other warning lamps also do not illuminate, it is probably a blown fuse.




When the ignition key is turned to "ON", do other warning lamps (excluding the door ajar warning lamp) illuminate?
No
Inspect fuse no. 11. If it is blown, replace the fuse after eliminating the cause of the blowout.
Yes
Remove the combination meter and inspect with the ignition key turned to "ON".
Does system voltage show between the harness side connector terminal no. 38 and the earth?
No
Broken harness wire between fuse no. 11 and the combination meter
Repair the harness
Yes
Broken circuit wire inside the combination meter
Repair or replace the combination meter
Inspect with the ignition key at OFF
Is the ABS warning lamp normal? (Blown bulb inspection)
No
Broken wire in the ABS warning lamp bulb
Replace the ABS warning lamp bulb
Yes
Is there continuity between the combination meter terminal no. 38 and terminal no. 18?
No
Combination meter is defective
Repair or replace the combination meter
Yes
Is each of the connectors connected?
No
Securely connect the connector. (Repair the pin if it is missing or bent.)
Yes
Broken wire in both the ABS-ECU and valve relay drive circuits. Both circuits should be checked and repaired according to each of the following flow charts.



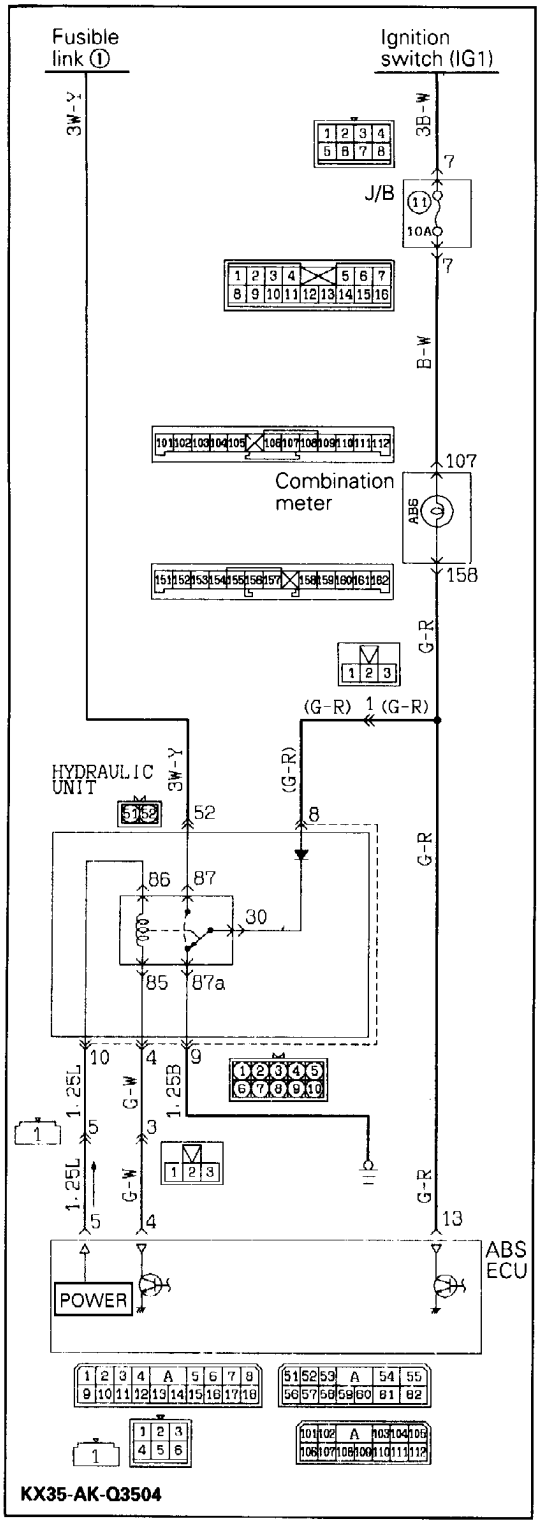
NOTE
For inspection sections marked by *, pay attention to the polarity of the diodes. (Refer to the circuit diagram on P.35-13.)

NOTES

B When the ignition switch is turned to "ON", the ABS warning lamp remains illuminated

<Vehicles built up to October, 1993>

[Comment] This symptom occurs when the ABS-ECU is not functioning due to a broken wire, etc., in the ABS-ECU power circuit, when the fail-safe function is operating to isolate the system, or when there is a short in the warning lamp drive circuit.

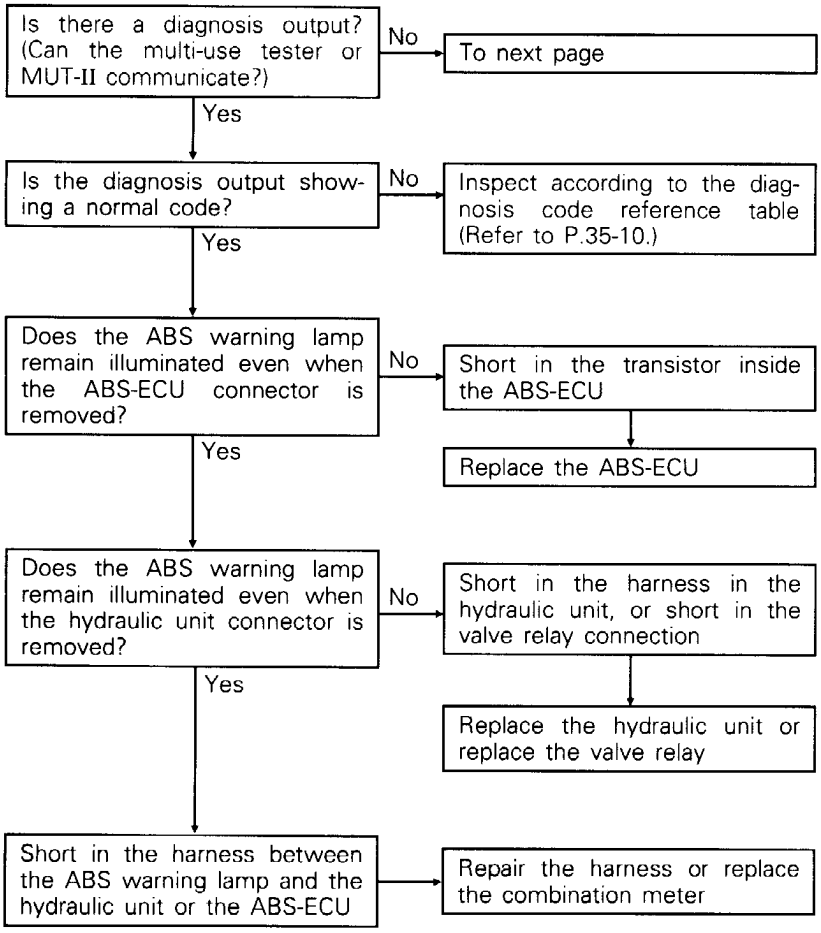


KX35-AK-Q3504

(Hint) Check the diagnosis output, and if there is no output voltage, or the multi-use tester and the ABS-ECU cannot communicate, then there is a high possibility that power is not being supplied to the ABS-ECU.

Caution

- **If no malfunction code is output, there is a high possibility that the fail-safe function is operating. In this case, to check if there is a current problem, the memory should be temporarily erased, and a test run should be carried out.**



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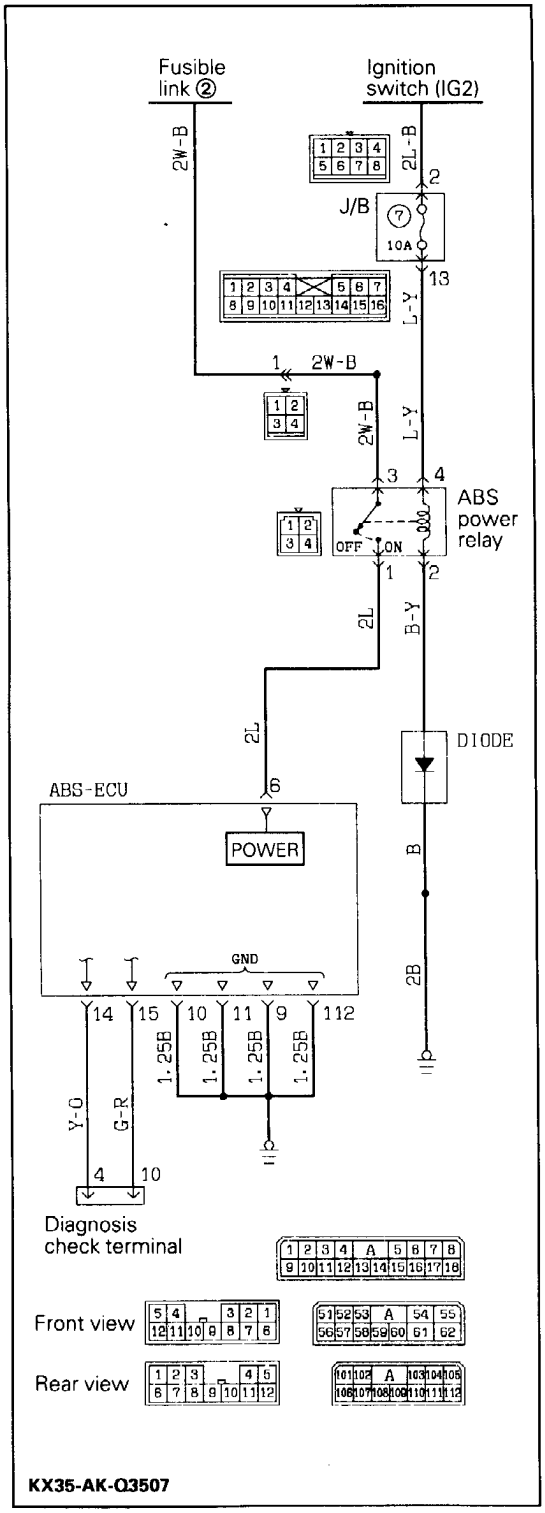


From previous page

Can other electronic control systems communicate with the multi-use tester or MUT-II?
- No → Malfunction in the multi-use tester or MUT-II. Repair or reinspect.
- Yes ↓

Is fuse no. 7 normal?
- No → Replace the fuse after eliminating the cause of the blowout.
- Yes ↓

Does the power relay operate normally? (Refer to P.35-53)
- No → Power relay is defective → Replace the power relay
- Yes ↓

Disconnect the ABS-ECU connector, and inspect the harness side connector.

When the ignition key is turned to "ON", does system voltage show between the harness-side connector terminal no. 6 and the earth?
- No → Broken harness wire between the power relay and the ABS-ECU. → Repair the harness
- Yes ↓

Is there continuity between each of the harness-side connector terminal nos. 9, 10, 11 and 112 and the earth?
- No → Broken wire in the ABS-ECU earth line → Repair the harness
- Yes ↓

Is there continuity between the harness-side connector terminals no. 14 and 15 and the diagnosis check connector terminals no. 4 and 10?
- No → Broken harness wire between the diagnosis check connector and the ABS-ECU. → Repair the harness
- Yes ↓

ABS-ECU is defective → Replace the ABS-ECU

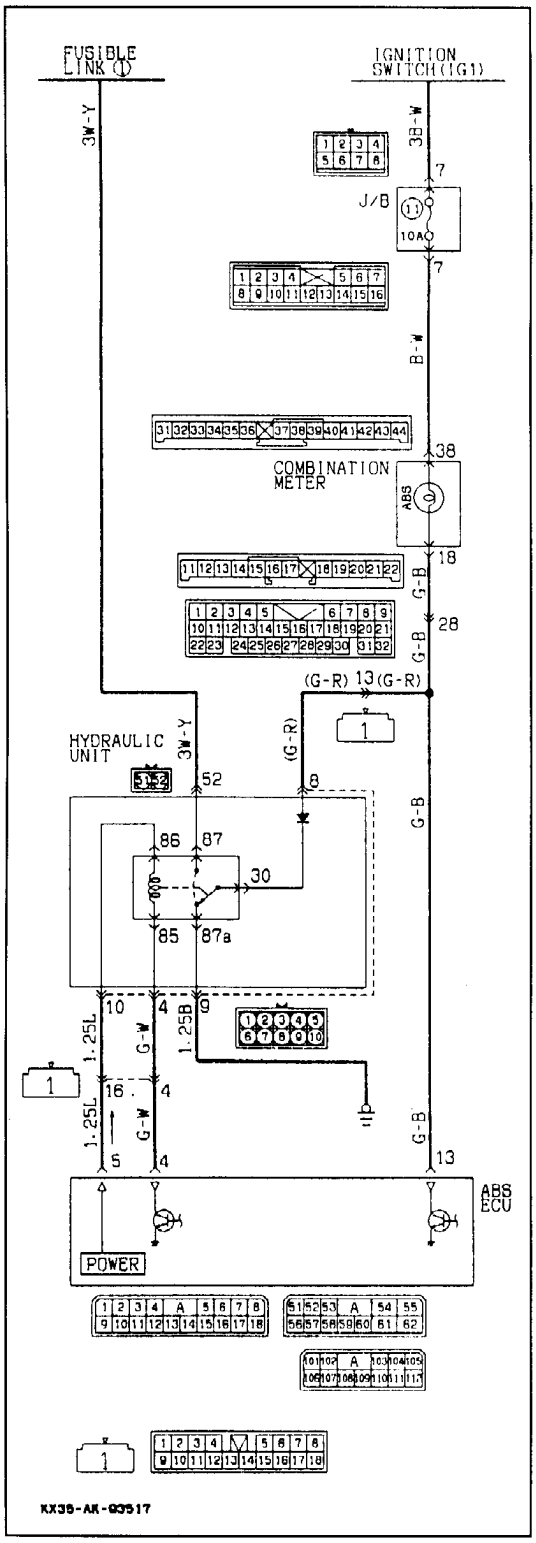
<Vehicles built from November, 1993>

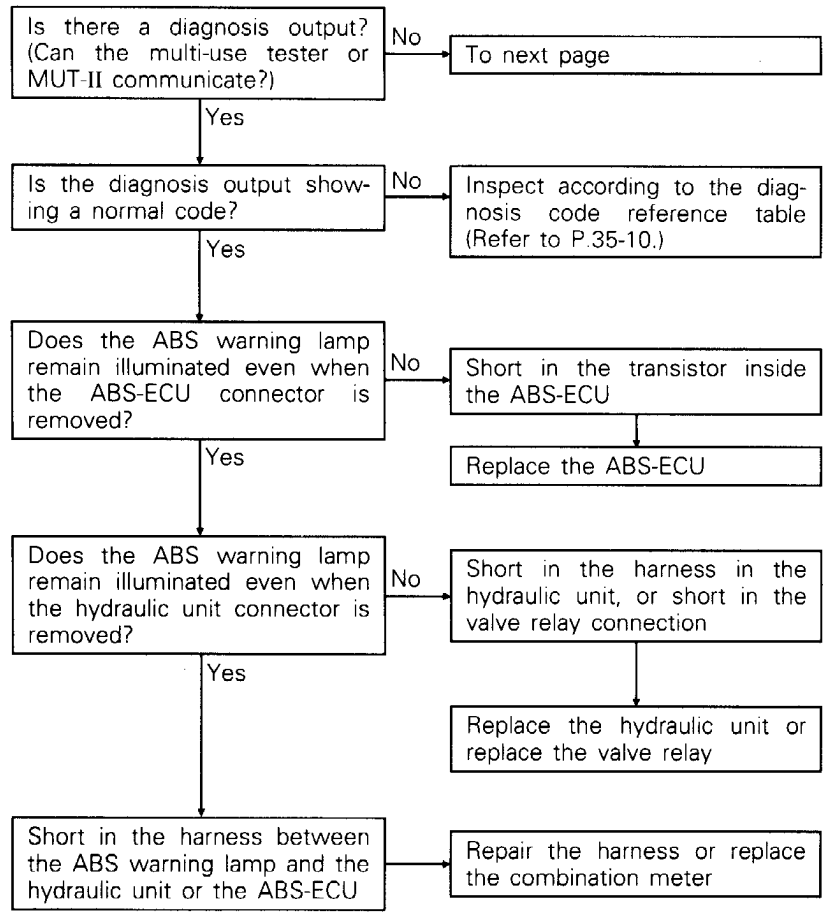
[Comment] This symptom occurs when the ABS-ECU is not functioning due to a broken wire, etc., in the ABS-ECU power circuit, when the fail-safe function is operating to isolate the system, or when there is a short in the warning lamp drive circuit.

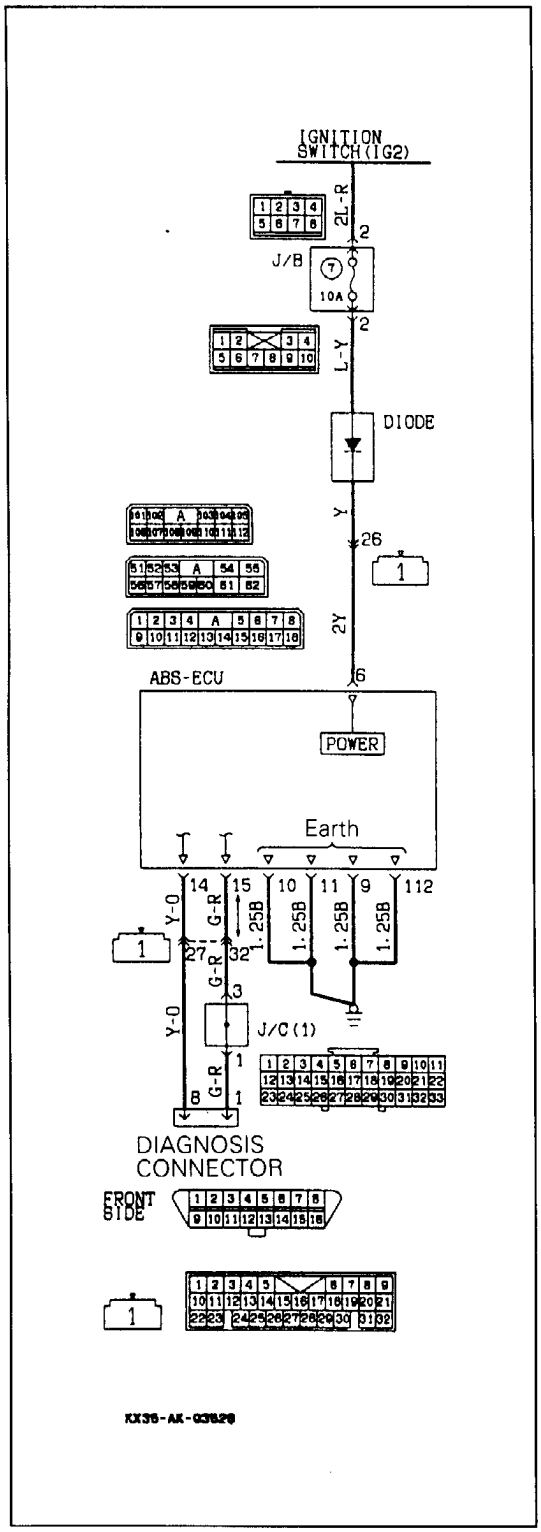
(Hint) Check the diagnosis output, and if there is no output voltage, or the multi-use tester and the ABS-ECU cannot communicate, then there is a high possibility that power is not being supplied to the ABS-ECU.

Caution

- **If no malfunction code is output, there is a high possibility that the fail-safe function is operating. In this case, to check if there is a current problem, the memory should be temporarily erased, and a test run should be carried out.**







From previous page

Can other electronic control systems communicate with the multi-use tester or MUT-II?
- No → Malfunction in the multi-use tester or MUT-II. Repair or reinspect.
- Yes ↓

Is fuse no. 7 normal?
- No → Replace the fuse after eliminating the cause of the blowout.
- Yes ↓

Disconnect the ABS-ECU connector, and inspect the harness side connector.

When the ignition key is turned to "ON", does system voltage show between the harness-side connector terminal no. 6 and the earth?
- No → Broken harness wire between the power relay and the ABS-ECU. → Repair the harness
- Yes ↓

Is there continuity between each of the harness-side connector terminal nos. 9, 10, 11 and 112 and the earth?
- No → Broken wire in the ABS-ECU earth line → Repair the harness
- Yes ↓

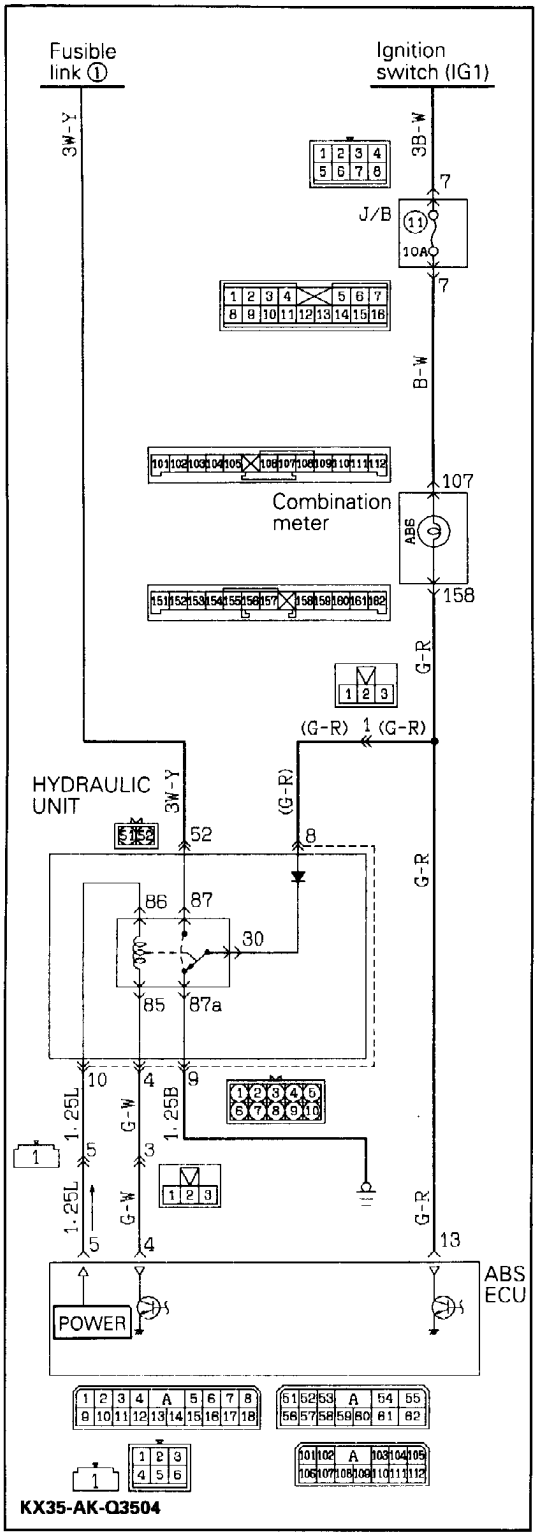
Is there continuity between the harness-side connector terminals no. 14 and 15 and the diagnosis check connector terminals no. 8 and 1?
- No → Broken harness wire between the diagnosis check connector and the ABS-ECU. → Repair the harness
- Yes ↓

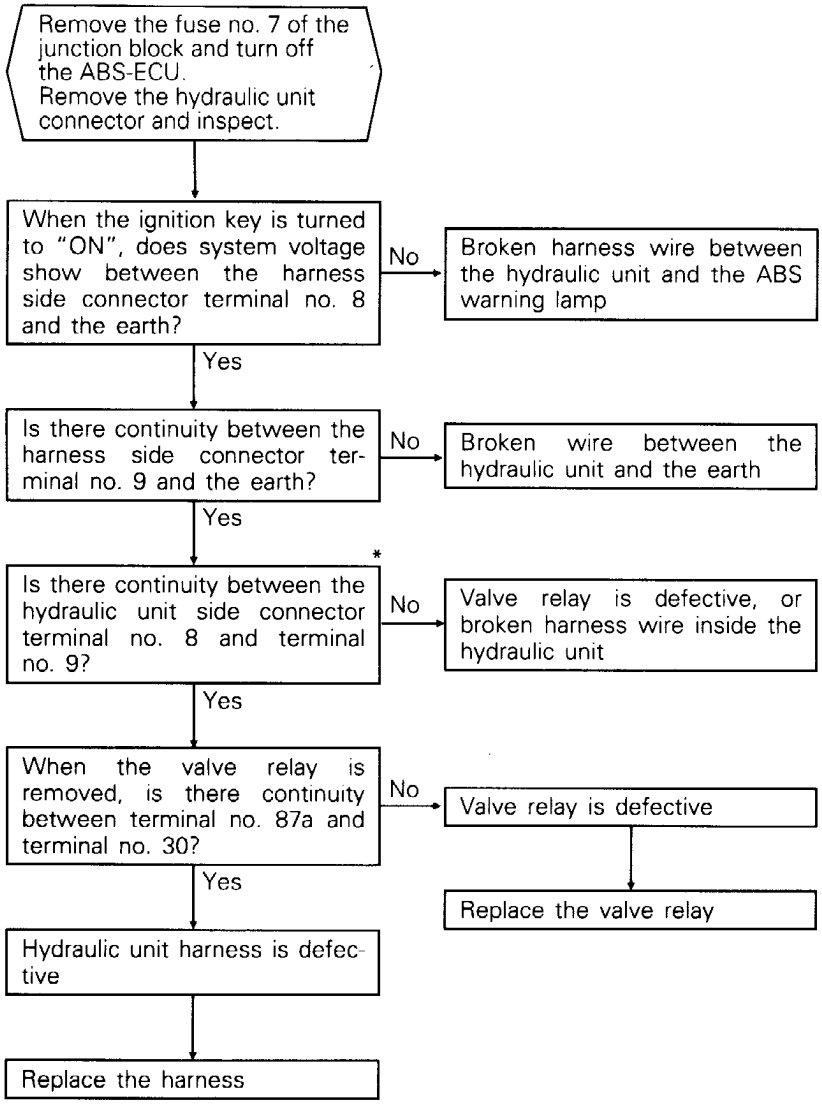
ABS-ECU is defective → Replace the ABS-ECU

C When ignition key is turned to "START", ABS warning lamp switches off

<Vehicles built up to October, 1993>

[Comment] The ABS-ECU uses the power to the IG2 which is cut when the ignition switch is turned to "START". The ABS warning lamp uses IG1 power which is not cut even when the ignition switch is turned to "START". Accordingly, because the power to the ABS-ECU is stopped in "START" position, the valve relay turns OFF. At this time, if the warning lamp does not illuminate, the cause is a problem in the lamp illumination circuit in the valve relay.





NOTE
For inspection sections marked by *, pay attention to the polarity of the diodes. (Refer to the circuit diagram)

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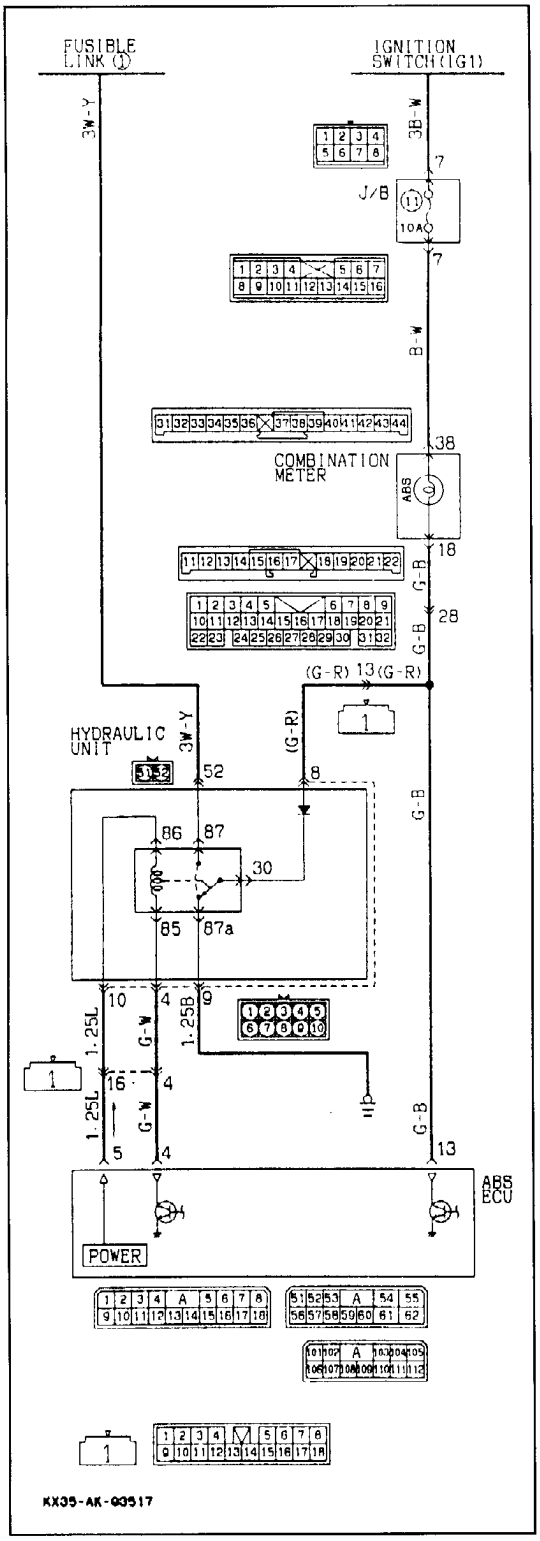
<Vehicles built from November, 1993>

[Comment] The ABS-ECU uses the power to the IG2 which is cut when the ignition switch is turned to "START". The ABS warning lamp uses IG1 power which is not cut even when the ignition switch is turned to "START". Accordingly, because the power to the ABS-ECU is stopped in "START" position, the valve relay turns OFF. At this time, if the warning lamp does not illuminate, the cause is a problem in the lamp illumination circuit in the valve relay.



Remove the fuse no. 7 of the junction block and turn off the ABS-ECU.
Remove the hydraulic unit connector and inspect.

When the ignition key is turned to "ON", does system voltage show between the harness side connector terminal no. 8 and the earth?
- No → Broken harness wire between the hydraulic unit and the ABS warning lamp
- Yes ↓

Is there continuity between the harness side connector terminal no. 9 and the earth?
- No → Broken wire between the hydraulic unit and the earth
- Yes ↓

* Is there continuity between the hydraulic unit side connector terminal no. 8 and terminal no. 9?
- No → Valve relay is defective, or broken harness wire inside the hydraulic unit
- Yes ↓

When the valve relay is removed, is there continuity between terminal no. 87a and terminal no. 30?
- No → Valve relay is defective → Replace the valve relay
- Yes ↓

Hydraulic unit harness is defective ↓

Replace the harness

NOTE
For inspection sections marked by *, pay attention to the polarity of the diodes. (Refer to the circuit diagram)

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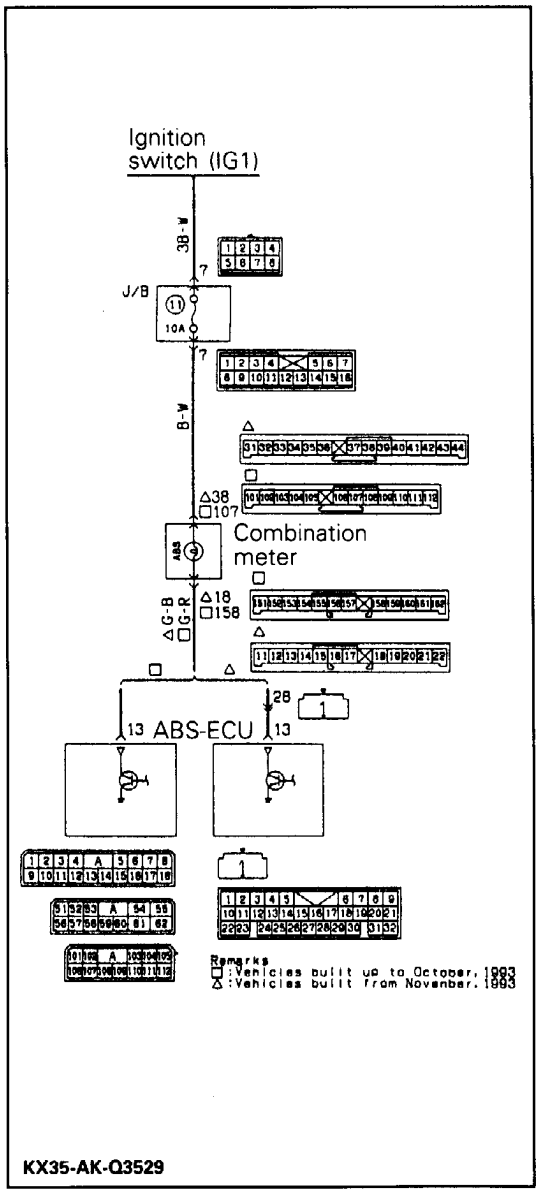
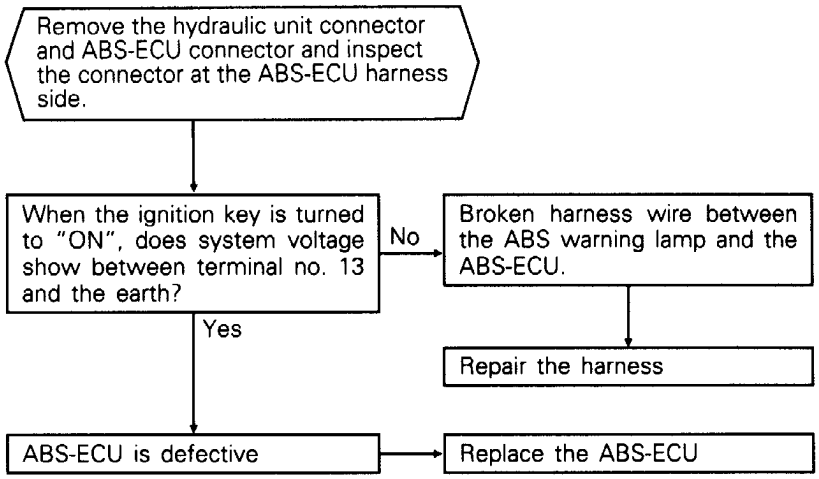
NOTES

D **The ABS warning lamp flashes twice after the ignition key is turned to "ON". The lamp illuminates when the ignition key is turned to "START", and when the key is returned to "ON", it flashes once.**

[Comment] The ABS-ECU causes the ABS warning lamp to illuminate during the initial check (approx. 1 second). During the initial check, the valve relay changes from OFF to ON→OFF→ON, and if there is a broken harness wire between the ABS-ECU and the ABS warning lamp, the lamp will illuminate only when the valve relay is OFF because of a valve relay test, etc.



KX35-AK-Q3529



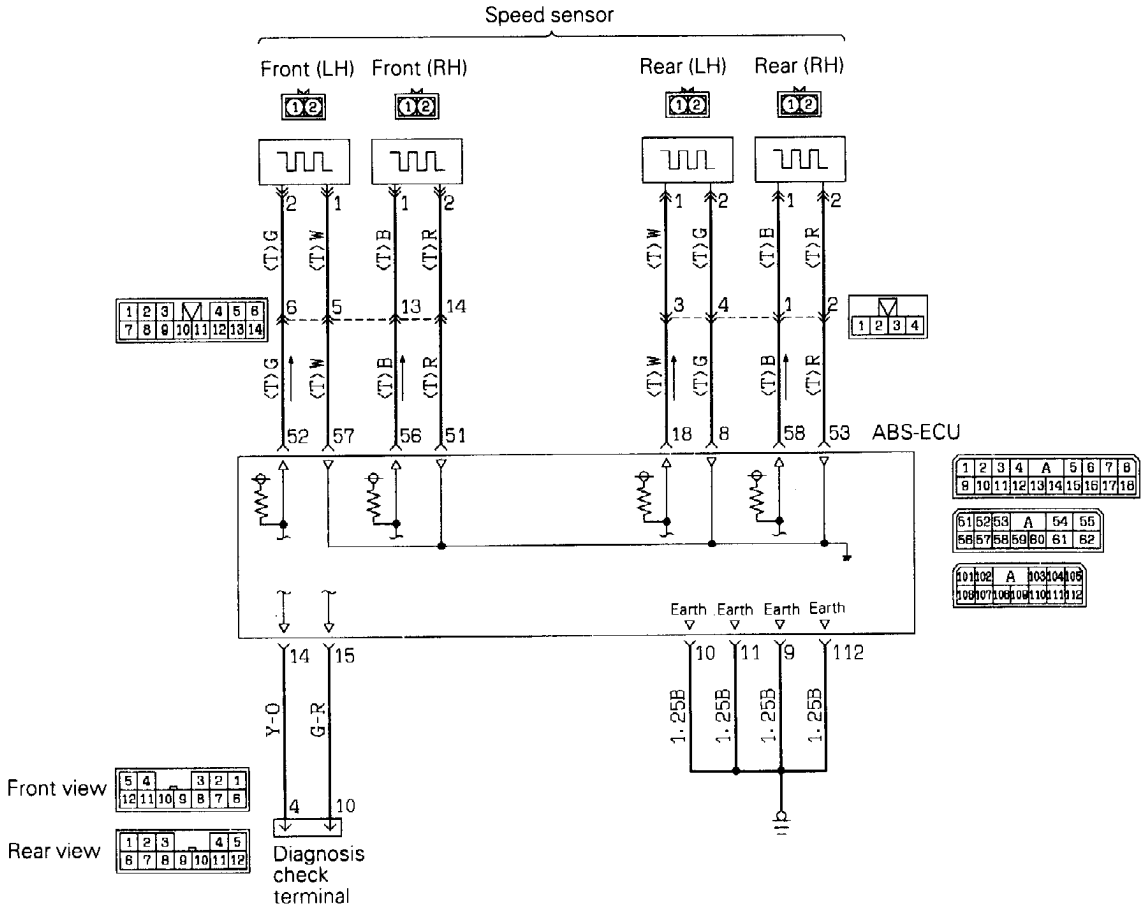
E-1	When diagnosis code nos. 11, 12, 13, or 14 are displayed

[Comment] These codes are displayed when there is a broken (+) wire or (–) wire in one of the vehicle speed sensors detected by the ABS-ECU hardware circuit.

(Hint) Apart from a broken wire in a vehicle speed sensor, the cause could also be an intermittent break in a sensor harness or a defective harness connection, so check these also.

NOTE
1. When there is a defective contact, inspect the sensor cable by lightly flexing and stretching it.
2. If there is no current problem, a normal value will result even if a problem is detected, so when the malfunction in the sensor circuit indicated cannot be discovered, momentarily turn the ignition switch to OFF, and carry out another driving test. At this time, replace the ABS-ECU only if the same problem code is output. After this, if the code does not reappear, there is a problem with the ABS-ECU interface. (For a problem that is difficult to reproduce, there is a possibility that the code will recur even when the ABS-ECU is replaced.)

<Vehicles built up to October, 1993>



KX35-AK-Q3509

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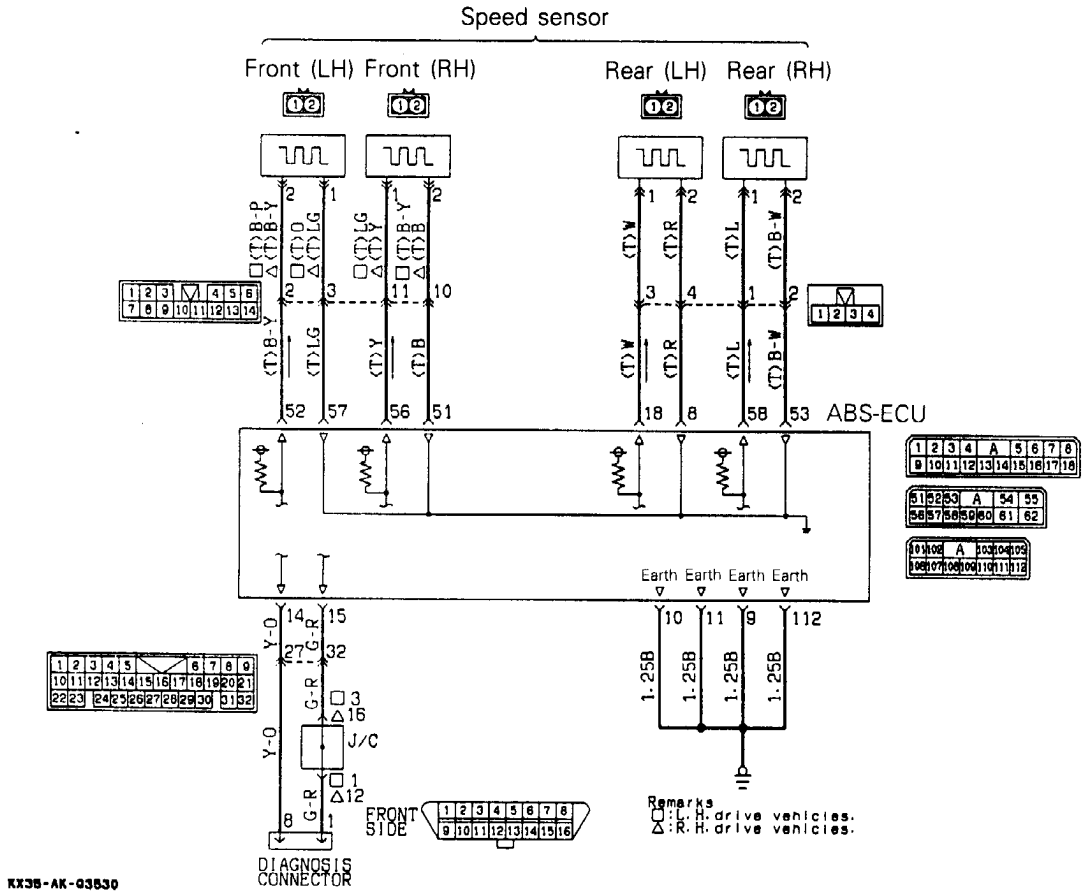
<Vehicles built from November, 1993>



Is the resistance value of the wheel speed sensor that displayed the malfunction code normal?
Standard value:
Front 0.9–1.1 kΩ
Rear 1.3–2.1 kΩ

No → Wheel speed sensor is defective → Replace the wheel speed sensor

Yes ↓

Is the resistance value of the ABS-ECU connector normal?
Standard value:
Front 0.9–1.1 kΩ
Rear 1.3–2.1 kΩ

No → Broken harness wire in the wheel speed sensor circuit. → Repair the harness

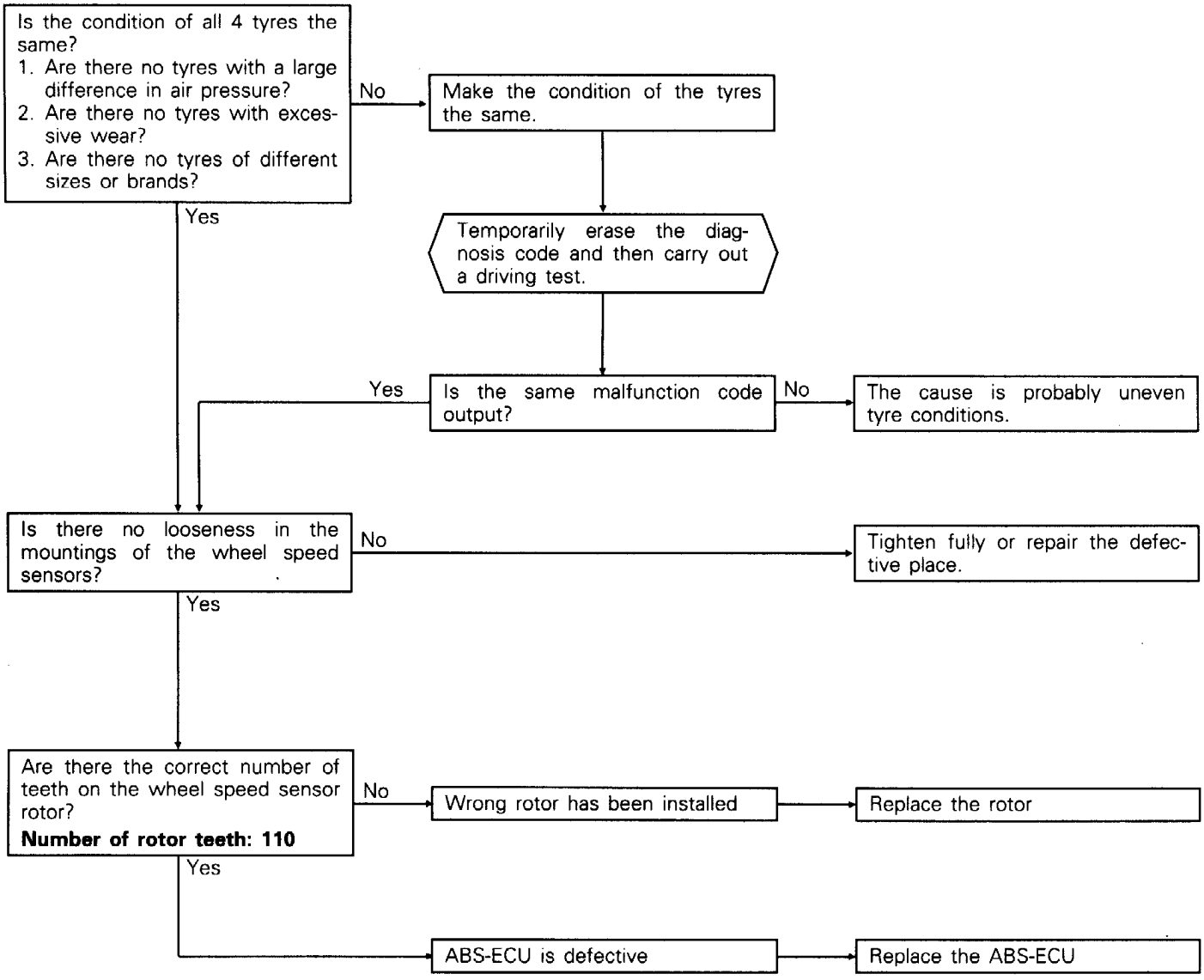
Yes ↓

Broken wire in the ABS-ECU interface circuit. → Replace the ABS-ECU

E-2 When diagnosis code no. 15 is displayed

[Comment] This malfunction code is output when any one of the wheel speed sensor output signals during driving is abnormal.

(Hint) The cause of the abnormal wheel speed sensor output could be noise in the sensor signal from a loose wheel speed sensor.



NOTES

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E-3 When diagnosis code no. 21, 22, 23 or 24 is displayed

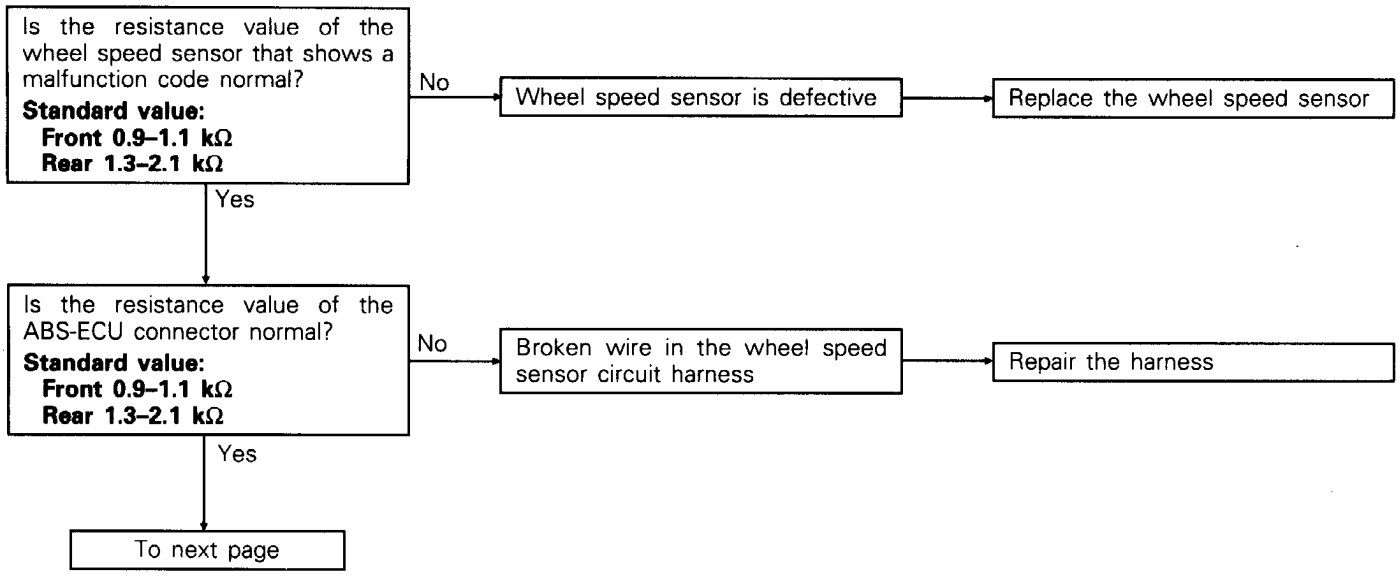
[Comment] These malfunction codes are displayed when a broken wire cannot be verified, and when the vehicle speed reaches 8 km/h (5 mph) or more, no pulses are input.

(Hint) The cause is likely to be either a short between the sensor harnesses, a short between the sensor (+) wire and the body, or an excessive sensor gap.

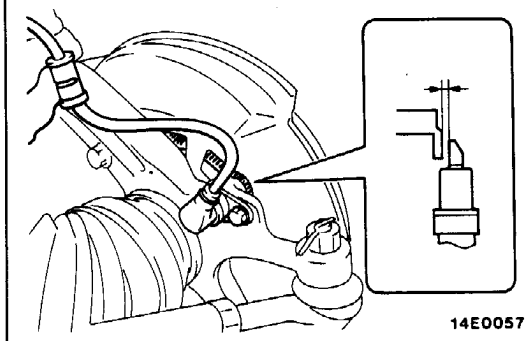
NOTE

(1) When there is a defective contact, inspect the sensor cable by lightly flexing and stretching it.

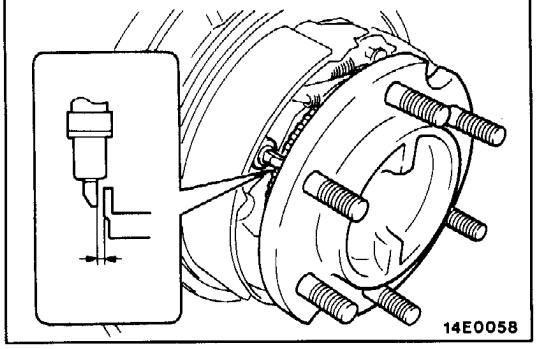
(2) If there is no current problem, a normal value will result even if a problem is detected, so when the malfunction in the sensor circuit indicated cannot be discovered, momentarily erase the diagnosis code and turn the ignition switch to OFF, and carry out another driving test. At this time, replace the ABS-ECU only if the same malfunction code is output. After this, if the code does not reappear, there is a problem with the ABS-ECU interface. (For a problem that is difficult to reproduce, there is a possibility that the code will recur even when the ABS-ECU is replaced.)



Front wheel speed sensor



Rear wheel speed sensor



From previous page

Is the clearance between the wheel speed sensor that shows a malfunction code output and the rotor normal?
Standard value:
Front: 0.2–1.0 mm (0.008–0.039 in.)
Rear: 0.3–0.9 mm (0.012–0.035 in.)

No →
1. When it is a front wheel speed sensor
   Repair the place where there is a loose sensor mounting bolt, etc.
2. When it is a rear wheel speed sensor
   Adjust the clearance between the sensor and the rotor.

Yes ↓

Is the rotor of the wheel speed sensor that shows a malfunction code output normal, with no parts deformed or chipped?

No → Replace the rotor with deformed or chipped teeth.

Yes ↓

Inspect the output of each wheel speed sensor, including wave patterns from an oscilloscope. (Refer to P.35-48.)
Is the output voltage from each wheel speed sensor at the standard value or above, and are all wave patterns normal also?

No → If voltage is below the standard value, or if there is an abnormal wave pattern, re-inspect, and replace any sensor or rotor that is defective.

Yes ↓

If all of the above checks are normal and this problem code reappears frequently, then the ABS-ECU is defective.

→ Replace the ABS-ECU and check if the problem doesn't recur.

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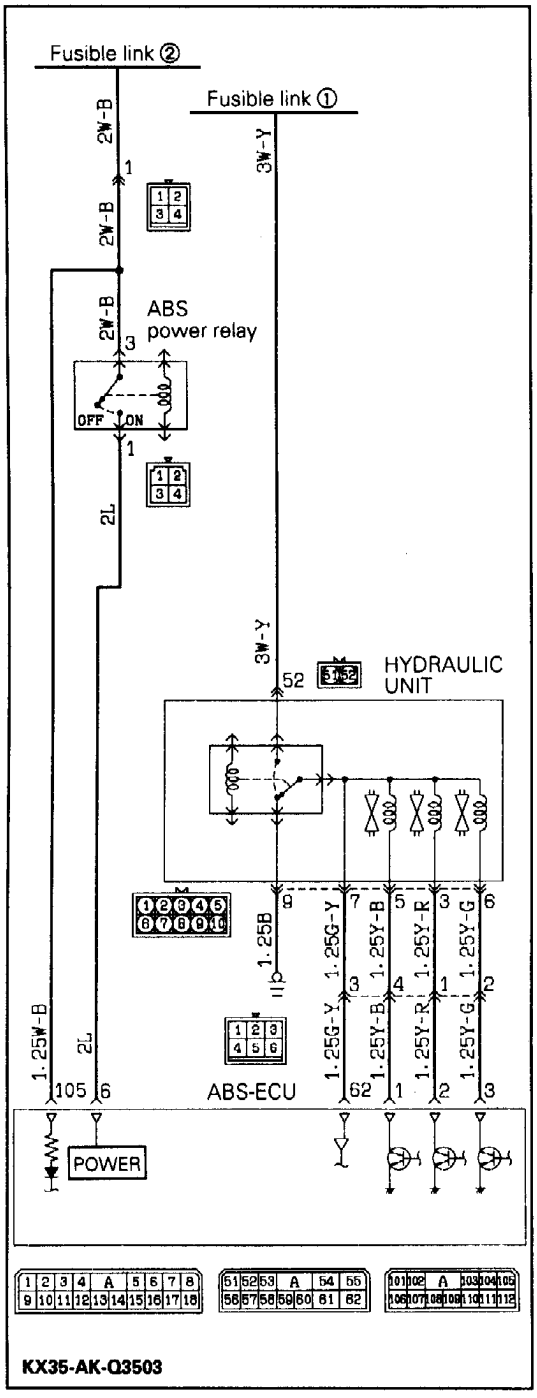
E-4 When diagnosis code no. 16 is displayed

<Vehicles built up to October, 1993>

[Comment] This indicates that the ABS-ECU power voltage or the solenoid valve power voltage is lower than the standard value.
If the voltage returns to standard voltage or above, this malfunction code will not be output.

Caution
If the system voltage drops during inspection, this code will be output as a current problem, and correct diagnosis of the problem cannot be made. Before carrying out the following inspection, check the battery, and charge it if necessary.



When the engine is running, does a voltage of 10V or more show between the ABS-ECU power terminal no. 6 and the earth?
- No → Check that there are no defective contacts in the fusible link or in each connector.
- Yes ↓

When the engine is running, does a voltage of 10V or more show between the ABS-ECU solenoid valve voltage monitor terminal no. 62 and the earth?
- No → Check that there are no defective contacts in the fusible link or in each connector.
- Yes ↓

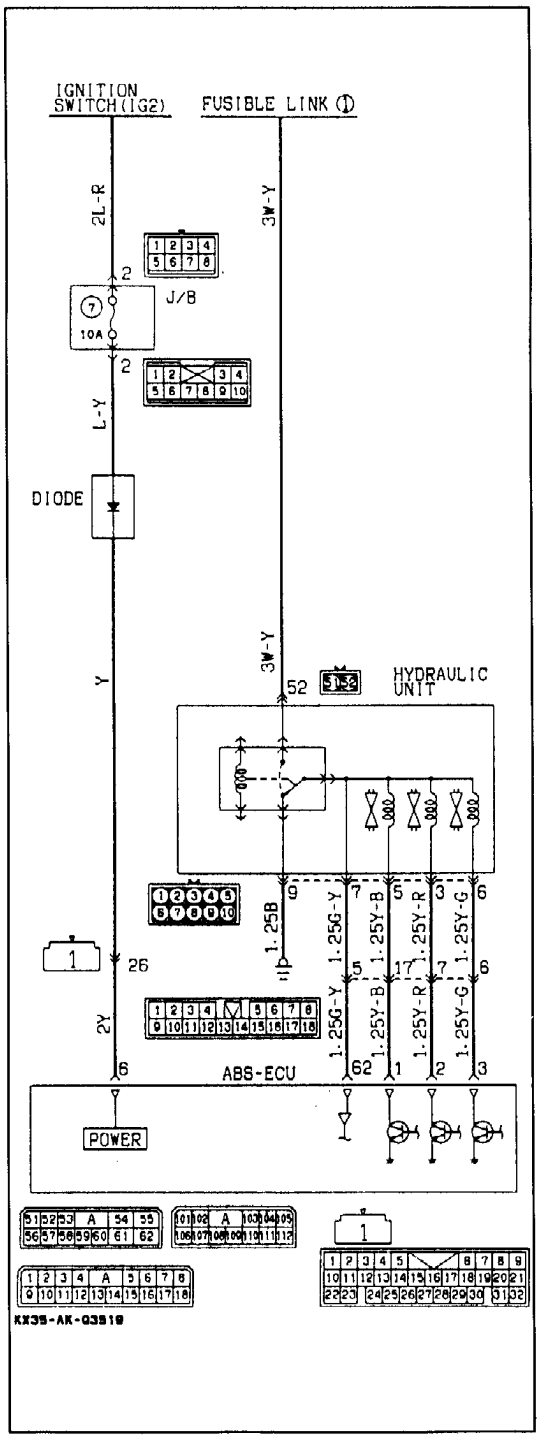
Is the ABS-ECU connection normal? (When the connector is disconnected, check if there are no bends in the pins, or that contact pressure is sufficient.)
- No → Repair the ABS-ECU connector
- Yes ↓

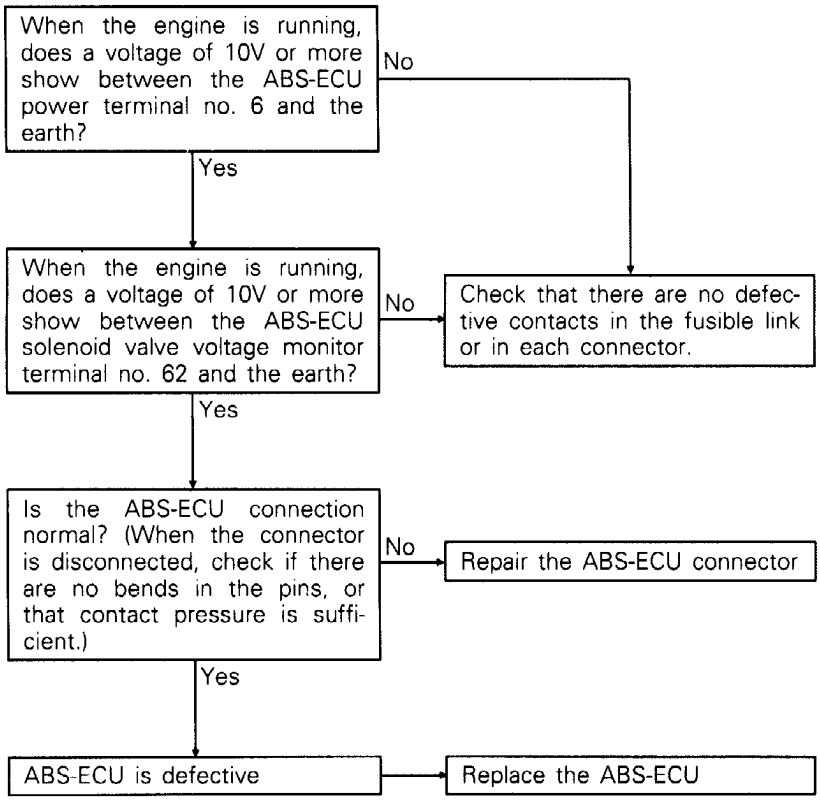
ABS-ECU is defective → Replace the ABS-ECU

<Vehicles built from November, 1993>

[Comment] This indicates that the ABS-ECU power voltage or the solenoid valve power voltage is lower than the standard value.
If the voltage returns to standard voltage or above, this malfunction code will not be output.

Caution
If the system voltage drops during inspection, this code will be output as a current problem, and correct diagnosis of the problem cannot be made. Before carrying out the following inspection, check the battery, and charge it if necessary.



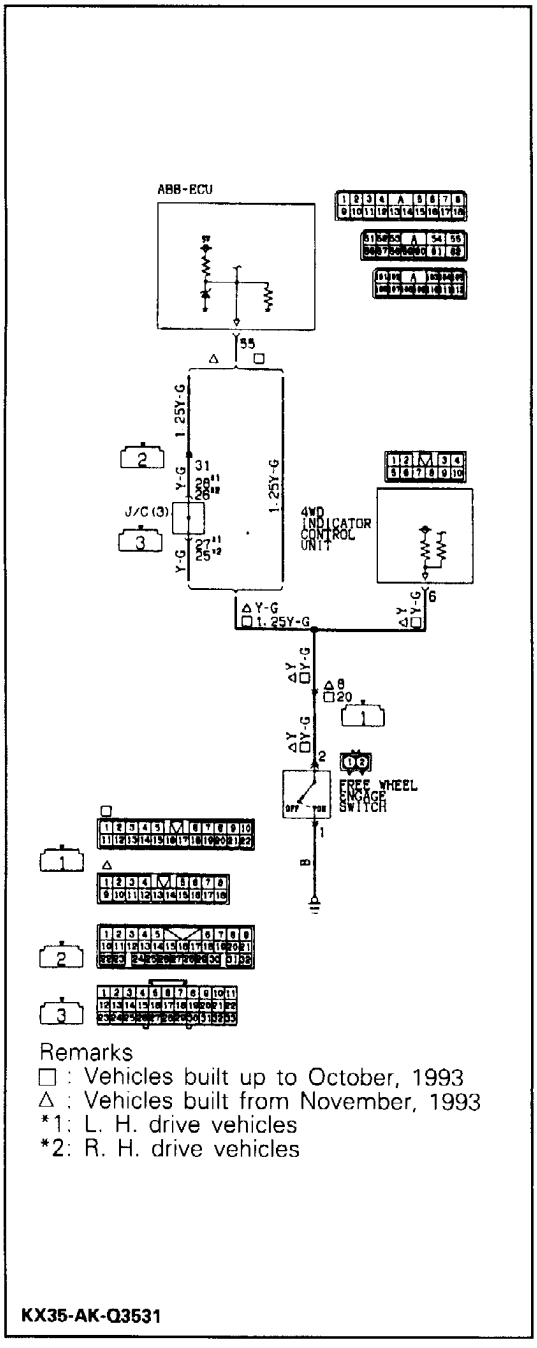


NOTES

E-5 When diagnosis code no. 25 is displayed

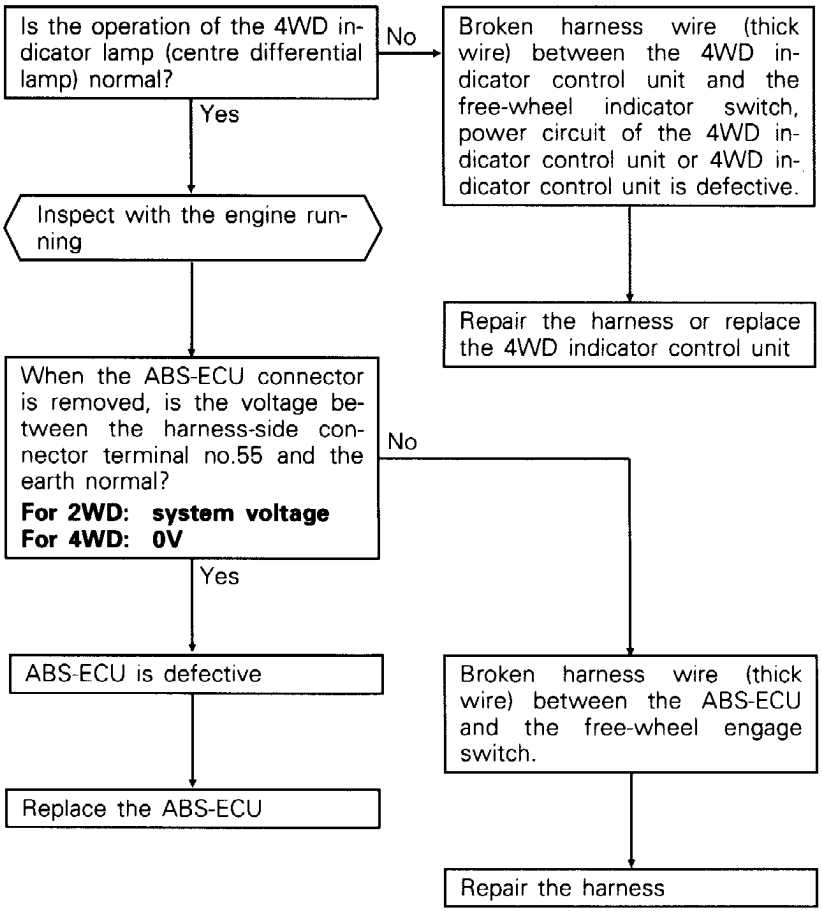
[Comment] This malfunction code is output by the ABS-ECU when there is a broken harness wire or defective 4WD indicator circuit in the free-wheel engage switch (thick wire in centre of circuit diagram).

(Hint) When this malfunction code is output, and also none of the 4WD indicator lamps (excluding the rear differential lamp) are illuminated, the cause is likely to be the power circuit in the 4WD indicator control unit.



Remarks
□ : Vehicles built up to October, 1993
△ : Vehicles built from November, 1993
*1: L. H. drive vehicles
*2: R. H. drive vehicles

KX35-AK-Q3531



E-6 When diagnosis code no. 26 is displayed

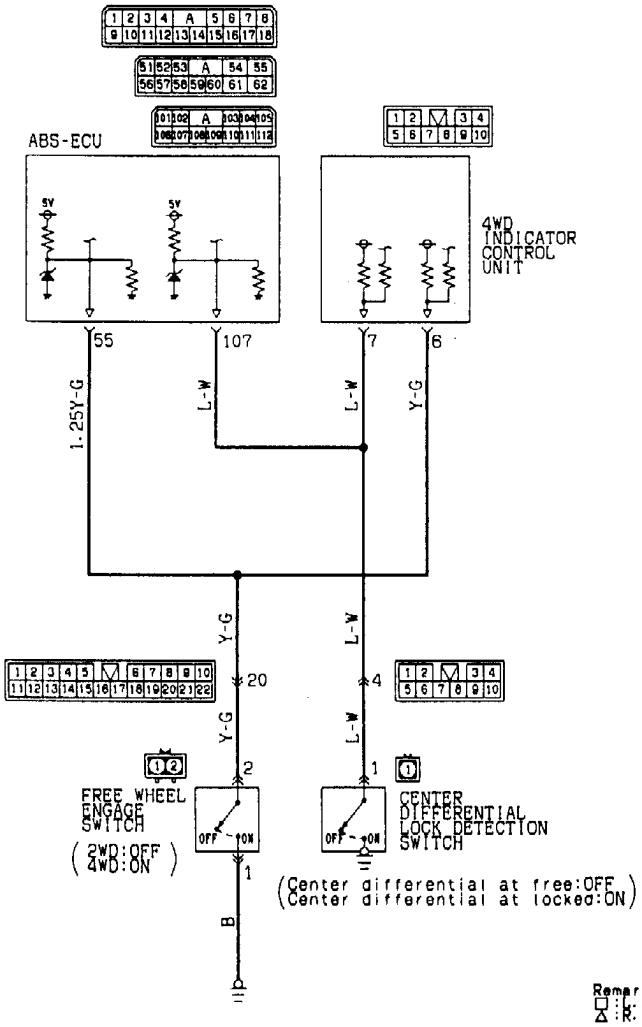
[Comment] This malfunction code is output by the ABS-ECU in the following cases:
- Broken harness wire (thick wire) in the center differential lock detection switch system
- At a vehicle speed of 15 km (9 mph) or higher, the free-wheel engage switch is OFF and the center differential lock switch is ON for a continuous period of 5 seconds or more (Combination switch signal abnormality)
- When the 4WD indicator circuit is defective

(Hint) 1.
- A combination switch signal abnormality occurs at the following times:
  Broken harness wire (thick wire) in the free-wheel engage switch system or defective switch (stays OFF)
- (Short in harness wire (thick wire) in the center differential lock switch system or defective switch (stays ON)

The above malfunctions are also affected by the 4WD indicator, so it might be the case that the malfunction is caused by a trouble symptom in the 4WD indicator.

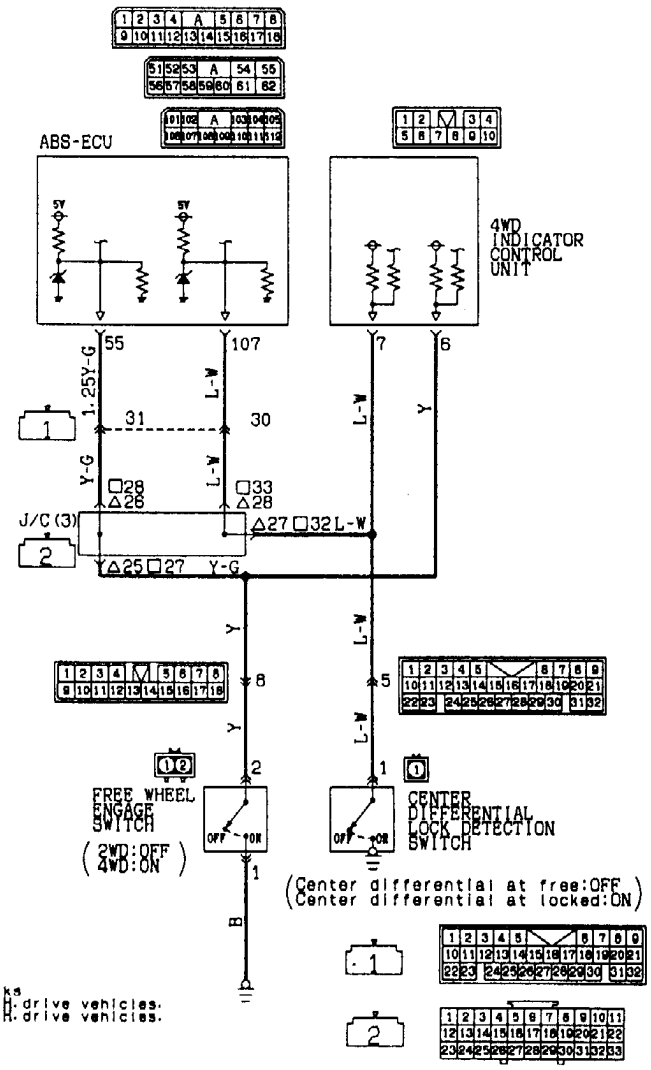
2. When this malfunction code is output, and also none of the 4WD indicator lamps (excluding the rear differential lamp) are illuminated, the cause is likely to be the power circuit in the 4WD indicator control unit.

<Vehicles built up to October, 1993>



KX35-AK-Q3521

<Vehicles built from November, 1993>



KX35-AK-Q3532

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Does the 4WD indicator operate normally?

No

Yes

Trouble symptom	Main cause	Remedy
Even when the transfer shift lever is in the "4H" position, the 4WD front wheel indicator lamp does not illuminate.	Broken harness wire between the 4WD indicator ECU and the free-wheel engage switch, or broken earth wire from the free-wheel engage switch.	Repair the harness
	Free wheel engage switch is defective	Replace the switch
Even when the transfer shift lever is in the "4H" position, the 4WD center differential lamp does not illuminate.	Broken harness wire between the 4WD indicator ECU and the center differential lock switch	Repair the harness
	Broken wire in the 4WD indicator ECU circuit	Replace the ECU
4WD indicator center differential lamp illuminates regardless of the position of the transfer shift lever	Short in the harness wire in the center differential lock detection switch circuit	Repair the harness
	Center differential lock detection switch is defective	Replace the switch
	Short inside the ABS-ECU circuit	Replace the ABS-ECU
	Short inside the 4WD indicator ECU circuit	Replace the 4WD indicator ECU
No indicator is illuminated	Power circuit in the 4WD indicator ECU is defective	Repair the harness
	4WD indicator ECU is defective	Replace the 4WD indicator ECU

NOTE
When checking a short in the ABS-ECU circuit, remove the ABS-ECU connector and check if the 4WD indicator returns to normal. If it returns to normal, the ABS-ECU is defective. Furthermore, if the ABS-ECU is normal, then the 4WD indicator ECU will be defective.

When the ABS-ECU connector is removed, is the voltage between the harness-side connector terminal no. 107 and the earth normal?
When center differential is locked: 0V
When center differential is free: system voltage

No

Yes

ABS-ECU is defective

Replace the ABS-ECU

Broken harness wire between the ABS-ECU and the center differential lock detection switch

Repair the harness

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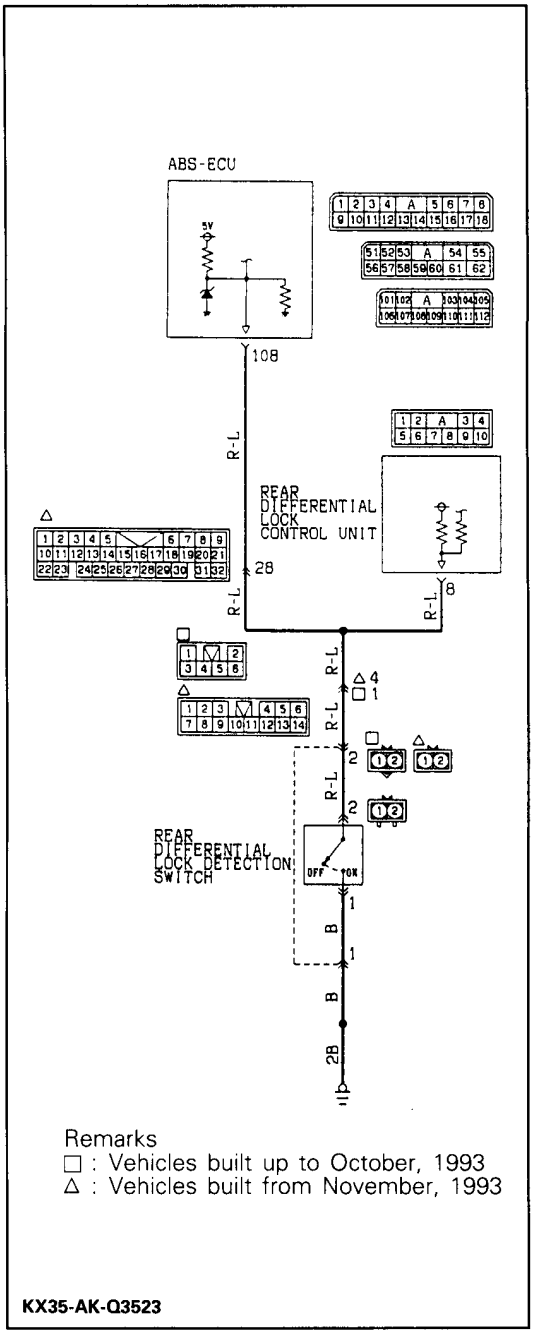
E-7 When diagnosis code no. 27 is displayed

<Vehicles with rear differential lock>

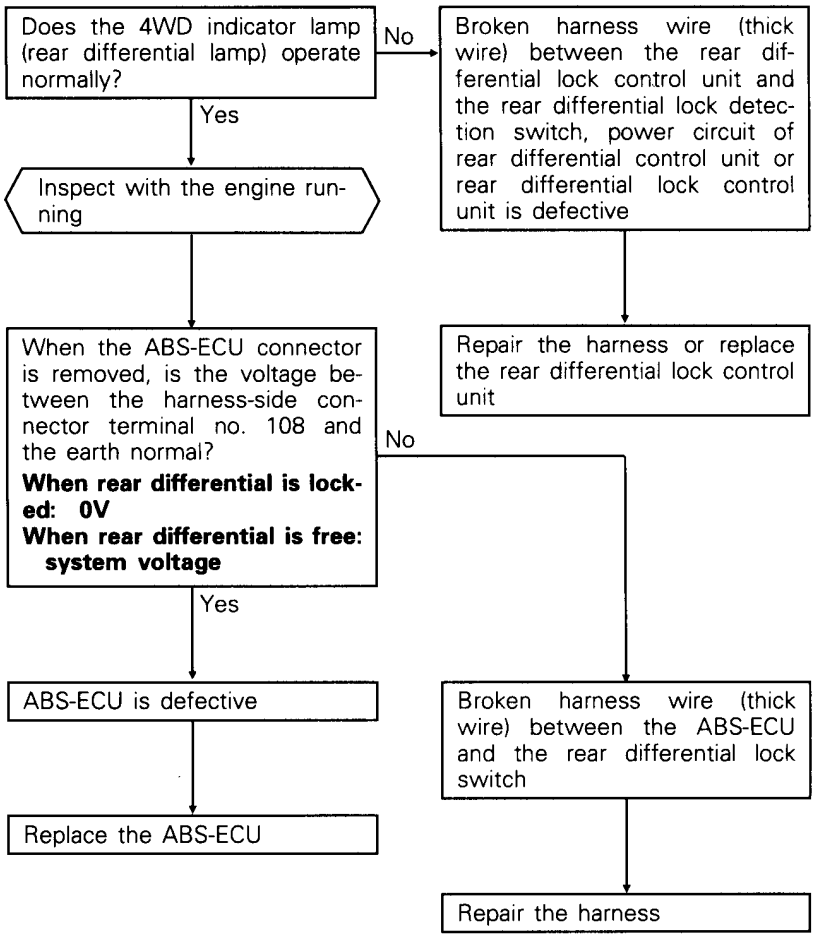
[Comment] This malfunction code is output by the ABS-ECU when there is a broken harness wire or a defective rear differential lock circuit (thick wire in circuit diagram) in the rear differential lock detection switch system.

[Hint] When this malfunction code is output, and also none of the 4WD indicator lamps (rear differential lamp) are illuminated, the cause is likely to be the power circuit in the 4WD indicator control unit.



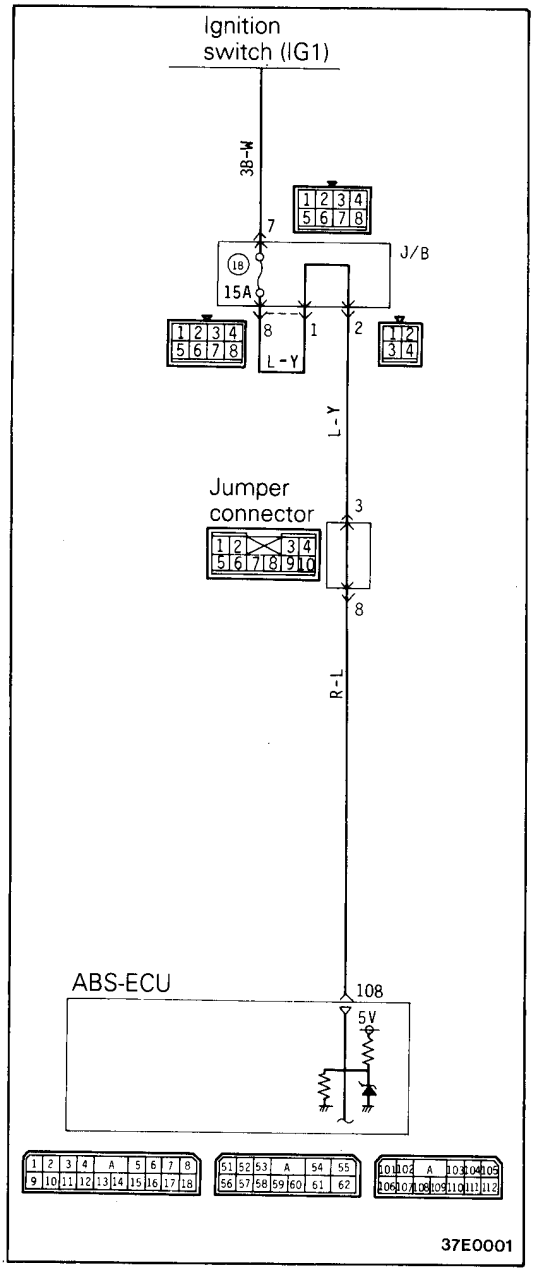
Remarks
□ : Vehicles built up to October, 1993
△ : Vehicles built from November, 1993

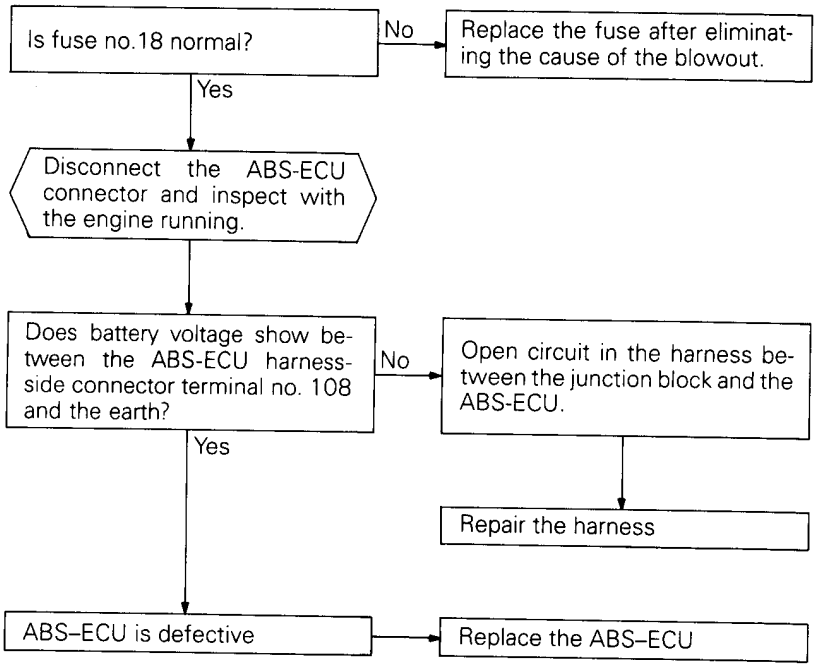
KX35-AK-Q3523



<Vehicles without rear differential lock>
(Vehicles built up to October, 1993)

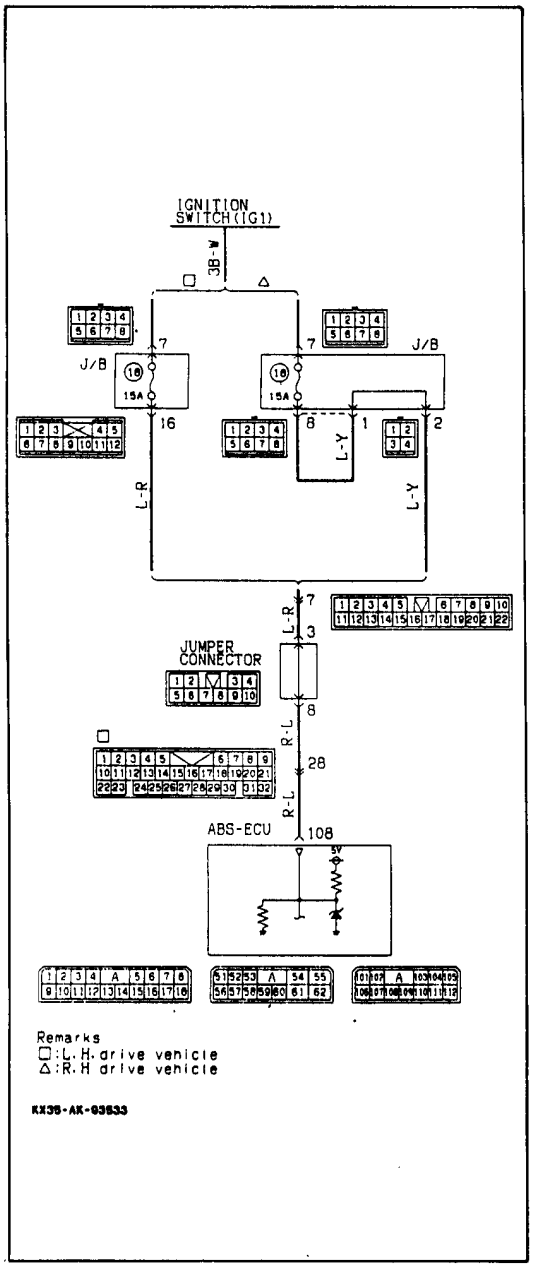
[Comment] For vehicles without rear differential lock, battery voltage is applied to the ABS-ECU terminal no. 108. This malfunction code is output when this line is interrupted.

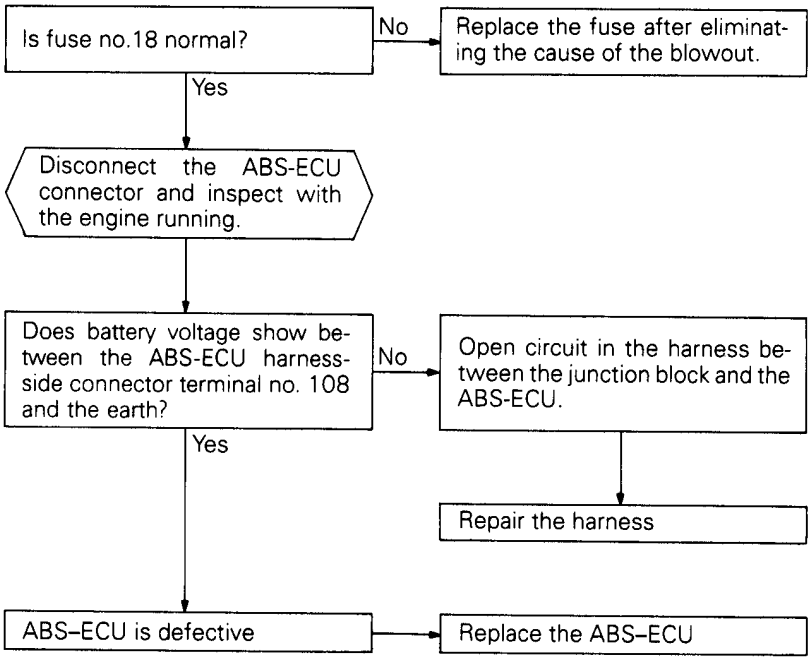




(Vehicles built from November, 1993)

[Comment] For vehicles without rear differential lock, battery voltage is applied to the ABS-ECU terminal no. 108. This malfunction code is output when this line is interrupted.

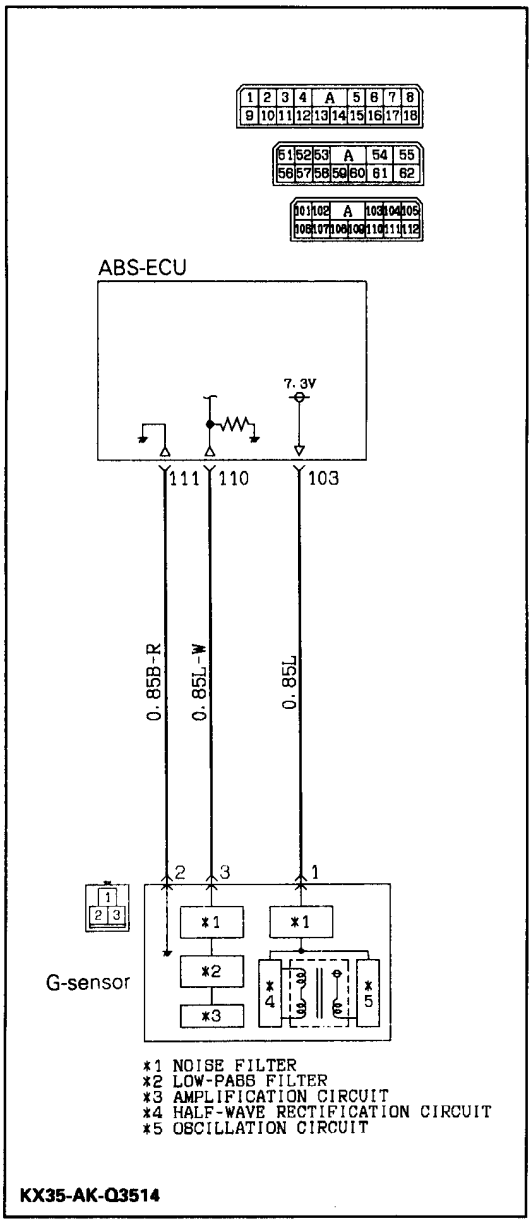


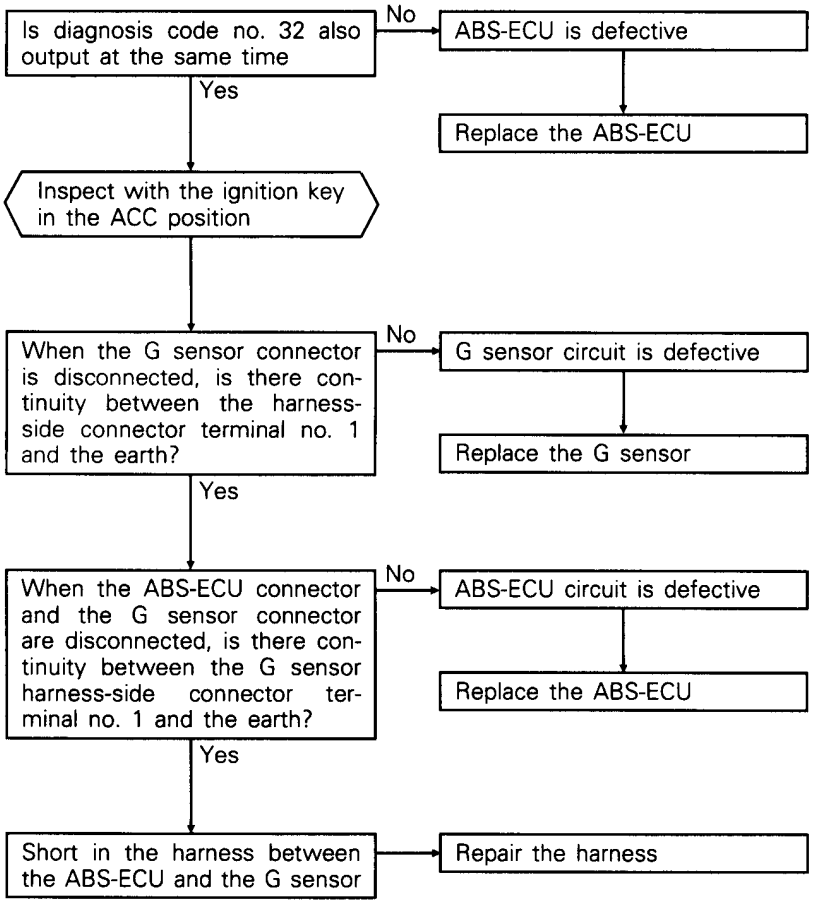


E-8 When diagnosis code no. 31 is displayed

[Comment] This code is displayed when there is an abnormality in the G sensor power voltage (including a short in the G sensor power harness).

(Hint) If there is a short in the G sensor power harness, code no. 32 will be output at the same time as this code.





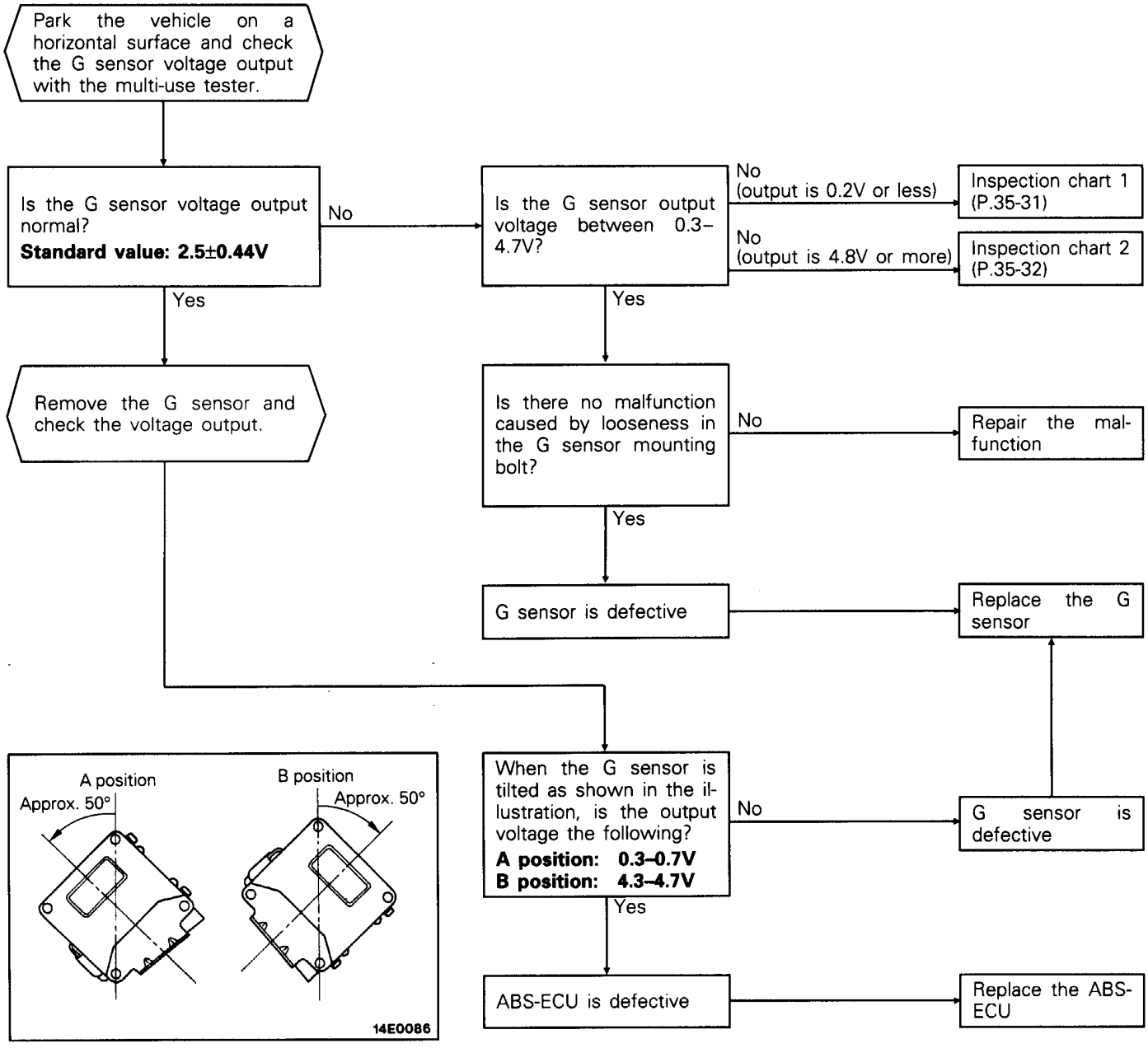
E-9 When diagnosis code no. 32 is displayed

<Vehicles built up to October, 1993>

[Comment] This malfunction code is output when there is an abnormality in the G sensor voltage output. This code is also output when there is a broken wire or short in the G sensor power or signal harness or a broken earth wire.

(Hint) Malfunctions can be distinguished by the G sensor output voltage read by the multi-use tester or MUT-II service data.

G sensor output voltage (when vehicle is on a horizontal surface)	Main problem location
2.5±0.44V	Normal
0.2V or less	Broken wire or short in the power harness or signal harness
4.8V or more	Broken earth wire
Other than the above	G sensor is defective (including defective installation)



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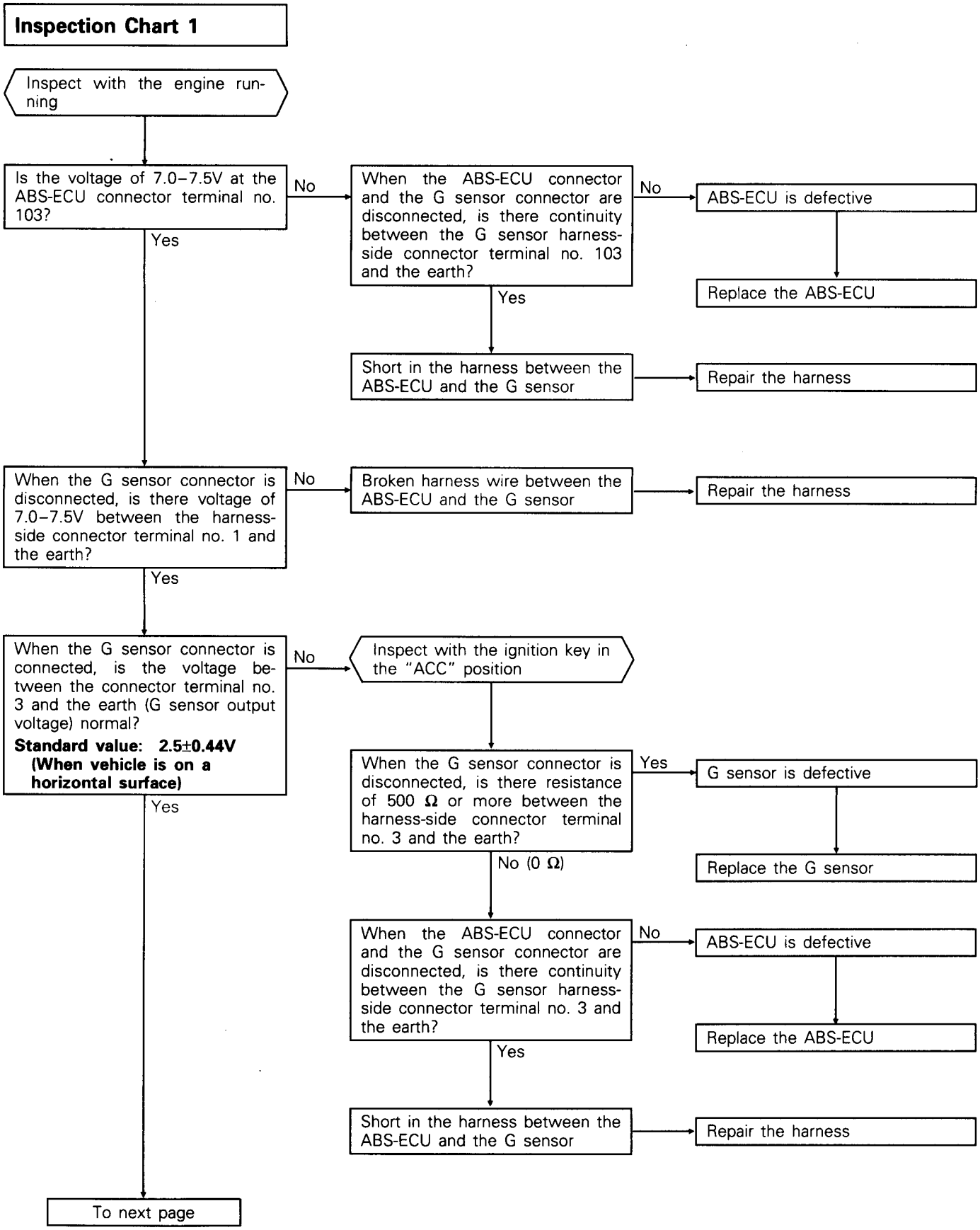
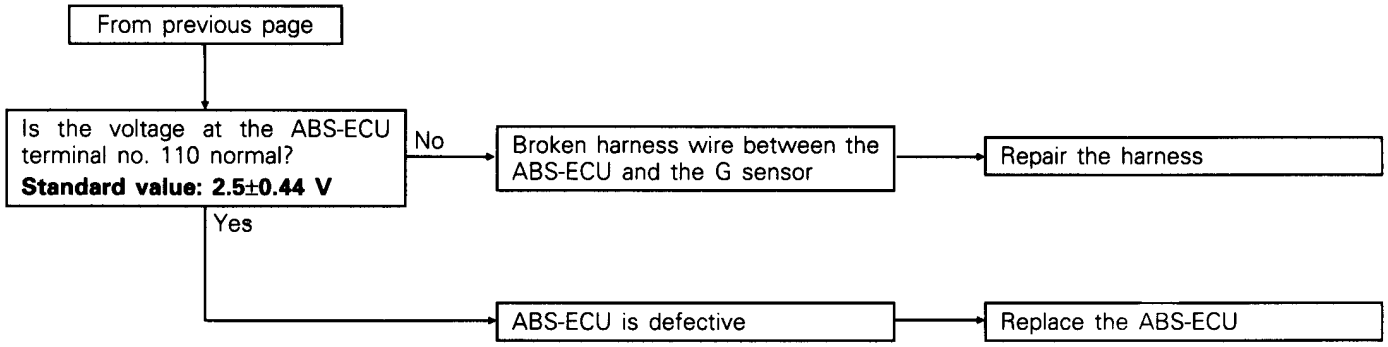
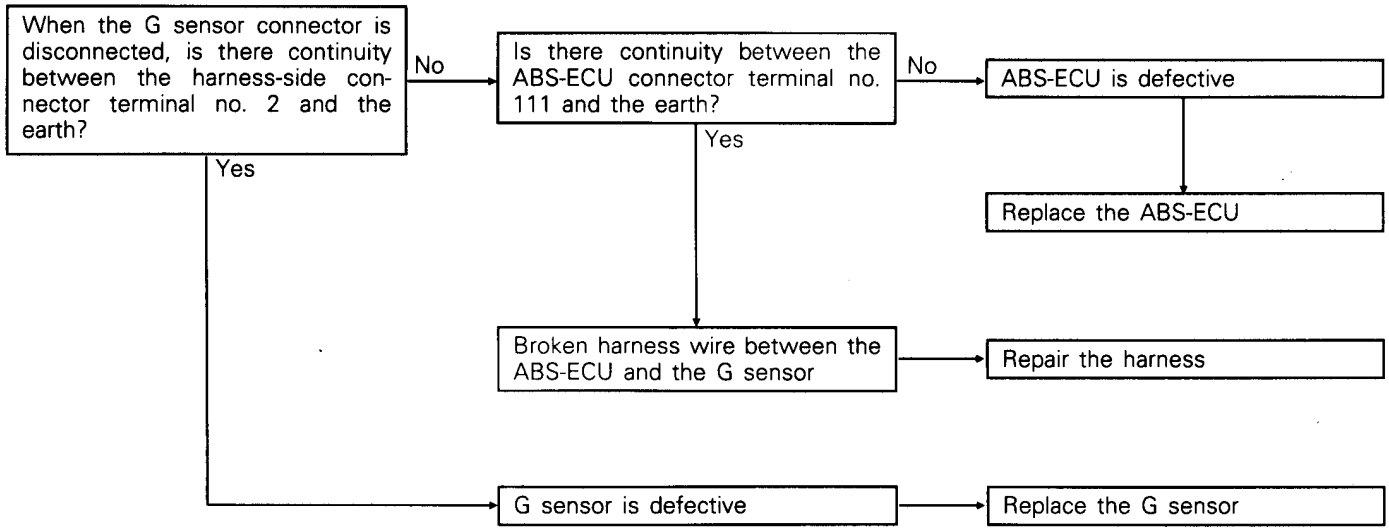
Inspection Chart 1





Inspection Chart 2

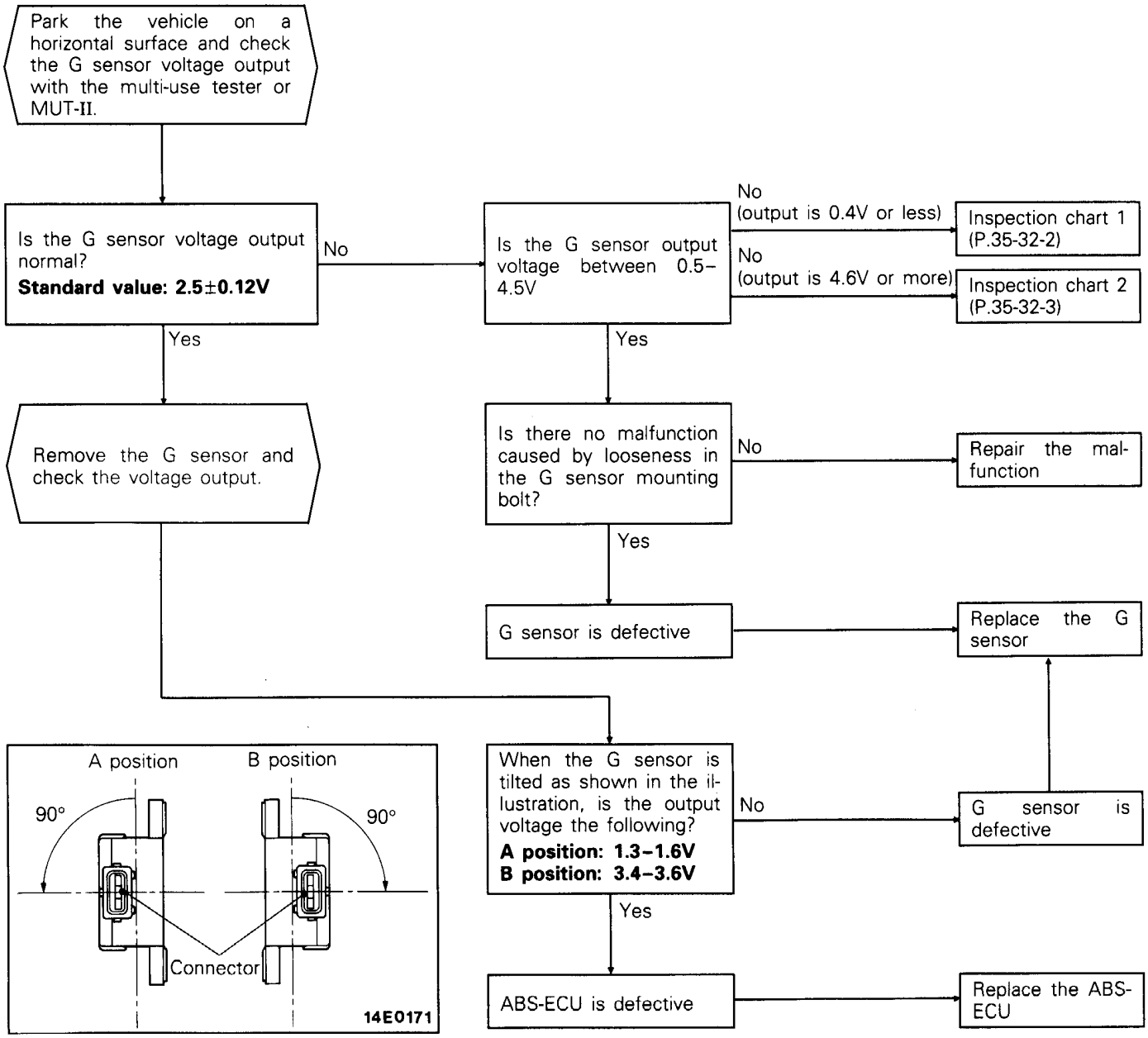


<Vehicles built from November, 1993>

[Comment] This malfunction code is output when there is an abnormality in the G sensor voltage output. This code is also output when there is a broken wire or short in the G sensor power or signal harness or a broken earth wire.

(Hint) Malfunctions can be distinguished by the G sensor output voltage read by the multi-use tester or MUT-II service data.

G sensor output voltage (when vehicle is on a horizontal surface)	Main problem location
2.5±0.12V	Normal
0.4V or less	Broken wire or short in the power harness or signal harness
4.6V or more	Broken earth wire
Other than the above	G sensor is defective (including defective installation)



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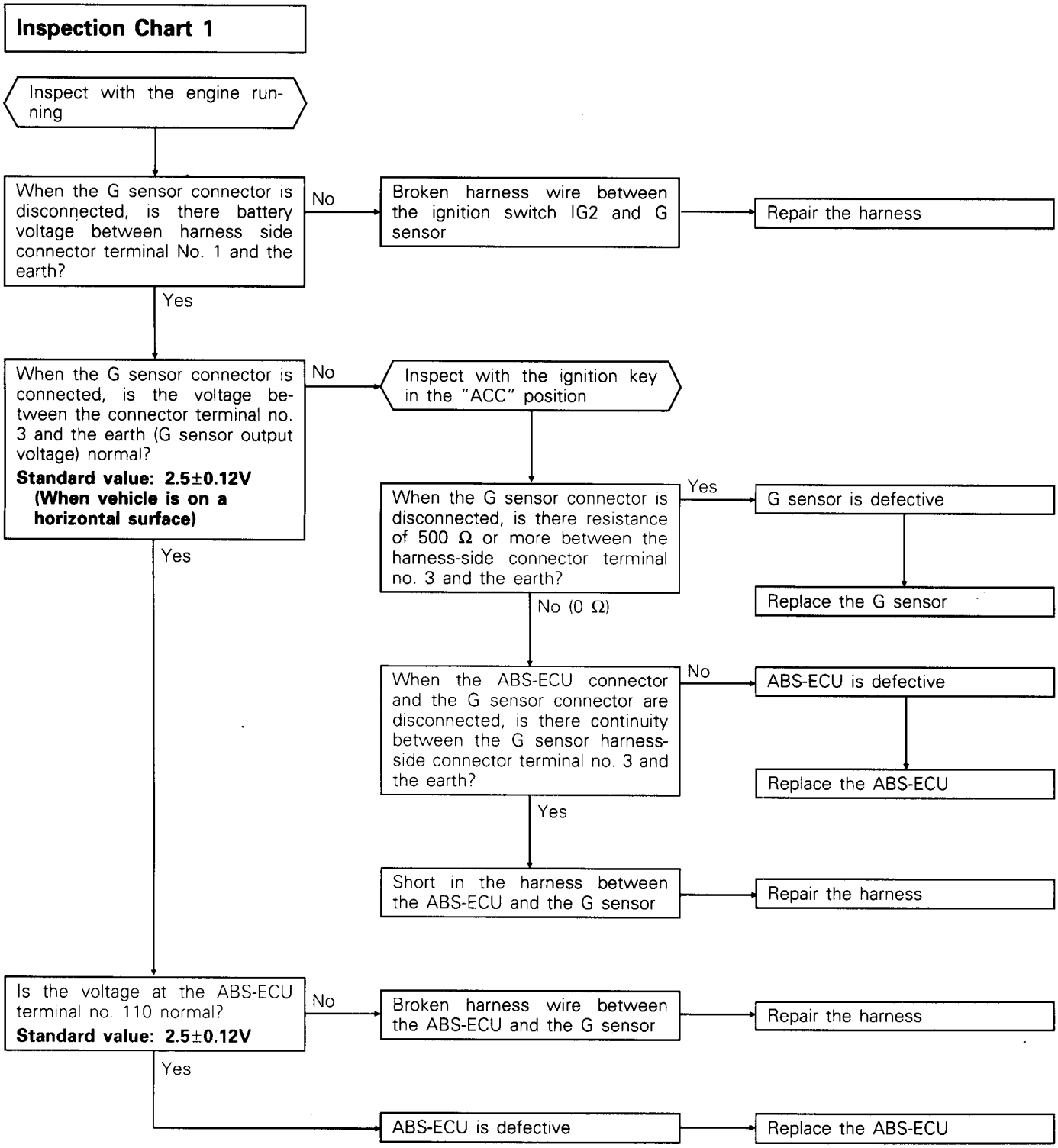
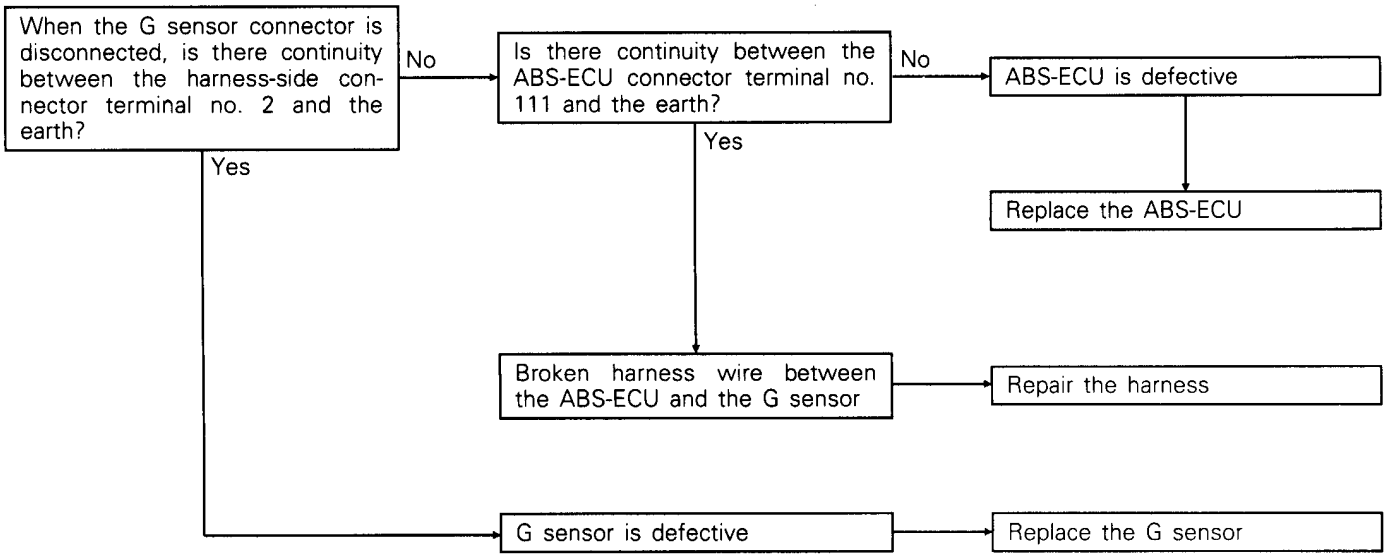
Inspection Chart 1



Inspection Chart 2



NOTES

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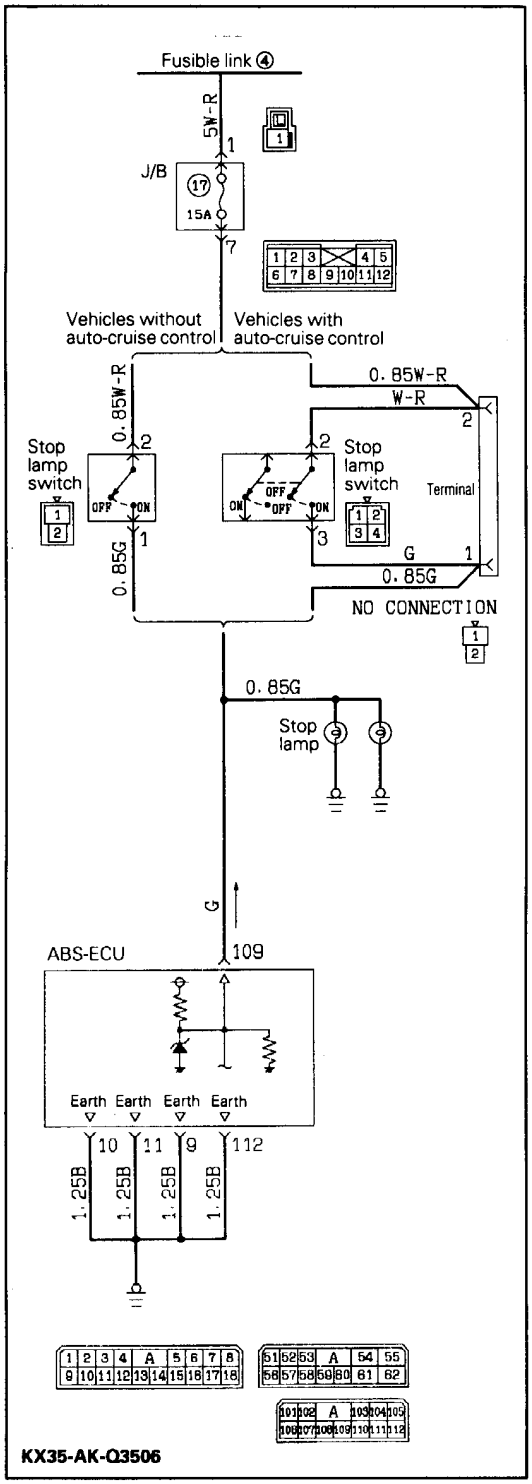
E-10 When diagnosis code no. 33 is displayed

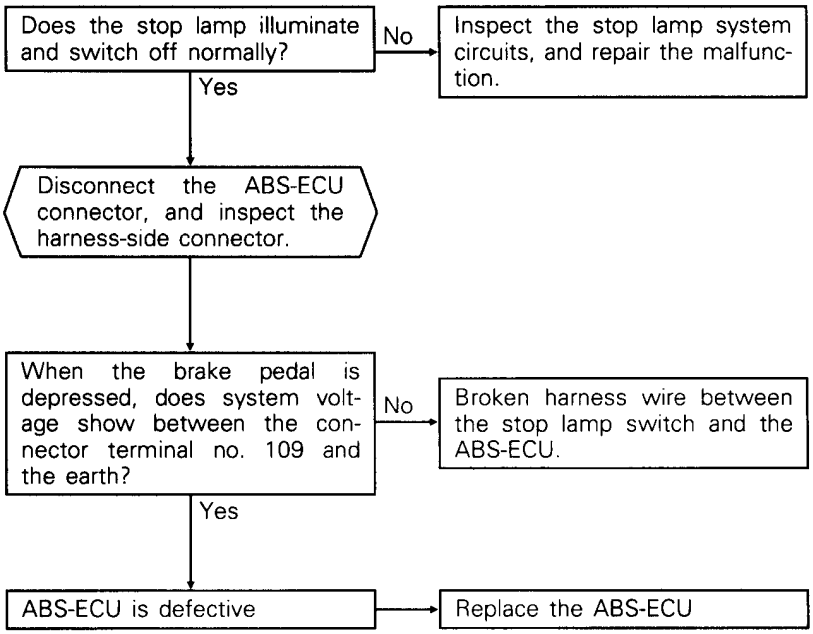
<Vehicles built up to October, 1993>

[Comment] This malfunction code is output by the ABS-ECU in the following cases:

- Problem with the stop lamp switch being ON (even though the ABS is not operating, the stop lamp is continuously diagnosed as being ON for a continuous period of 15 minutes or more.)
- Broken harness wire in the stop lamp switch system.

(Hint) If the stop lamp illuminates and switches off normally, then there is a broken harness wire in the stop lamp switch input circuit, or the ABS-ECU circuit is defective.





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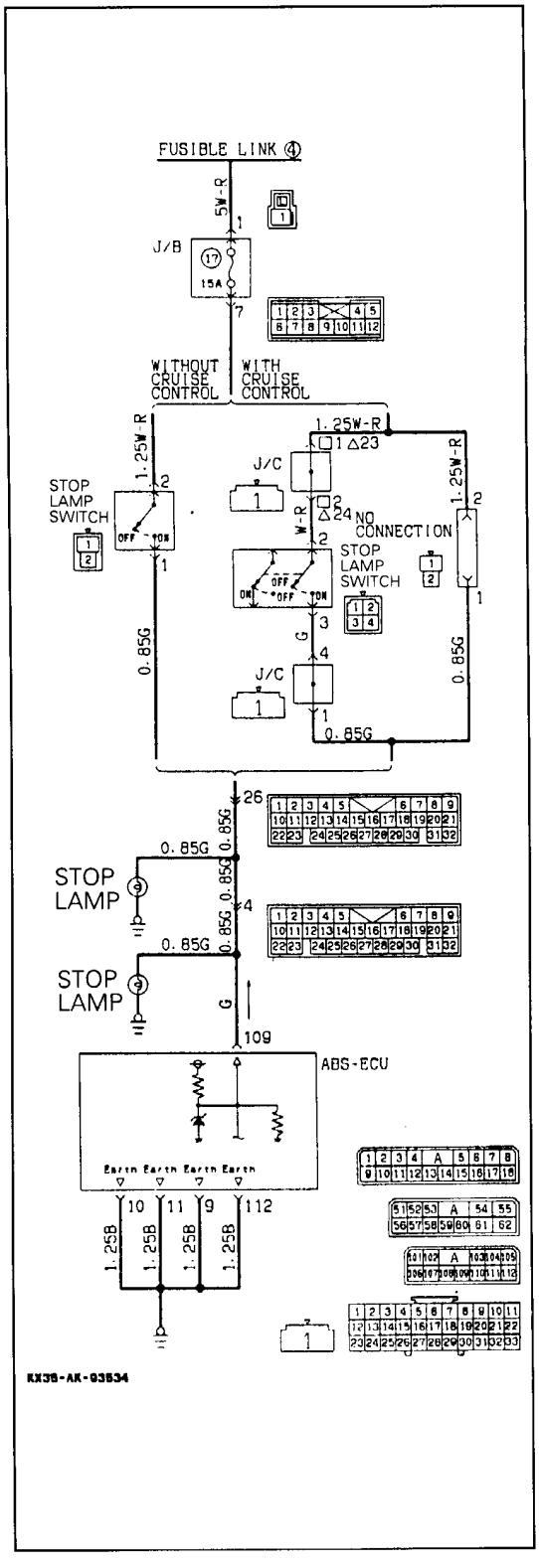
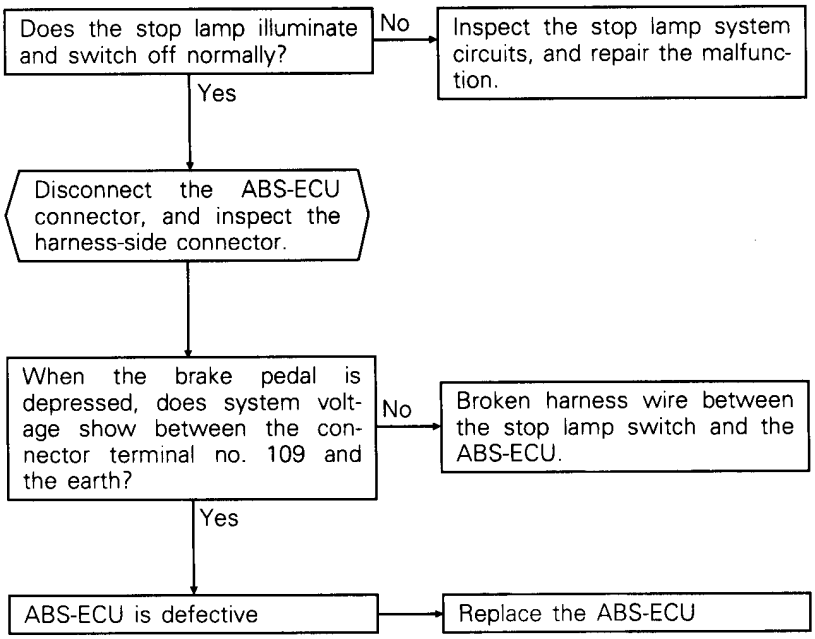
<Vehicles built from November, 1993>

[Comment] This malfunction code is output by the ABS-ECU in the following cases:

- Problem with the stop lamp switch being ON (even though the ABS is not operating, the stop lamp is continuously diagnosed as being ON for a continuous period of 15 minutes or more.)
- Broken harness wire in the stop lamp switch system.

(Hint) If the stop lamp illuminates and switches off normally, then there is a broken harness wire in the stop lamp switch input circuit, or the ABS-ECU circuit is defective.





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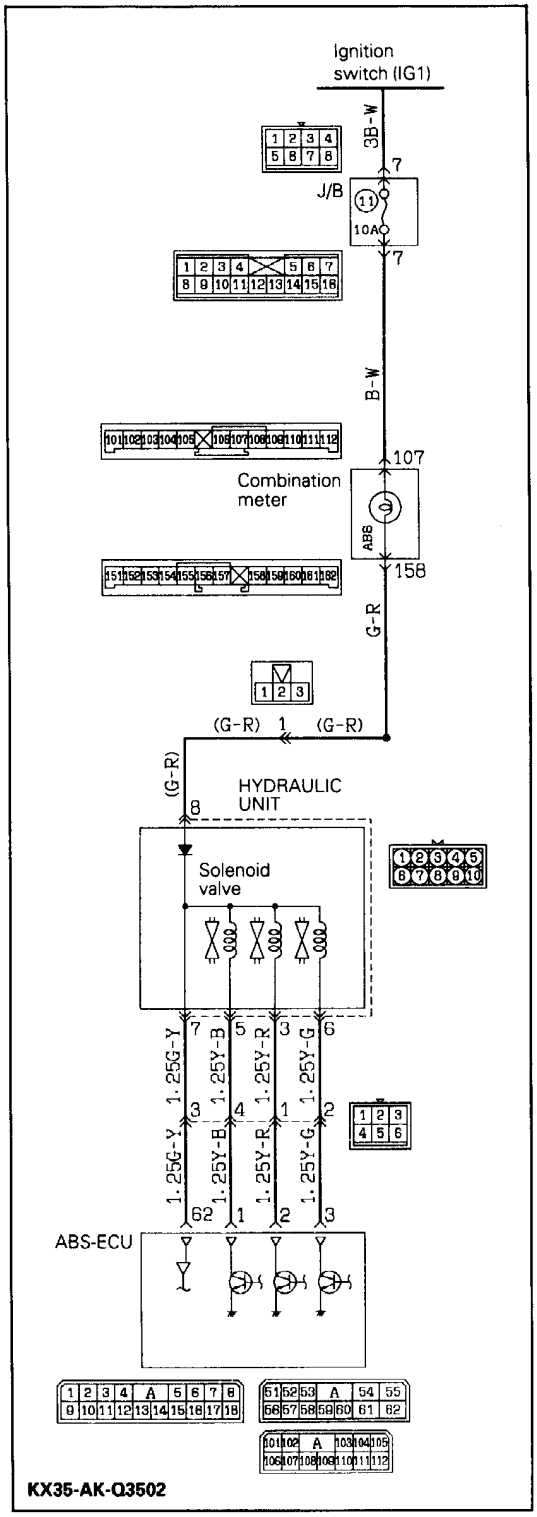
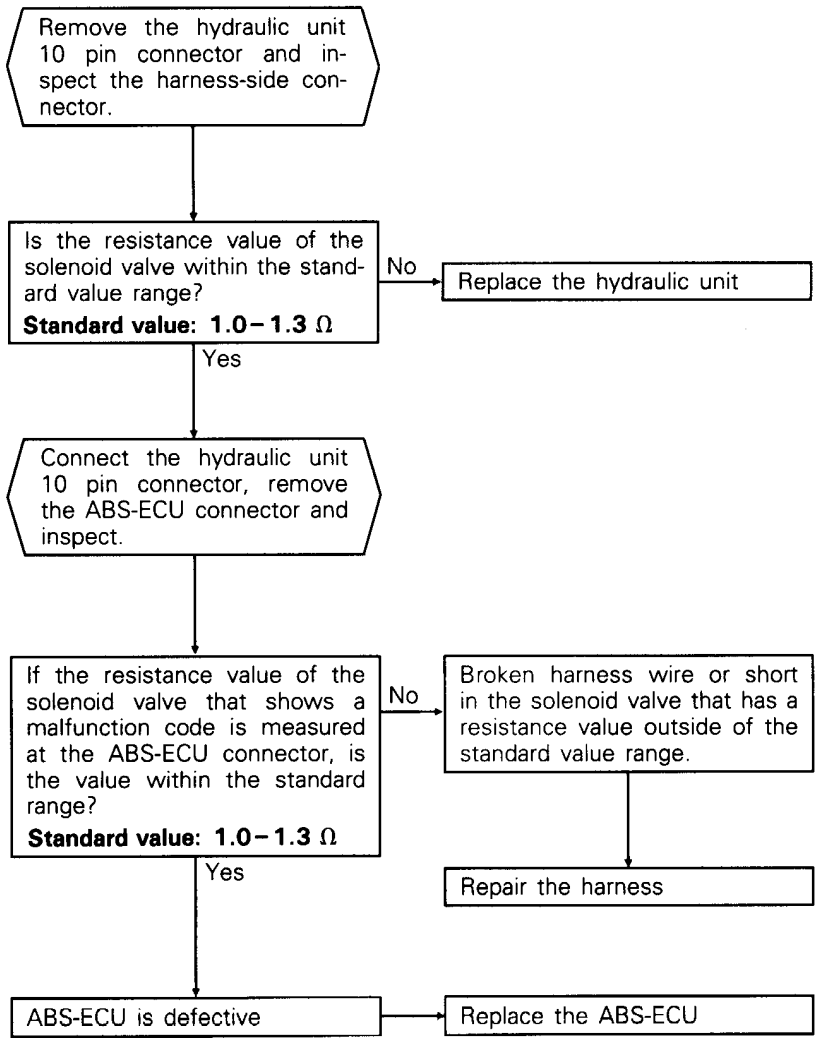
NOTES

E-11 When diagnosis code nos. 41, 43 or 45 are displayed

<Vehicles built up to October, 1993>

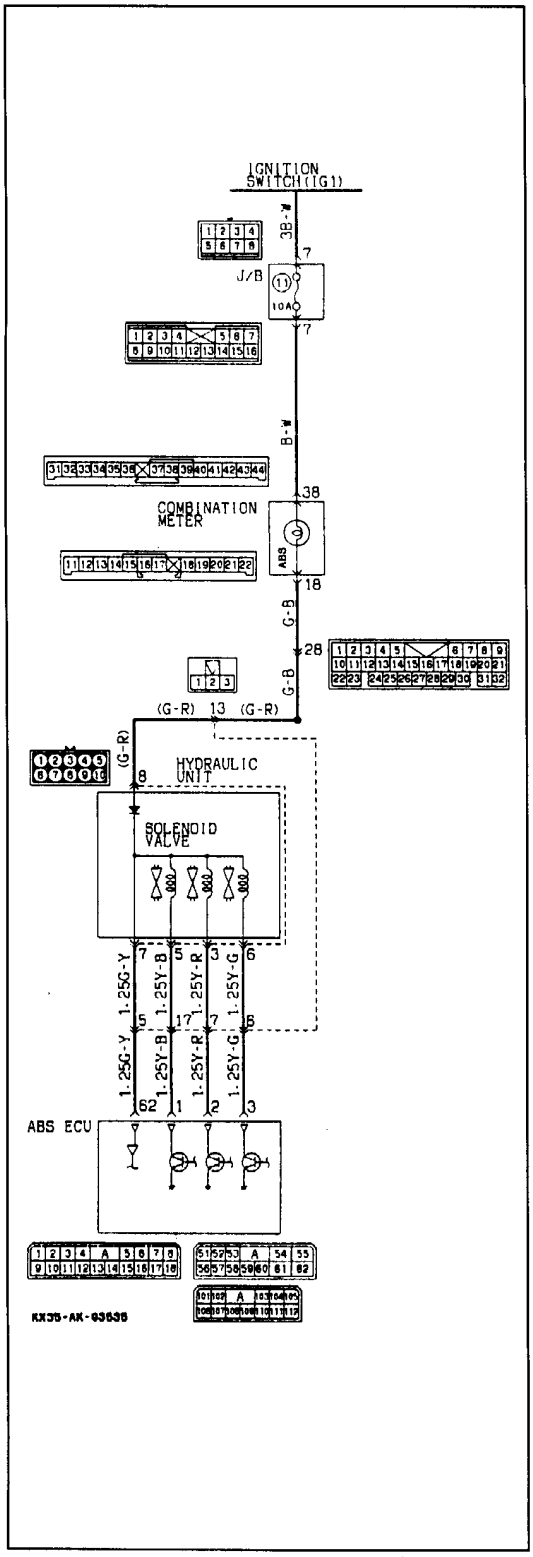
[Comment] The ABS-ECU normally monitors the solenoid valve drive circuit. If there is no current flowing to the solenoid even when the solenoid is ON, or the current continues to flow to the solenoid even when the solenoid is OFF, the ABS-ECU diagnoses a broken wire or short in the solenoid coil or a broken wire or short in the harness, and this malfunction code is output.

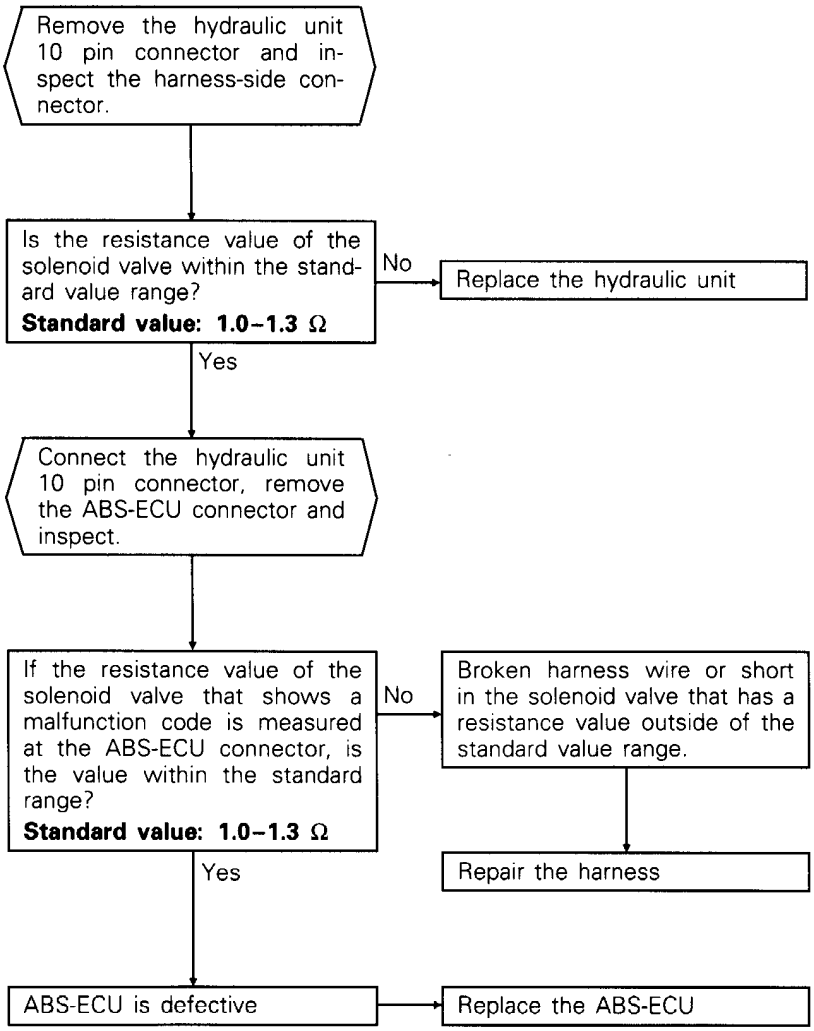




<Vehicles built from November, 1993>

[Comment] The ABS-ECU normally monitors the solenoid valve drive circuit. If there is no current flowing to the solenoid even when the solenoid is ON, or the current continues to flow to the solenoid even when the solenoid is OFF, the ABS-ECU diagnoses a broken wire or short in the solenoid coil or a broken wire or short in the harness, and this malfunction code is output.





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NOTES

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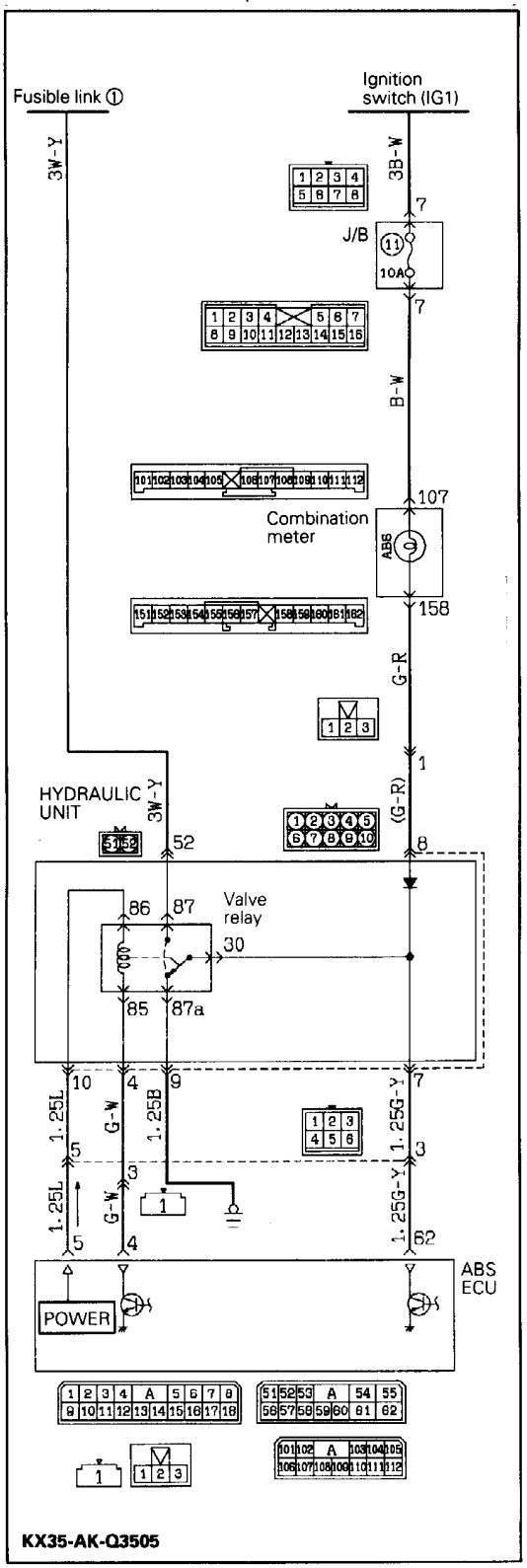
E-12 When diagnosis code no. 51 is displayed

<Vehicles built up to October, 1993>

[Comment] When the ignition switch is turned to ON, the valve relay is switched ON and OFF during the initial check, and the ABS-ECU compares the signal to the valve relay and the voltage in the valve power monitor line to check if the valve relay is operating normally. Normally, the valve relay is ON, so if power is not being supplied to the valve power monitor line, this malfunction code is output.



Remove the valve relay and inspect.

When the valve relay unit is inspected, are the results as follows?
- No.85–No.86: resistance value 60–120Ω
- No.30–No.87a: continuity
- No.30–No.87: no continuity

Battery voltage applied between terminals No.85–No.85
- No.30–No.87: continuity
- No.30–No.87a: no continuity

No → Valve relay is defective → Replace the valve relay

Yes

Replace the valve relay and remove the hydraulic unit connector

When the ignition switch is turned to "ON", does system voltage show between the hydraulic unit harness-side connector terminal no. 52 and the earth?

No → Broken wire in the hydraulic unit power harness → Repair the harness

Yes

Is there continuity between the hydraulic unit connector terminals no. 8 and no. 7?

No → Harness in the hydraulic unit is defective → Repair the harness or replace the hydraulic unit

Yes

Connect the hydraulic unit connector and remove the ABS-ECU connector

Does a resistance value of 60–120Ω show between the harness-side connector terminals no. 5 and no. 4?

No → Harness between the ABS-ECU and the hydraulic unit is defective → Repair the harness

Yes

Is there continuity between harness-side connector terminal no. 62 and the earth?

No → Harness between the ABS-ECU and the hydraulic unit is defective → Repair the harness

Yes

ABS-ECU is defective → Replace the ABS-ECU

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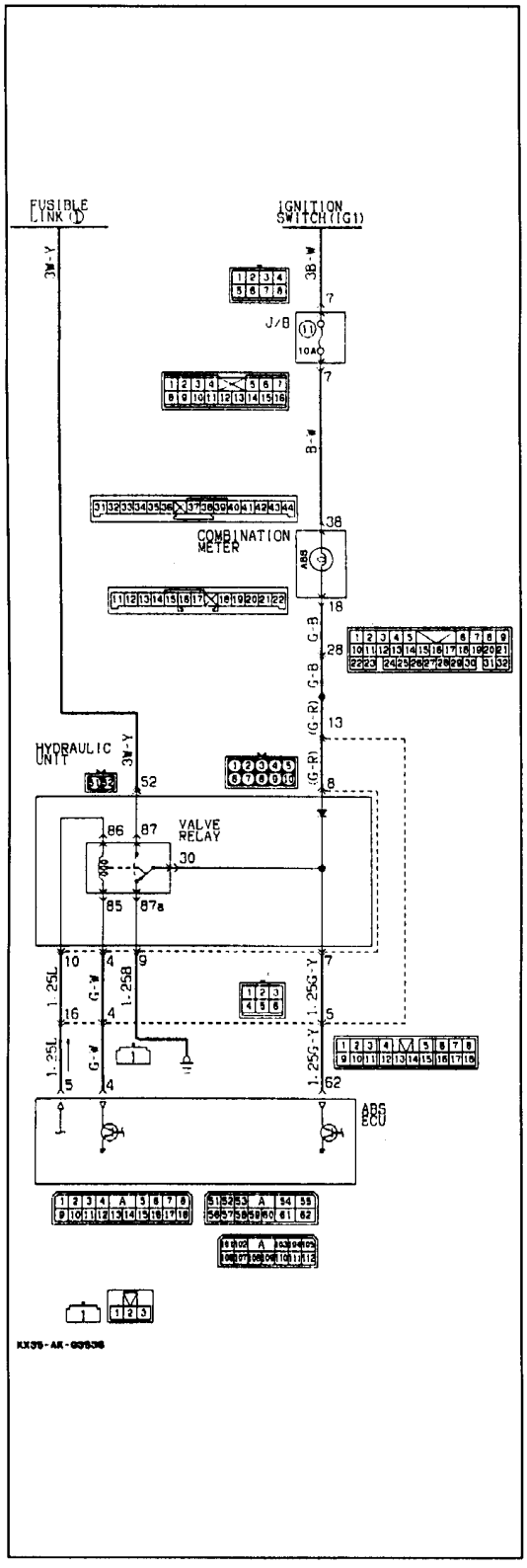
<Vehicles built from November, 1993>

[Comment] When the ignition switch is turned to ON, the valve relay is switched ON and OFF during the initial check, and the ABS-ECU compares the signal to the valve relay and the voltage in the valve power monitor line to check if the valve relay is operating normally. Normally, the valve relay is ON, so if power is not being supplied to the valve power monitor line, this malfunction code is output.



Remove the valve relay and inspect.

When the valve relay unit is inspected, are the results as follows?
- No.85–No.86: resistance value 60–120Ω
- No.30–No.87a: continuity
- No.30–No.87: no continuity

Battery voltage applied between terminals No.85–No.85
- No.30–No.87: continuity
- No.30–No.87a: no continuity

No → Valve relay is defective → Replace the valve relay

Yes

Replace the valve relay and remove the hydraulic unit connector

When the ignition switch is turned to "ON", does system voltage show between the hydraulic unit harness-side connector terminal no. 52 and the earth?

No → Broken wire in the hydraulic unit power harness → Repair the harness

Yes

Is there continuity between the hydraulic unit connector terminals no. 8 and no. 7?

No → Harness in the hydraulic unit is defective → Repair the harness or replace the hydraulic unit

Yes

Connect the hydraulic unit connector and remove the ABS-ECU connector

Does a resistance value of 60–120Ω show between the harness-side connector terminals no. 5 and no. 4?

No → Harness between the ABS-ECU and the hydraulic unit is defective → Repair the harness

Yes

Is there continuity between harness-side connector terminal no. 62 and the earth?

No → Harness between the ABS-ECU and the hydraulic unit is defective → Repair the harness

Yes

ABS-ECU is defective → Replace the ABS-ECU

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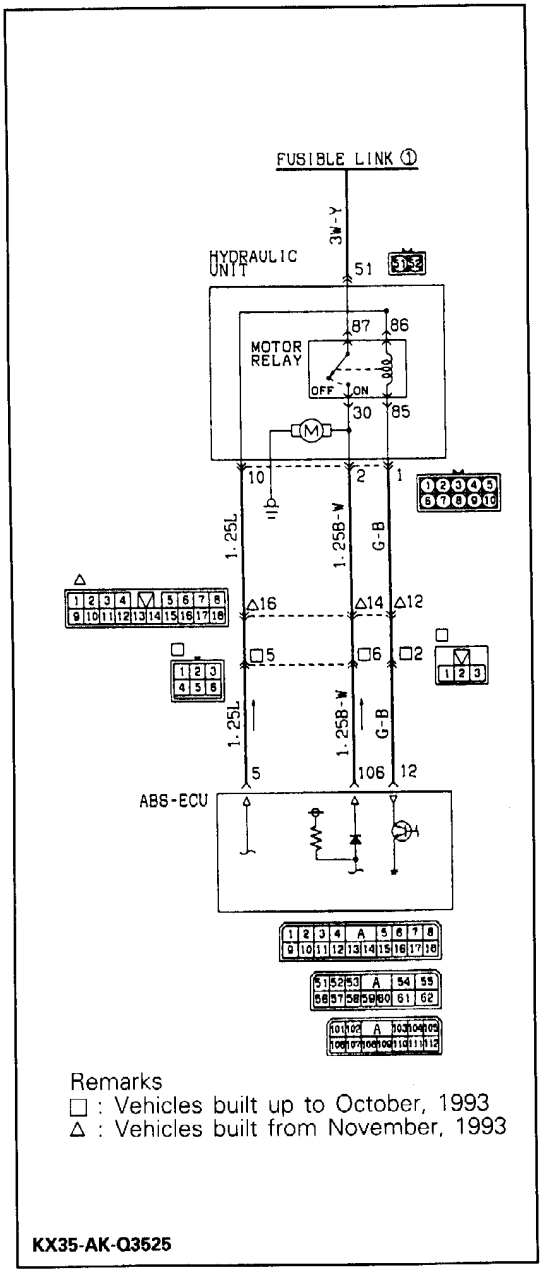
NOTES

E-13 When diagnosis code no. 53 is displayed

[Comment] This code is output by the ABS-ECU when the motor relay or motor is as follows:

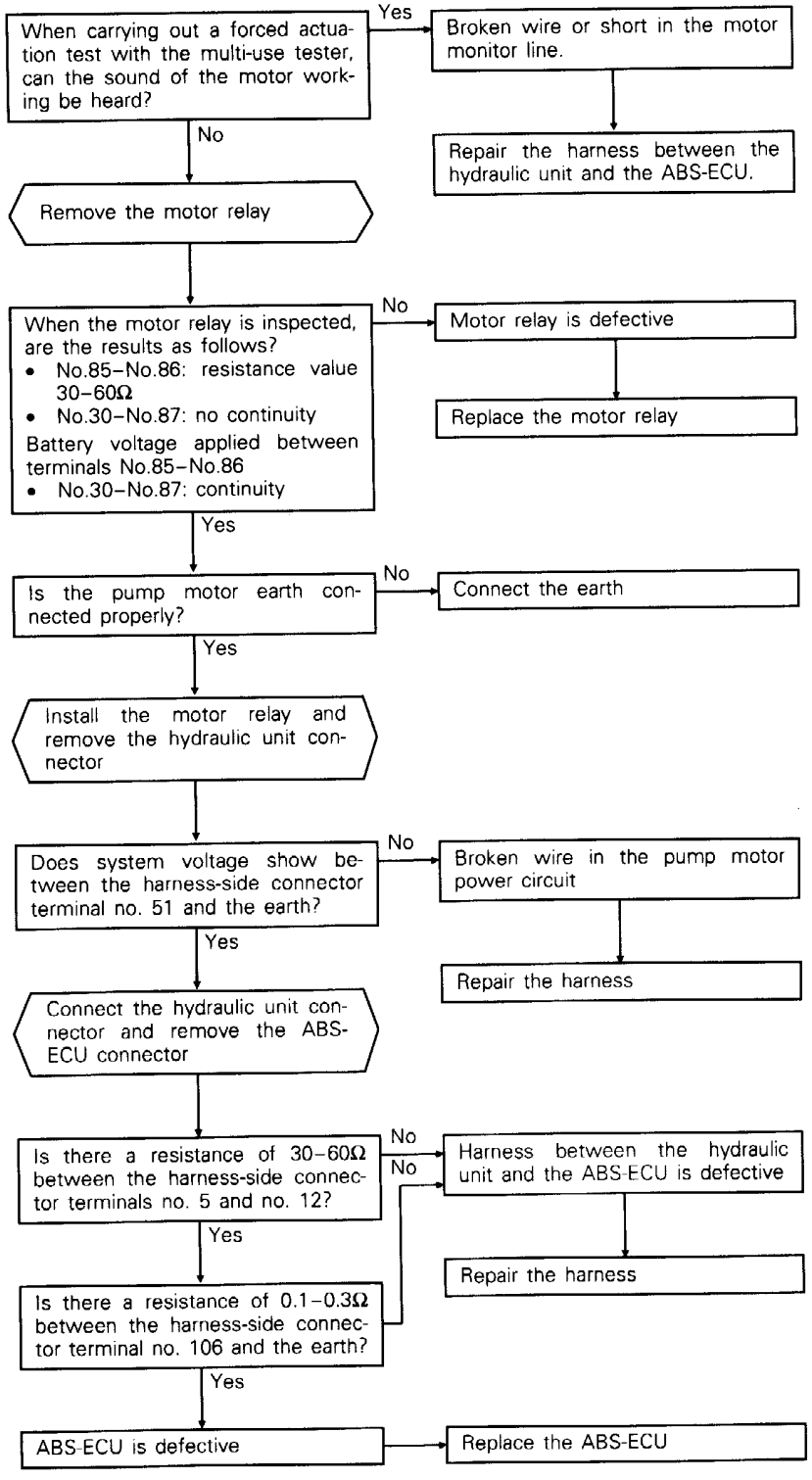
- Motor relay does not operate
- Motor will not work due to some problem
- Motor will not work because the earth is insufficient
- Motor will not stop

(Hint) Temporarily turn the ignition switch to OFF and after releasing the fail-safe mechanism, carry out an actuator test with the multi-use tester. If the sound of the motor working is heard during the multi-use tester actuator test, there is a broken wire or short in the motor monitor line.



Remarks
□ : Vehicles built up to October, 1993
△ : Vehicles built from November, 1993

KX35-AK-Q3525



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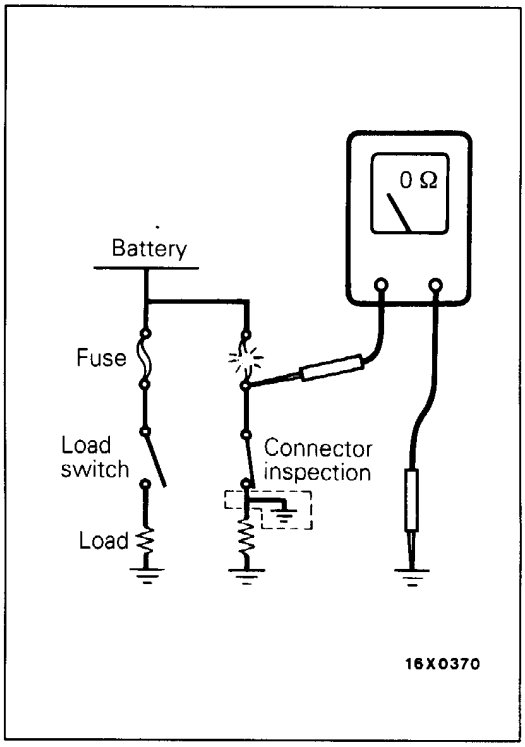


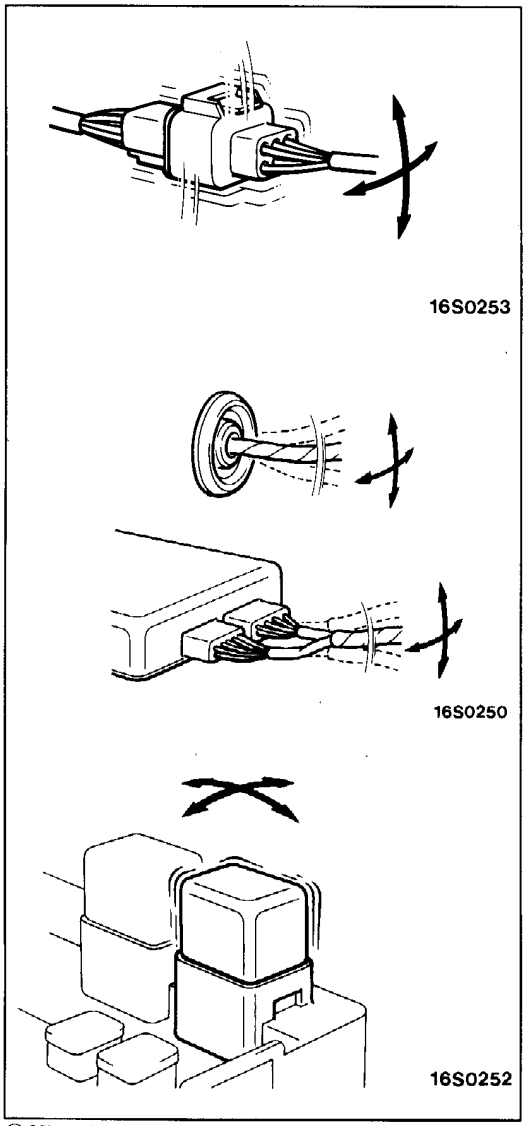
ABS TROUBLESHOOTING <Vehicles built from June, 1994>

INSPECTION SERVICE POINTS FOR A BLOWN FUSE

Remove the fuse and measure the resistance between the load side of the fuse and the earth. Set the switches of all circuits which are connected to this fuse to a condition of continuity. If the resistance is almost 0 Ω at this time, there is a short circuit somewhere between these switches and the load. If the resistance is not 0 Ω, there is no short circuit at the present time, but a momentary short circuit has probably caused the fuse to blow.

The main causes of a short circuit are the following.

- Harness being clamped by the vehicle body
- Damage to the outer, casing of the harness due to wear or heat
- Water getting into the connector or circuitry
- Human error (mistakenly shorting a circuit, etc.)



POINTS TO NOTE FOR INTERMITTENT MALFUNCTIONS.

Intermittent malfunctions often occur under certain conditions, and if these conditions can be ascertained, determining the cause becomes simple. In order to ascertain the conditions under which an intermittent malfunction occurs, first ask the customer for details about the driving conditions, weather conditions, frequency of occurrence and trouble symptoms, and then try to recreate the trouble symptoms. Next, ascertain whether the reason why the trouble symptom occurred under these conditions is due to vibration, temperature or some other factors. If vibration is thought to be the cause, carry out the following checks with the connectors and components to confirm whether the trouble symptom occurs.

The objects to be checked are connectors and components which are indicated by inspection procedures or given as probable causes (which generate diagnosis codes or trouble symptoms).

- Gently shake the connector up, down and to the left and right.
- Gently shake the wiring harness up, down and to the left and right.
- Gently rock each sensor and relay, etc. by hand.
- Gently shake the wiring harness at suspensions and other moving parts.

NOTE
If determining the cause is difficult, the flight recorder function of the MUT-II can also be used.

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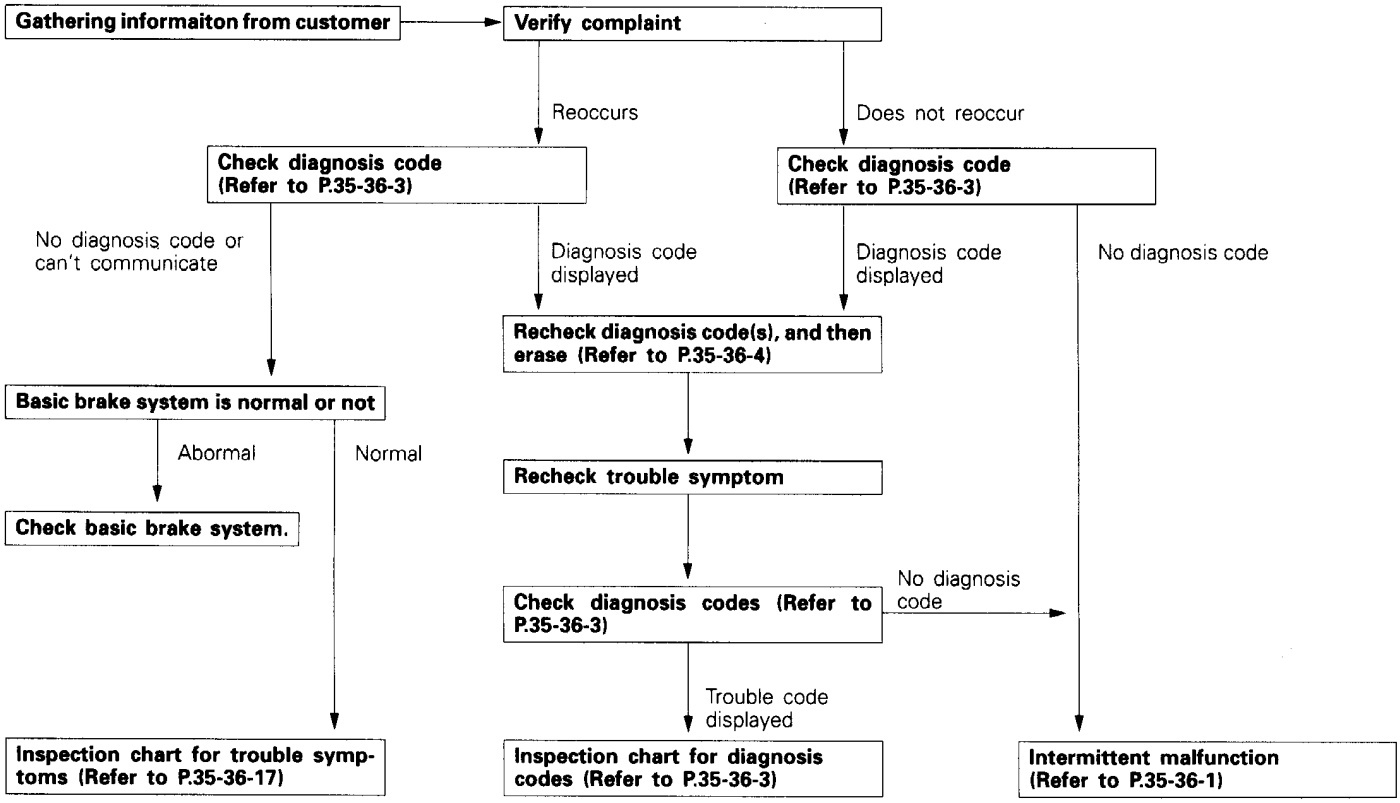
STANDARD FLOW OF DIAGNOSTIC TROUBLESHOOTING

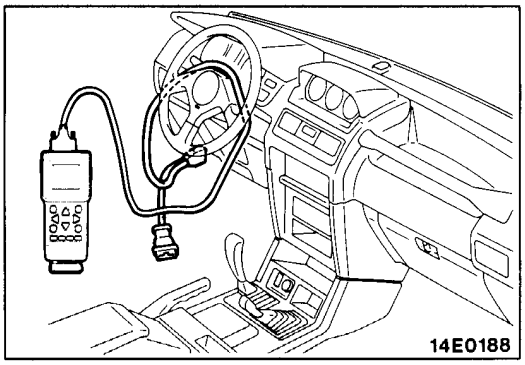


NOTES WITH REGARD TO DIAGNOSIS

The phenomena listed in the following table are not abnormal.

Phenomenon	Explanation of phenomenon
System check sound	When starting the engine, a thudding sound can sometimes be heard coming from inside the engine compartment. However, the sound doesn't mean any malfunction, but indicates that the system operation check is working.
ABS operation sound	1. Sound of the motor inside the ABS hydraulic unit operating. (whine) 2. Sound is generated along with vibration of the brake pedal. (scraping) 3. When ABS operates, sound is generated from the vehicle chassis due to repeated brake application and release. (Thump: suspension: squeak: tyres)
ABS operation (Long braking distance)	For road surfaces such as snow-covered roads and gravel roads, the braking distance for vehicles with ABS can sometimes be longer than that for other vehicles. Accordingly, advise the customer to drive safely on such roads by lowering the vehicle speed and not being too overconfident.

Diagnosis detection condition depends on a diagnosis code. So, when rechecking a trouble symptom, be sure to satisfy the condition in the listed in the "Comments" column of the inspection procedure for diagnosis codes.



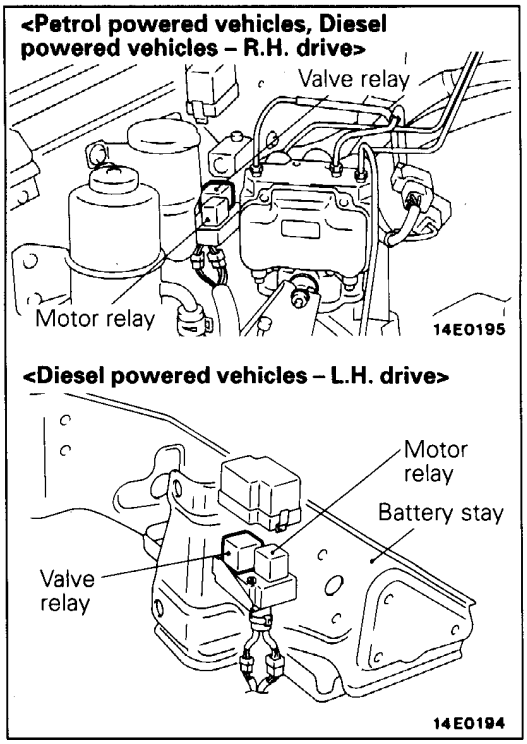
DIAGNOSTIC FUNCTION

DIAGNOSIS CODES CHECK

With the MUT-II

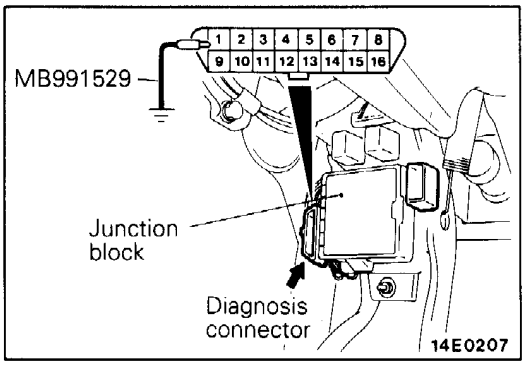
Connect the MUT-II to the diagnosis connector (16-pin), then check diagnosis codes.

Caution
Turn the ignition switch off before connecting or disconnecting the MUT-II.



Without the MUT-II

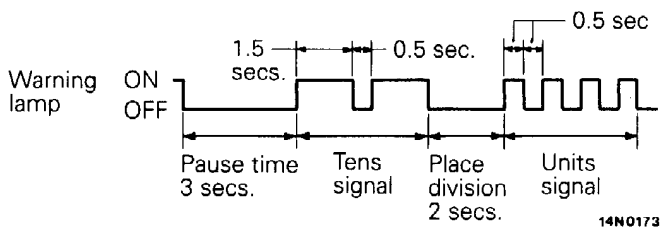
1. Turn the ignition switch off and then disconnect the valve relay connector.
2. Use the special tool to earth diagnosis connector terminal No. 1.



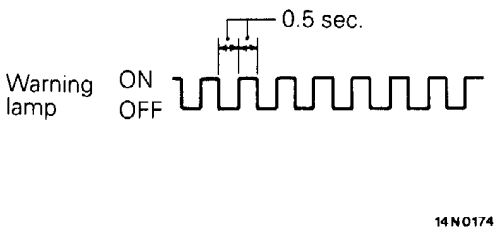
2. Use the special tool to earth diagnosis connector terminal No. 1.
3. Turn the ignition switch to ON and then take a reading of the diagnosis codes from the flashing of the ABS warning lamp.

NOTE
Diagnosis code No. 51 (indicating an open or short circuit in the valve relay) will be always output, because the valve relay connector is disconnected.
All diagnosis code numbers are the same as those when using the MUT-II.

When diagnosis code No. 24 is output



When no diagnosis code is output



4. Remedy the malfunctions indicated by the diagnosis codes, disconnect the diagnosis code check harness, and then install the valve relay. Then turn the ignition switch to ON again to check the ABS warning lamp. (Refer to P.35-36-16.) If the lamp indicates a malfunction, the valve relay system may be detective. (Refer to P.35-36-14.)

ERASING DIAGNOSIS CODES

With the MUT-II

Connect the MUT-II to the diagnosis connector 16-pin), and then erase the diagnosis codes.

Without the MUT-II

Remove the battery cable from the battery (–) terminal for 10 seconds or more, and then reconnect the cable.

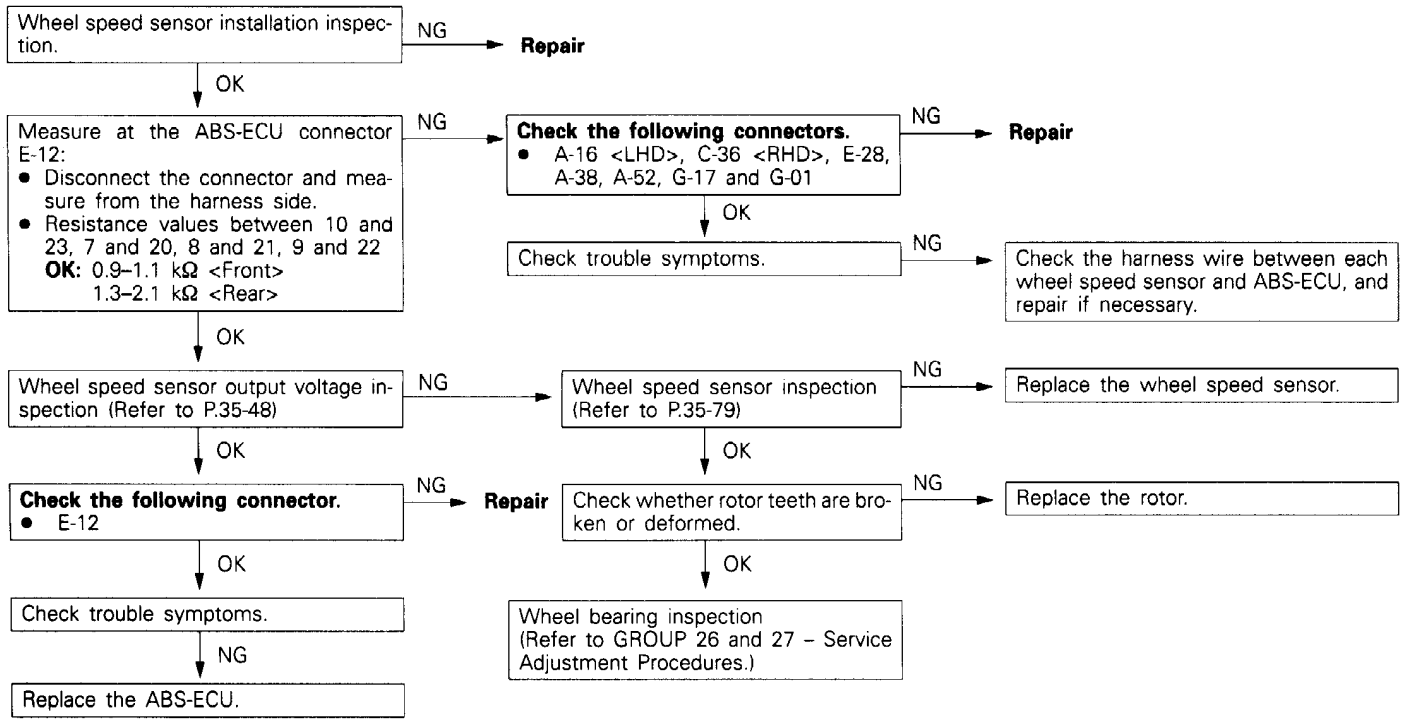
INSPECTION CHART FOR DIAGNOSIS CODES

Inspect according to the inspection chart that is appropriate for the diagnosis code.

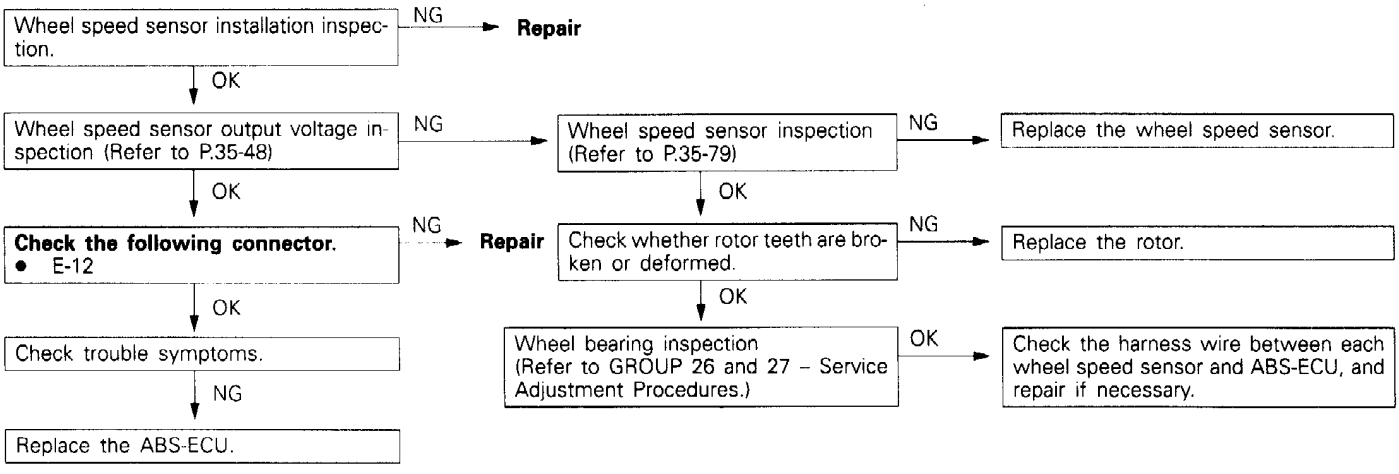
Diagnosis code no.	Inspection item	Diagnosis content	Reference page
11	Front right wheel speed sensor	Open circuit	P.35-36-6
12	Front left wheel speed sensor		
13	Rear right wheel speed sensor		
14	Rear left wheel speed sensor		
15	Wheel speed sensor	Abnormal output signal	P.35-36-6
16	Power supply system		P.35-36-7
21	Front right wheel speed sensor	Short circuit	P.35-36-7
22	Front left wheel speed sensor		
23	Rear right wheel speed sensor		
24	Rear left wheel speed sensor		
25	Free-wheeling engage switch		P.35-36-8
26	Center differential lock detection switch		P.35-36-9
27	Rear differential lock detection switch		P.35-36-10
32	G-sensor system		P.35-36-11
33	Stop lamp switch system		P.35-36-12
41	Front right solenoid valve		P.35-36-13
42	Front left solenoid valve		
43	Rear solenoid valve		
51	Valve relay		P.35-36-14
53	Motor relay, motor		P.35-36-15
63	Replace the ABS-ECU		–
64			

INSPECTION PROCEDURE FOR DIAGNOSIS CODES

Code No. 11, 12, 13, 14 Wheel speed sensor open circuit	Probable cause
[Comment] The ABS-ECU determines that an open circuit occurs in more than one line of wheel speed sensors.	• Malfunction of wheel speed sensor • Malfunction of wiring harness or connector • Malfunction of ABS-ECU



Code No. 15 Wheel speed sensor (Abnormal output signal)	Probable cause
[Comment] A wheel speed sensor outputs an abnormal signal (other than an open or short-circuit).	• Improper installation of wheel speed sensor • Malfunction of wheel speed sensor • Malfunction of rotor • Malfunction of wheel bearing • Malfunction of wiring harness or connector • Malfunction of ABS-ECU



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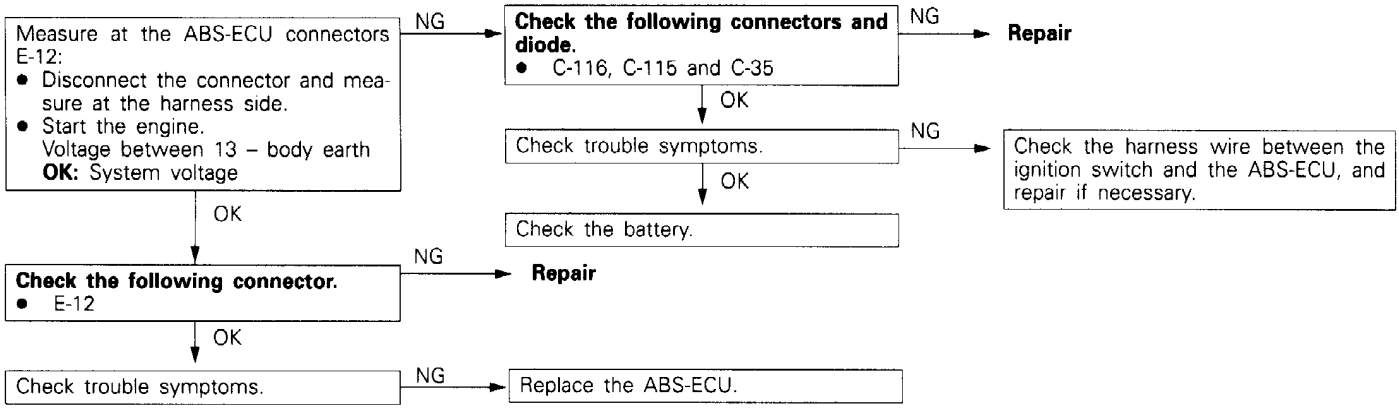
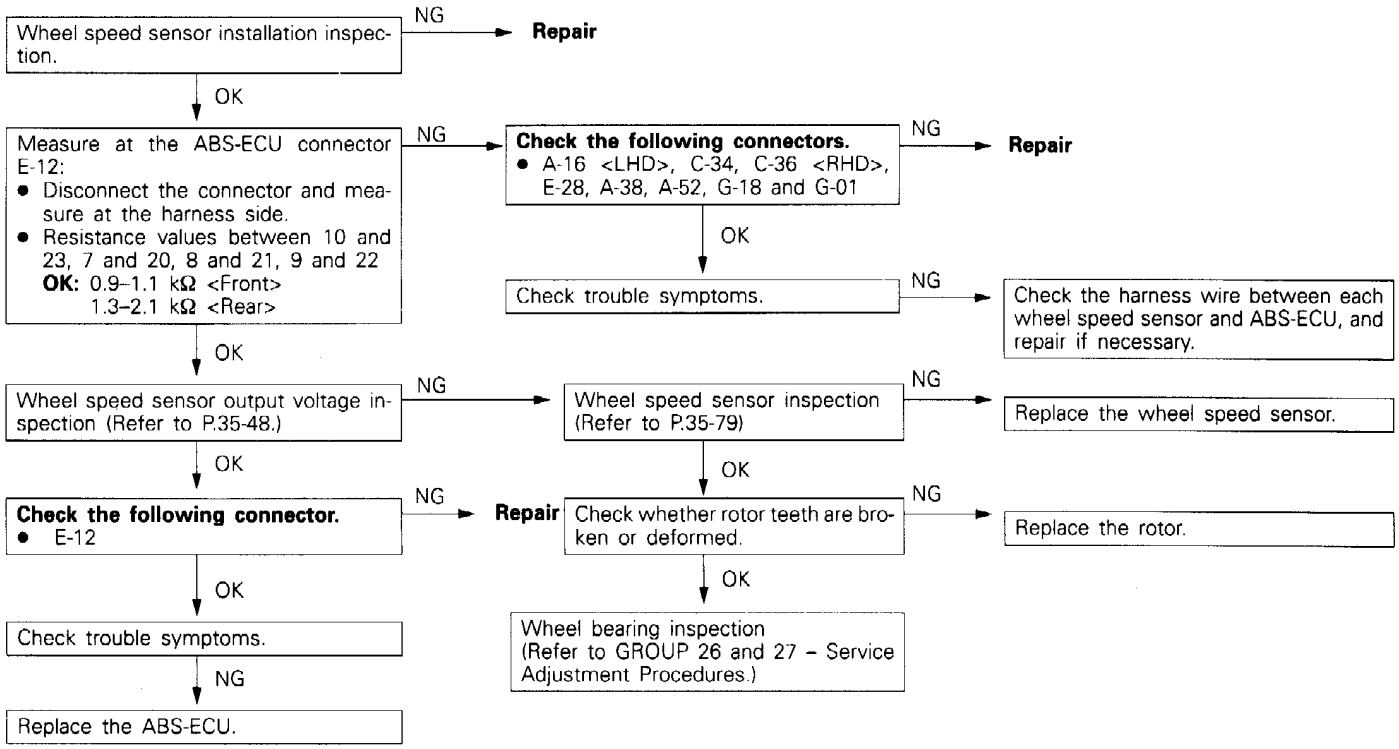
Code No. 16 Power supply system	Probable cause
[Comment] The voltage of the ABS-ECU power supply drops lower or rises higher than the specified value. If the voltage returns to the specified value, this code is no longer output.	• Malfunction of wiring harness or connector. • Malfunction of ABS-ECU

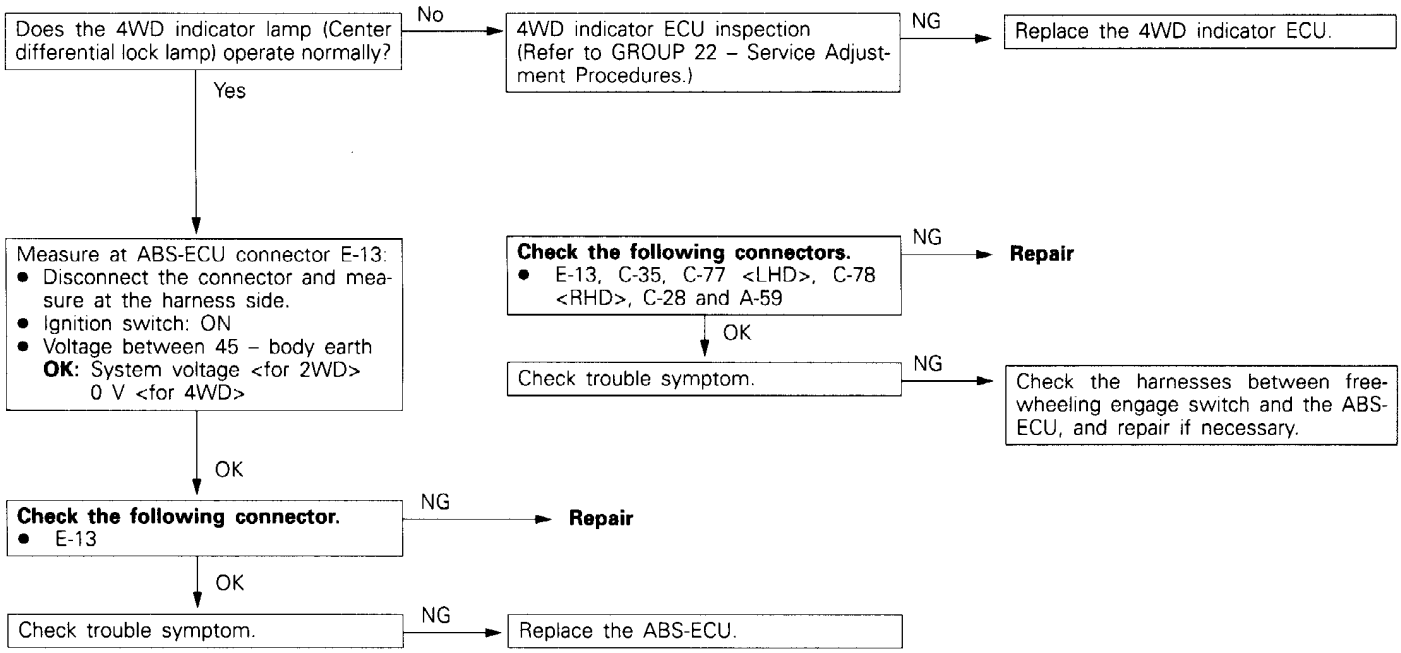
Caution
If battery voltage drops or rises during inspection, this code will be output as well. If the voltage returns to the specified value, this code is no longer output.
Before carrying out the following inspection, check the battery level, and refill it if necessary.



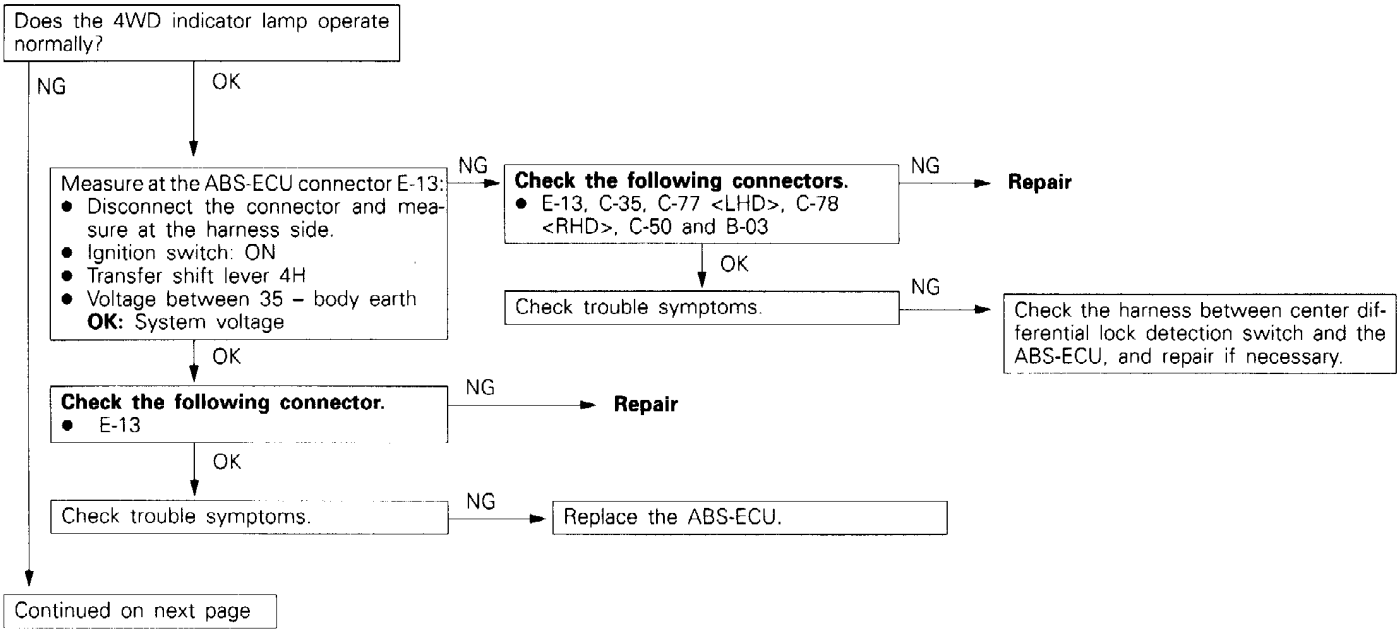
Code No. 21, 22, 23, 24 Wheel speed sensor short circuit	Probable cause
[Comment] These codes are output at the following times: • When an open circuit cannot be found, but more than one wheel speed sensor does not output any signal during driving at 8 km/h or higher. • When a chipped or plugged-up rotor tooth, etc. is detected. • When the sensor output drops and anti-lock control is continuously carried out due to a defective sensor or a warped rotor.	• Malfunction of wheel speed sensor • Malfunction of rotor • Malfunction of wheel bearing • Malfunction of wiring harness or connector • Malfunction of ABS-ECU



Code No. 25 Free-wheeling engage switch	Probable cause
[Comment] ABS-ECU determines that an open circuit exists in the free-wheeling engage switch system.	• Malfunction of wiring harness or connector • Malfunction of 4WD indicator ECU • Malfunction of ABS-ECU



Code No. 26 4WD position detection switch	Probable cause
[Comment] This code is output at the following times: • ABS-ECU determines that an open circuit exists in the 4WD detection switch system. • The free-wheeling engage switch is off and the 4WD detection switch is on at a vehicle speed of 15 km/h or more for 5 seconds or more.	• Malfunction of wiring harness or connector • Malfunction of free-wheeling engage switch • Malfunction of 4WD indicator ECU • Malfunction of 4WD position detection switch • Malfunction of ABS-ECU



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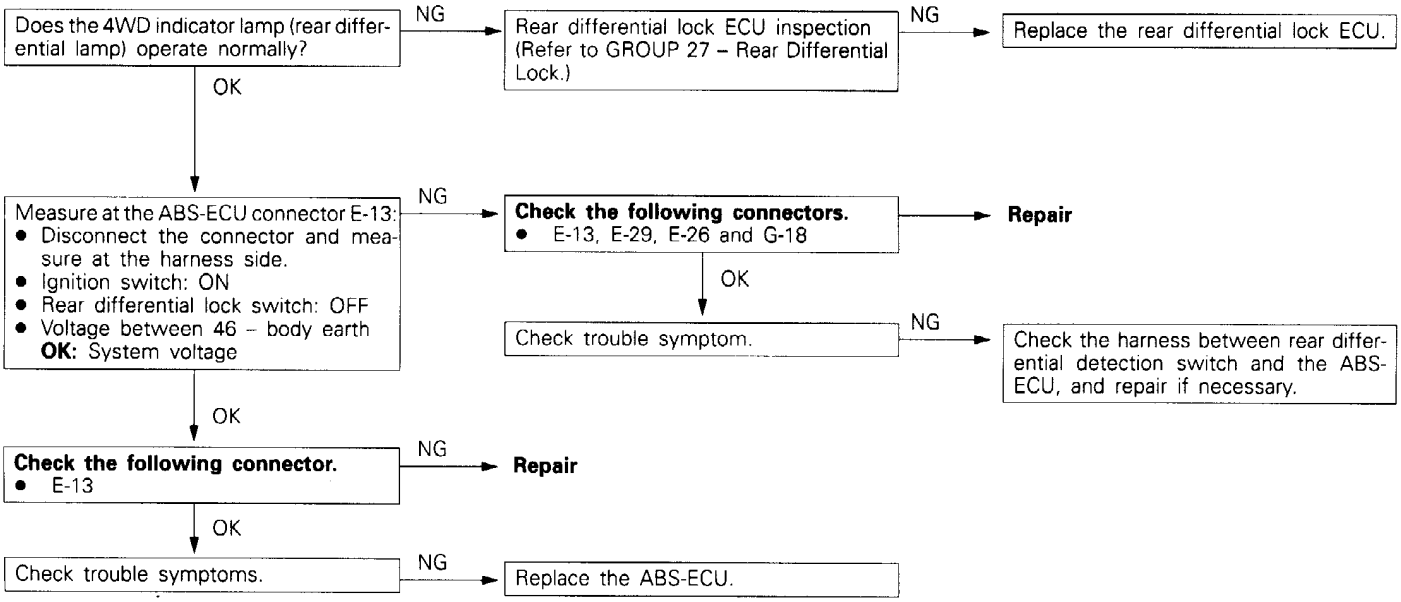
Continued from previous page

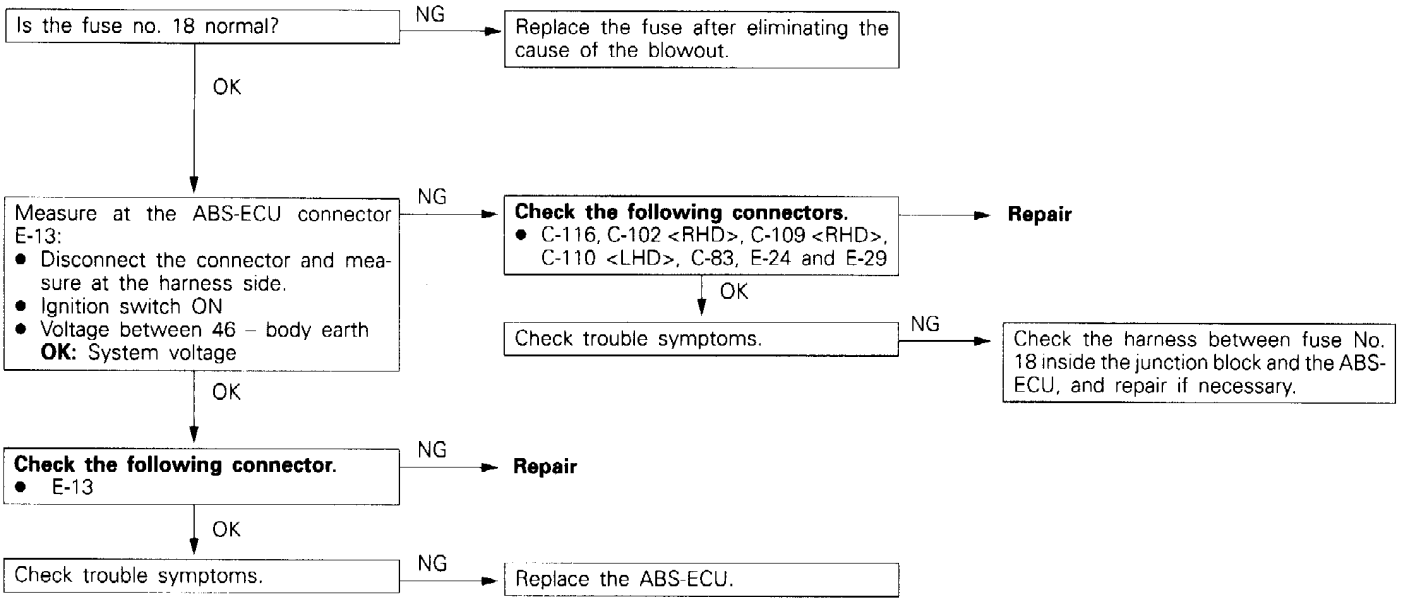
Trouble symptom	Main causes	Remedy
Even when the transfer shift lever is in the "4H" position, the 4WD front wheel indicator lamp does not illuminate.	Broken harness wire between the 4WD indicator ECU and the free-wheel engage switch, or broken earth wire from the free-wheel engage switch.	Repair the harness
	Free-wheeling engage switch is detective	Replace the switch
Even when the transfer shift lever is in the "4H" position, the 4WD center differential lamp does not illuminate.	Broken harness wire between the 4WD indicator ECU and the center differential lock switch	Repair the harness
	Broken wire in the 4WD indicator ECU circuit	4WD indicator ECU inspection (Refer to GROUP 22 – Service Adjustment Procedures.)
4WD indicator center differential lamp illuminates regardless of the position of the transfer shift lever	Short in the harness wire in the center differential lock detection switch circuit	Repair the harness
	Center differential lock detection switch is defective	Replace the switch
	Short inside the ABS-ECU circuit	Replace the ABS-ECU
	Short inside the 4WD indicator ECU circuit	4WD indicator ECU inspection (Refer to GROUP 22 – Service Adjustment Procedures.)
No indicator is illuminated	Power circuit in the 4WD indicator ECU is defective	Repair the harness
	4WD indicator ECU is defective	4WD indicator ECU inspection (Refer to GROUP 22 – Service Adjustment Procedures.)

NOTE
When checking a short in the ABS-ECU circuit, remove the ABS-ECU connector and check if the 4WD indicator returns to normal. If it returns to normal, the ABS-ECU is defective. Furthermore, if the ABS-ECU is normal, then the 4WD indicator ECU will be defective.

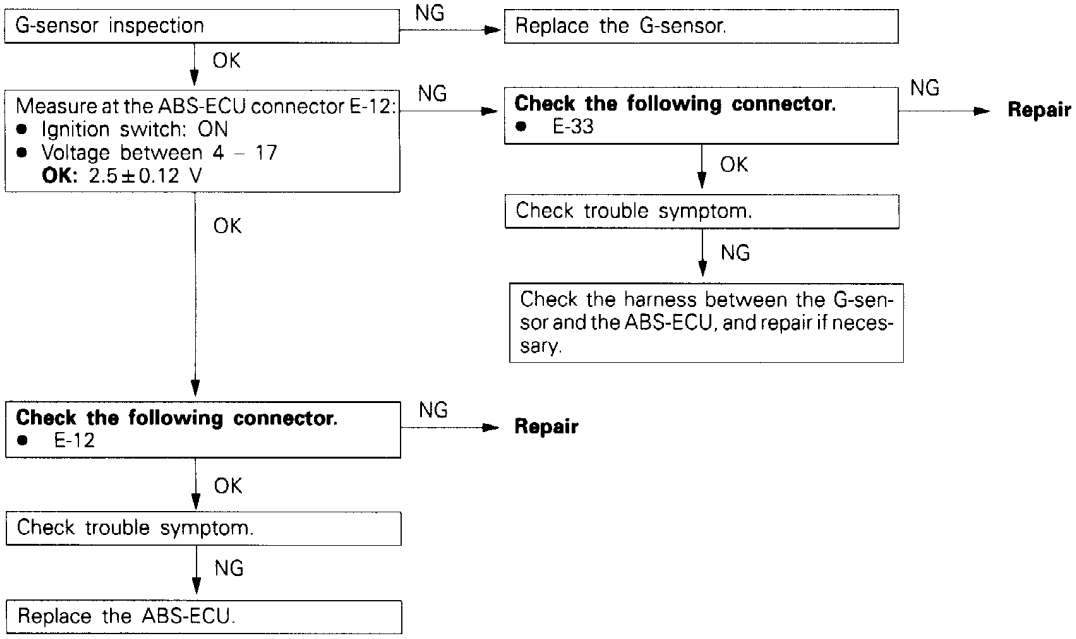
Code No. 27 Rear differential lock detection switch <Vehicles with rear differential lock>	Probable cause
[Comment] The ABS-ECU determines that an open circuit occurs in rear differential detection switch system.	• Malfunction of wiring harness or connector • Malfunction of rear differential lock ECU • Malfunction of ABS-ECU



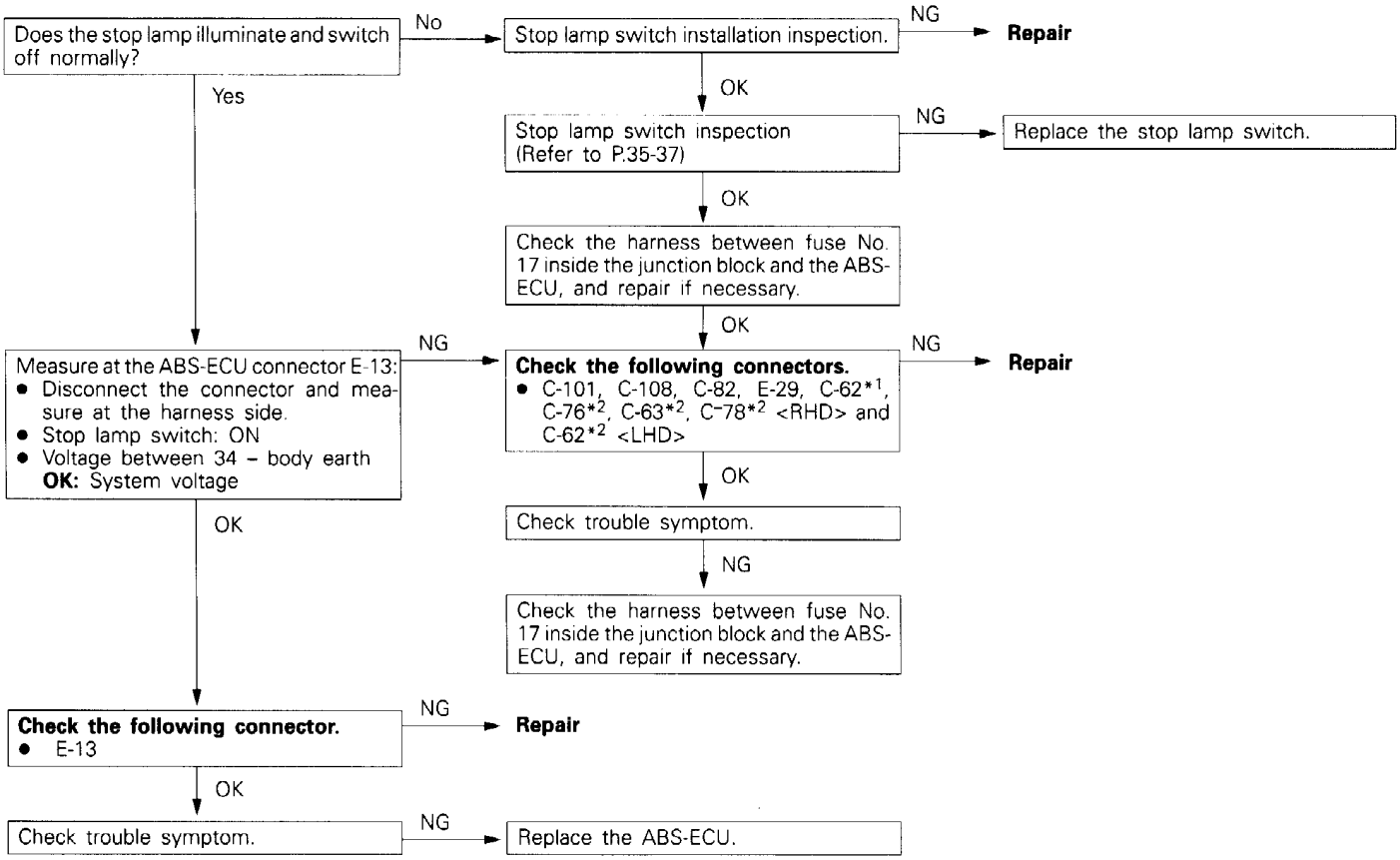
Code No. 27 Rear differential lock detection switch <Vehicles without rear differential lock>	Probable cause
[Comment] For vehicles without rear differential lock, battery voltage is applied to the ABS-ECU terminal no. 46. This code is output when this line is interrupted.	• Malfunction of wiring harness or connector • Malfunction of ABS-ECU



Code No. 32 G-sensor system	Probable cause
[Comment] This code is output at the following times: • The G-sensor output is less than 0.5 V or more than 4.5 V. • An open or short circuit is present in the G-sensor system.	• Malfunction of G-sensor • Malfunction of wiring harness or connector • Malfunction of ABS-ECU

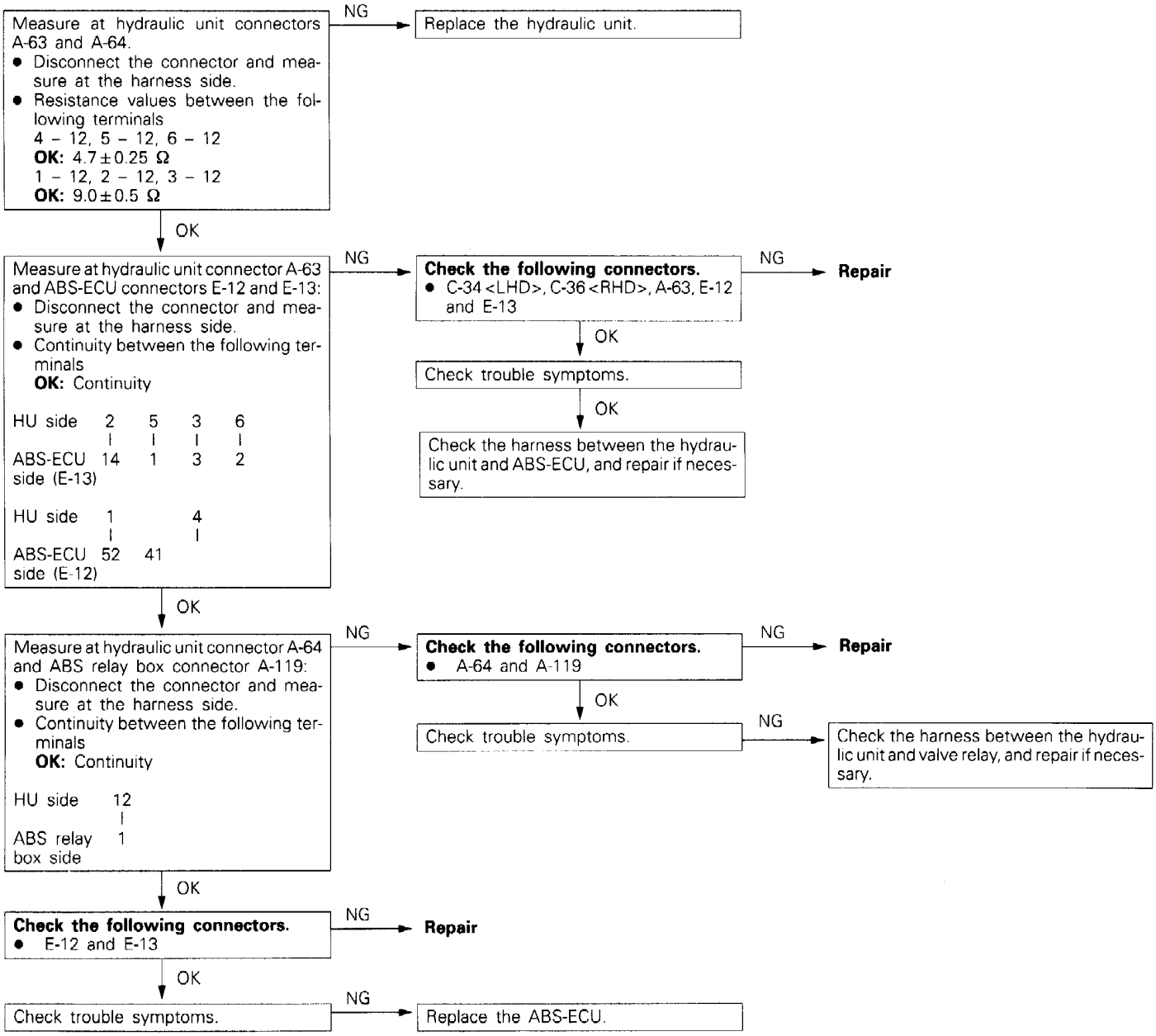


Code No. 33 Stop lamp switch system	Probable cause
[Comment] These codes are output at the following times: • When the stop lamp switch is not be turned off (when the stop lamp switch stays on for 15 minutes or more although the ABS is not operating) • When the ABS-ECU determines that there is an open circuit in harness of the stop lamp switch system.	• Malfunction of stop lamp switch • Malfunction of harness or connector • Malfunction of ABS-ECU



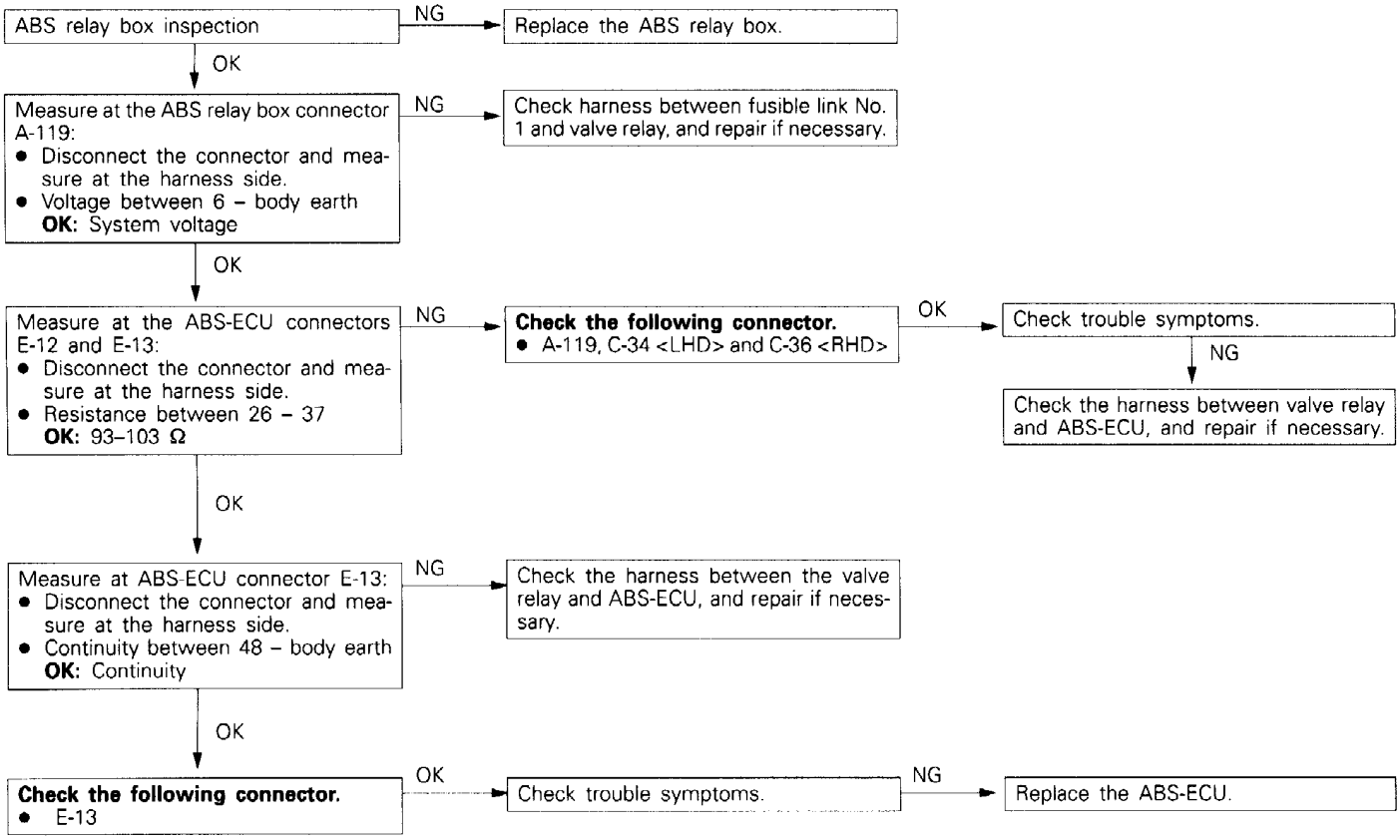
NOTE
(1) *1 indicates vehicles without auto-cruise control system.
(2) *2 indicates vehicles with auto-cruise control system.

Code No. 41, 42, 43 Solenoid valve	Probable cause
[Comment] The ABS-ECU always monitors the solenoid valve drive circuit. It determines that there is an open or short-circuit in the solenoid coil or in a harness: • When no current flows in the solenoid even though the ABS-ECU turns on it, and vice versa.	• Malfunction of wiring harness • Malfunction of hydraulic unit • Malfunction of ABS-ECU



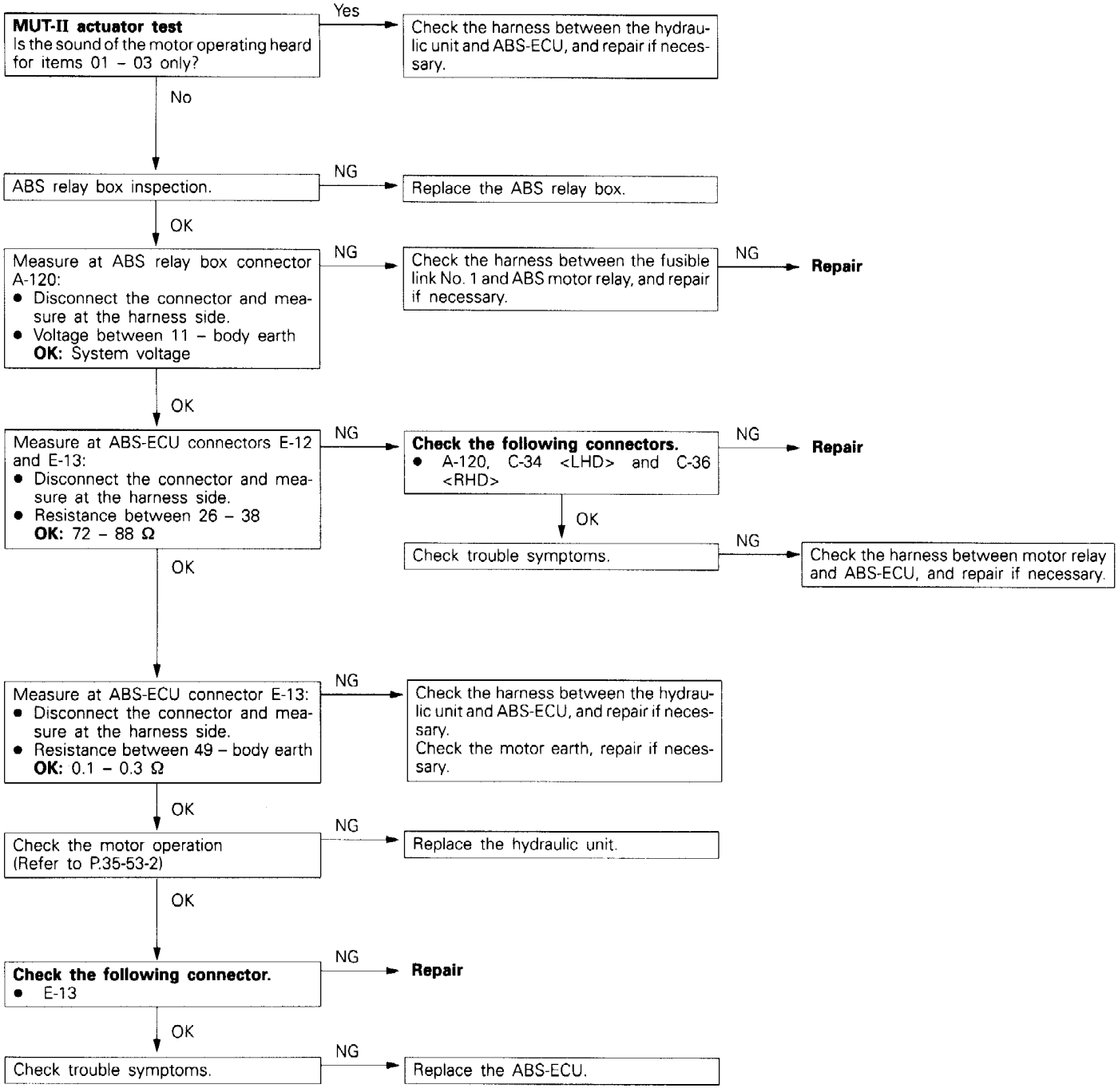
Code No. 51 Valve relay	Probable cause
[Comment] When the ignition switch is turned to ON, the ABS-ECU switches the valve relay off and on during the initial check. In that way, the ABS-ECU compares the signals sent to the valve relay with the voltage in the valve power monitor line. That is how to check if the valve relay is operating normally. The ABS-ECU always checks if current flows in the valve power monitor line, too. It determines that there is an open circuit when no current flows. If no current flows in the valve power monitor line, this diagnosis code is output.	• Malfunction of valve relay • Malfunction of wiring harness or connector • Malfunction of ABS-ECU • Malfunction of hydraulic unit

NOTE
Whenever reading the diagnosis codes using the ABS warning lamp (P.35-36-16), this diagnosis code will be output. That is not a malfunction but because the valve relay connector is disconnected. After repairing all other malfunctions, connect the valve relay connector again to check the valve relay. Then check that the ABS warning lamp does not illuminate. If it illuminates, the valve relay may be defective. So carry out the following procedure.



Code No. 53 Motor relay, motor	Probable cause
[Comment] These codes are output at the following times: • When the motor relay is on but no signal is input to the motor monitor line (motor is not operating, etc.) • When the motor relay is off but a signal is input to the motor monitor line for 5 seconds or more (motor continues operating, etc.) When the motor relay does not operate	• Malfunction of motor relay • Malfunction of wiring harness or connector • Malfunction of hydraulic unit • Malfunction of ABS-ECU

Caution
Because force-driving of the motor by means of the actuator test will drain the battery, the engine should be started and left to run for a while after testing is completed.



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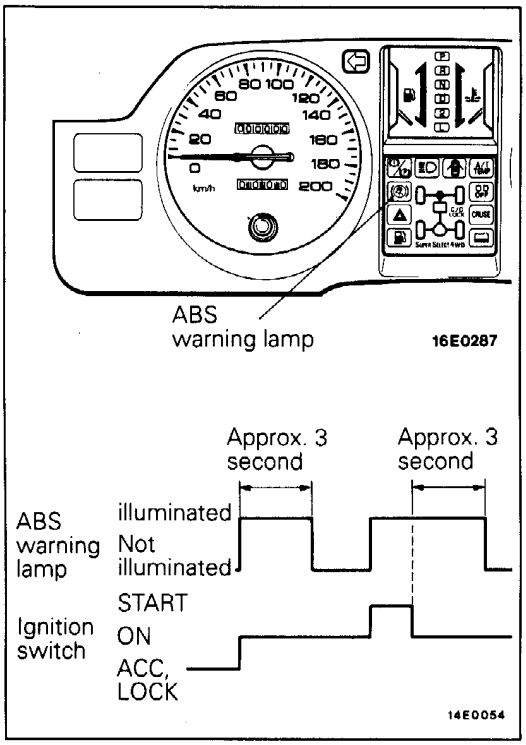


ABS WARNING LAMP INSPECTION

Check that the ABS warning lamp illuminates as follows.

1. When the ignition key is turned to "ON", the ABS warning lamp illuminates for approximately 3 seconds and then switches off.
2. When the ignition key is turned to "START", the ABS warning lamp remains illuminated.
3. When the ignition key is turned from "START" back to "ON", the ABS warning lamp illuminates for approximately 3 seconds and then stays switched off.
4. If the illumination is other than the above, check the diagnosis codes.

INSPECTION CHART FOR TROUBLE SYMPTOMS

Get an understanding of the trouble symptoms and check according to the inspection procedure chart.

Trouble symptom		Inspection procedure No.	Reference page
Communication with MUT-II is not possible.	No communication with any system is possible.	1	P.35-36-18
	Communication is not possible with ABS only.	2	P.35-36-18
When the ignition key is turned to "ON" (engine stopped), the ABS warning lamp does not illuminate.		3	P.35-36-19
After the engine starts, the lamp remains illuminated.		4	P.35-36-19
When the ignition key is turned to "START", the ABS warning lamp does not illuminate.		5	P.35-36-20
After the ignition key is turned on "ON", the ABS warning lamp blinks twice, and when turned to "START", it illuminates. When returned to "ON", the lamp flashes once, and then switches off.		6	P.35-36-20
Faulty ABS operation	Unequal braking power on both sides	7	P.35-36-21
	Insufficient braking power		
	ABS operates under normal braking conditions		
	ABS operates before vehicle stops under normal braking conditions		
	Large brake pedal vibration (Caution 2.)	–	–

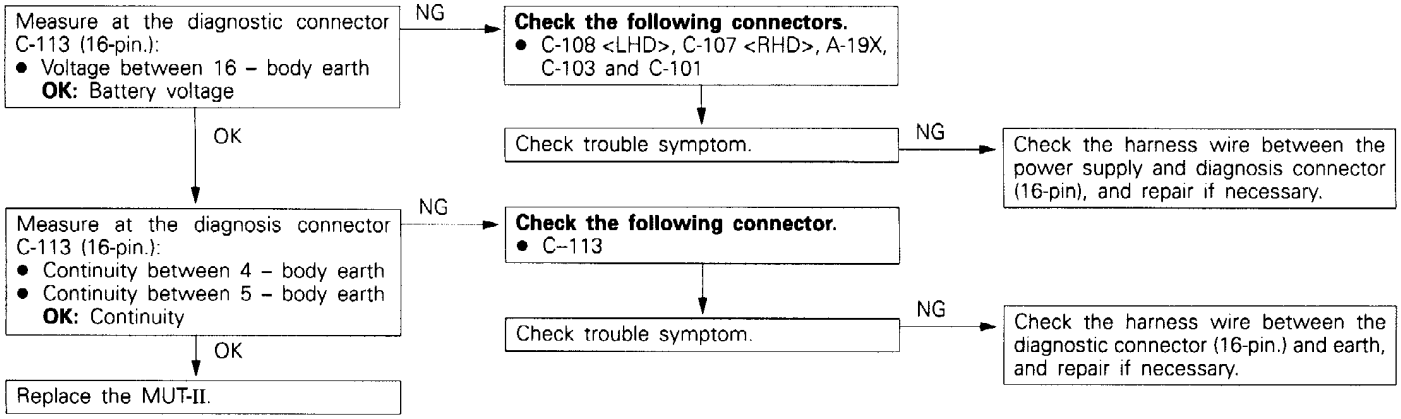
Caution

1. **If steering movements are made when driving at high speed, or when driving on road surfaces with low frictional resistance, or when passing over bumps, the ABS may operate even though sudden braking is not being applied. Because of this, when getting information from the customer, check if the problem occurred while driving under such conditions as these.**
2. **During ABS operation, changes in the feeling of the brake pedal (vibration may occur or pedal may not be able to be depressed). Such changes are due to intermittent changes in hydraulic pressure inside the brake line to prevent the wheels from locking and is not an abnormality.**

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

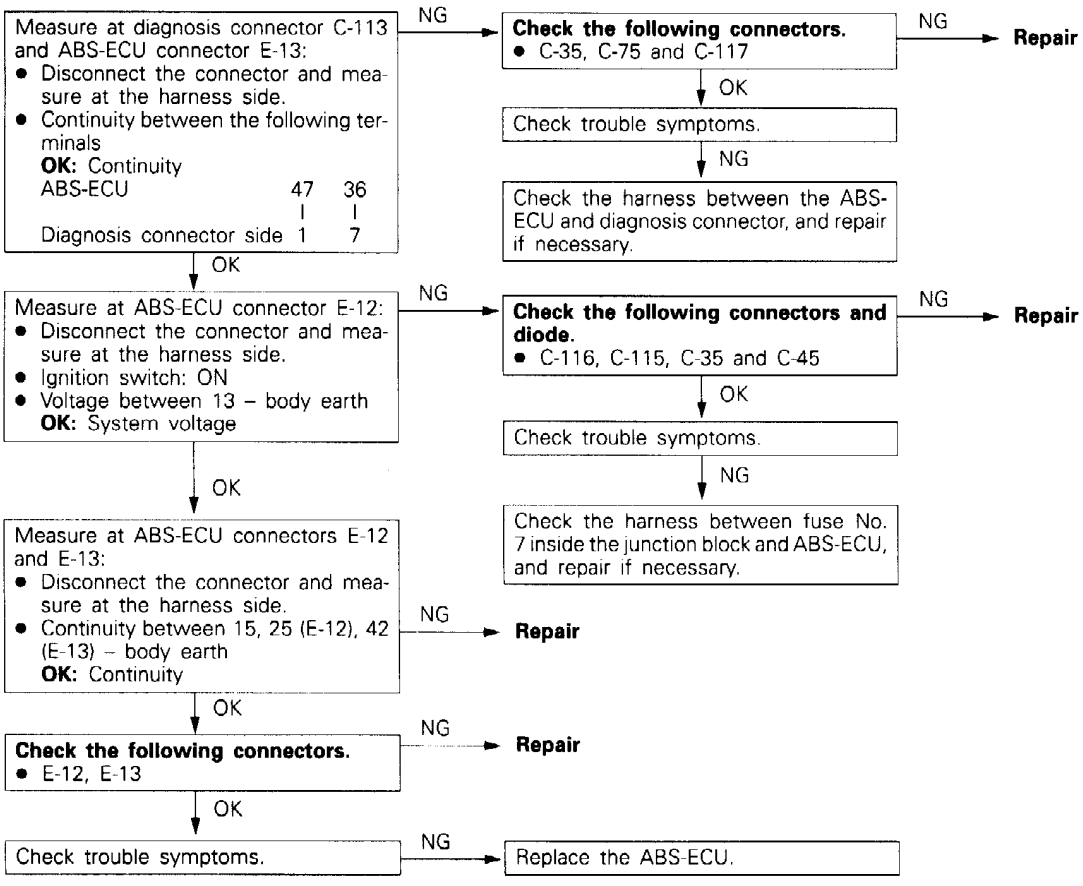
Inspection Procedure 1

Communication with MUT-II is not possible. (No communication with any system is possible.)	**Probable cause**
[Comment] The reason is probably a defect in the power supply system (including earth) for the diagnosis line.	• Malfunction of connector • Malfunction of harness



Inspection Procedure 2

Communication with MUT-II is not possible. (Communication is not possible with ABS only.)	**Probable cause**
[Comment] When communication with the MUT-II is not possible, the cause is probably an open circuit in the ABS-ECU power circuit or an open circuit in the diagnosis output circuit.	• Blown fuse • Malfunction of wiring harness or connector • Malfunction of ABS-ECU



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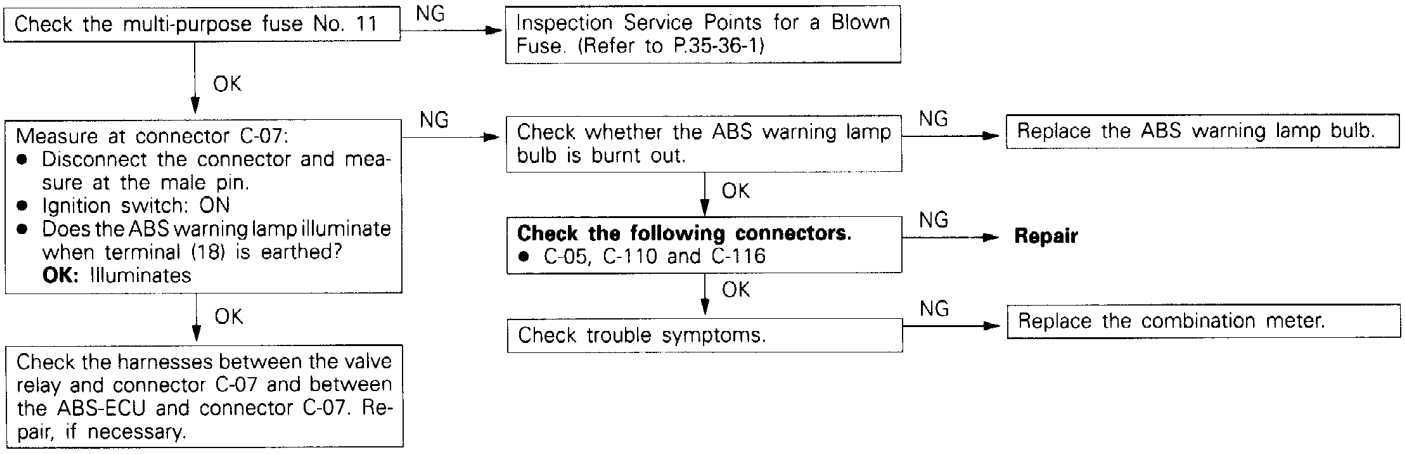
Inspection Procedure 3

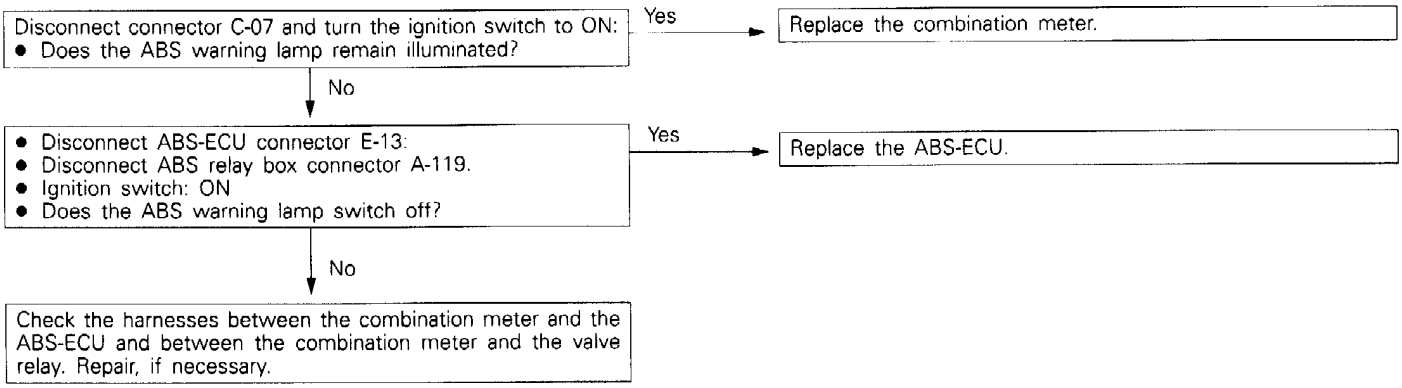
When ignition key is turned to "ON" (engine stopped), ABS warning lamp does not illuminate.	Probable cause
[Comment] When current flows in the ABS-ECU, the valve relay turns from off to on, off and back to on again as the initial check. So the ABS warning lamp will illuminate twice when the valve relay is off even if there is a problem with the circuit between the ABS warning lamp and the ABS-ECU. Therefore, if the lamp does not illuminate, the cause may be: an open circuit in the lamp power supply circuit, a blow lamp bulb, an open circuit in both the circuit between the ABS warning lamp and the ABS-ECU and in the circuit between the ABS warning lamp and the valve relay	• Blow fuse • Burnt out ABS warning lamp bulb • Malfunction of wiring harness or connector



Inspection Procedure 4

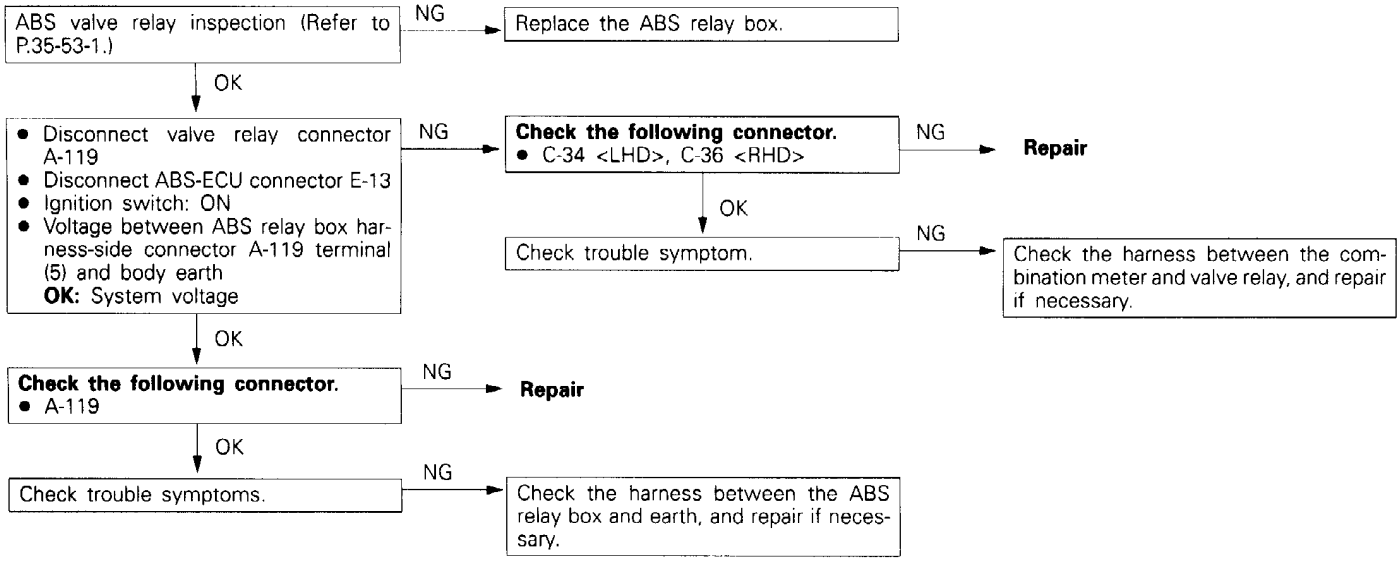
Even after the engine is started, the ABS warning lamp remains illuminated.	Probable cause
[Comment] The cause is probably a short-circuit in the ABS warning lamp illumination circuit.	• Malfunction of combination meter • Malfunction of ABS-ECU • Malfunction of wiring harness

NOTE
This trouble symptom is limited to cases where communication with the MUT-II is possible (ABS-ECU power supply is normal) and the diagnosis code is a normal diagnosis code.



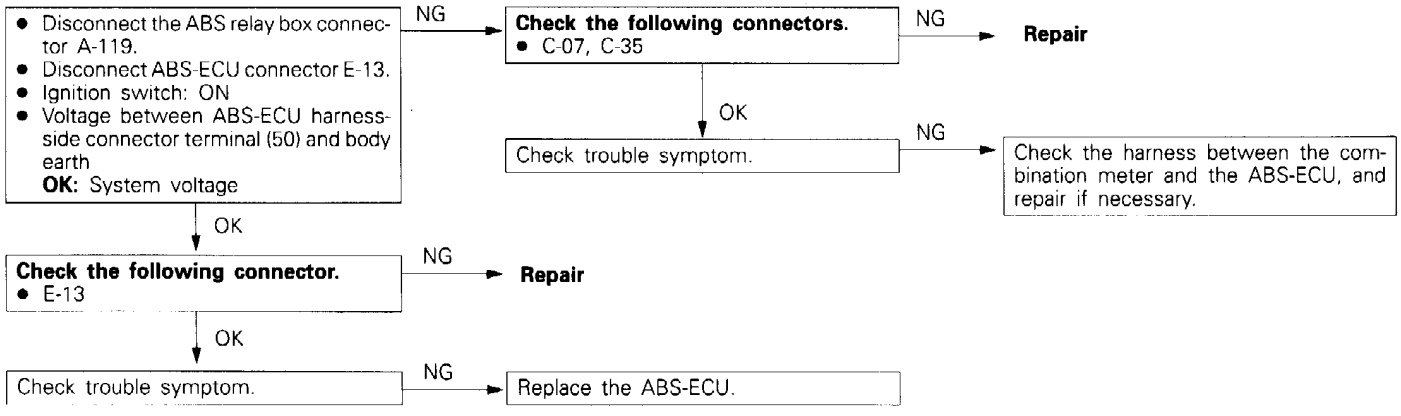
Inspection Procedure 5

When ignition key is turned to "START", ABS warning lamp does not illuminate.	Probable cause
[Comment] Current does not flow in the ABS-ECU when the ignition switch is turned to START. Current flows in the ABS warning lamp even when the ignition switch is turned to START. Therefore, the valve relay, which current is supplied through the ABS-ECU, turns off when the ignition switch is at START. However, the warning lamp circuit of the valve relay must turn on in turn. So the cause must be a defective circuit on valve relay side.	• Malfunction of wiring harness or connector • Malfunction of ABS-ECU.



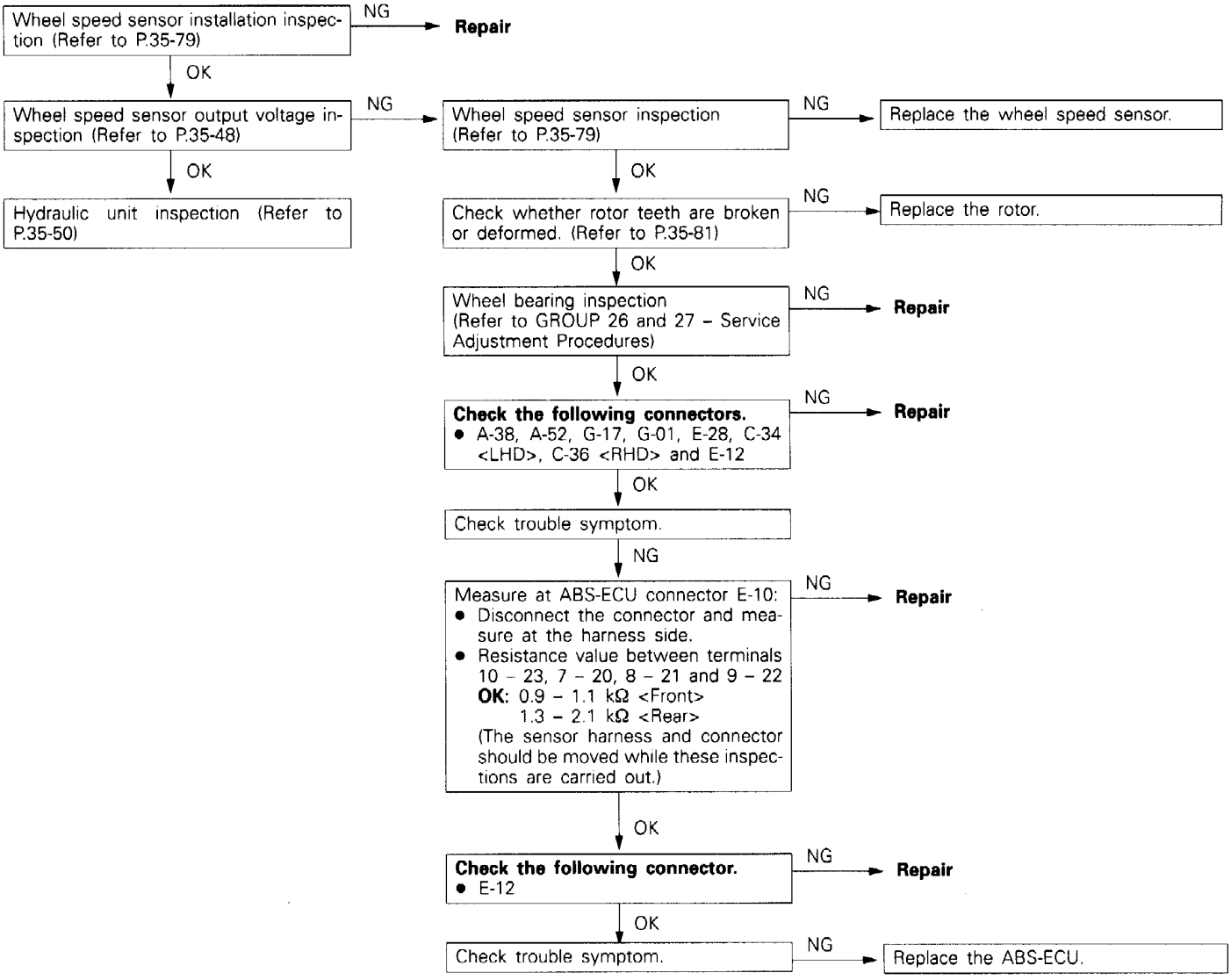
Inspection Procedure 6

The ABS warning lamp flashes twice after the ignition key is turned to "ON". The lamp illuminates when the ignition key is turned to "START", and when the key is returned to "ON", it flashes once.	Probable cause
[Comment] The ABS-ECU causes the ABS warning lamp to illuminate during the initial check (approx. 3 seconds). During the initial check, the valve relay turns from off to on, off and back to on again. If there is an open circuit in the harness between the ABS-ECU and the ABS warning lamp, the lamp will illuminate only when the valve relay is OFF during valve relay test, etc.	• Malfunction of wiring harness or connector • Malfunction of ABS-ECU.



Inspection Procedure 7

Brake operation is abnormal	Probable cause
[Comment] This depends on the driving conditions and the road surface conditions, so problem diagnosis is difficult. However, if a normal diagnosis code is displayed, carry out the following inspection.	• Improper installation of wheel speed sensor • Incorrect sensor harness contact • Foreign material adhering to wheel speed sensor • Malfunction of wheel speed sensor • Malfunction of rotor • Malfunction of wheel bearing • Malfunction of hydraulic unit • Malfunction of ABS-ECU



DATA LIST REFERENCE TABLE

The following items can be read by the MUT-II from the ABS-ECU input data.

1. When the system is normal

Item No.	Check item	Checking Requirements	Normal Value
11	Front-right wheel speed sensor	Do a test run.	Vehicle speeds displayed on the speedometer and MUT-II are identical.
12	Front-left wheel speed sensor		
13	Rear-right wheel speed sensor		
14	Rear-left wheel speed sensor		
16	ABS-ECU power supply voltage	IG power supply voltage and valve monitor voltage	9–16V
25	Free-wheeling engage switch	Engage 4WD.	ON
		Engage 2WD.	OFF
26	Center differential lock detection switch	Place the transfer lever at 4HLC.	ON
		Place the transfer lever at 4H.	OFF
27	Rear differential lock detection switch	Turn on the switch.	ON
		Turn off the switch.	OFF
32	G-sensor output voltage	Stop the vehicle.	2.5 ± 0.12V
		Do a test turn.	Display value fluctuates with a mean value of 2.5 V.
33	Stop lamp switch	Depress the brake pedal.	ON
		Release the brake pedal.	OFF

2. When the ABS-ECU shut off ABS operation.

When the diagnosis system stops the ABS-ECU, the MUT-II display data will be unreliable.

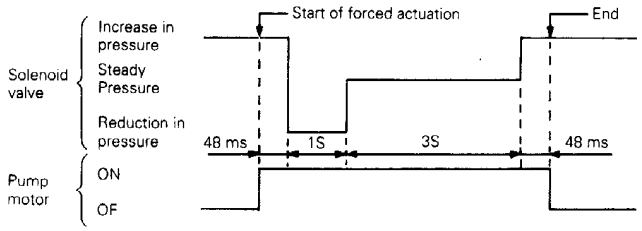
ACTUATOR TEST REFERENCE TABLE

The MUT-II activates the following actuators for testing.

NOTE

1. If the ABS-ECU runs down, actuator testing cannot be carried out.
2. Actuator testing is only possible when the vehicle is stationary. If the vehicle speed during actuator testing exceeds 10 km/h, forced actuation will cancels.

ACTUATOR TEST SPECIFICATIONS

No.	Driving objective		Driving pattern
01	Solenoid valves and pump motors for each corresponding channel in the hydraulic unit	Solenoid valve for front left wheel	
02		Solenoid valve for front right wheel	
03		Solenoid valve for rear wheels	

CHECK AT ABS-ECU

120000123

TERMINAL VOLTAGE CHECK CHART

1. Measure the voltages between terminals (15), (25) and (42) (earth terminals) and each respective terminal.
2. The terminal layouts are shown in the illustrations below.

14W0043

Item No.	Signal	Checking Requirements	Normal Condition
1	Output to front-left hydraulic unit solenoid valve (OUT side)	Ignition switch: ON (When solenoid valve is off approximately 1 second after engine is started)	System voltage
2	Output to rear hydraulic unit solenoid valve (OUT side)		
3	Output to rear hydraulic unit solenoid valve (IN side)		
4	G-sensor signal	Ignition switch: ON	2.5 ± 0.12V (Horizontal condition)
13	ABS-ECU power supply	Ignition switch: ON	System voltage
		Ignition switch: START	0 V

Connector Terminal No.	Signal	Checking Requirements		Normal Condition
14	Output to front-left hydraulic unit solenoid valve (IN side)	Ignition switch: ON (When solenoid valve is off approximately 1 second after engine is started)		System voltage
17	G-sensor earth	Always		0 V
26	Output to relay power supply	Ignition switch: ON		System voltage
32	Memory power supply	Always		System voltage
34	Input from stop lamp switch	Ignition switch: ON	Stop lamp switch ON	System voltage
			Stop lamp switch OFF	1 V or less
35	Input from center differential lock detection switch	Ignition switch: ON	Transfer lever position: 4H	System voltage
			Transfer lever position: 4Lc	1 V or less
36	MUT-II	Connect the MUT-II.		Serial communication with MUT-II
		Do not connect the MUT-II.		1 V or less
37	Output to valve relay	Ignition switch: ON	Approximately 1 second after engine is started. The relay is on.	2 V or less
			The system runs down. The relay is off.	System voltage
38	Output to motor relay	Ignition switch: ON (Approximately 1 second after engine is started)	Motor is on	2 V or less
			Motor is off	System voltage
39	Idle-up solenoid valve (–)	Ignition switch: ON (When motor is on approximately 1 second after engine is started)		2 V or less
41	Output to front-right hydraulic unit solenoid valve (OUT side)	Ignition switch: ON (When solenoid valve is off approximately 1 second after engine is started)		System voltage
43	Idle-up solenoid valve (+)	Ignition switch: ON (When motor is on approximately 1 second after engine is started)		System voltage

RESISTANCE AND CONTINUITY BETWEEN HARNESS-SIDE CONNECTOR TERMINALS

1. Turn the ignition switch off and disconnect the ABS-ECU connectors before checking resistance and continuity.
2. Check them between the terminals indicated in the table below.
3. The terminal layouts are shown in the illustrations below.

14W0042

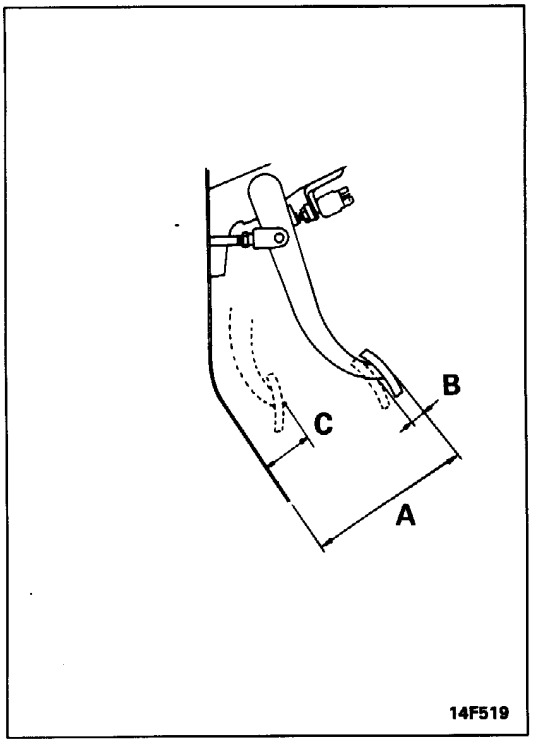
Connector Terminal No.	Signal	Checking Requirements			Normal Condition
45	Input from free-wheeling engage switch	Ignition switch: ON	Engage 2WD.		System voltage
			Engage 4WD.		1 V or less
46*1	Ignition switch	Ignition switch: ON			System voltage
		Ignition switch: START			0 V
46*2	Input from rear differential lock detection switch	Ignition switch: ON	Rear differential lock switch: ON		0 V
			Rear differential lock switch: OFF		System voltage
47	Input from diagnosis indication selection	Connect the MUT-II.			0 V
		Do not connect the MUT-II.			Approx. 12 V
48	Input from valve relay monitor	Ignition switch: ON			System voltage
49	Motor monitor	Ignition switch: ON (Approximately 1 second after engine is started)		Motor is on	System voltage
				Motor is off	0.5 V or less
50	Output to ABS warning lamp	Ignition switch: ON	The lamp is switched off		System voltage
			The lamp illuminates		0–2 V
52	Output to front-right hydraulic unit solenoid valve (IN side)	Ignition switch: ON (When solenoid valve is off approximately 1 second after engine is started)			System voltage

NOTE
(1) *1: Vehicles without rear differential lock
(2) *2: Vehicles with rear differential lock

RESISTANCE AND CONTINUITY BETWEEN HARNESS-SIDE CONNECTOR TERMINALS

1. Turn the ignition switch off and disconnect the ABS-ECU connectors before checking resistance and continuity.
2. Check them between the terminals indicated in the table below.
3. The terminal layouts are shown in the illustrations below.

Connector Terminal No.	Signal	Normal Condition
1 – Body earth	Front-left solenoid valve (OUT side)	4.7 ± 0.25 Ω
2 – Body earth	Rear solenoid valve (OUT side)	4.7 ± 0.25 Ω
3 – Body earth	Rear solenoid valve (IN side)	9.0 ± 0.5 Ω
7–20	Front-left wheel speed sensor (+ wire)	0.9 ± 1.1 Ω
8–21	Rear-right wheel speed sensor (+ wire)	1.3 ± 2.1 Ω
9–22	Rear-left wheel speed sensor (+ wire)	1.3 ± 2.1 Ω
10–23	Front-right wheel speed sensor (+ wire)	0.9 ± 1.1 Ω
14 – Body earth	Front-left solenoid valve (IN side)	9.0 ± 0.5 Ω
15 – Body earth	ABS-ECU earth	Continuity
25 – Body earth		
39–43	Idle-up solenoid valve	36 – 44 Ω
41 – Body earth	Front-right solenoid valve (OUT side)	4.7 ± 0.25 Ω
42 – Body earth	ABS-ECU earth	Continuity
48 – Body earth	Valve relay monitor input	Continuity
49 – Body earth	Motor monitor	Continuity
52 – Body earth	Front-right solenoid valve (IN side)	9.0 ± 0.5 Ω

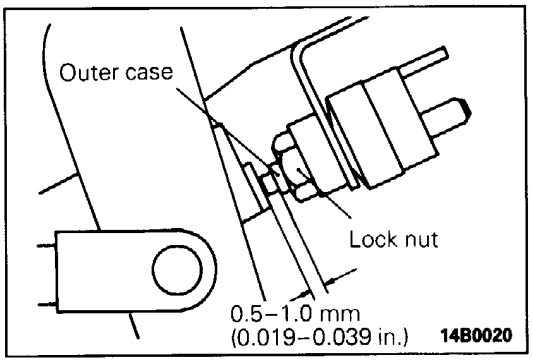


SERVICE ADJUSTMENT PROCEDURES

E35FAAH

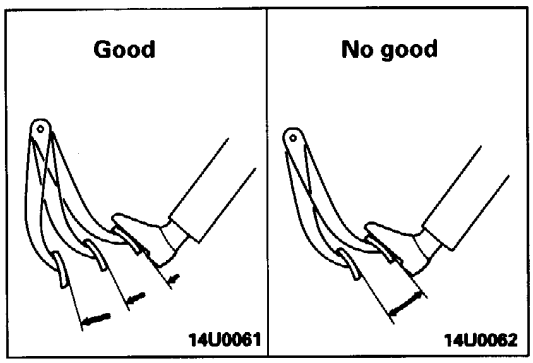
BRAKE PEDAL INSPECTION AND ADJUSTMENT

1. Measure the brake pedal height (A) as illustrated.
   Standard value (A): 186–191 mm (7.3–7.5 in.)
2. Start the engine, depress the brake pedal with approximately 500N (50 kg, 110 lbs.) of force, and measure the clearance between the brake pedal and the floorboard.
   Standard value (C): 100 mm (3.94 in.) or more
3. While the engine is stopped, depress the brake pedal two or three times. After thus eliminating the vacuum in the brake booster, press the pedal down by hand, and confirm that the free play (B) is within the standard value range.
   Standard value (B): 3–8 mm (0.12–0.31 in.)



4. Adjust the brake pedal height.
   (1) Sufficiently loosen the stop lamp switch by loosening lock nut.
   (2) Adjust the brake pedal height by turning the operating rod with pliers (with lock nut loosened).
   (3) After turning the stop lamp switch until it contacts the pedal stop (until immediately before the brake pedal begins to move), turn the stop lamp switch back 1/2 to 1 revolution and secure with a lock nut.

   Caution
   Check that the stop lamp is not illuminated when the brake pedal is not depressed.



BRAKE BOOSTER OPERATING TEST

E35FCAAa

For simple checking of the brake booster operation, carry out the following tests:

1. Run the engine for one or two minutes, and then stop it. If the pedal depresses fully the first time but gradually becomes higher when depressed succeeding times, the booster is operating properly. If the pedal height remains unchanged, the booster is defective.

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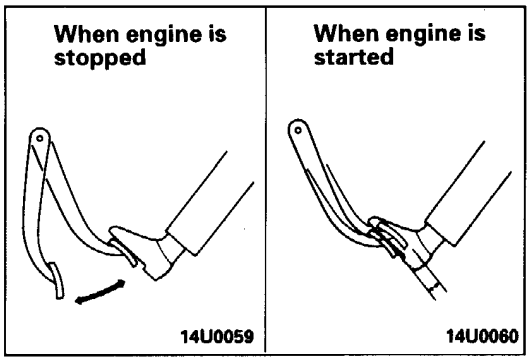
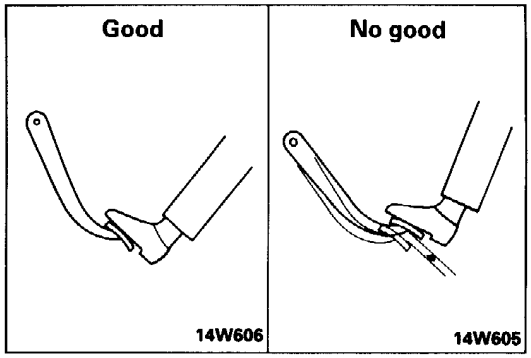
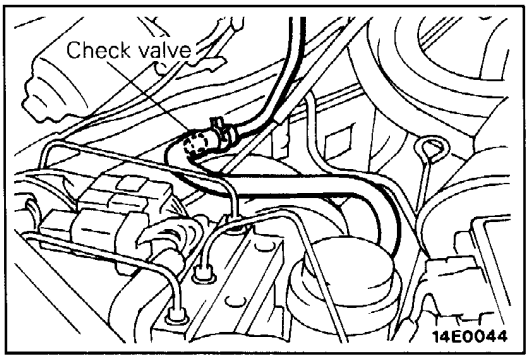


2. With the engine stopped, step on the brake pedal several times.
   Then step on the brake pedal and start the engine.
   If the pedal moves downward slightly, the booster is in good condition. If there is no change, the booster is defective.



3. With the engine running, step on the brake pedal and then stop the engine.
   Hold the pedal depressed for 30 seconds. If the pedal height does not change, the booster is in good condition, if the pedal rises, the booster is defective.

If the above three tests are okay, the booster performance can be determined as good.
If one of the above three tests is not okay at last, the check valve, vacuum hose, or booster will be defective.

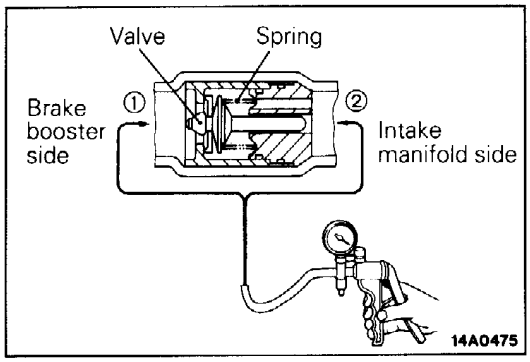


CHECK VALVE OPERATION CHECK E35FEAI

When checking the check valve, keep the check valve fit in the vacuum hose.

1. Remove the vacuum hose.

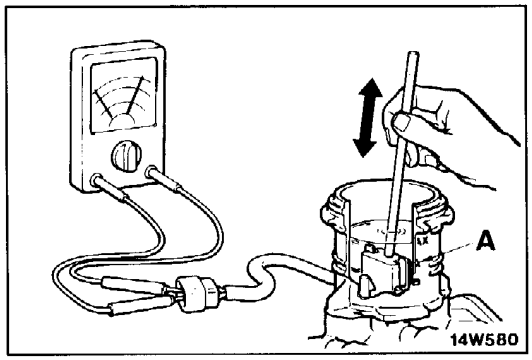
   NOTE
   The check valve is press-fit inside the vacuum hose.



2. Check the operation of the check valve by using a vacuum pump.

Vacuum pump connection	Accept/reject criteria
Connection at the brake booster side ①	A negative pressure (vacuum) is created and held.
Connection at the engine side ②	A negative pressure (vacuum) is not created.

Caution
If the check valve is defective, replace it as an assembly unit together with the vacuum hose.



BRAKE FLUID LEVEL SENSOR CHECK E35FBAE

The brake fluid level sensor is in good condition if there is no continuity when the float surface is above "A", and if there is continuity when the float surface is below "A".

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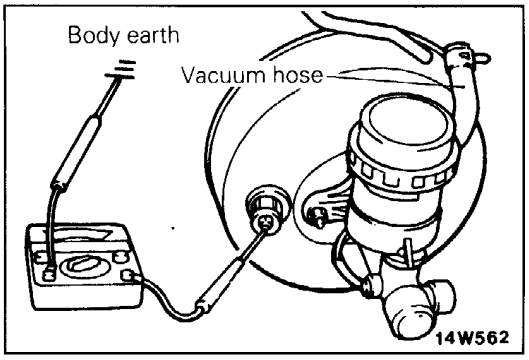
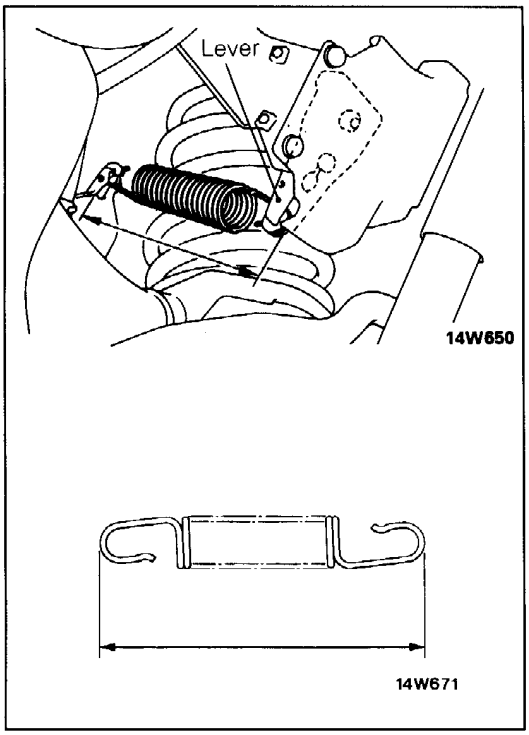


BRAKE BOOSTER VACUUM SWITCH CHECK <2500D>

E35FDAAb

1. Connect an ohmmeter to the connector of the vacuum switch.
2. Start the engine and check for continuity when the vacuum hose is connected and when it is disconnected. The vacuum switch is in good condition if there is no continuity when the vacuum hose is connected, and if there is continuity when it is not connected.



LOAD SENSING SPRING LENGTH CHECK AND ADJUSTMENT

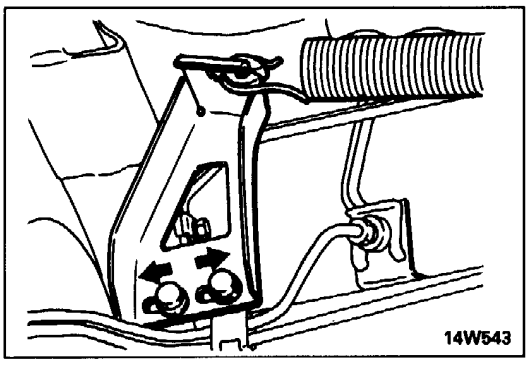
E35FHAK

1. Park the vehicle on a level ground. The vehicle should be unloaded and supported only by wheels.

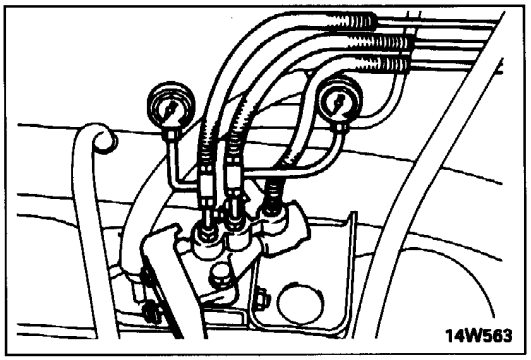
   Caution
   Never support the vehicle with jacks or other similar means.

2. With the lever pressed all the way to the load-sensing proportioning valve side, check whether or not the length (shown in the figure) of the spring (the length between its ends) is the standard value.

   Standard value: 224–228 mm (8.8–9.0 in.)



3. If the spring length is not within the standard value, loosen the bolt attaching the support and adjust the distance by moving the support.



LOAD SENSING PROPORTIONING VALVE FUNCTION TEST

E35FKAK

1. Connect pressure gauges to the input and output ports of the load sensing proportioning valve. Bleed the system.

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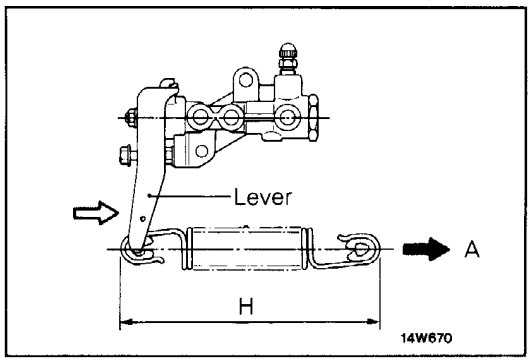

2. Disconnect the spring at the support side.
3. Place the spring so that it is in parallel with the load-sensing proportioning valve, and then pull in the direction indicated by arrow A so that its length H shown in the figure (the length between its ends) is as noted below.

   NOTE
   At this time the lever is pressed all the way to the load-sensing proportioning valve side.

   Check at this time whether or not the output fluid's pressure, relative to the load-sensing proportioning valve's input fluid pressure, is within the standard value.

Standard value:

Items	Spring length H mm (in.)	Input fluid pressure MPa (kg/cm^2, psi)	Output fluid pressure MPa (kg/cm^2, psi)
2-door models	227.5 (9.0)	10 (100, 1422)	5.37–6.27 (53.7–62.7, 763.8–891.8)
		18 (180, 2560)	7.17–8.47 (71.7–84.7, 1019.8–1204.7)
4-door models	226.7 (8.9)	10 (100, 1422)	6.14–7.04 (61.4–70.4, 873.3– 1001.3)
		18 (180, 2560)	7.94–9.24 (79.4–92.4, 1129.3–1314.2)

4. In the same manner as in step 3., check whether or not the output fluid's pressure, relative to the load-sensing proportioning valve's input fluid pressure, is within the standard valve when the spring's length H is the dimension noted below.

Standard value:

Items	Spring length H mm (in.)	Input fluid pressure MPa (kg/cm^2, psi)	Output fluid pressure MPa (kg/cm^2, psi)
2-door models	255.6 (10.1)	18 (180, 2560)	13.1–15.1 (131–151, 1863.3–2147.7)
4-door models	257.7 (10.1)	18 (180, 2560)	10.4–12.4 (104–124, 1479.2–1763.7)

5. After making the check, install the spring. Disconnect the pressure gauges from the load-sensing proportioning valve and bleed the air.

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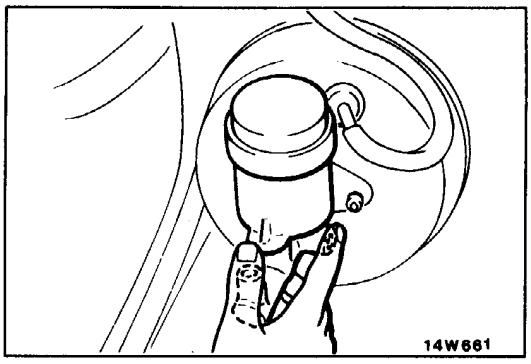


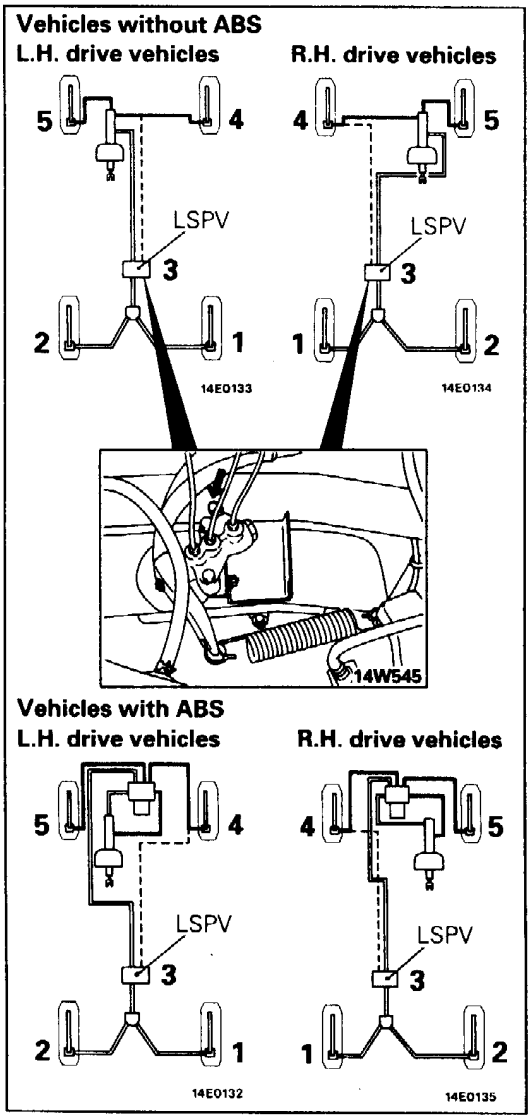
BLEEDING E35FYAJ

Caution
Use the specified brake fluid. Avoid using a mixture of the specified brake fluid and other fluid.

Specified brake fluid: DOT3 or DOT4

AIR BLEEDING OF THE MASTER CYLINDER

If there is no brake fluid in the master cylinder, bleed air from the master cylinder by following the steps below.
(1) Supply brake fluid to the reservoir tank.
(2) Depress and hold the brake pedal.
(3) Another person should then plug the outlet of the master cylinder with a finger.
(4) In the (3) condition, return the brake pedal.
(5) Repeat steps (2) to (4) three or four times so as to supply brake fluid inside the master cylinder.



AIR BLEEDING OF THE BRAKE PIPE LINE

Bleed the brake system in the sequence shown in the illustration.
Furthermore, for vehicles with ABS, start the engine before bleeding the air.

Caution
When supplying brake fluid for vehicles with ABS, the filter should be installed to the master cylinder reserve tank.

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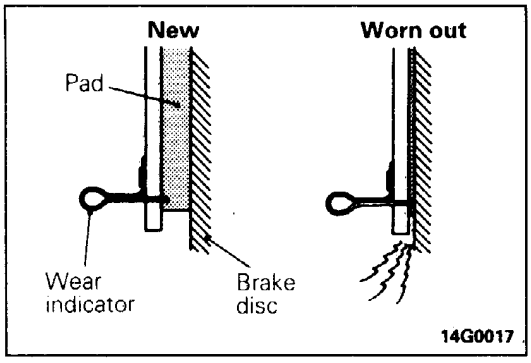


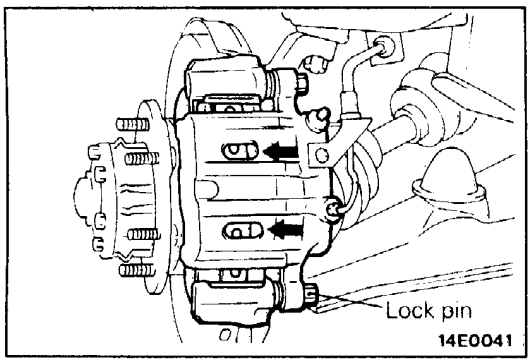
DISC BRAKE PAD CHECK E35FQAG

Check brake pad thickness through caliper body check port.

Standard valve: **10.0 mm (0.39 in.)**
Limit: **2.0 mm (0.079 in.)**

Replace brake pads on both sides when wear exceeds limit value. Replace both left and right brake pads at a time.

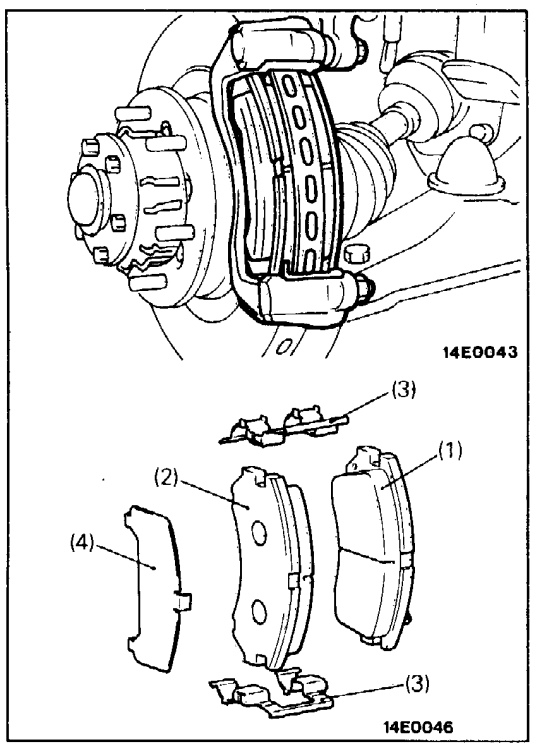
NOTE
The brake pads have been equipped with wear indicator, so that when the brake pad thickness reaches 2 mm (0.08 in.), the wear indicator touches the brake disc and produces a warning squeaking sound.



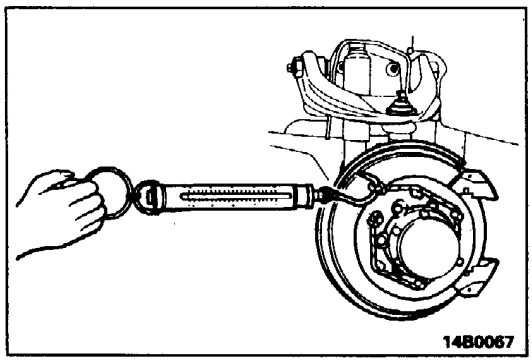
FRONT DISC BRAKE PAD REPLACEMENT AND BRAKE DRAG CHECK E35FQBA

1. Remove lock pin. Lift caliper assembly and retain with wires.

Caution
Do not wipe off the special grease that is on the lock pin or allow it to contaminate the lock pin.



2. Remove the following parts from caliper support.
   (1) Pad and wear indicator assembly
   (2) Pad assembly
   (3) Clip
   (4) Outer shim



3. In order to measure the dragging force of the disc brakes after installation of the brake pads, use a spring balance to measure the rotational sliding resistance of the hub in the forward direction with the pads removed.
4. Securely attach the pad clip to the caliper support.

Caution
Do not deposit grease or other dirt on pad or brake disc friction surfaces.

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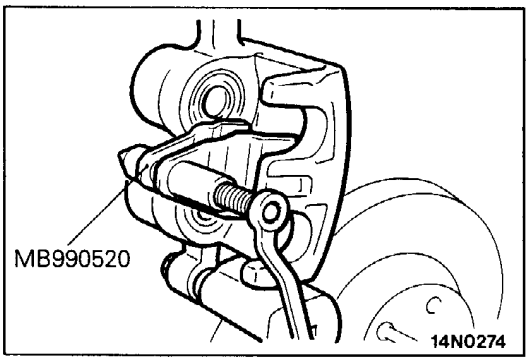
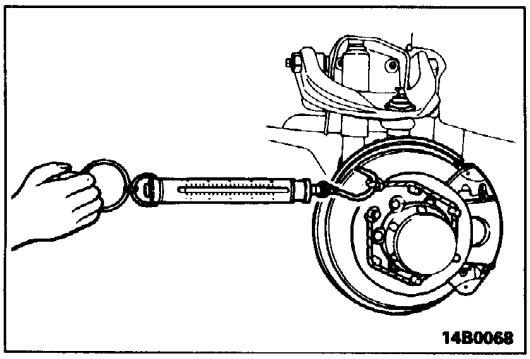


5. Clean piston and insert into cylinder with special tool. Be careful that the piston boot does not become caught, when lowering the caliper assembly and install the lock pin.



6. Start the engine and, after strongly depressing the brake pedal 2-3 times, stop the engine.
7. Turn brake disc forward 10 times.
8. Use a spring balance to measure the rotational sliding resistance of the hub in the forward direction.
9. Calculate the dragging force of the disc brakes (the difference between the values measured in steps 8 and 3).

   Standard value: 57N (5.7 kg. 13 lbs.) or less

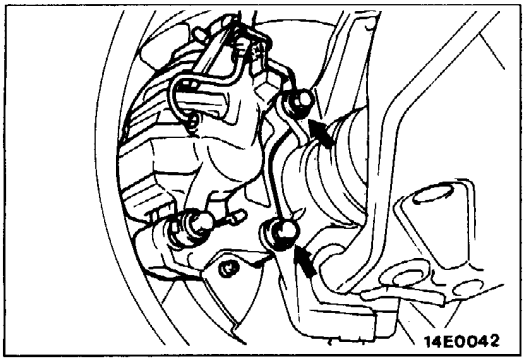
10. If the dragging force of the disc brakes exceeds the standard value, disassemble piston and clean the piston. Check for corrosion or worn piston seal, and check the sliding condition of the lock pin sleeve and guide pin sleeve.

FRONT DISC BRAKE ROTOR INSPECTION

CAUTION
When servicing disc brakes, it is necessary to exercise caution to keep the disc brakes within the allowable service values in order to maintain normal brake operation.

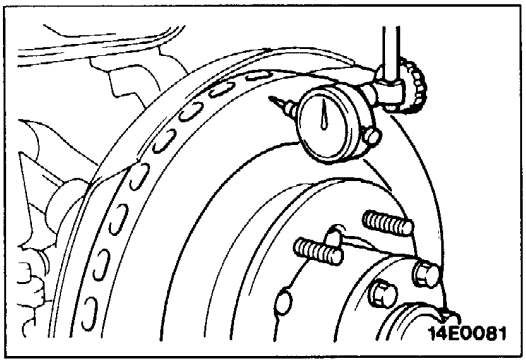
Before re-finishing or re-processing the brake disc surface, the following conditions should be checked.

Inspection items	Remarks
Scratches, rust, saturated lining materials and wear	• If the vehicle is not driven for a certain period, the sections of the discs that are not in contact with lining will become rusty, causing noise and shuddering. • If grooves resulting from excessive disc wear and scratches are not removed prior to installing a new pad assembly, there will momentarily be inappropriate contact between the disc and the lining (pad).
Run-out or drift	Excessive run-out or drift of the discs will increase the pedal depression resistance due to piston knock-back.
Change in thickness (parallelism)	If the thickness of the disc changes, this will cause pedal pulsation, shuddering and surging.
Inset or warping (flatness)	Overheating and improper handling while servicing will cause inset or warping.



FRONT BRAKE DISC RUN-OUT CHECK

1. Remove the caliper support; then raise the caliper assembly upward and secure by using wire.



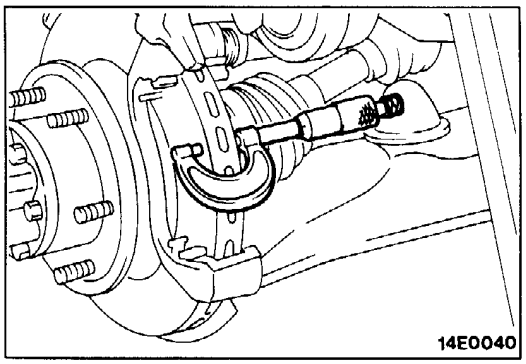
2. Place a dial gauge approximately 5 mm (.2 in.) from the outer circumference of the brake disc, and measure the run-out of the disc.

   Limit: 0.1 mm (0.0039 in.)

   If the measurement exceeds the limit, change the relative position of the hub and brake disc, and measure the run-out again. If the result still does not fall within the limit, check the run-out of the hub, and replace either the hub or disc, whichever is appropriate.

FRONT BRAKE DISC RUN-OUT CORRECTION

1. If the run-out of the brake disc is equivalent to or exceeds the limit specification, change the phase of the disc and hub, and then measure the run-out again. (Refer to P. 35-44)
2. If the run-out cannot be corrected by changing the phase of the brake disc, replace the disc or turn rotor with on the car type brake lathe ("MAD, DL–8700PF" or equivalent).


14E0040

FRONT BRAKE DISC THICKNESS CHECK E35FRAB

1. Inspect the disc surface for grooves, cracks, and rust. Clean the disc thoroughly and remove all rust.
2. Using a micrometer, measure disc thickness at eight positions, approximately 45° apart and 10 mm (0.39 in.) in from the outer edge of the disc.

   Standard value: **24 mm (0.94 in.) <Except 3500>**
   27 mm (1.01 in.) <3500>

   Limit: **22.4 mm (0.882 in.) <Except 3500>**
   25.4 mm (1.0 in.) <3500>

   The difference between any thickness measurements should not be more than 0.015 mm (0.0006 in.)
3. Replace the discs and pad assembly for both sides left and right of the vehicle if they are beyond the limits for thickness.
4. If thickness variation exceeds the specification, replace the disc or turn rotor with on the car type brake lathe ("MAD, DL–8700PF" or equivalent).

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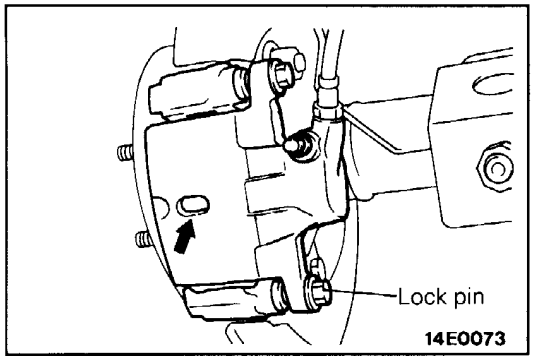
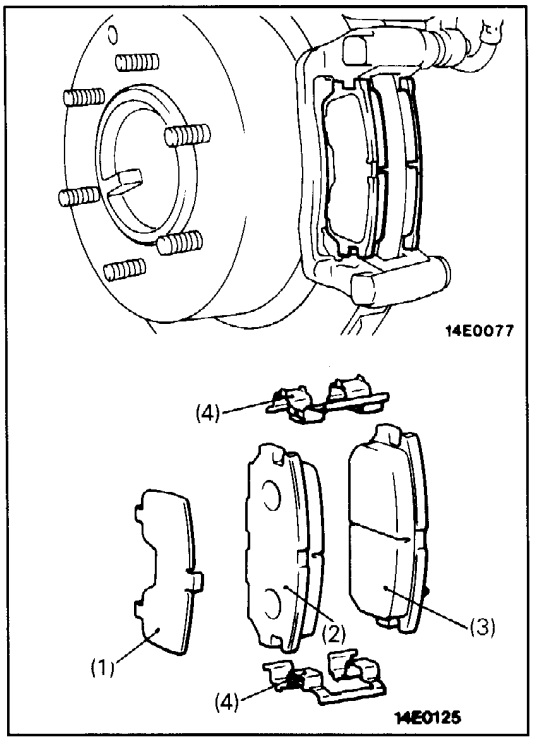
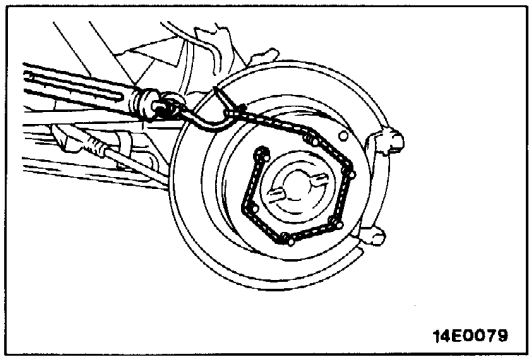






REAR DISC BRAKE PAD CHECK AND REPLACEMENT

E35FUAC

1. Check brake pad thickness through caliper body check port.

   Standard value: 9.0 mm (0.35 in.)
   Limit: 2.0 mm (0.079 in.)

   Caution
   1. When the limit is exceeded, replace the pads at both sides, and also the brake pads for the wheels on the opposite side at the same time.
   2. If there is a significant difference in the thicknesses of the pads on the left and right sides, check the sliding condition of the piston, lock pin sleeve and guide pin sleeve.

2. Remove lock pin. Lift caliper assembly and retain with wires.

   Caution
   Do not wipe off the special grease that is on the lock pin or allow it to contaminate the lock pin.

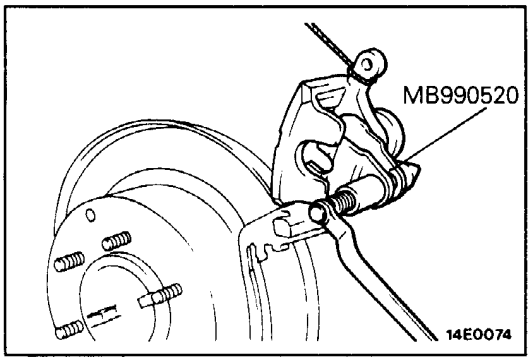
3. Remove the following parts from caliper support.
   (1) Outer shim
   (2) Pad assembly
   (3) Pad and wear indicator assembly
   (4) Clip

4. In order to measure the dragging force of the disc brakes after installation of the brake pads, use a spring balance to measure the rotational sliding resistance of the hub in the forward direction with the pads remove

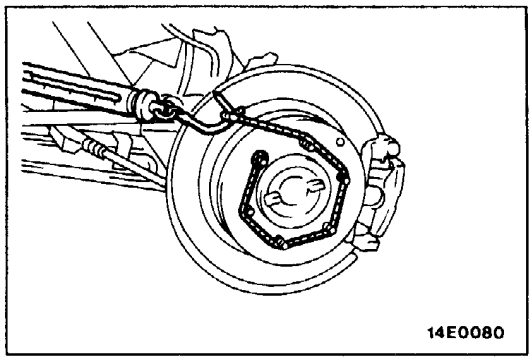
   NOTE
   To secure the disc to the hub, tighten the nuts.

5. Securely attach the pad clip to the caliper support.

   Caution
   Do not deposit grease or other dirt on pad or brake disc friction surfaces.



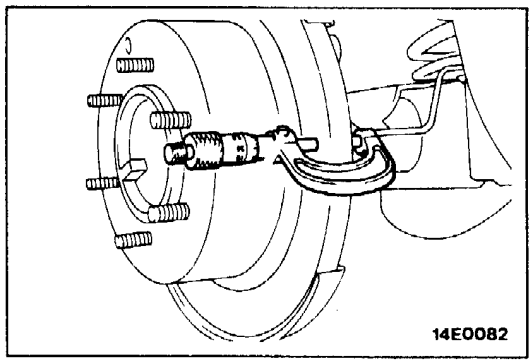
6. Clean piston and insert into cylinder with special tool. Be careful that the piston boot does not become caught, when lowering the caliper assembly and install the lock pin.



7. Start the engine and, after strongly depressing the brake pedal 2-3 times, stop the engine.
8. Turn brake disc forward 10 times.
9. Use a spring balance to measure the rotational sliding resistance of the hub in the forward direction.
10. Calculate the dragging force of the disc brakes (the difference between the values measured in steps 9 and 4).

    Standard value: 57N (5.7 kg. 13 lbs.) or less

11. If the dragging force of the disc brakes exceeds the standard value, disassemble piston and clean the piston. Check for corrosion or worn piston seal, and check the sliding condition of the lock pin sleeve and guide pin sleeve.

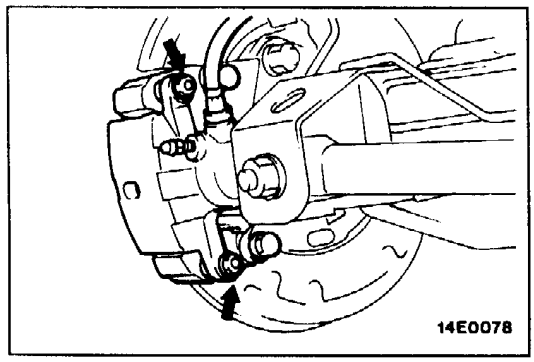


REAR BRAKE DISC THICKNESS CHECK E35FVAB

1. Remove dirt and rust from brake disc surface.
2. Measure disc thickness at 4 locations or more.

Standard value:	**18.0 mm (0.71 in.)**
Limit:	**16.4 mm (0.646 in.)**

Replace the discs and pad assembly for both sides left and right of the vehicle if they are worn beyond the specified limit.



REAR BRAKE DISC RUN-OUT CHECK E35PWAB

1. Remove the caliper support, raise the caliper assembly, and secure it by using a wire, etc.

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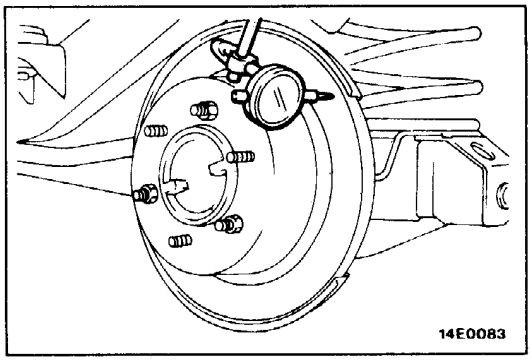
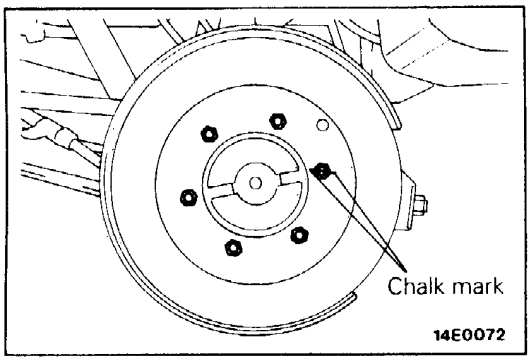


2. Place a dial gauge approximately 5 mm (0.2 in.) from the outer circumference of the brake disc, and measure the run-out of the disc.

   Limit: 0.08 mm (0.0031 in.)

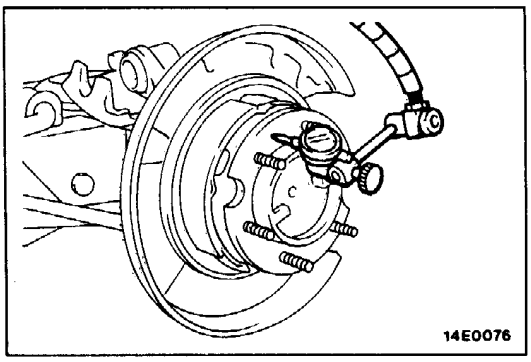
   NOTE
   To secure the disc to the hub, tighten the nuts.



REAR BRAKE DISC RUN-OUT CORRECTION

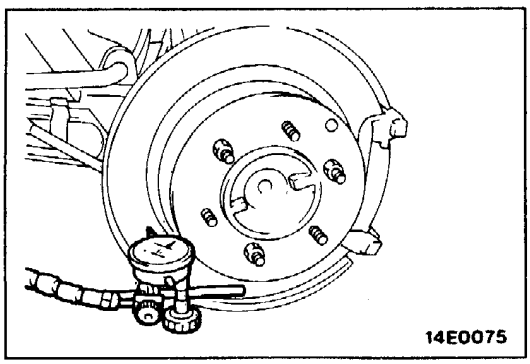
E35FTAA

1. If the run-out of the brake disc is equivalent to or exceeds the limit specification, change the phase of the disc and axle shaft and then measure the run-out again.
   (1) Before removing the brake disc, chalk both sides of the wheel stud on the side at which run-out is greatest.



   (2) Remove the brake disc, and then place a dial gauge then move the hub in the axial direction and measure the play.

   Limit: 0.25 mm (0.0098 in.) or less



   (3) If the play does not exceed the limit specification, install the brake disc at a different phase, and then check the run-out of the brake disc once again.

2. If the runout cannot be corrected by changing the phase of the brake disc, replace the disc.

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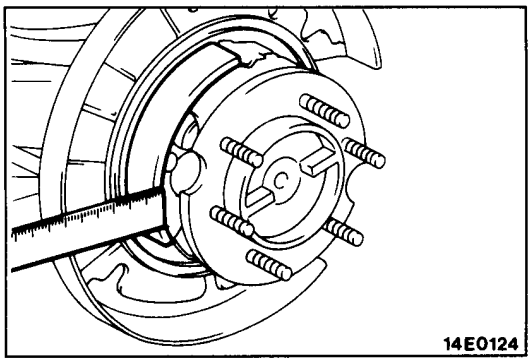

14E0124

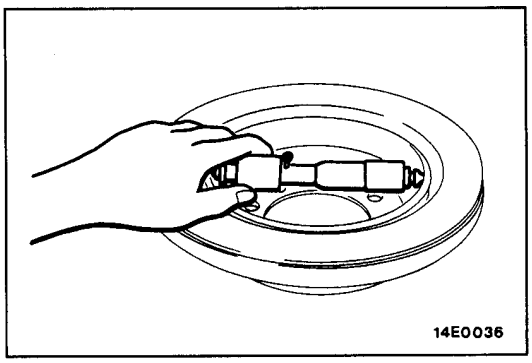
BRAKE LINING THICKNESS CHECK E35FFAA

1. Remove the rear brake assembly and secure it with wire.
2. Remove the brake drum.
3. Measure the wear of the brake lining at the place worn the most.

Standard value: 6.5 mm (0.256 in.)
Limit: 4.5 mm (0.177 in.)

Replace the shoe and lining assembly if brake lining thickness is less than the limit if it is not worn evenly. For information concerning the procedures for installation of the shoe and lining assembly, refer to GROUP 36 – Parking Brake Drum.

Caution
1. Whenever the shoe and lining assembly is replaced, replace both RH and LH assemblies as a set to prevent car from pulling to one side when braking.
2. If there is a significant difference in the thicknesses of the shoe and lining assemblies on the left and right sides, check the sliding condition of the piston.

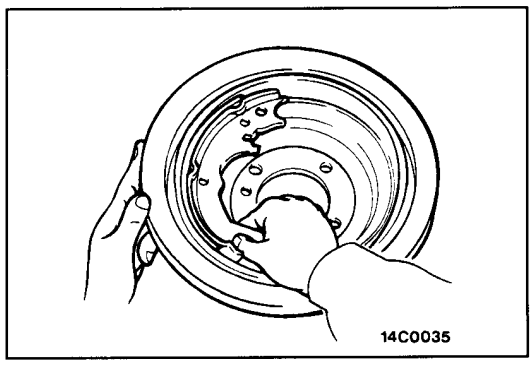

14E0036

BRAKE DRUM INSIDE DIAMETER CHECK E35FGAA

1. Remove the rear brake assembly and secure it with wire.
2. Remove the brake drum.
3. Measure the inside diameter of the brake drum at two or more locations.

Standard value: 197 mm (7.76 in.)
Limit: 198 mm (7.8 in.)

4. Replace brake drums and shoe and lining assembly when wear exceeds the limit value or is badly imbalanced.


14C0035

BRAKE LINING AND BRAKE DRUM CONNECTION CHECK E35FIAA

1. Remove the rear brake assembly and secure it with wire.
2. Remove the brake drum.
3. Remove the shoe and lining assembly, refer to GROUP 36 – Parking Brake Drum.
4. Chalk inner surface of brake drum and rub with shoe and lining assembly.
5. Replace shoe and lining assembly or brake drums if very irregular contact area.
6. For information concerning the procedures for installation of the shoe and lining assembly, refer to GROUP 36 – Parking Brake Drum.

NOTE
Wipe off chalk after check.

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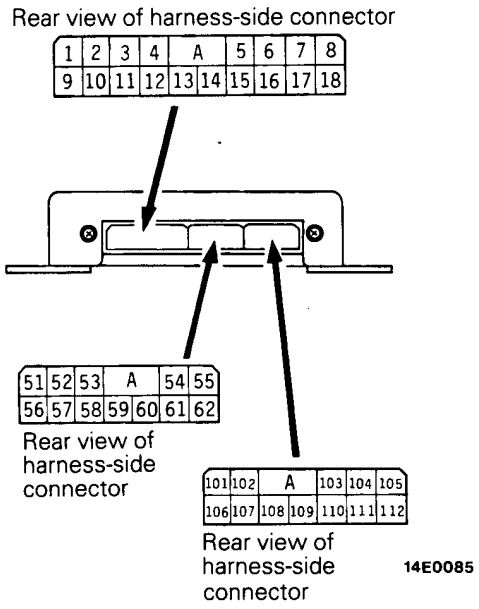
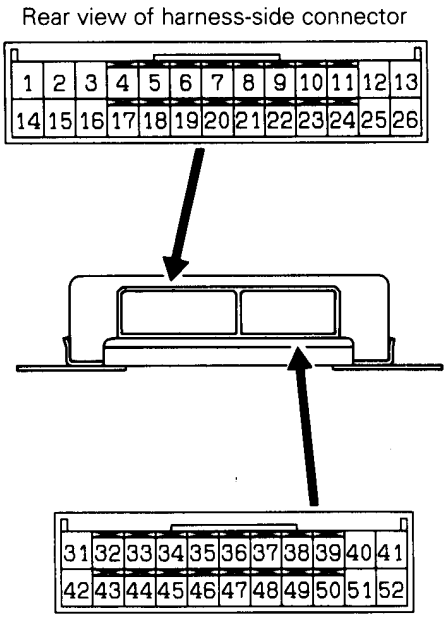
<Vehicles built up to May, 1994>



<Vehicles built from June, 1994>



WHEEL SPEED SENSOR OUTPUT VOLTAGE MEASUREMENT <A.B.S.>

E35FPAR

1. Check that the clearance between the wheel speed sensor and the rotor are within the standard values.
2. Raise up the wheels and release the parking brake.
3. Remove the ABS-ECU harness connector and measure from the harness-side connector.

Caution
Be sure to remove the connector double lock and insert the probe into the harness side. Inserting it into the terminal side will result in a bad connection.

4. Rotate the wheel by hand to be measured at approximately 1/2 – 1 rotations per second and check the output voltage using a voltmeter (AC mV range) or an oscilloscope.

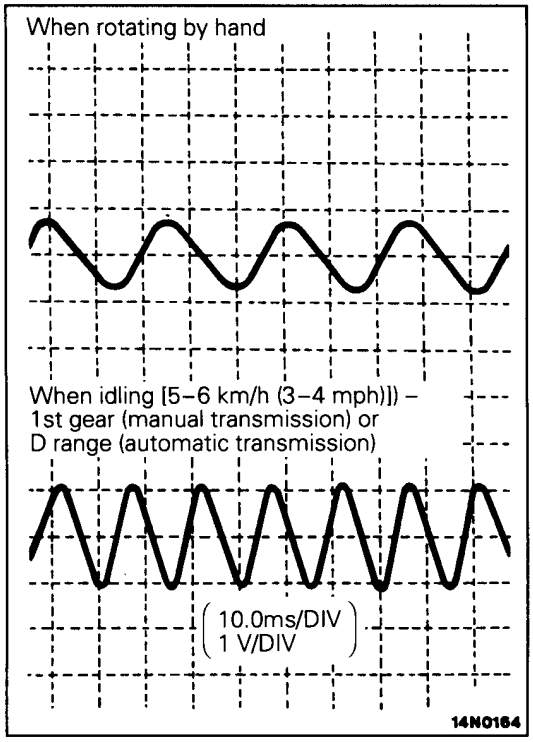
<Terminal no.>
[Vehicles built up to May, 1994]

Polarity	Front LH	Front RH	Rear LH	Rear RH
+	52	51	8	53
–	57	56	18	58

[Vehicles built from June, 1994]

Polarity	Front LH	Front RH	Rear LH	Rear RH
+	7	10	9	8
–	20	23	22	21

Output voltage:
When measuring with a voltmeter:
70mV or more
When measuring with an oscilloscope:
200mVp-p or more



5. If the output voltage is lower than the above values, the reason could be as follows:
   - Excessive clearance between the wheel speed sensor pole piece and the rotor
   - Wheel speed sensor is defective

   If necessary, adjust the wheel speed sensor or replace it.
6. Next, to observe the output of the wheel speed sensors, move the transfer shift lever to "4H", and the transmission control lever to "1" (M/T vehicles) or "D" range (A/T vehicles), and rotate the wheels.

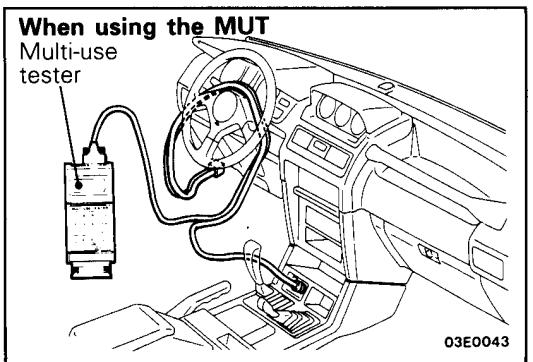
   NOTE
   1. Check the connection of the sensor harness and connector before using the oscilloscope
   2. The wave form measurements can also be taken while the vehicle is actually moving.
   3. The output voltage will be small when the wheel speed is low, and similarly it will be large when the wheel speed is high.

WAVE OBSERVATION POINTS

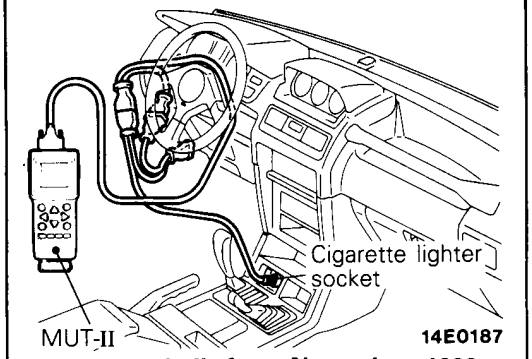
Symptom	Cause	Suggested remedy
Wave amplitude is too small, or doesn't appear at all	Wheel speed sensor is defective	Replace the sensor
	Wrong clearance between the pole piece and rotor	Adjust the clearance
Excessive variation in the wave amplitude (However, if the lowest amplitude occurs at 200mV-p-p, there is no problem)	Excessive runout or eccentricity in the axle hub	Replace the hub
Noise or interference in the wave pattern	Broken sensor wire	Replace the sensor
	Broken harness wire	Repair the harness
	Defective wheel speed sensor attachment	Repair the sensor attachment
	Eccentric rotor or broken rotor teeth	Replace the rotor

NOTE
As the wheel speed sensor harness move in conjunction with the movement of the front and rear suspension, the wires might break while driving on rough roads, but may have continuity while driving on normal roads. Accordingly, when measuring the wave pattern of the wheel speed sensor output voltage, take a measurement while shaking the sensor harness to simulate the special conditions of a rough road.

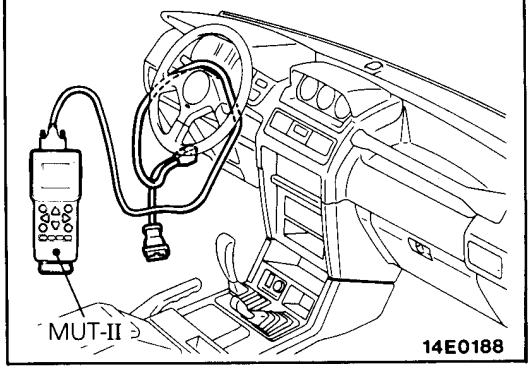
When using the MUT



When using the MUT-II
<Vehicles built up to October, 1993>



<Vehicles built from November, 1993>



HYDRAULIC UNIT CHECK <ABS> E35FPAS

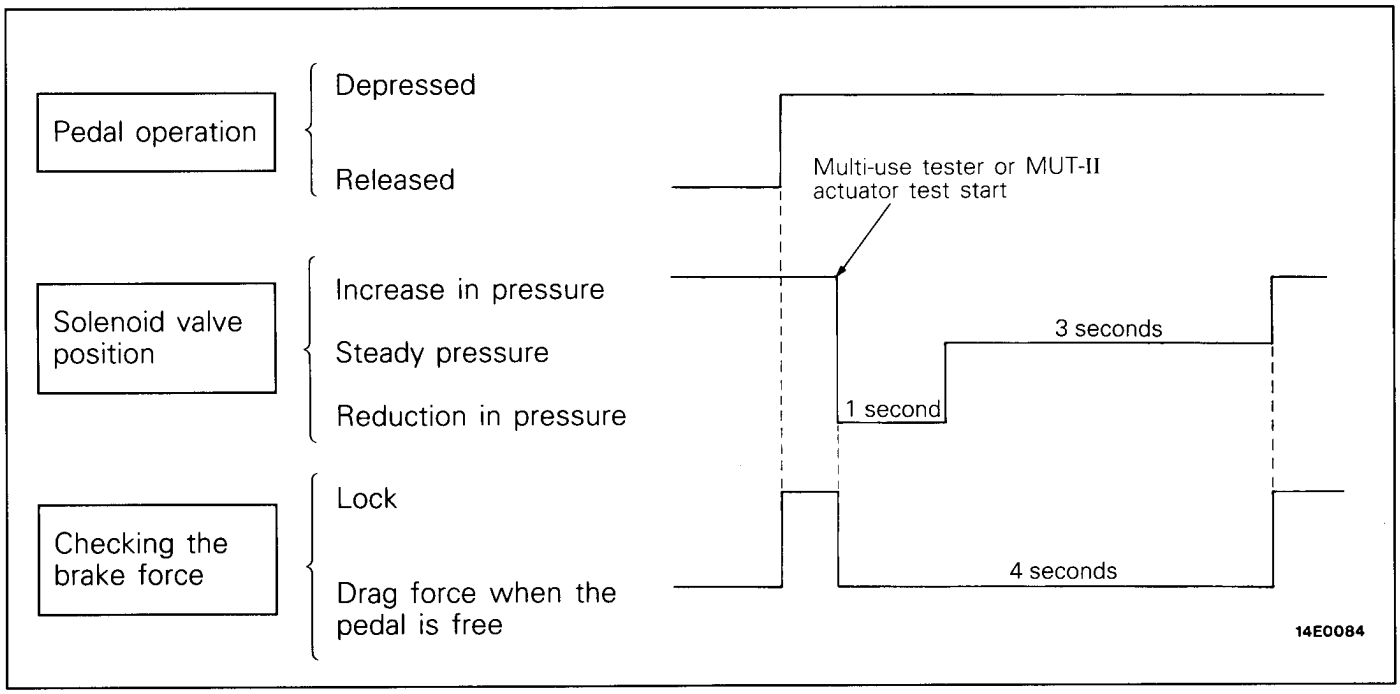
1. Jack up the vehicle and support it on axle stands.
2. Release the parking brake and feel the drag force (drag torque) on each wheel brake.
3. Turn the ignition key to the ACC position and set the multi-use tester or MUT-II as shown in the illustration.
4. After checking that the selector lever is in neutral, start the engine.

   Caution
   At this time, check that the ABS warning lamp illuminates for a brief period before turning off. If it doesn't turn off, refer to the "Troubleshooting" section (P.35-6).
5. Depress the brake pedal to lock the wheels.
6. Select the item number on the multi-use tester actuator test for the wheel to be inspected.

Item no.	Drive object	
01	Front left wheel	Solenoid valve and pump monitor in the hydraulic unit corresponding to each wheel at left
02	Front right wheel	
03	Rear wheels	

7. Use the multi-use tester or MUT-II to force-drive the actuator, and turn the wheel by hand to check the change in braking force when the brake pedal is depressed.
The result should be as shown in the following illustration.

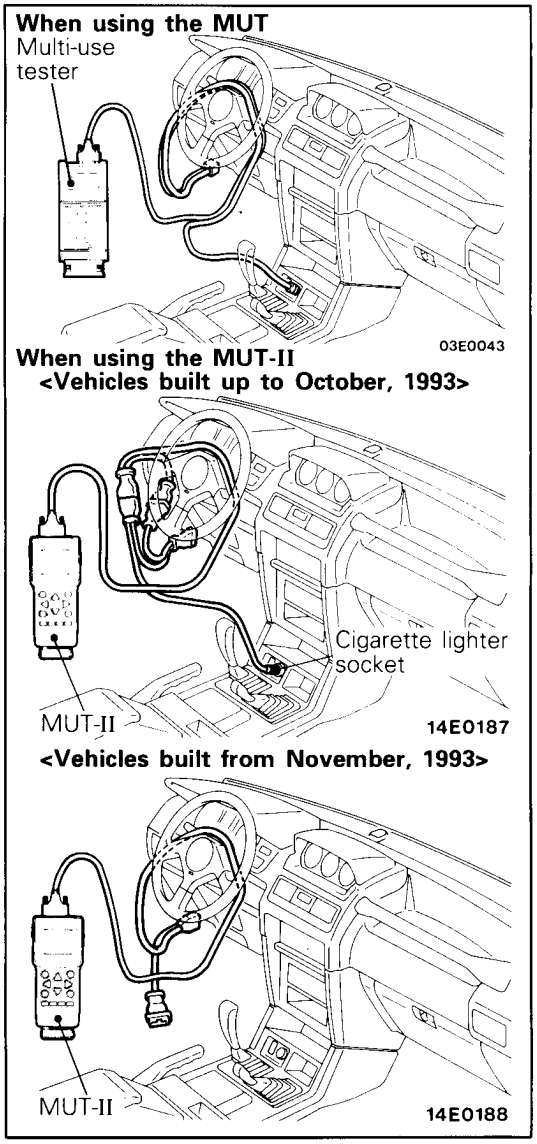
NOTE
1. When the multi-use tester or MUT-II is used and the ABS system is selected, the ABS system will switch to multi-use tester mode and the ABS warning lamp will illuminate.
2. When the ABS function has been interrupted by the fail-safe, the multi-use tester or MUT-II actuator testing cannot be used.



8. If a different result is obtained when checking, correct it by following the procedure in the "Diagnosis Table for Simple Inspection" below.

Diagnosis Table for Simple Inspection

Diagnosis		Cause	Suggested remedy
Normal	Problem		
After locking for a 4 second period, the braking force will release.	The wheel will not lock even when the pedal is depressed.	Blockage in the brake line outside the hydraulic unit	Inspect the brake line and clean
		Blockage in the oil pressure circuit in the hydraulic unit	Replace the hydraulic unit
	Braking force does not release.	Hydraulic unit brake pipes are incorrectly connected	Connect correctly
		Hydraulic unit solenoid valve is defective	Replace the hydraulic unit



G-SENSOR OUTPUT VOLTAGE CHECK <A.B.S.>

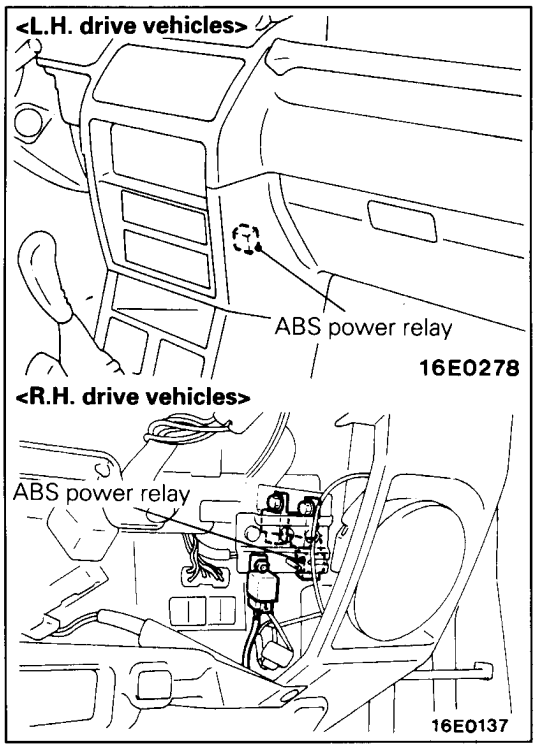
E35FPAT

1. Unload the vehicle and move it to a horizontal surface.
2. Turn the ignition key to the ACC position and connect the multi-use tester or MUT-II as shown in the illustration.

   Caution
   Make certain that the ignition switch is OFF when the multi-use tester or MUT-II is connected or disconnected.
3. Start the engine.

   Caution
   At this time, check that the ABS warning lamp momentarily illuminates before turning off.
   If it does not turn off, refer to "Troubleshooting" (P.35-6).
4. Check whether the G-sensor output voltage is within the standard value range.

   Standard value: 2.5±0.44 V
   <Vehicles built up to October, 1993>
   2.5±0.12 V
   <Vehicles built from November, 1993>
5. If the G-sensor output voltage is not within the standard value range, check the installation condition of the G sensor; if there is bolt loose, deformation of the G-sensor bracket, etc., repair it. If the problem is not repairable, replace the G sensor.



A.B.S. POWER RELAY CHECK <A.B.S.>

E35FPAEa

1. Remove the A.B.S. power relay.

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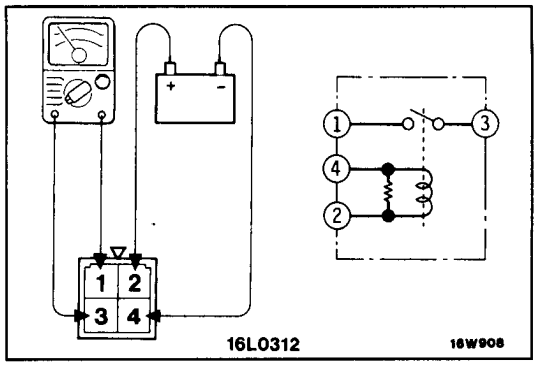
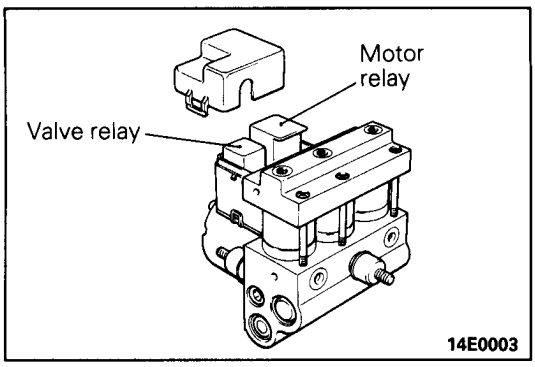


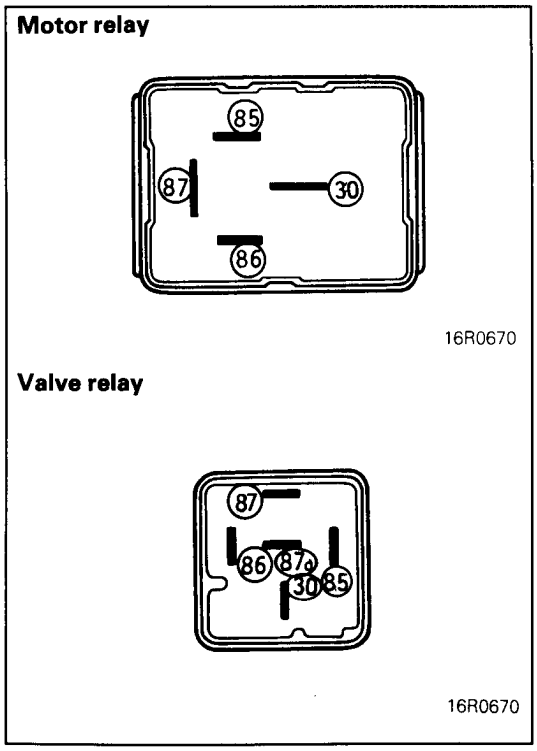
2. Connect battery to terminal 2 and check continuity between terminals with terminal 4 earthed.

Power is supplied	1–3 terminals	Continuity
Power is not supplied	1–3 terminals	No continuity
	2–4 terminals	Continuity



VALVE RELAY AND MOTOR RELAY CHECK <ABS> [Vehicles built up to May, 1994] E35FPAU

1. Remove the motor relay and valve relay from the hydraulic unit.



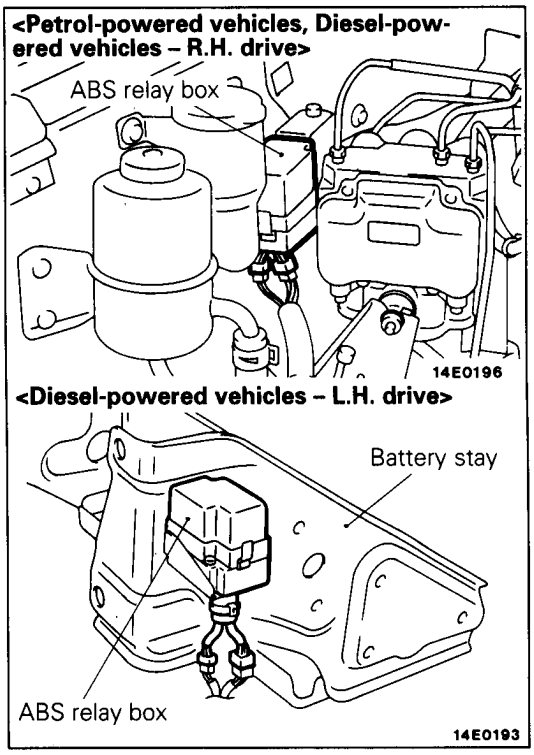
2. Check whether there is continuity between terminals when there is no current flow at each relay and when there is current flow.

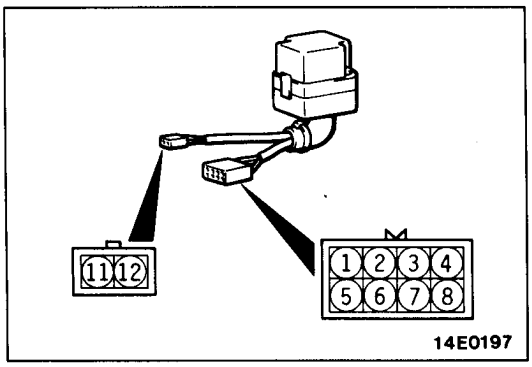
MOTOR RELAY

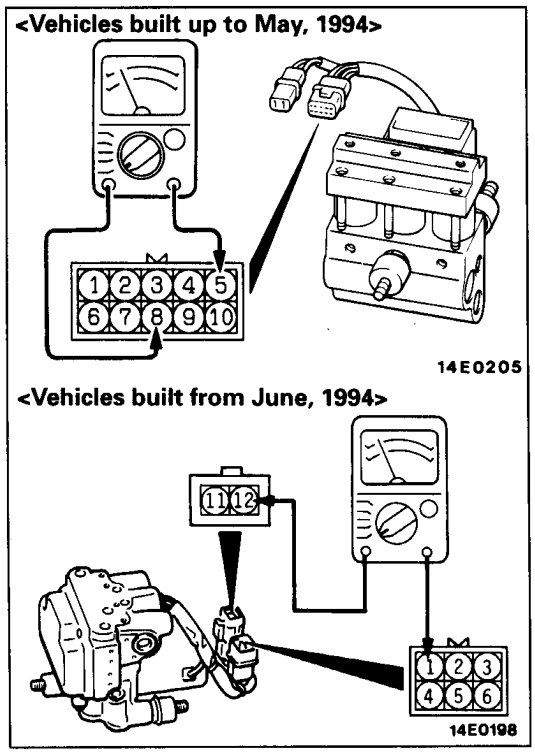
When no current flows	Between terminals 85–86	30–60 Ω
	Between terminals 30–87	No continuity (∞ Ω)
When current flows between terminal 85–86	Between terminals 30–87	Continuity (approx. 0 Ω)

VALVE RELAY

When no current flows	Between terminals 85–86	60–120 Ω
	Between terminals 30–87a	Continuity (approx. 0 Ω)
	Between terminals 30–87	No continuity (∞ Ω)
When current flows between terminal 85–86	Between terminals 30–87a	No continuity (∞ Ω)
	Between terminals 30–87	Continuity (approx. 0 Ω)







ABS RELAY BOX CHECK <ABS> [Vehicles built from June, 1994]

Disconnect the ABS relay box connector and check for continuity at the connector side.

When no current flows	Between terminals (7) – (4)	72 – 88 Ω
	Between terminals (7) – (8)	93 – 113 Ω
	Between terminals (11) – (12)	No continuity (∞ Ω)
	Between terminals (6) – (2)	No continuity (∞ Ω)
	Between terminals (5) – (2)	No continuity (approx. 0 Ω)
When current flows between terminals (7) – (4)	Between terminals (11) – (12)	Continuity (approx. 0 Ω)
When current flows between terminals (7) – (8)	Between terminals (5) – (2)	No continuity (∞ Ω)
	Between terminals (6) – (2)	Continuity (approx. 0 Ω)

SOLENOID VALVE CHECK <ABS>

Measure the resistance between terminals.

Standard value:

<Vehicles built up to May, 1994>

Solenoid valve	Measurement terminal	Resistance between terminals
Front (right)	8 – 5	1.0 – 1.3 Ω
Front (left)	8 – 3	
Rear	8 – 6	

<Vehicles built from June, 1994>

Solenoid valve	Measurement terminal	Resistance between terminals
Front OUT (right)	12 – 4	3.8 Ω
Front OUT (left)	12 – 5	
Rear OUT	12 – 6	
Front IN (right)	12 –1	8.2 Ω
Front IN (left)	12 – 2	
Rear IN	12 – 3	

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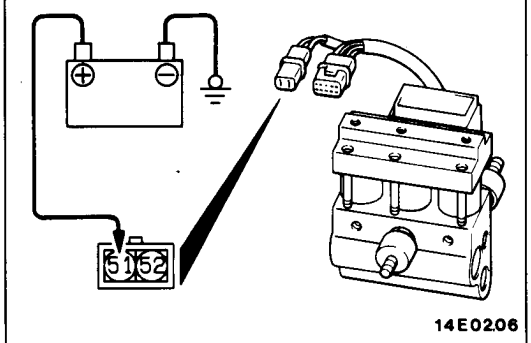
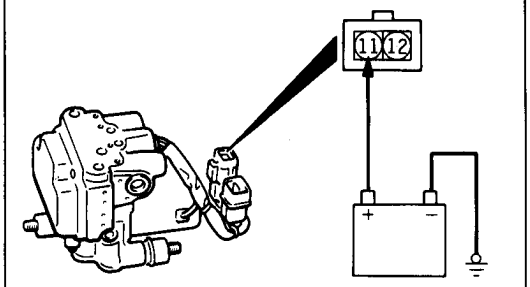
<Vehicles built up to May, 1994>



14E0206

<Vehicles built from June, 1994>

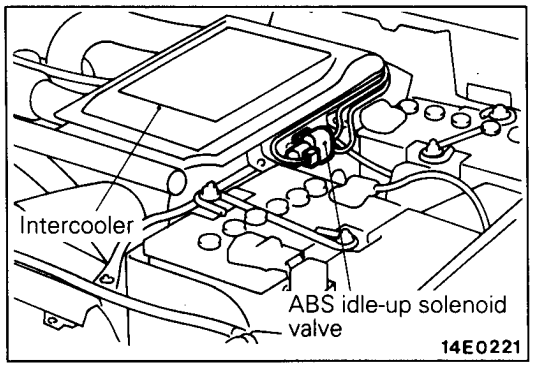


14E0199

MOTOR OPERATION CHECK <ABS>

Connect the battery and check to be sure that the sound of the hydraulic unit motor operating can be heard.

Caution
The battery power should not be applied for more than 1 second.

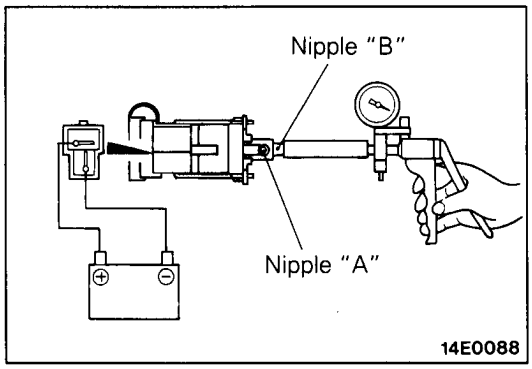


14E0221

ABS IDLE-UP SOLENOID VALVE CHECK <DIESEL-POWERED VEHICLES – M/T> [Vehicles built from June, 1994>

NOTE
When disconnecting the vacuum hose, always make a mark so that the hose can be reconnected at original position.

1. Remove the idle-up solenoid valve from the intercooler.
2. Connect a hand vacuum pump to the nipple "A".
3. Check airtightness by applying a vacuum with voltage applied directly from the battery to the solenoid valve terminal and without applying voltage.



14E0088

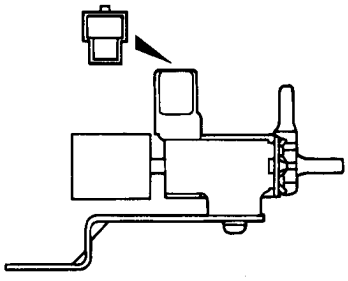
Battery voltage	Solenoid valve nipple "B"	Normal condition
Applied	Open	Vacuum leaks
	Blocked with finger	Vacuum maintained
Not applied	Open	Vacuum maintained

ABS IDLE-UP SOLENOID VALVE CHECK <DIESEL-POWERED VEHICLES – M/T> [Vehicles built up to May, 1994]

NOTE
When disconnecting the vacuum hose, always make a mark so that the hose can be reconnected at original position.

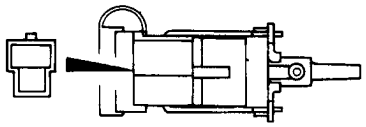
1. Remove the idle-up solenoid valve from the hydraulic unit.

<L.H. drive vehicles>



14E0094

<R.H. drive vehicles>



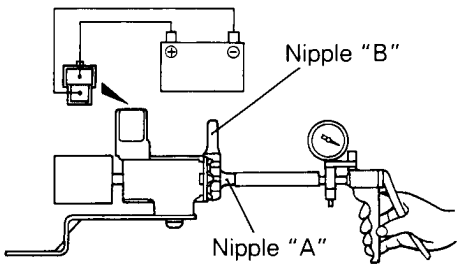
14E0087

2. Measure the resistance between the solenoid valve terminals.

Standard value:

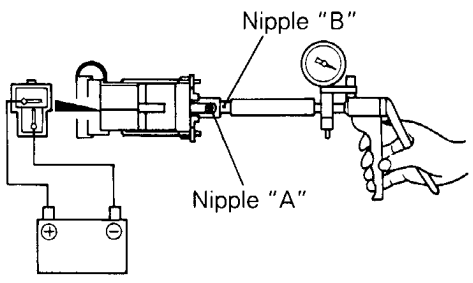
<L.H. drive vehicles>	**38–44 Ω**
<R.H. drive vehicles>	**33–39 Ω**

<L.H. drive vehicles>



14E0095

<R.H. drive vehicles>



14E0088

3. Connect a hand vacuum pump to the nipple "A".
4. Check airtightness by applying a vacuum with voltage applied directly from the battery to the solenoid valve terminal and without applying voltage.

Battery voltage	Solenoid valve nipple "B"	Normal condition
Applied	Open	Vacuum leaks
	Blocked with finger	Vacuum maintained
Not applied	Open	Vacuum maintained

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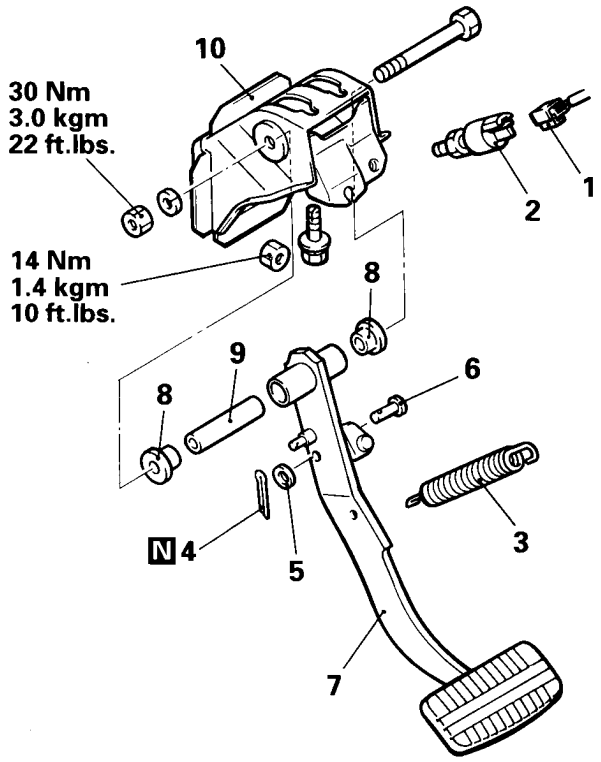
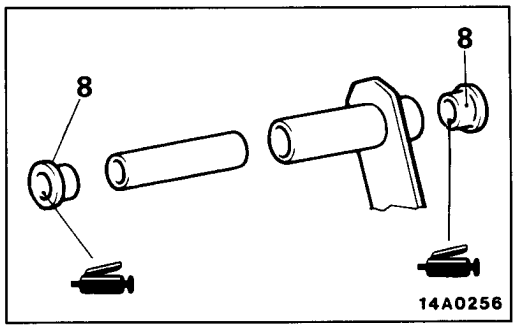
BRAKE PEDAL

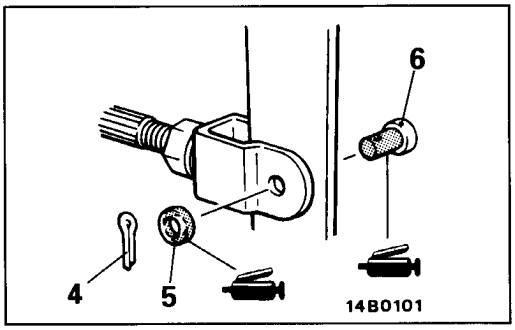
REMOVAL AND INSTALLATION

Post-installation Operation
- Adjustment of Brake Pedal (Refer to P.35-37.)



14E0128





Removal steps of stop lamp switch

1. Stop lamp switch connector
2. Stop lamp switch

Removal steps of brake pedal

3. Return spring
4. Split pin
5. Washer
6. Clevis pin
7. Brake pedal
8. Bushing
9. Spacer
10. Pedal support member

Removal steps of pedal support member

2. Stop lamp switch
7. Brake pedal
10. Pedal support member

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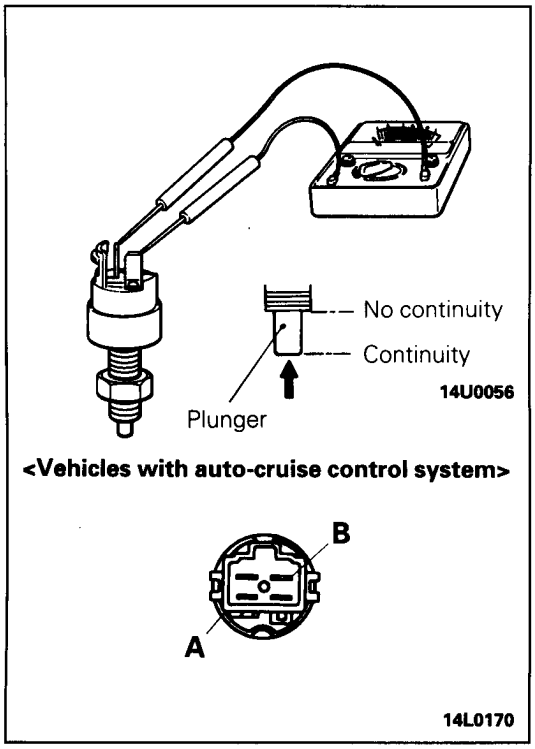

<Vehicles with auto-cruise control system>

14L0170

INSPECTION

E35GCAE

STOP LAMP SWITCH

The stop lamp switch is in good condition if there is no continuity when the plunger is pressed in, and if there is continuity when the plunger is released outward.
For models equipped with auto-cruise control system, check for continuity at stop lamp switch connectors A and B.

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MASTER CYLINDER AND BRAKE BOOSTER

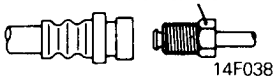
REMOVAL AND INSTALLATION

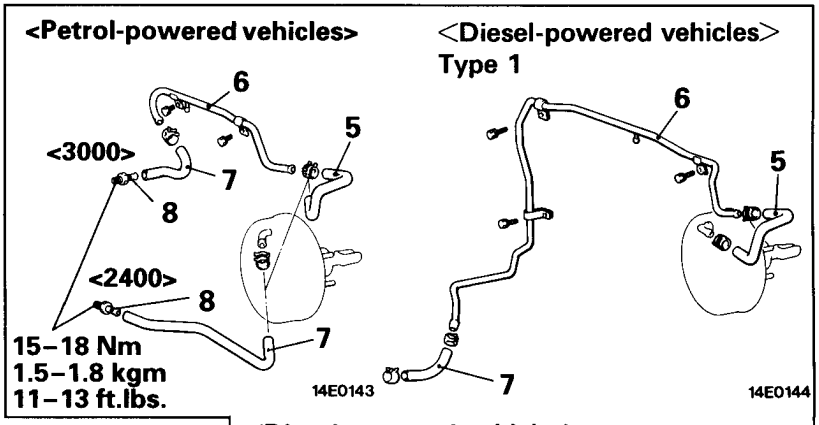
E35JA--

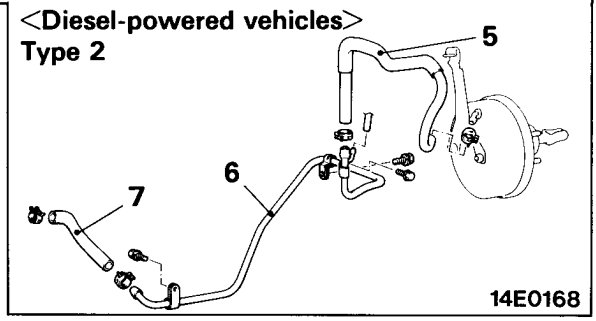
Pre-removal Operation
- Draining of Brake Fluid

Post-installation Operation
(1) Draining of Brake Fluid and Bleeding of Air (Refer to P.35-41.)
(2) Adjustment of Brake Pedal (Refer to P.35-37.)

Brake pipe flare nut
15 Nm
1.5 kgm
11 ft.lbs.

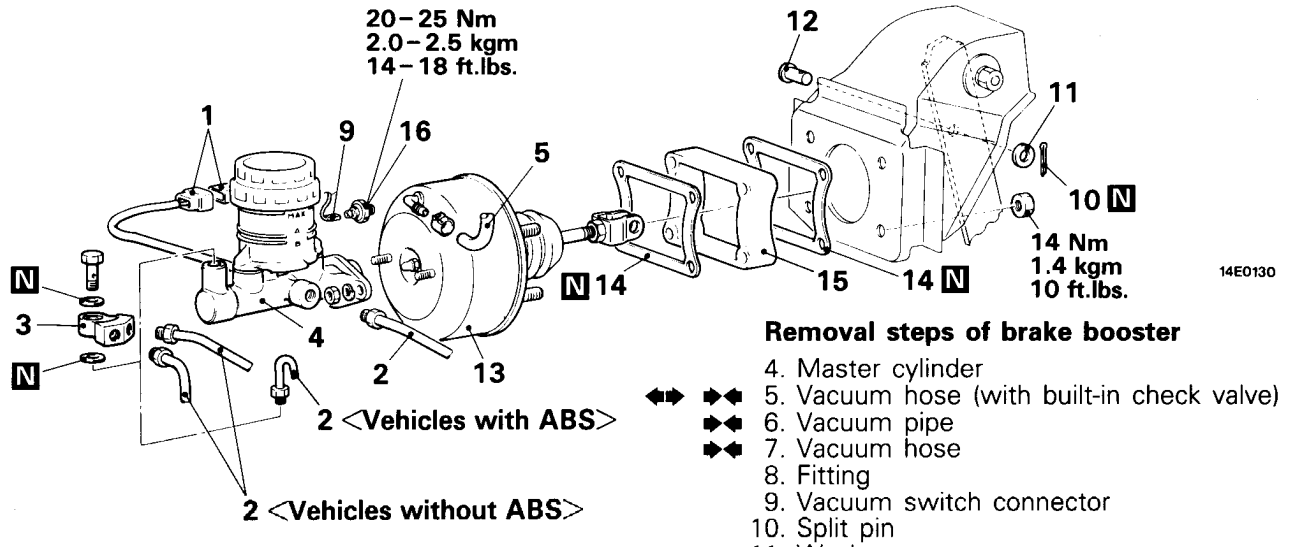

14F038



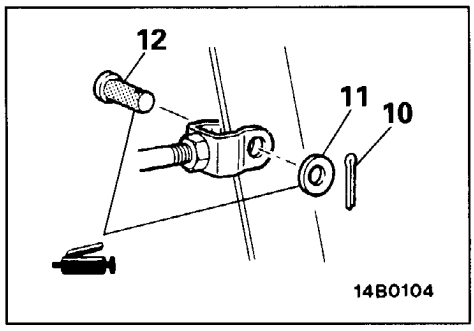


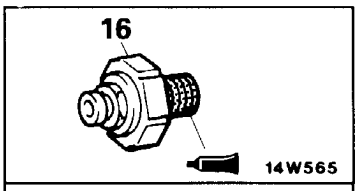
Removal steps of master cylinder
1. Brake fluid level sensor connector
2. Brake pipe
3. Connector <Vehicles without ABS>
4. Master cylinder

◆◆ • Clearance check and adjustment between primary piston and push rod

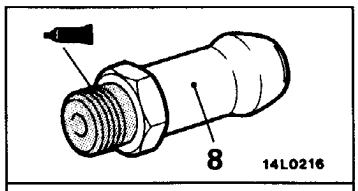


Removal steps of brake booster
4. Master cylinder
◆◆ ◆◆ 5. Vacuum hose (with built-in check valve)
◆◆ 6. Vacuum pipe
◆◆ 7. Vacuum hose
8. Fitting
9. Vacuum switch connector
10. Split pin
11. Washer
12. Clevis pin
13. Brake booster
14. Sealer
15. Spacer
16. Vacuum switch

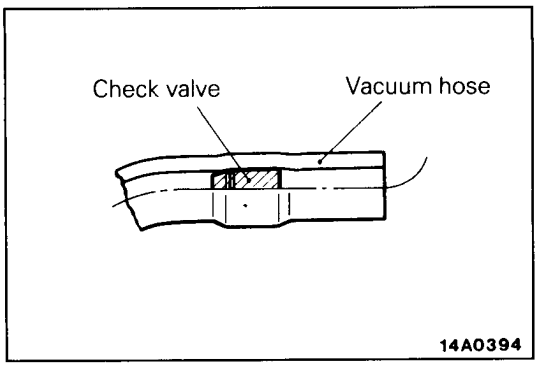




Sealant: 3M ATD Part No. 8659 or equivalent



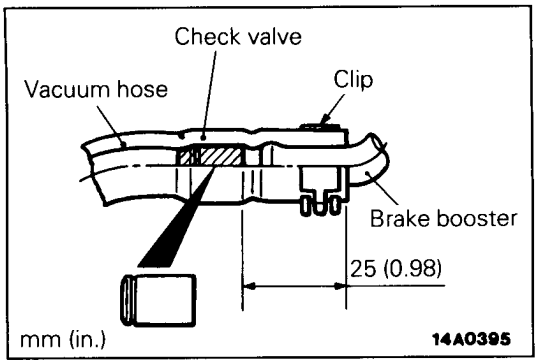
Sealant: 3M ATD Part No. 8663, 8661 or equivalent



SERVICE POINTS OF REMOVAL E35JBAK

5. REMOVAL OF VACUUM HOSES WITH CHECK VALVE

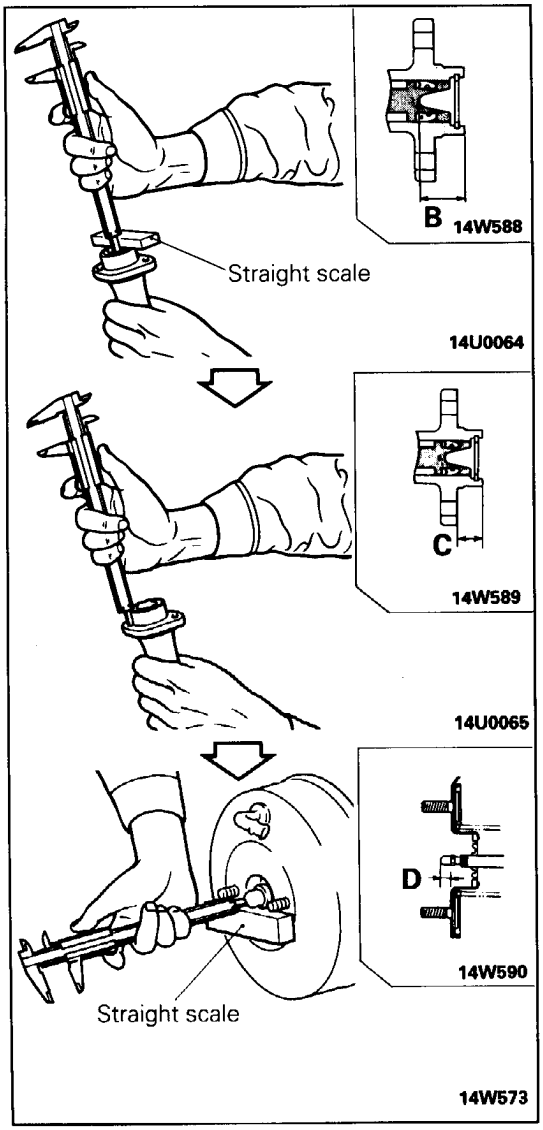
NOTE
Since the check valve is fit to the vacuum hose, replace the check valve as an assembly unit together with the vacuum hose if the check valve is defective.



SERVICE POINTS OF INSTALLATION

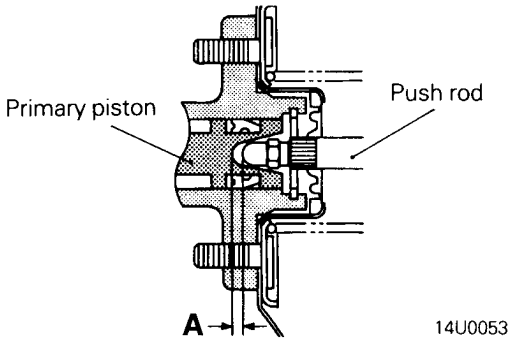
7. INSTALLATION OF VACUUM HOSE/6. VACUUM PIPE/5. VACUUM HOSE WITH CHECK VALVE

(1) The vacuum hose at the engine should be securely connected until it contacts the hexagonal edge of the fitting, and then should be secured by the hose clip.
(2) Attach the vacuum hose so that it may be inserted to a dimension illustrated.



- **ADJUSTMENT OF CLEARANCE BETWEEN BRAKE BOOSTER PUSH ROD AND PRIMARY PISTON**

Adjust the clearance (A) between the brake booster push rod and primary piston as follows:



Calculate clearance A from the B, C and D measurements.
A = B–C–D

Standard value:

Brake booster size	Clearance A standard value mm (in.)
7 + 8 inch tandem brake booster	0.85–1.10 (0.033–0.043)
8 + 9 inch tandem brake booster	0.65–0.90 (0.026–0.035)

NOTE
When brake booster negative pressure (diesel powered vehicles: –66.7 kPa [500 mmHg, 20.4 in.Hg], petrol powered vehicles: –93.3 kPa [700 mmHg, 27.6 in.Hg] is applied, clearance value will become 0.05–0.30 mm (0.0020–0.012 in.).

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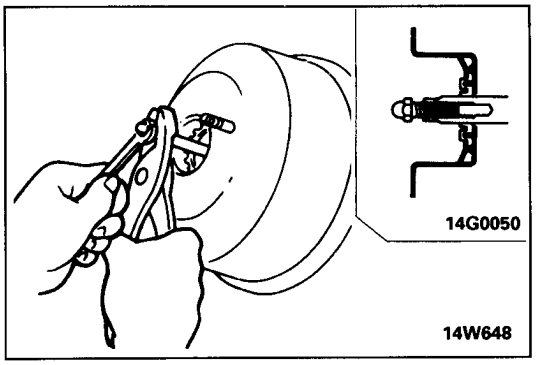
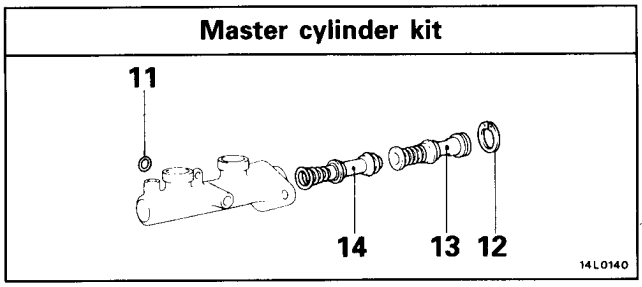
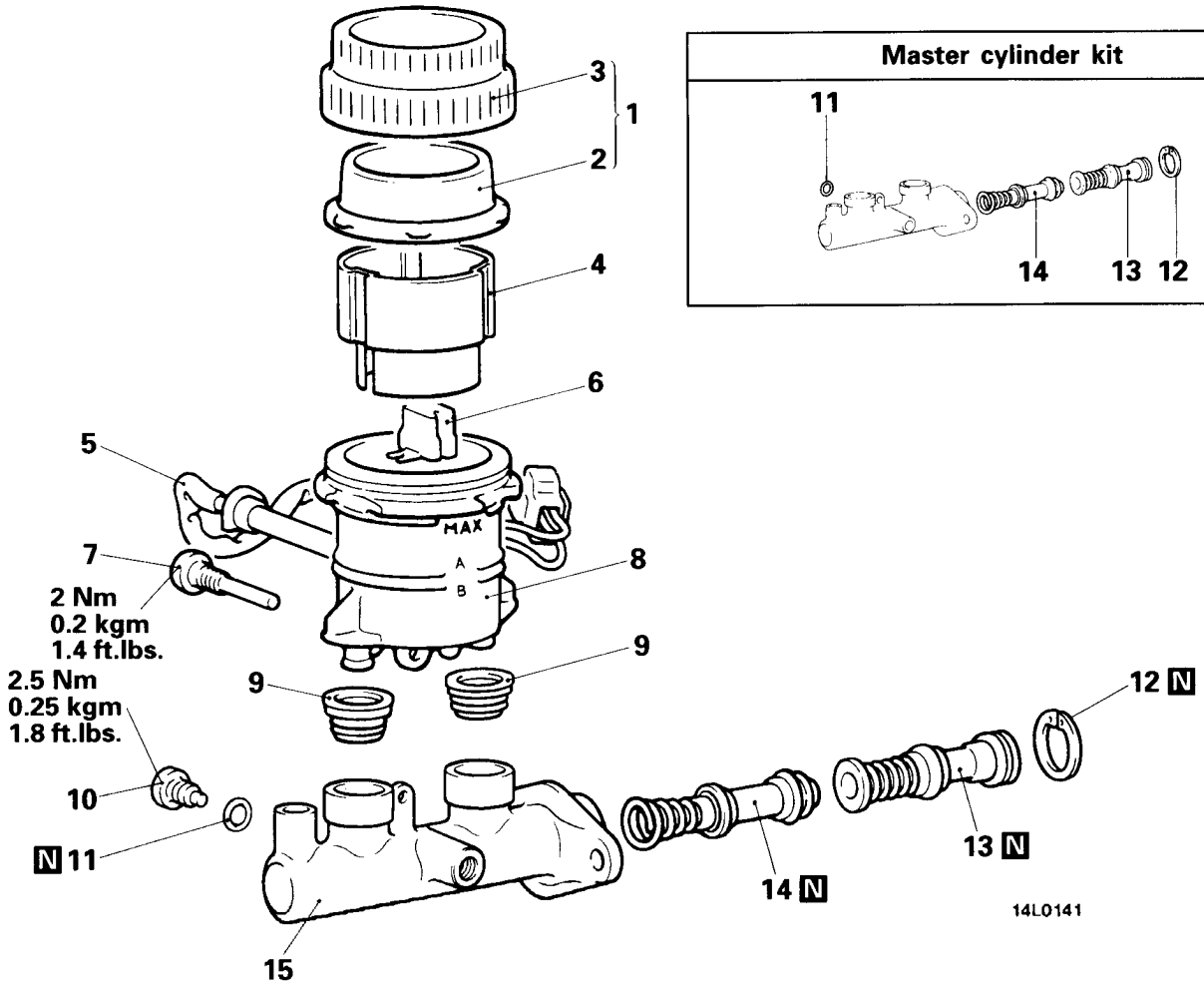


If the clearance is not within the standard value range, adjust by changing the push rod length by turning the screw of the push rod.

DISASSEMBLY AND REASSEMBLY

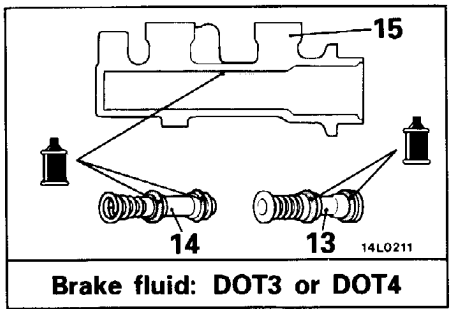
E35IE--





Disassembly steps

1. Reservoir cap assembly
2. Diaphragm
3. Reservoir cap
4. Filter <Vehicles with ABS>
5. Brake fluid level sensor
6. Float
7. Reservoir stopper bolt
8. Reservoir tank
9. Reservoir seal
10. Piston stopper bolt ◆◆
11. Gasket
12. Stopper ring ◆◆
13. Primary piston assembly
14. Secondary piston assembly
15. Master cylinder body



Caution
Do not disassemble the secondary and primary piston assembly.

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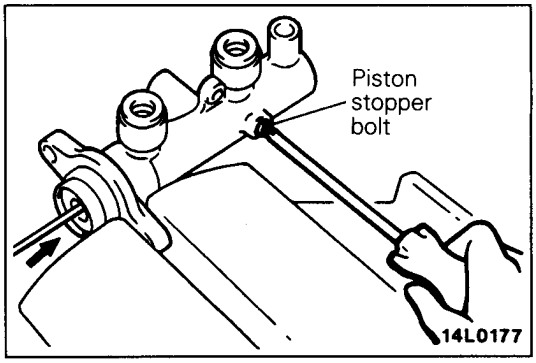
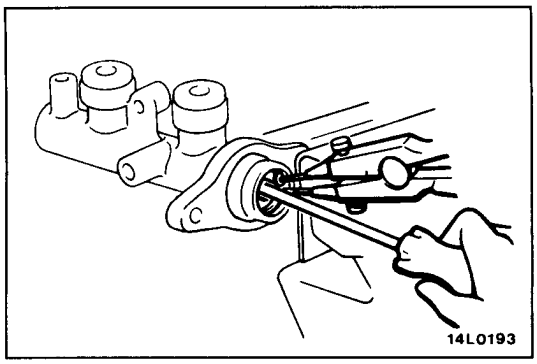


SERVICE POINTS OF DISASSEMBLY E35IFAD

10. REMOVAL OF PISTON STOPPER BOLT

Remove the piston stopper bolt, while depressing the piston.



12. REMOVAL OF STOPPER RING

Remove the piston stopper ring, while depressing the piston.

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BRAKE LINE

REMOVAL AND INSTALLATION

E35KA--

L.H. drive vehicles

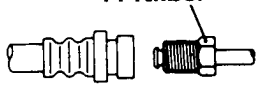
<Vehicles without ABS>

Pre-removal Operation
- Draining of Brake Fluid

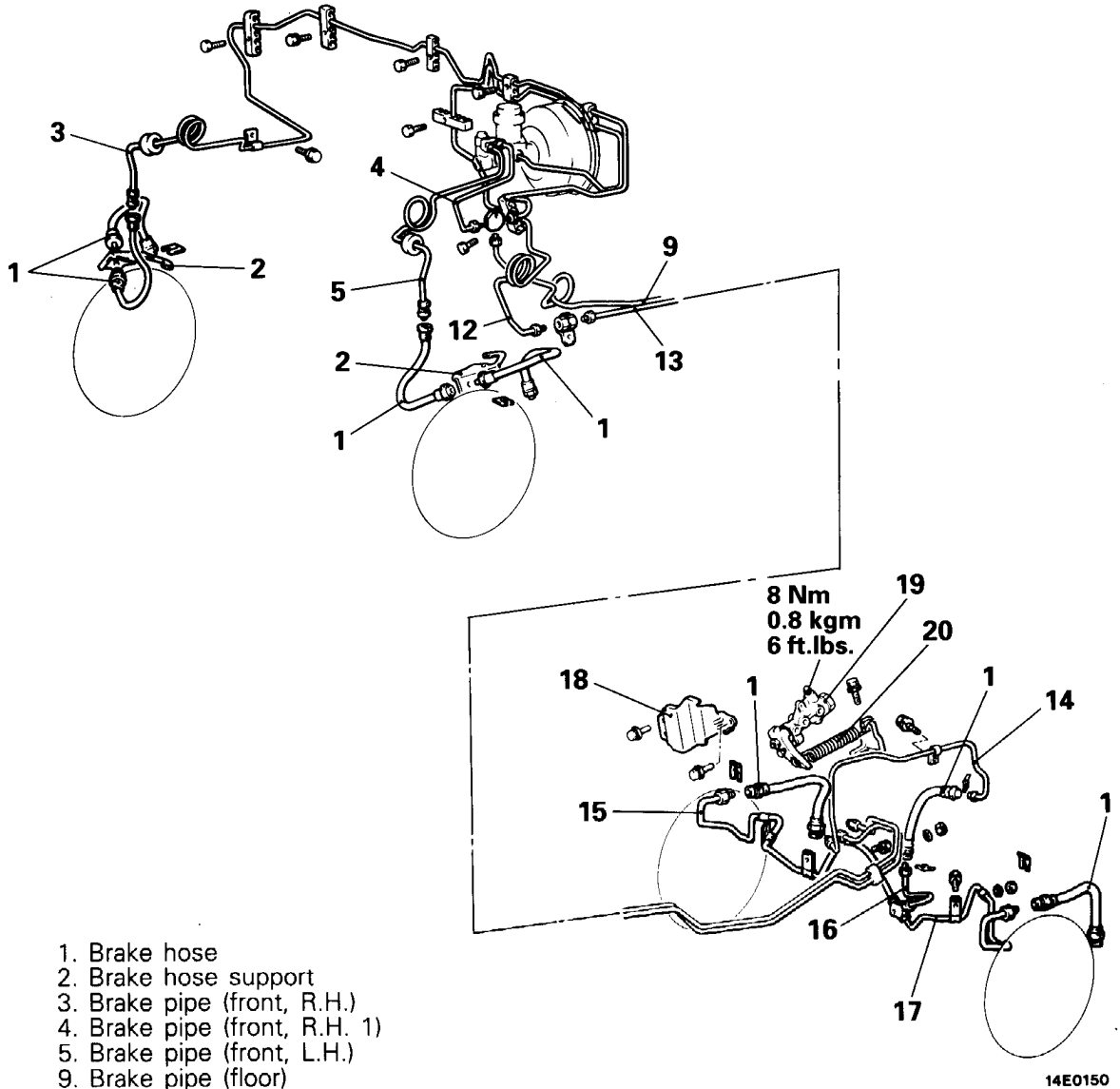
Post-installation Operation
- Supplying of Brake Fluid
- Bleeding (Refer to P.35-41.)

Flare nut

15 Nm
1.5 kgm
11 ft.lbs.



14F038



14E0150

1. Brake hose
2. Brake hose support
3. Brake pipe (front, R.H.)
4. Brake pipe (front, R.H. 1)
5. Brake pipe (front, L.H.)
9. Brake pipe (floor)
12. Brake pipe (main 1)
13. Brake pipe (main 2)
14. Brake pipe (main 3)
15. Brake pipe (rear, R.H.)
16. Brake pipe (rear, center)
17. Brake pipe (rear, L.H.)
18. Protector
19. Load sensing proportioning valve
20. Load sensing spring

Caution
Do not disassemble the load sensing proportioning valve because its performance depends on the load of the spring.

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<Vehicles with ABS>

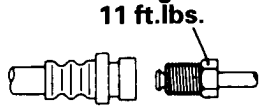
2500D

Pre-removal Operation
- Draining of Brake Fluid

Post-installation Operation
- Supplying of Brake Fluid
- Bleeding (Refer to P.35-41.)

Flare nut

15 Nm
1.5 kgm
11 ft.lbs.



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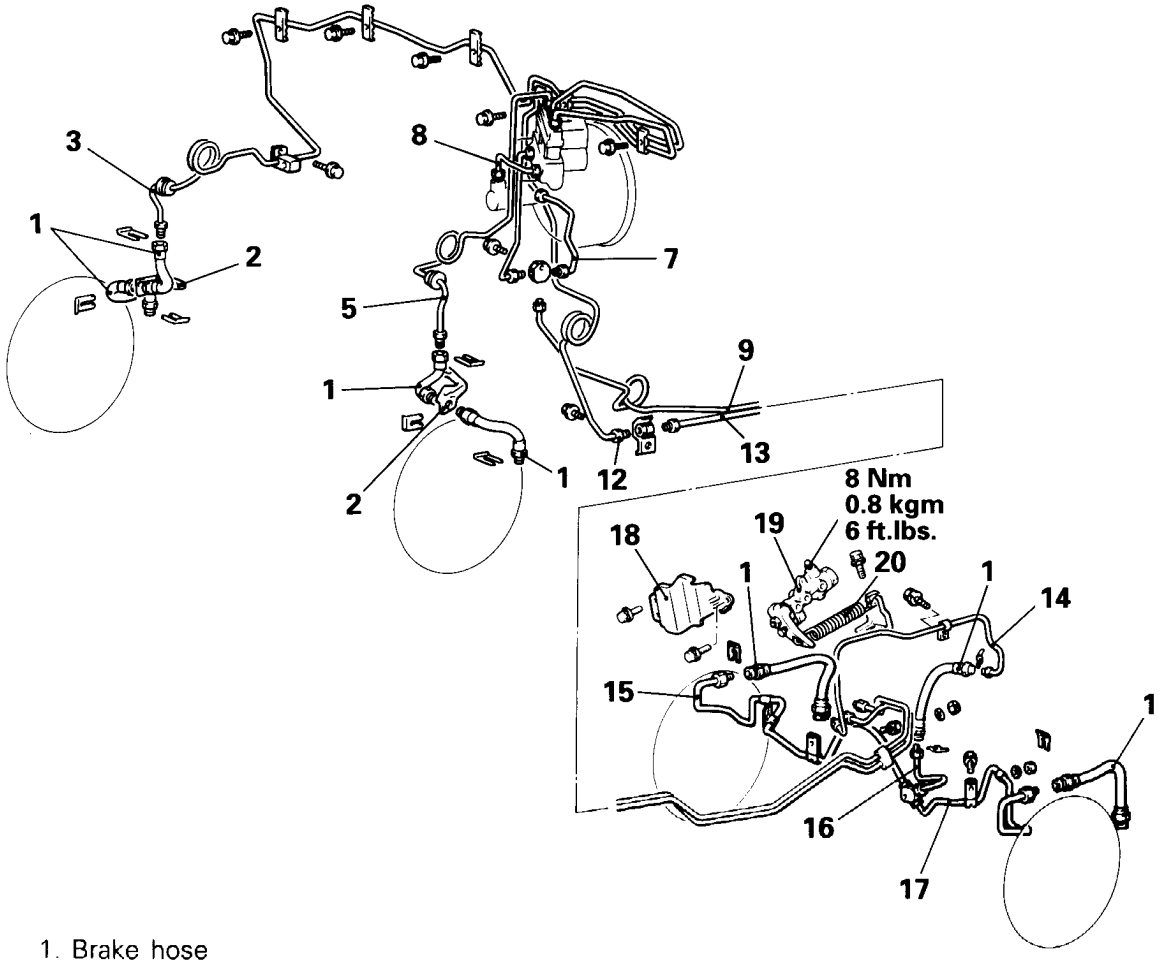

14E0154

1. Brake hose
2. Brake hose support
3. Brake pipe (front, R.H.)
4. Brake pipe (front, R.H. 1)
5. Brake pipe (front, L.H.)
7. Brake pipe (A)
8. Brake pipe (B)
9. Brake pipe (floor)
12. Brake pipe (main 1)
13. Brake pipe (main 2)
14. Brake pipe (main 3)
15. Brake pipe (rear, R.H.)
16. Brake pipe (rear, center)
17. Brake pipe (rear, L.H.)
18. Protector
19. Load sensing proportioning valve
20. Load sensing spring

Caution
Do not disassemble the load sensing proportioning valve because its performance depends on the set load of the spring.

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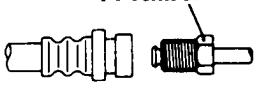
3000

Pre-removal Operation
- Draining of Brake Fluid

Post-installation Operation
- Supplying of Brake Fluid
- Bleeding (Refer to P.35-41.)

Flare nut

15 Nm
1.5 kgm
11 ft.lbs.



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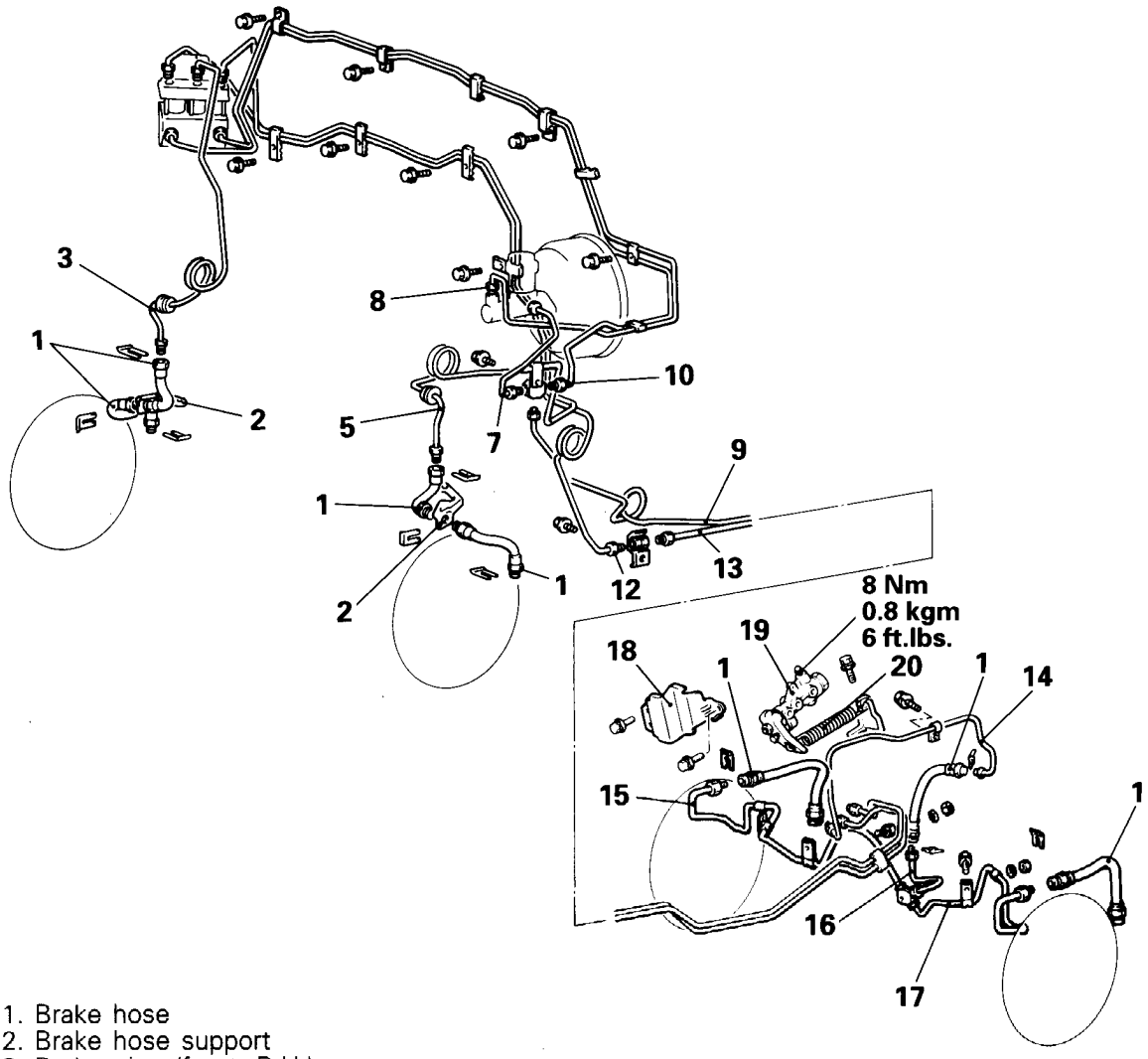

14E0152

1. Brake hose
2. Brake hose support
3. Brake pipe (front, R.H.)
5. Brake pipe (front, L.H.)
7. Brake pipe (A)
8. Brake pipe (B)
9. Brake pipe (floor)
10. Brake pipe (floor 1)
12. Brake pipe (main 1)
13. Brake pipe (main 2)
14. Brake pipe (main 3)
15. Brake pipe (rear, R.H.)
16. Brake pipe (rear, center)
17. Brake pipe (rear, L.H.)
18. Protector
19. Load sensing proportioning valve
20. Load sensing spring

Caution
Do not disassemble the load sensing proportioning valve because its performance depends on the set load of the spring.

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R.H. drive vehicles

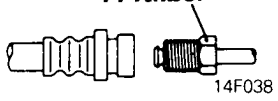
<Vehicles without ABS>

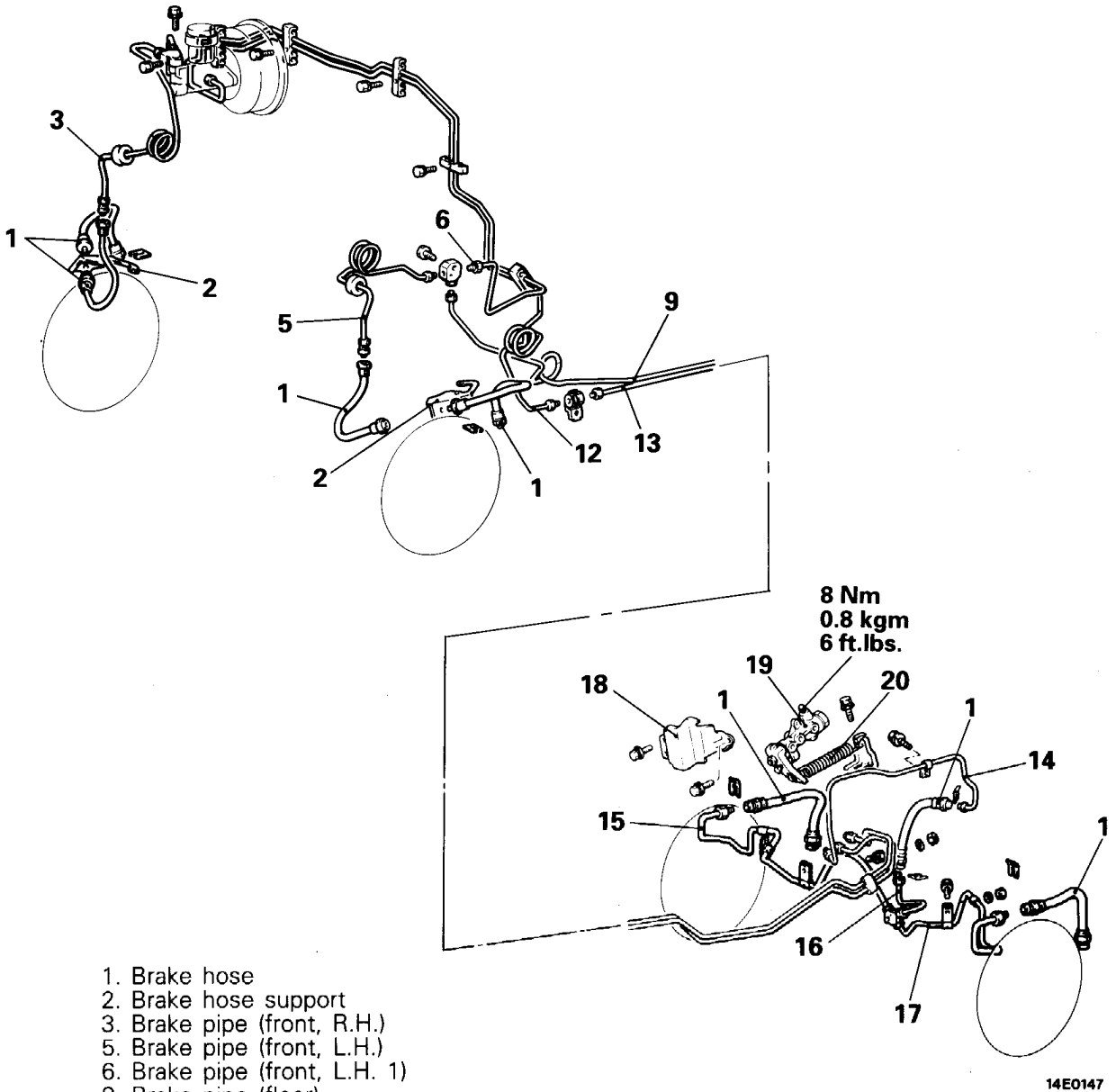
Pre-removal Operation
- Draining of Brake Fluid

Post-installation Operation
- Supplying of Brake Fluid
- Bleeding (Refer to P.35-41.)

Flare nut

15 Nm
1.5 kgm
11 ft.lbs.





1. Brake hose
2. Brake hose support
3. Brake pipe (front, R.H.)
5. Brake pipe (front, L.H.)
6. Brake pipe (front, L.H. 1)
9. Brake pipe (floor)
12. Brake pipe (main 1)
13. Brake pipe (main 2)
14. Brake pipe (main 3)
15. Brake pipe (rear, R.H.)
16. Brake pipe (rear, center)
17. Brake pipe (rear, L.H.)
18. Protector
19. Load sensing proportioning valve
20. Load sensing spring

Caution
Do not disassemble the load sensing proportioning valve because its performance depends on the set load of the spring.

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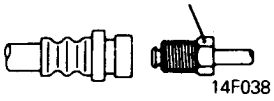
<Vehicles with ABS>

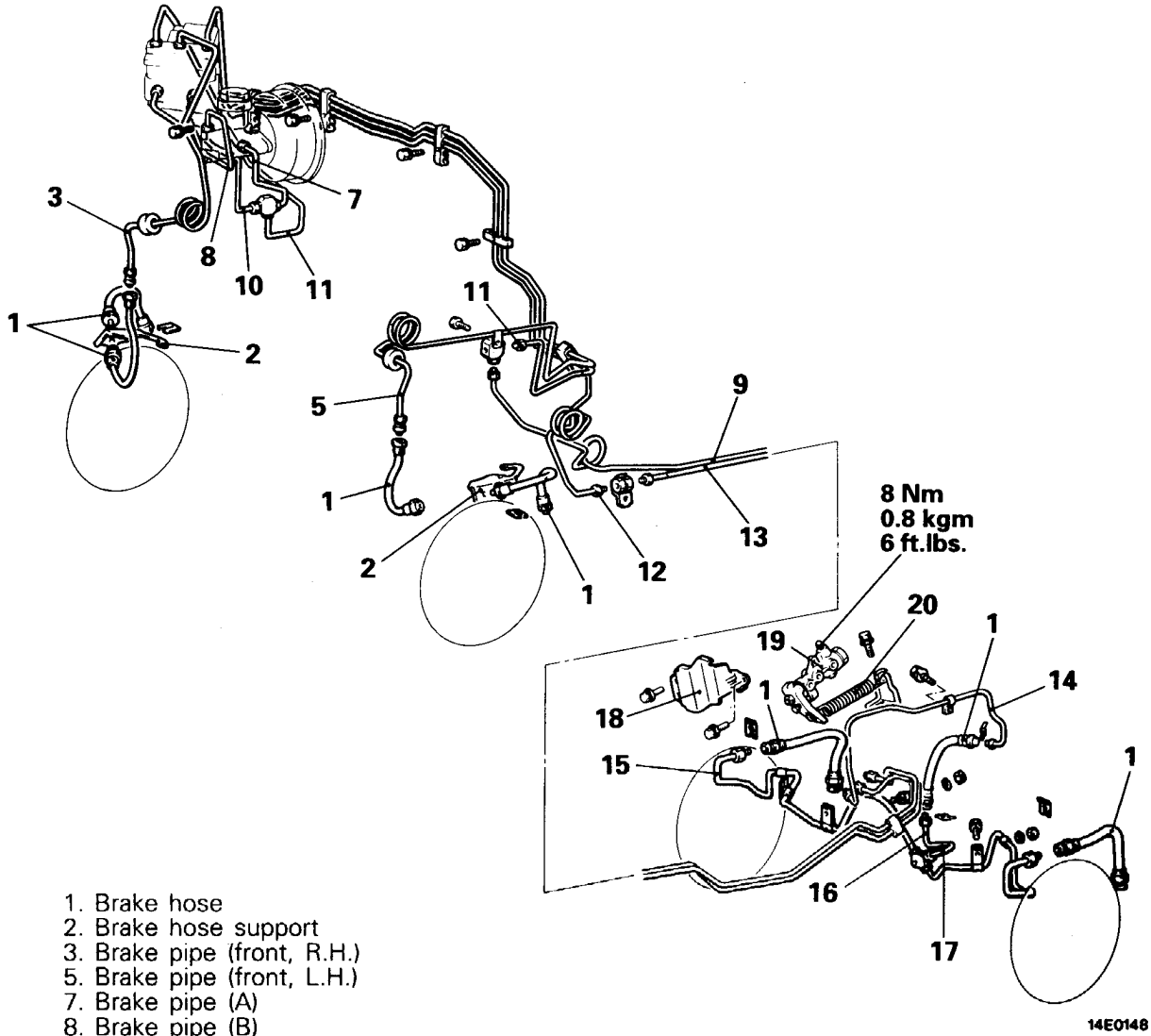
Pre-removal Operation
- Draining of Brake Fluid

Post-installation Operation
- Supplying of Brake Fluid
- Bleeding (Refer to P.35-41.)

Flare nut

15 Nm
1.5 kgm
11 ft.lbs.





1. Brake hose
2. Brake hose support
3. Brake pipe (front, R.H.)
5. Brake pipe (front, L.H.)
7. Brake pipe (A)
8. Brake pipe (B)
9. Brake pipe (floor)
10. Brake pipe (floor 1)
11. Brake pipe (floor 2)
12. Brake pipe (main 1)
13. Brake pipe (main 2)
14. Brake pipe (main 3)
15. Brake pipe (rear, R.H.)
16. Brake pipe (rear, center)
17. Brake pipe (rear, L.H.)
18. Protector
19. Load sensing proportioning valve
20. Load sensing spring

Caution
Do not disassemble the load sensing proportioning valve because its performance depends on the set load of the spring.

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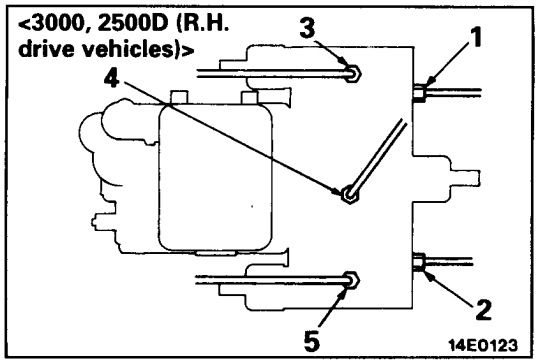
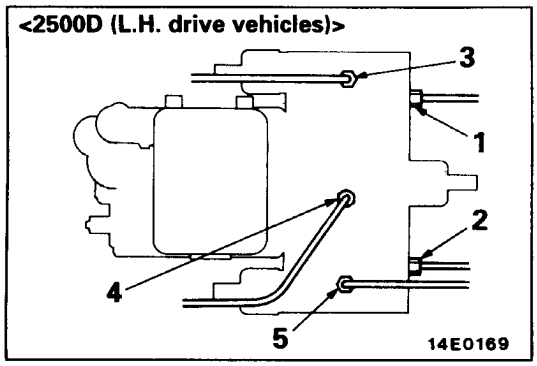




SERVICE POINTS OF INSTALLATION E35KDAL

INSTALLATION OF BRAKE PIPES TO HYDRAULIC UNIT

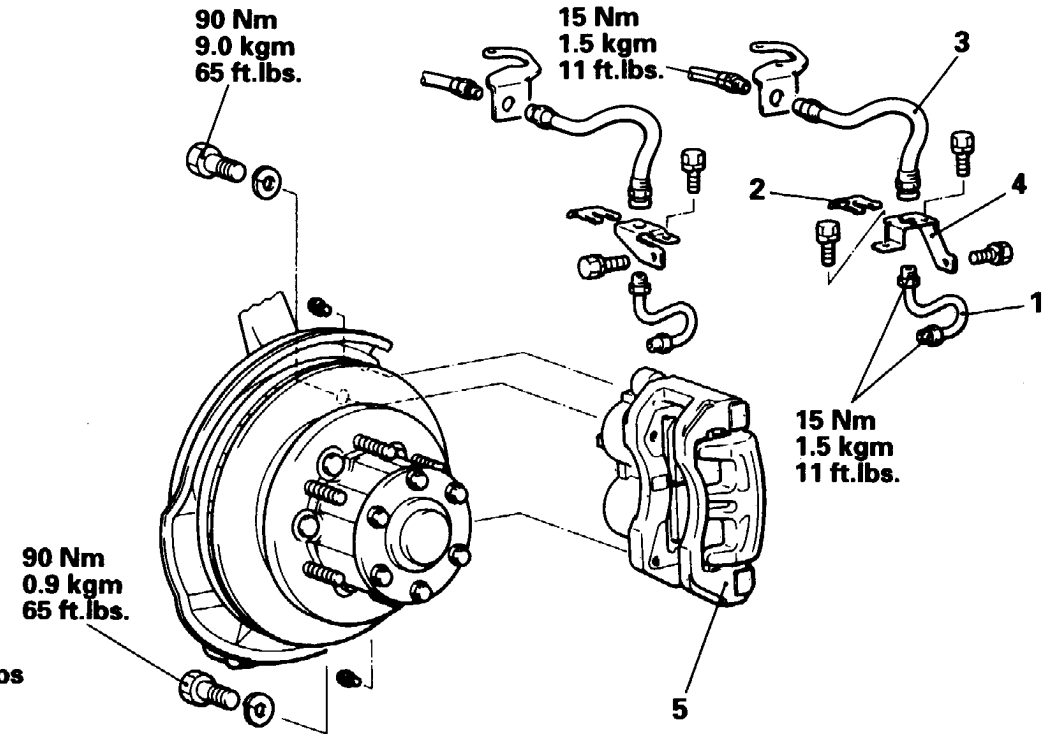
Install the brake pipes as shown in the illustration.
1. From master cylinder to hydraulic unit (to rear brake)
2. From master cylinder to hydraulic unit (to front brake)
3. From hydraulic unit to rear brake
4. From hydraulic unit to front brake (RH)
5. From hydraulic unit to front brake (LH)

FRONT DISC BRAKE

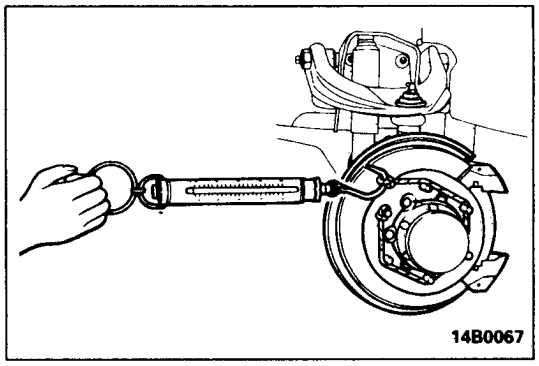
REMOVAL AND INSTALLATION E35LA--

Pre-Removal Operation
- Draining of Brake Fluid

Post-installation Operation
- Supplying of Brake fluid and Bleeding of Air (Refer to P.35-41.)



Removal steps
1. Brake pipe
2. Clip
3. Brake hose
4. Brake hose bracket
- ◆◆ 5. Front brake assembly

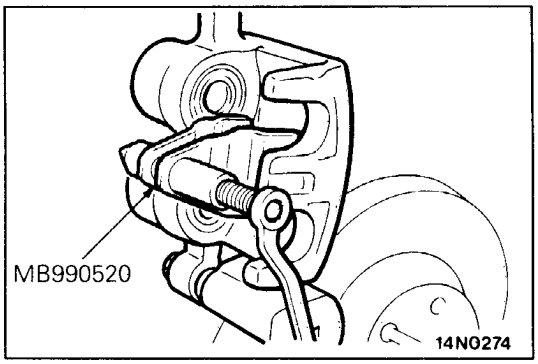


SERVICE POINTS OF INSTALLATION E35LBAG

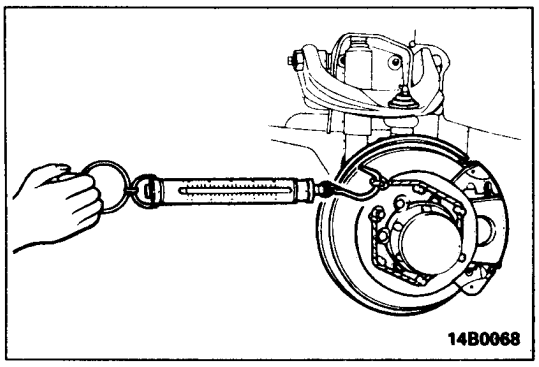
5. INSTALLATION OF FRONT BRAKE ASSEMBLY

After installation of the brake assembly, measure the dragging force of the disc brakes by the following procedure.

(1) With the brake assembly removed, use a spring balance to measure the rotational sliding resistance of the hub in the forward direction.



(2) After installing the caliper support to the knuckle, use the special tool to expand the piston, and then install the caliper body.



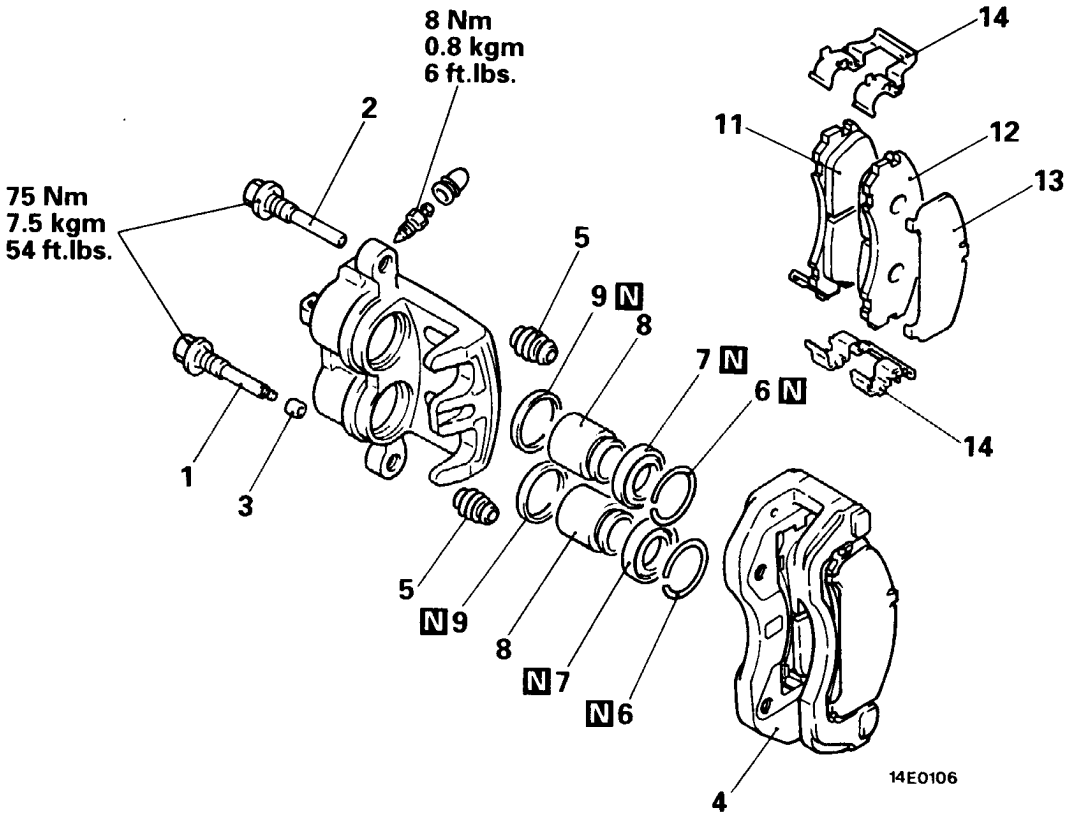
(3) Start the engine and, after strongly depressing the brake pedal 2-3 times, stop the engine.
(4) Turn brake disc forward 10 times.
(5) Use a spring balance to measure the rotational sliding resistance of the hub in the forward direction.
(6) Calculate the dragging force of the disc brakes (the difference between the values measured in steps 5 and 1).

Standard value: 57N (5.7 kg, 13 lbs.) or less

(7) If the dragging force of the disc brakes exceeds the standard value, disassemble piston and clean the piston. Check for corrosion or worn piston seal.

DISASSEMBLY AND REASSEMBLY

E35LF--



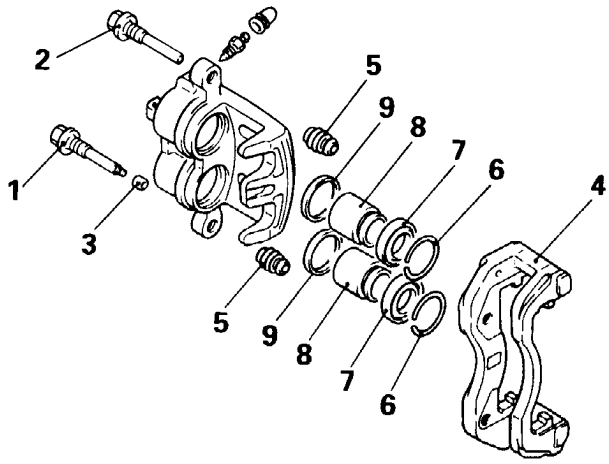
Disassembly steps of caliper assembly

- ◆◆ 1. Lock pin
- ◆◆ 2. Guide pin
- 3. Bushing
- 4. Caliper support (Pad, clip and shim)
- 5. Pin boot
- 6. Boot ring
- ◆◆ 7. Piston boot
- ◆◆ 8. Piston
- ◆◆ 9. Piston seal
- 10. Caliper body

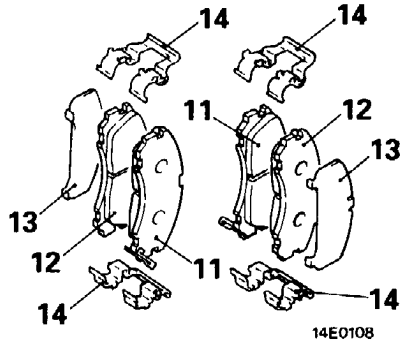
Disassembly steps of pad assembly

- ◆◆ 1. Lock pin
- ◆◆ 2. Guide pin
- 3. Bushing
- 4. Caliper support (Pad, clip and shim)
- 11. Pad and wear indicator assembly
- 12. Pad assembly
- 13. Outer shim
- 14. Clip

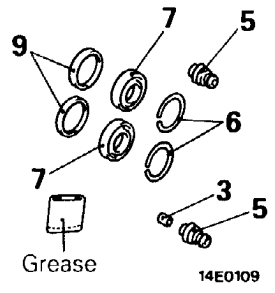
Brake caliper kit



Pad kit



Seal and boot kit



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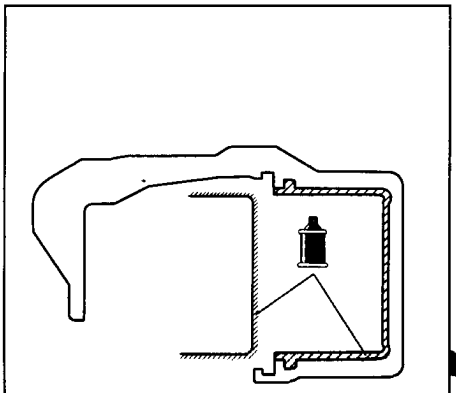
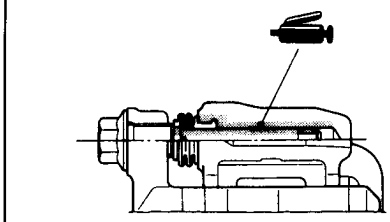
LUBRICATION POINTS



14E0131

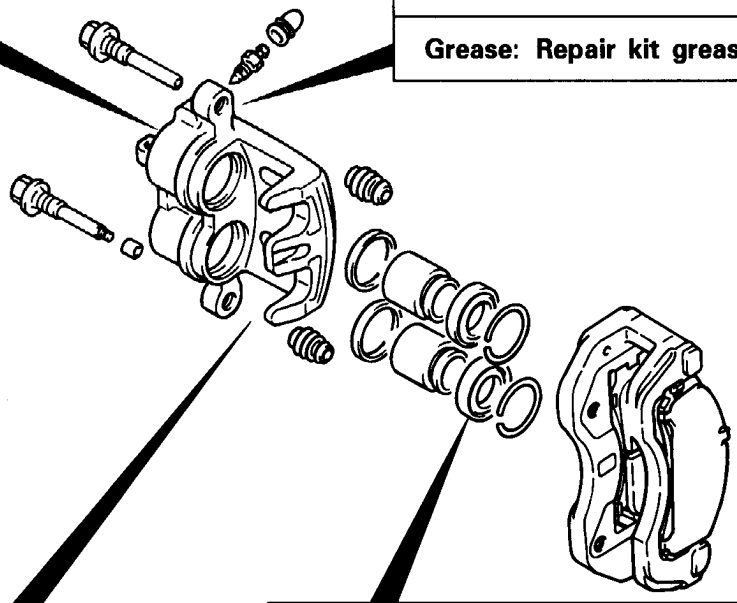
Caution
Special grease has been applied to the inside of the seal and boot kit, so this grease should not be wiped off.

Brake fluid: DOT3 or DOT4

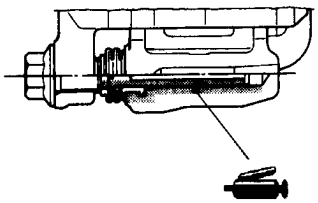


14A0541

Grease: Repair kit grease (orange)

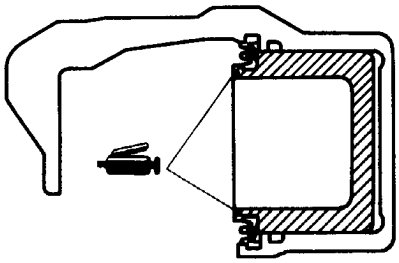


14E0106



14A0541

Grease: Repair kit grease (orange)



14L0128

Grease: Repair kit grease (orange)

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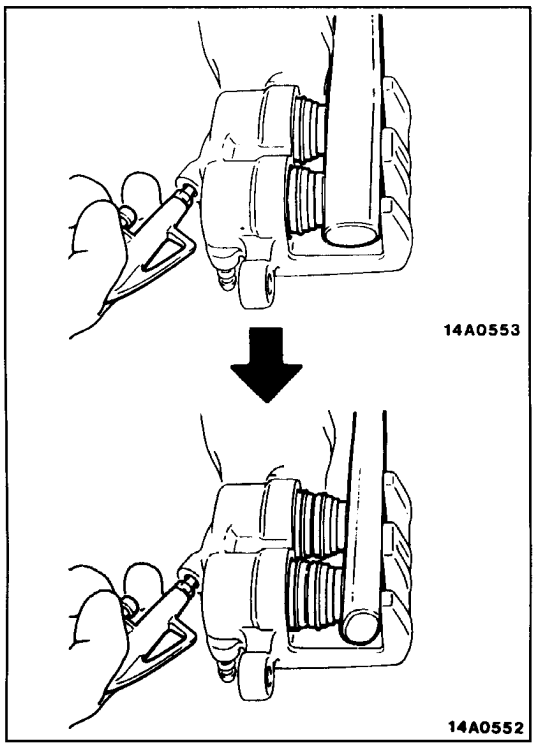
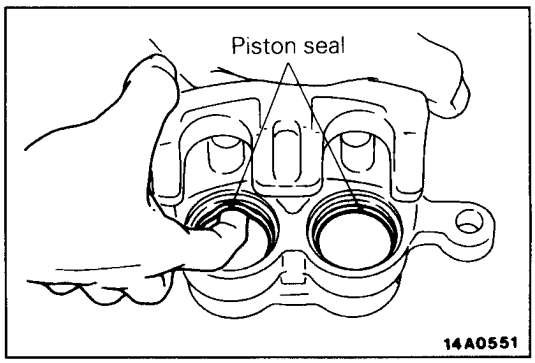


SERVICE POINTS OF DISASSEMBLY E35LGAD

7. REMOVAL OF PISTON BOOT/8. PISTON

Pump in compressed air through the brake hose installation hole and remove the pistons and piston boot.

Caution
When removing the pistons, be sure to use the handle of a plastic hammer and adjust the height of the two pistons while pumping in air slowly in so that the pistons protrude evenly.
Do not remove one piston completely before trying to remove the other piston because it will become impossible to remove the second piston.



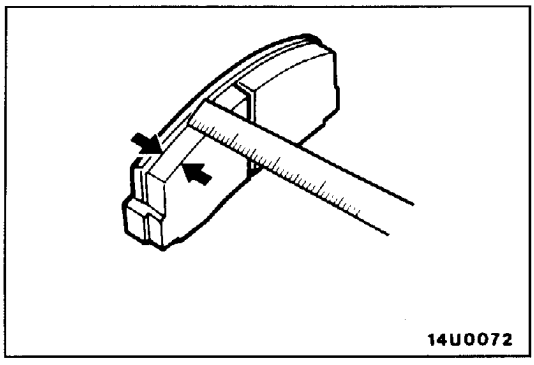
9. REMOVAL OF PISTON SEAL

(1) Remove piston seal with finger tip.

Caution
Do not use a screwdriver or other tool to prevent damage to inner cylinder.

(2) Clean piston surface and inner cylinder with trichloroethylene alcohol or specified brake fluid.

Specified brake fluid: DOT3 or DOT4



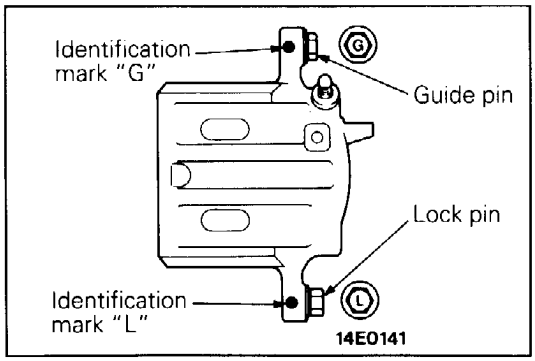
INSPECTION E35RIAD

PAD WEAR

Measure thickness at the thinnest and worn area of the pad. Replace pad assembly when pad thickness is less than the limit value.

Standard value:	**10.0 mm (0.39 in.)**
Limit value:	**2.0 mm (0.079 in.)**

Caution
1. **When the limit it exceeded, replace the pads at both sides, and also the brake pads for the wheels on the opposite side at the same time.**
2. **If there is a significant difference in the thicknesses of the pads on the left and right sides, check the sliding parts.**



SERVICE POINTS OF INSTALLATION

2. INSTALLATION OF GUIDE PIN/1. LOCK PIN

Install the guide pin and lock pin as illustrated so that each head mark of the guide pin and the lock pin matches the indication mark ("G" or "L") located on the caliper body.

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REAR DISC BRAKE

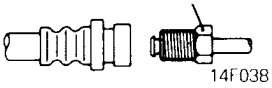
REMOVAL AND INSTALLATION

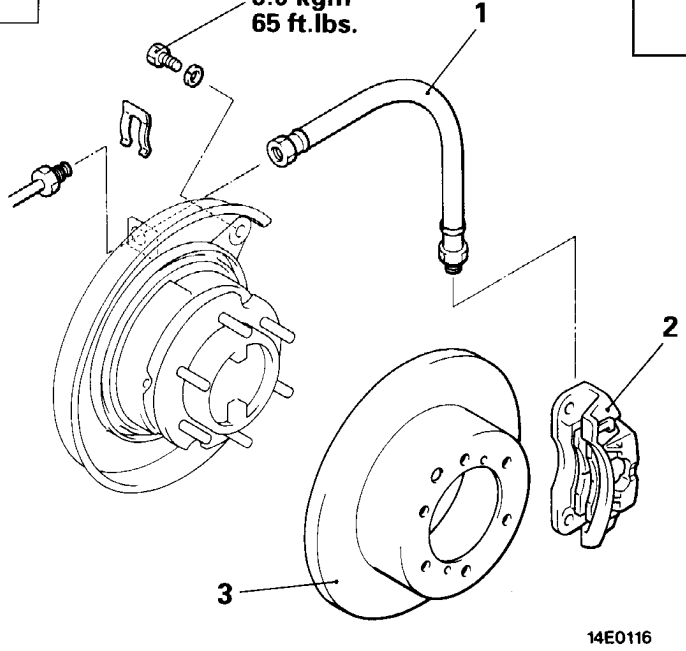
E35RA--

Pre-removal Operation
- Draining of Brake Fluid

Post-installation Operation
- Supplying of Brake Fluid
- Bleeding
  (Refer to P.35-41.)

Flare nut
15 Nm
1.5 kgm
11 ft.lbs.


14F038



14E0116

Removal steps
1. Brake hose connection
2. Rear brake assembly
3. Brake disc

INSPECTION

E35RCAB

BRAKE DISC

- Check disc for wear. (Refer to P.35-45.)
- Check disc for runout. (Refer to P.35-45.)
- Check disc for damage.

SERVICE POINTS OF INSTALLATION

E35RDAG

2. INSTALLATION OF THE REAR BRAKE ASSEMBLY

Install the rear brake assembly using the same procedure at that for the front brake assembly. (Refer to P.35-67.)

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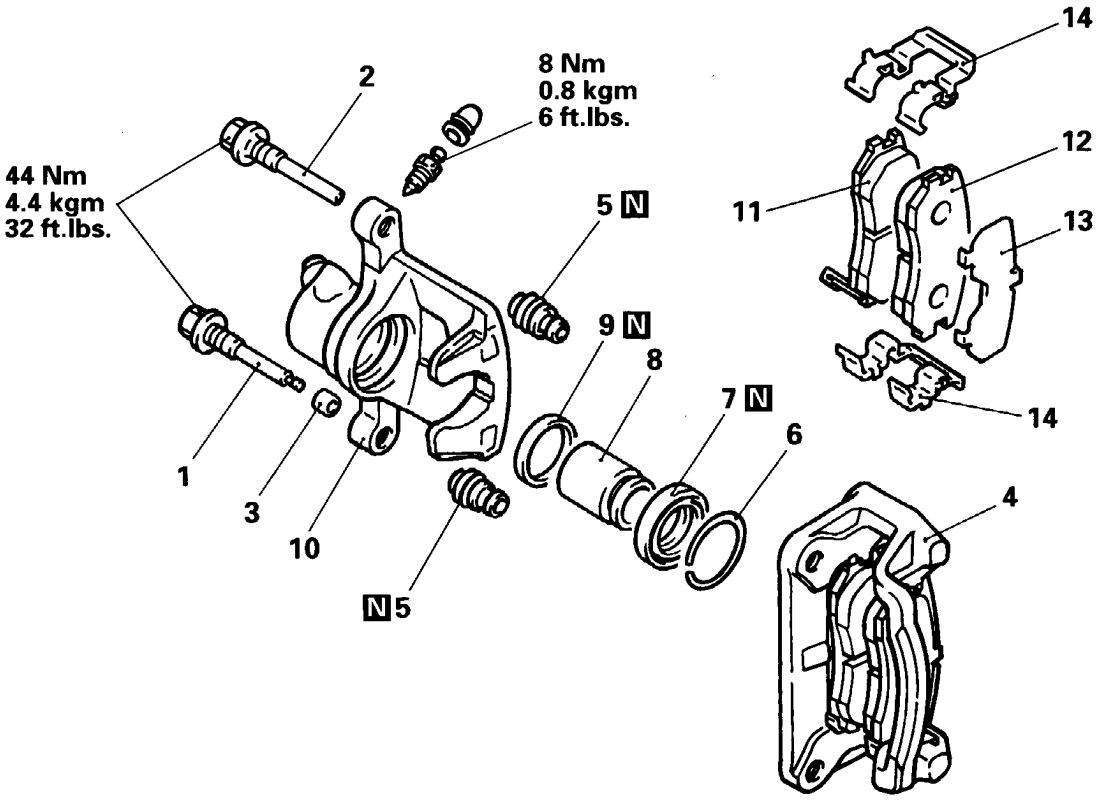
DISASSEMBLY AND REASSEMBLY

E35RF--



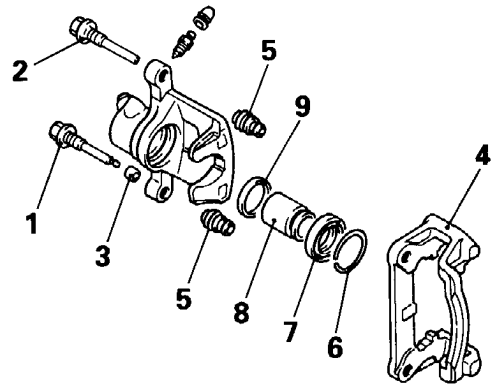
Disassembly steps of caliper assembly

- ◆◆ 1. Lock pin
- ◆◆ 2. Guide pin
- 3. Bushing
- 4. Caliper support (Pad, clip and shim)
- 5. Pin boot
- 6. Boot ring
- ◆◆ 7. Piston boot
- ◆◆ 8. Piston
- ◆◆ 9. Piston seal
- 10. Caliper body

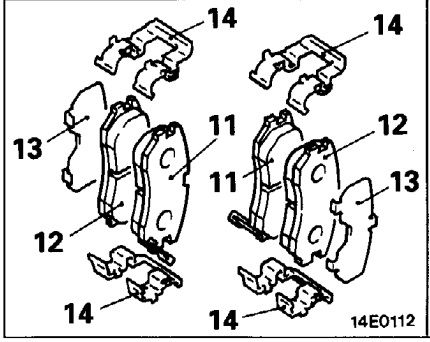
Disassembly steps of pad assembly

- ◆◆ 1. Lock pin
- ◆◆ 2. Guide pin
- 3. Bushing
- 4. Caliper support (Pad, clip and shim)
- 11. Pad and wear indicator assembly
- 12. Pad assembly
- 13. Outer shim
- 14. Clip

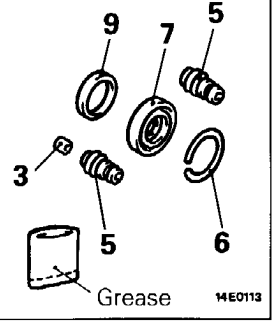
Brake caliper kit



Pad kit



Seal and boot repair kit



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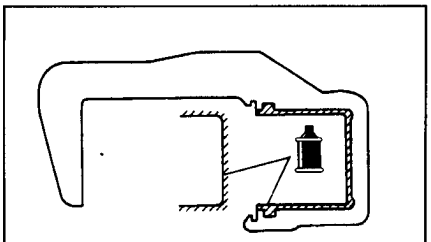
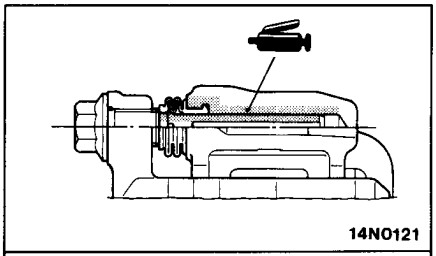
LUBRICATION POINTS



14E0121

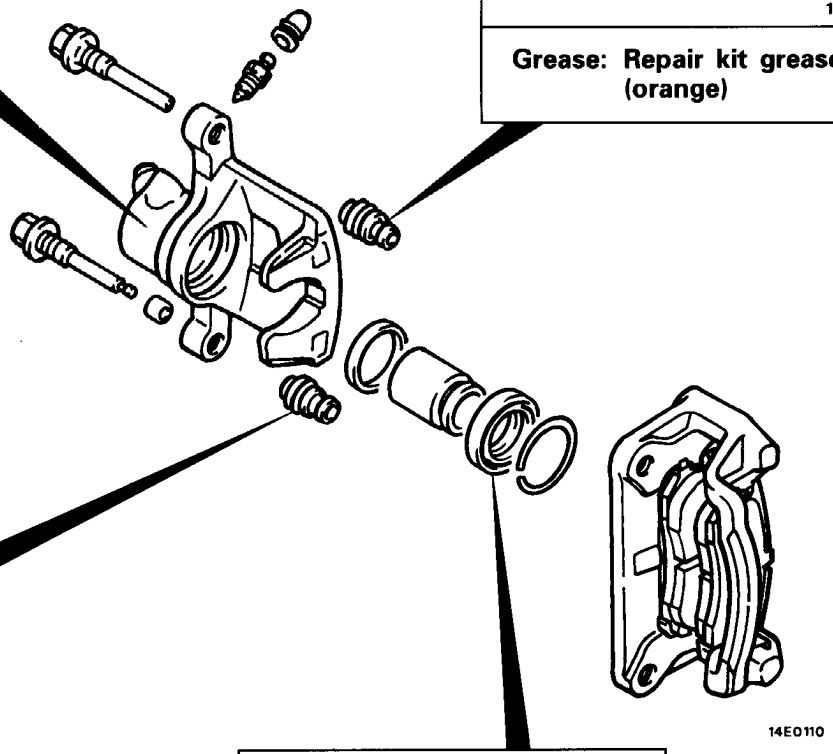
Caution
Special grease has been applied to the inside of the seal and boot kit, so this grease should not be wiped off.

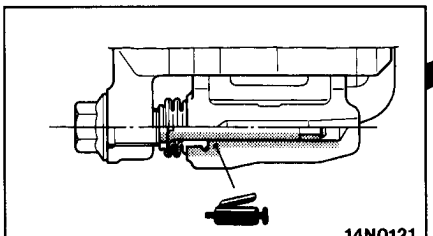
Brake fluid: DOT3 or DOT4



14N0121

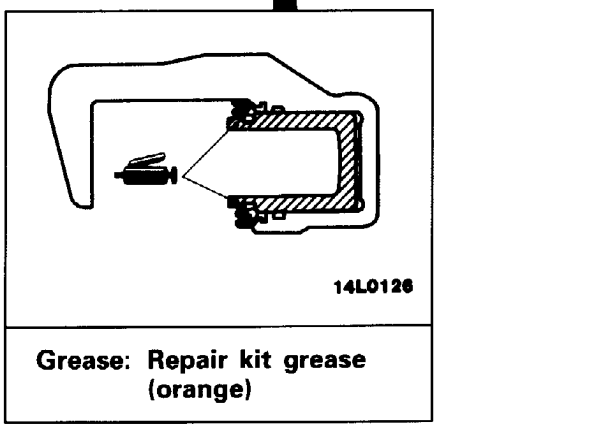
Grease: Repair kit grease (orange)





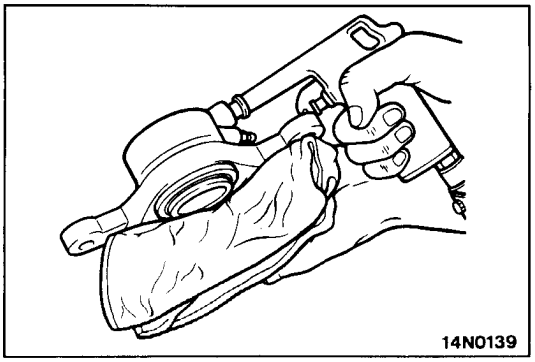
14N0121

Grease: Repair kit grease (orange)



14L0126

Grease: Repair kit grease (orange)

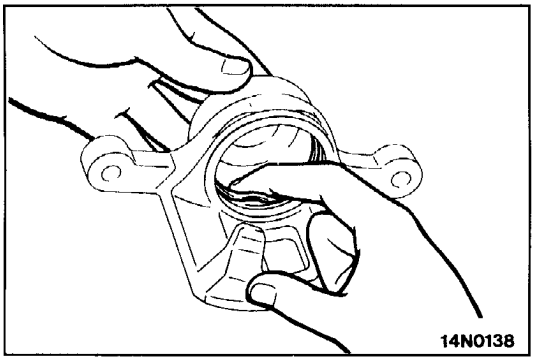


SERVICE POINTS OF DISASSEMBLY E35RGAE

7. REMOVAL OF PISTON BOOT/8. PISTON

Protect caliper body with cloth. Blow compressed air through brake hose to remove piston boot and piston.

Caution
Blow compressed air gently.



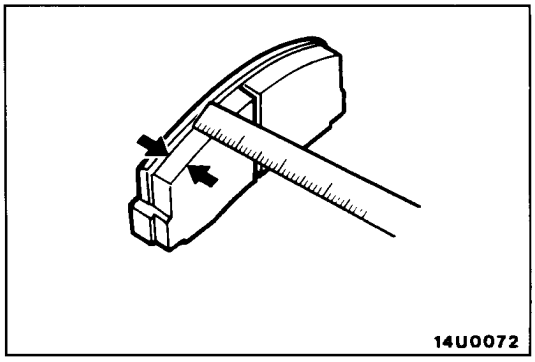
9. REMOVAL OF PISTON SEAL

(1) Remove piston seal with finger tip.

Caution
Do not use (–) screwdriver or other tool to prevent damage to inner cylinder.

(2) Clean piston surface and inner cylinder with trichloroethylene, alcohol or specified brake fluid.

Specified brake fluid: DOT3 or DOT4



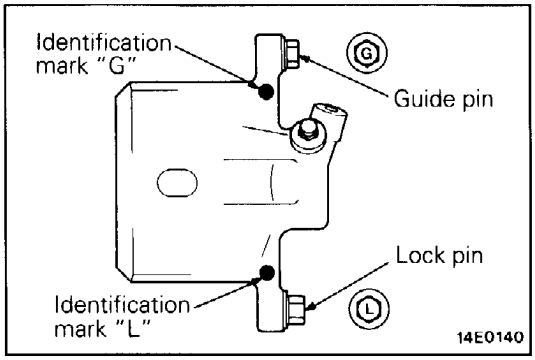
INSPECTION E35RHAC

PAD WEAR

Measure thickness at the thinnest and worn area of the pad. Replace pad assembly when pad thickness is less than the limit value.

Standard value: 9.0 mm (0.35 in.)
Limit: 2.0 mm (0.079 in.)

Caution
1. **When the limit is exceeded, replace the pads at both sides, and also the brake pads for the wheels on the opposite side at the same time.**
2. **If there is a significant difference in the thicknesses of the pads on the left and right sides, check the sliding parts.**



SERVICE POINTS OF REASSEMBLY E35RIAD

2. INSTALLATION OF GUIDE PIN/1. LOCK PIN

Install the guide pin and lock pin as illustrated so that each head mark of the guide pin and the lock pin matches the indication mark ("G" or "L") located on the caliper body.

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HYDRAULIC UNIT <A.B.S.>

E35WA--

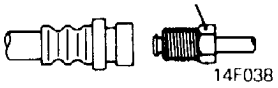
REMOVAL AND INSTALLATION

[Vehicles built up to May, 1994]

<Petrol-powered vehicles, Diesel-powered vehicles – R.H. drive>

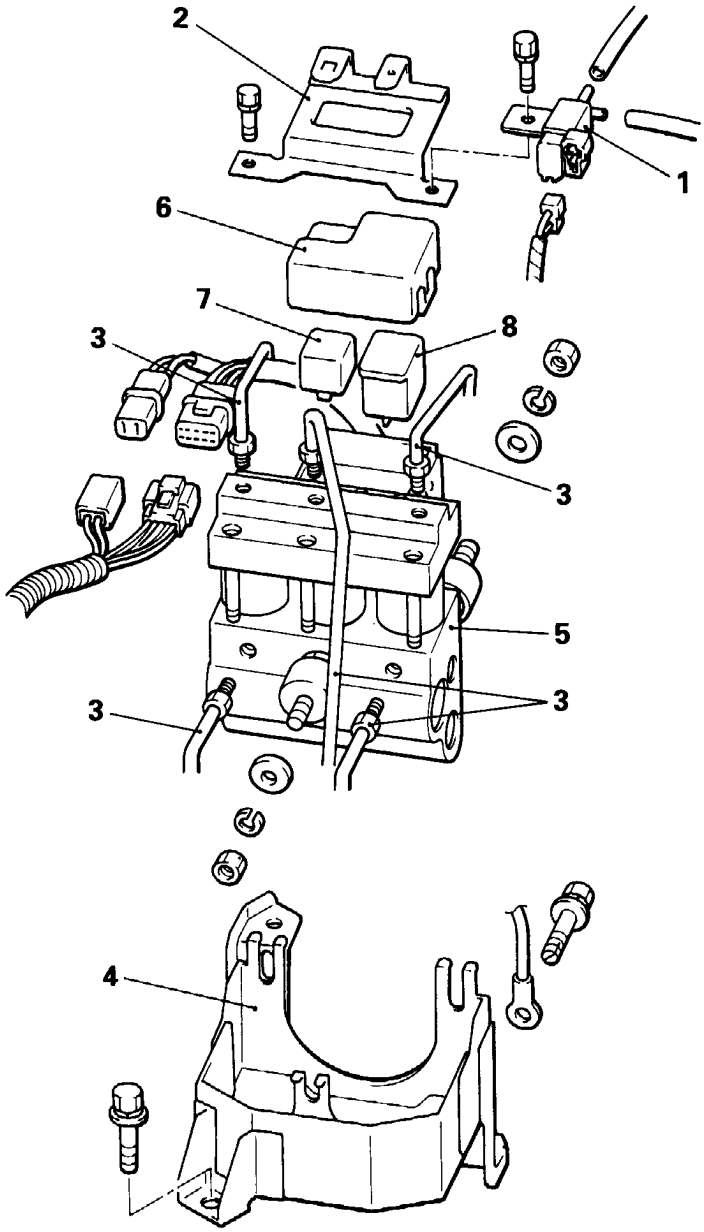
Flare nut

15 Nm
1.5 kgm
11 ft.lbs.



Pre-removal Operation
- Draining of Brake Fluid

Post-installation Operation
- Supplying of Brake Fluid
- Bleeding Brake Lines (Refer to P.35-41.)
- Checking by Using the Multi-use Tester (Refer to P.35-50.)



14E0068

Removal steps of relay

◆◆ 1. Idle-up solenoid valve (for ABS) <Diesel-powered vehicles – M/T>
2. Connector bracket
6. Relay box cover
7. Valve relay
8. Motor relay

Removal steps of hydraulic unit

◆◆ 1. Idle-up solenoid valve (for ABS) <Diesel-powered vehicles – M/T>
2. Connector bracket
3. Brake pipe
4. Hydraulic unit bracket
◆◆ 5. Hydraulic unit
6. Relay box cover
7. Valve relay
8. Motor relay

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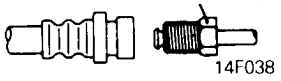
<Diesel-powered vehicles – L.H. drive>

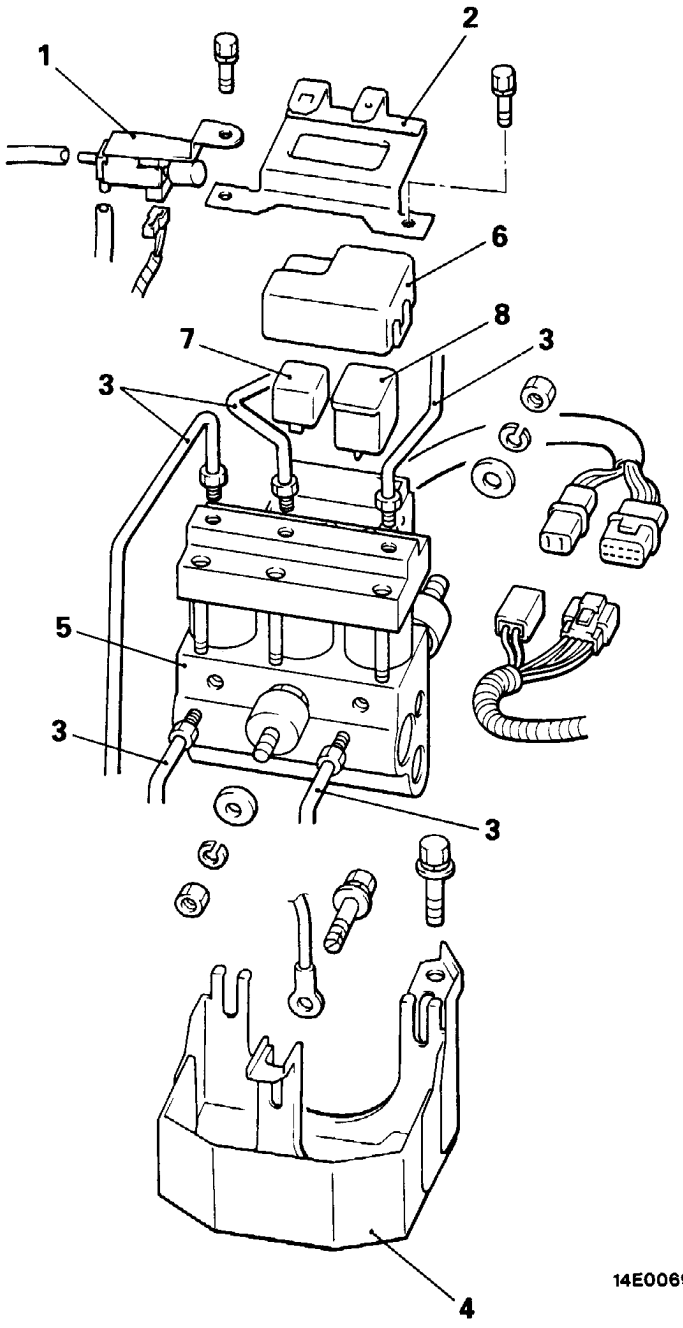
Flare nut

15 Nm
1.5 kgm
11 ft.lbs.



Pre-removal Operation
- Draining of Brake Fluid

Post-installation Operation
- Supplying of Brake Fluid
- Bleeding Brake Lines (Refer to P.35-41.)
- Checking by Using the Multi-use Tester (Refer to P.35-50.)



Removal steps of relay

1. Idle-up solenoid valve (for ABS) <M/T>
2. Connector bracket
6. Relay box cover
7. Valve relay
8. Motor relay

Removal steps of hydraulic unit

1. Idle-up solenoid valve (for ABS) <M/T>
2. Connector bracket
3. Brake pipe
4. Hydraulic unit bracket
5. Hydraulic unit
6. Relay box cover
7. Valve relay
8. Motor relay

SERVICE POINTS OF REMOVAL

E35WBAF

5. REMOVAL OF THE HYDRAULIC UNIT

Caution

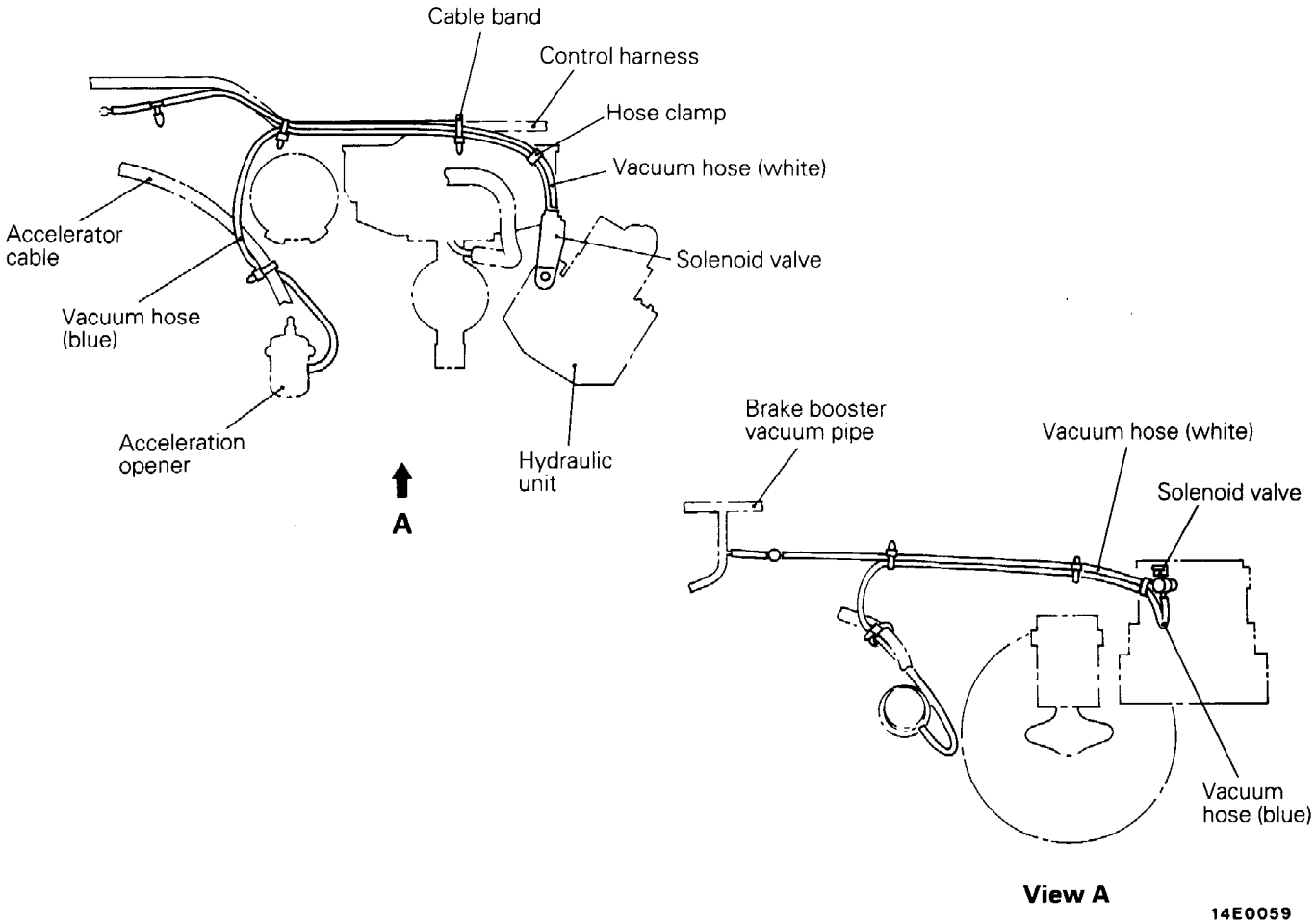
1. **The hydraulic unit is heavy, and so care should be taken when removing it.**
2. **The hydraulic unit is not to be disassembled; its nuts and bolts should absolutely not be loosened.**
3. **The hydraulic unit must not be dropped or otherwise subjected to impact shocks.**
4. **The hydraulic unit must not be turned upside down or laid on its side.**

SERVICE POINTS OF INSTALLATION

1. INSTALLATION OF IDLE-UP SOLENOID VALVE (FOR ABS) <2500D-M/T>

Install the solenoid valve and vacuum hose as shown in the illustration.

<L.H. drive vehicles>



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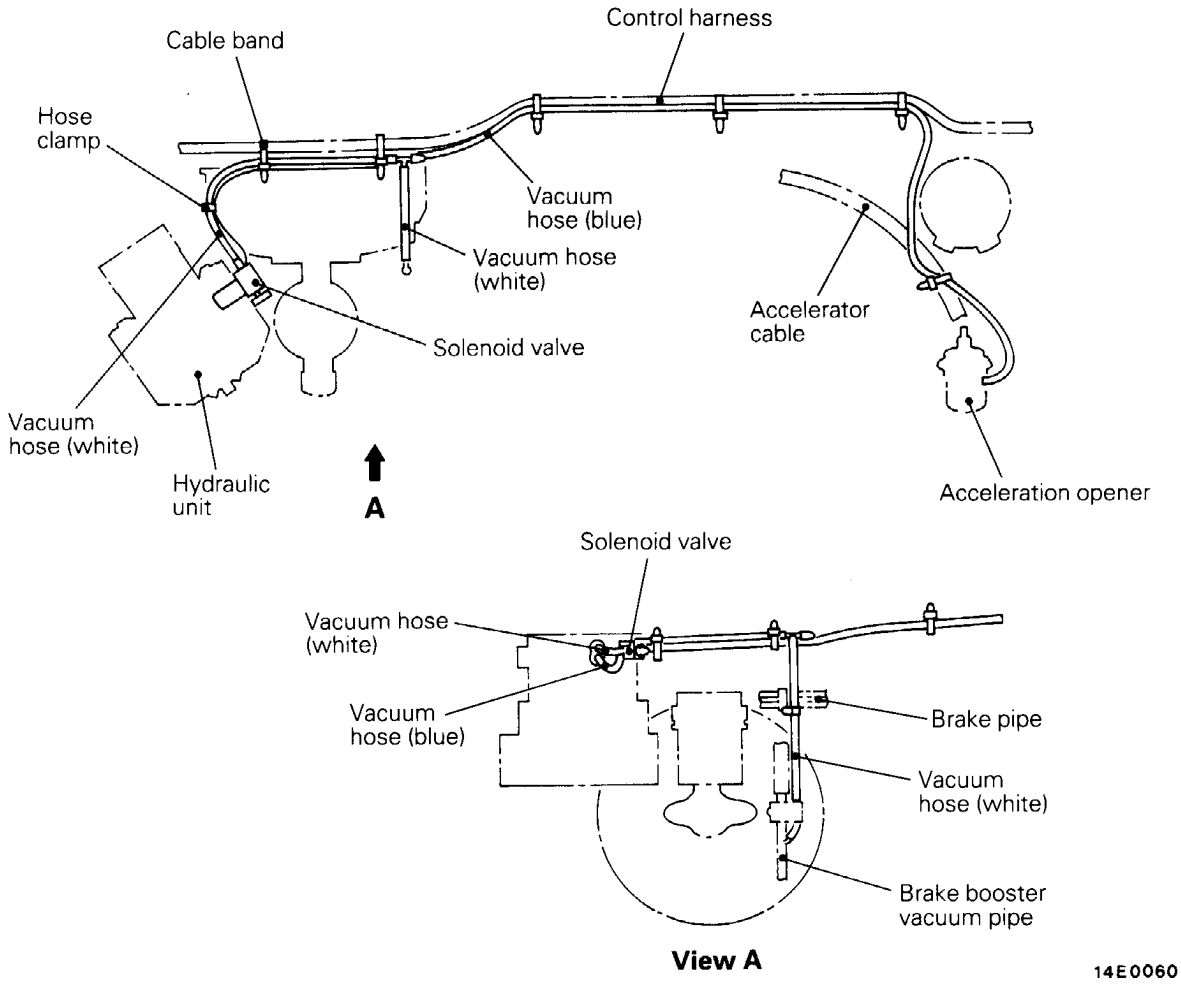
<R.H. drive vehicles>



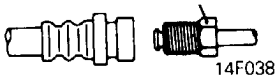
[Vehicles built from June, 1994]

Pre-removal Operation
- Draining of Brake Fluid

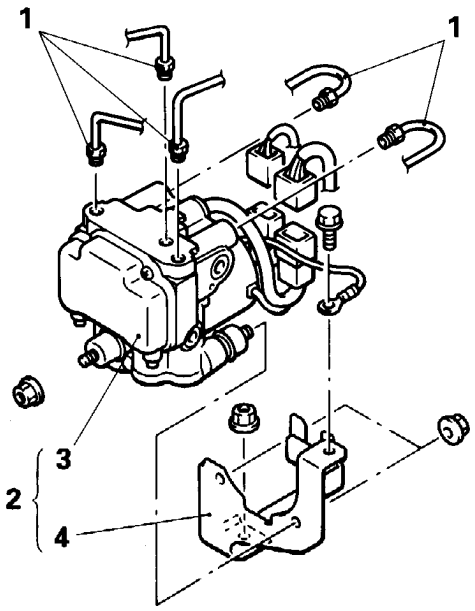
Post-installation Operation
- Supplying of Brake Fluid
- Bleeding Brake Lines (Refer to P.35-41.)
- Checking by Using the MUT-II (Refer to P.35-50.)

Flare nut

15 Nm
1.5 kgm
11 ft.lbs.

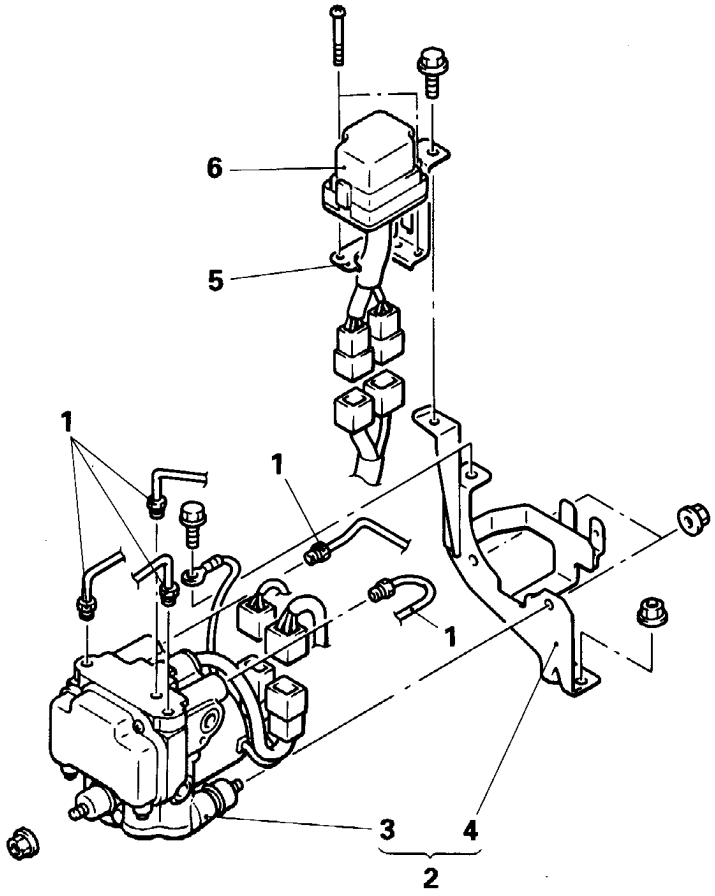

14F038

<Diesel-powered vehicles – L.H. drive>



14E0202

<Petrol-powered vehicles, Diesel powered vehicles – R.H. drive>



14E0203

Removal steps
1. Brake tube connection
2. Hydraulic unit assembly
3. Hydraulic unit
4. Hydraulic unit bracket
5. Relay box bracket
6. Relay box assembly

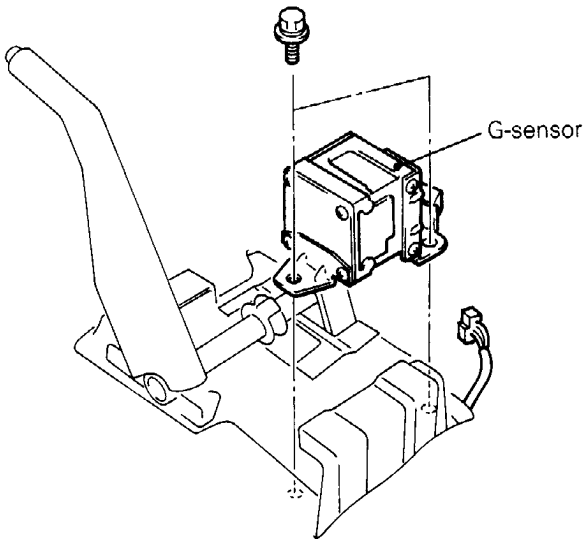
G-SENSOR <A.B.S.>

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Removal and Installation of Floor Console
  (Refer to GROUP 52 – Floor Console.)

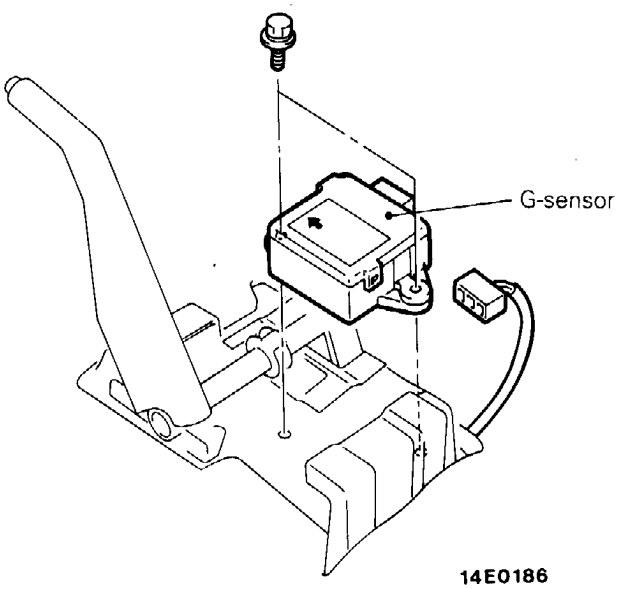
E35NA--

<Vehicles built up to October, 1993>



14E0062

<Vehicles built from November, 1993>



14E0186

Caution
When removing the G sensor, take care not to drop it or subject it to severe impact.

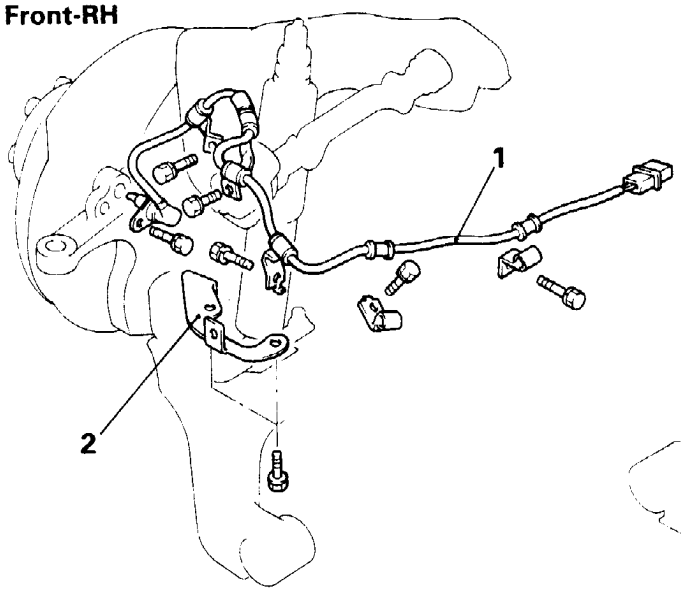
WHEEL SPEED SENSOR <A.B.S.>

E35YA--

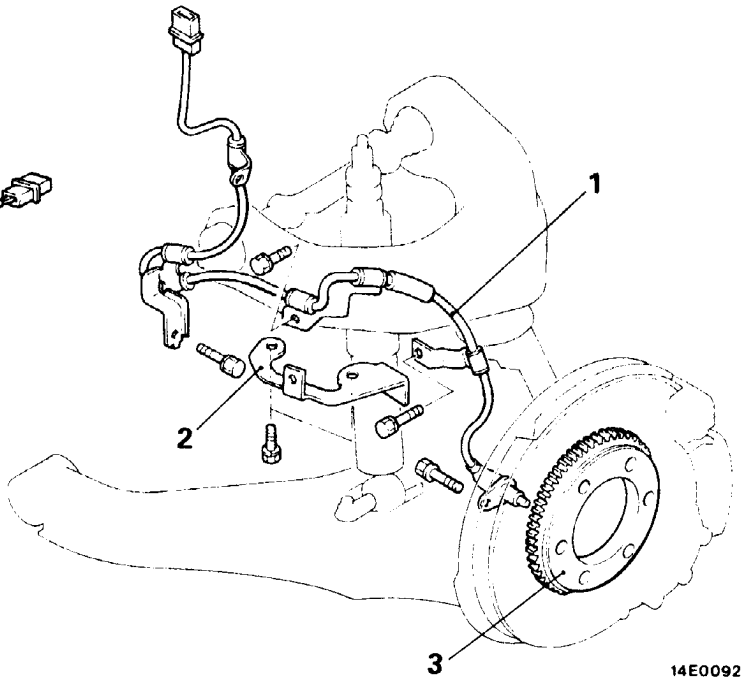
REMOVAL AND INSTALLATION

Post-installation Operation
- Checking of the Anti-lock Brake System (Refer to P.35-48.)

Front-RH



Front-LH

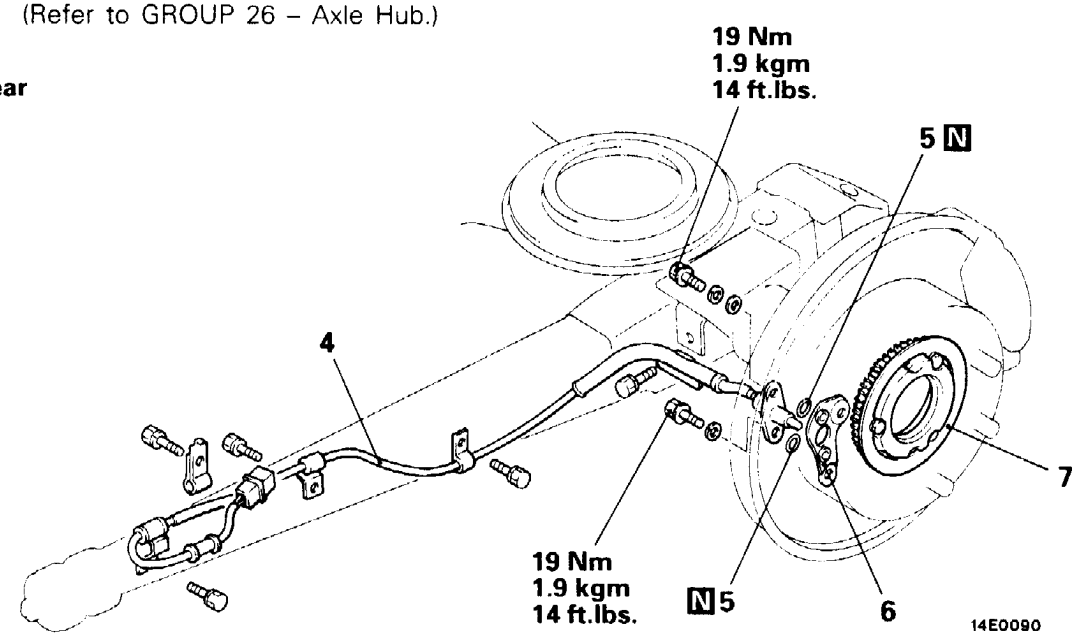


14E0092

Front speed sensor removal steps

◆◆ ◆◆ 1. Front speed sensor
2. Harness bracket
3. Front rotor
(Refer to GROUP 26 – Axle Hub.)

Rear



14E0090

Rear speed sensor removal steps

◆◆ ◆◆ 4. Rear speed sensor
5. Sealant
6. Sensor bracket } (Refer to
7. Rear rotor } GROUP 27 – Axle shaft.)

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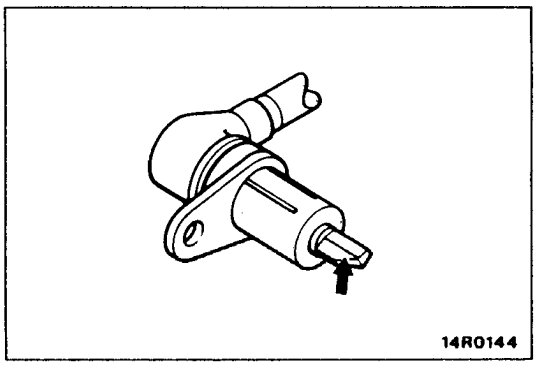


SERVICE POINTS OF REMOVAL E35YBAE

1. REMOVAL OF THE FRONT SPEED SENSOR/4. REAR SPEED SENSOR

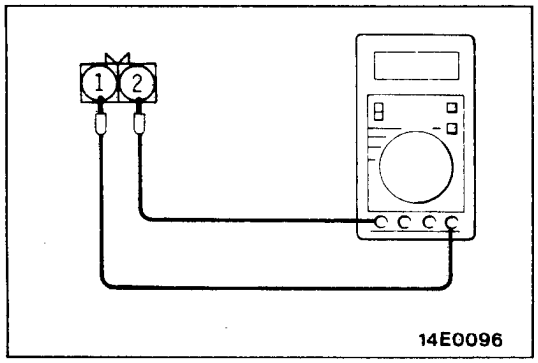
Caution
Be careful when handling the pole piece at the tip of the speed sensor and the toothed edge of the rotor so as not to damage them by striking against other parts.

INSPECTION E35YCAAa

SPEED SENSOR

(1) Check whether any metallic foreign material has adhered to the pole piece at the speed sensor tip, and, is so, remove it.
Also check whether the pole piece is damaged, and, if so, replace it with a new one.

NOTE
The pole piece can become magnetized because of the magnet built into the speed sensor, with the result that metallic foreign material easily adheres to it. Moreover, the pole piece may not be able to function to correctly sense the wheel rotation speed if it is damaged.

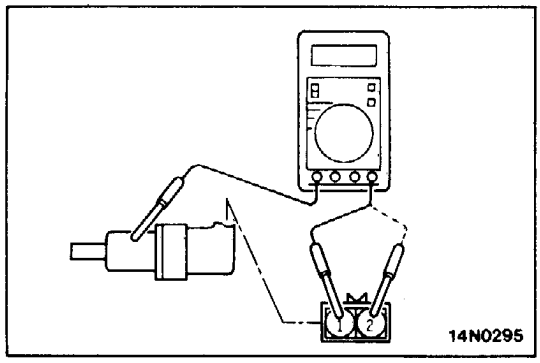


(2) Measure the resistance between the speed sensor terminals.

Standard value:

Front:	**0.9–1.1 kΩ**
Rear:	**1.3–2.1 kΩ**

If the internal resistance of the speed sensor is not within the standard value, replace it with a new speed sensor.



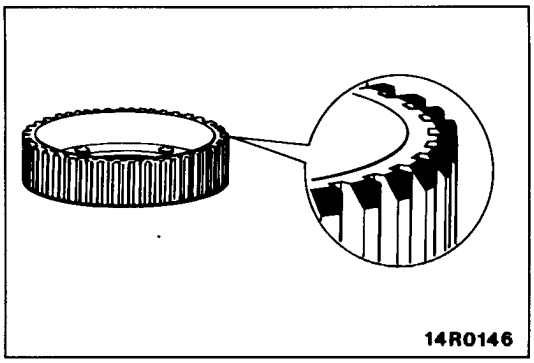
(3) Remove all connections from the speed sensor, and then measure the resistance between terminals (1) and (2) and the body of the speed sensor.

Standard value: 100kΩ or more

If the speed sensor insulation resistance is outside the standard value range, replace with a new speed sensor.

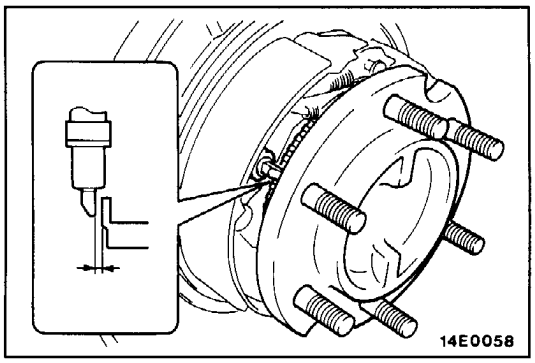
(4) Check the speed sensor cable for breakage, damage or disconnection; replace with a new one if a problem is found.

NOTE
When checking for cable damage, remove the cable clamp part from the body and then bend and pull the cable near the clamp to check whether or not temporary disconnection occurs.



TOOTHED ROTOR

Check whether rotor teeth are broken or deformed, and, if so, replace the rotor.



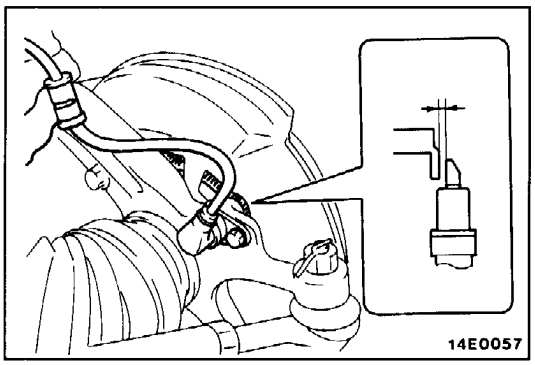
SERVICE POINTS OF INSTALLATION E35YDAE

4. INSTALLATION OF REAR SPEED SENSOR

Insert a thickness gauge into the space between the speed sensor's pole piece and the rotor's toothed surface and then tighten the speed sensors at the position where the clearance is the standard value.

Standard value: 0.3–0.9 mm (0.012–0.035 in.)

NOTE
Check to be sure that there is no contact of the speed sensor's pole piece and the rotor's toothed surface when the rear hub assembly is slowly rotated one time.
If there is contact, it is probable that the rotor or the rear hub is installed incorrectly, recheck installation.



1. INSTALLATION OF FRONT SPEED SENSOR

Insert a thickness gauge into the space between the speed sensor's pole piece and the rotor's toothed surface, and check that the clearance at all points is at the standard value.

Standard value: 0.2–1.0 mm (0.008–0.039 in.)

NOTE
If the clearance between the speed sensor's pole piece and the rotor's toothed surface is not within the standard value range, it is probable that the rotor is incorrectly installed, recheck installation.

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ELECTRONIC CONTROL UNIT <A.B.S.>

E35ZA--

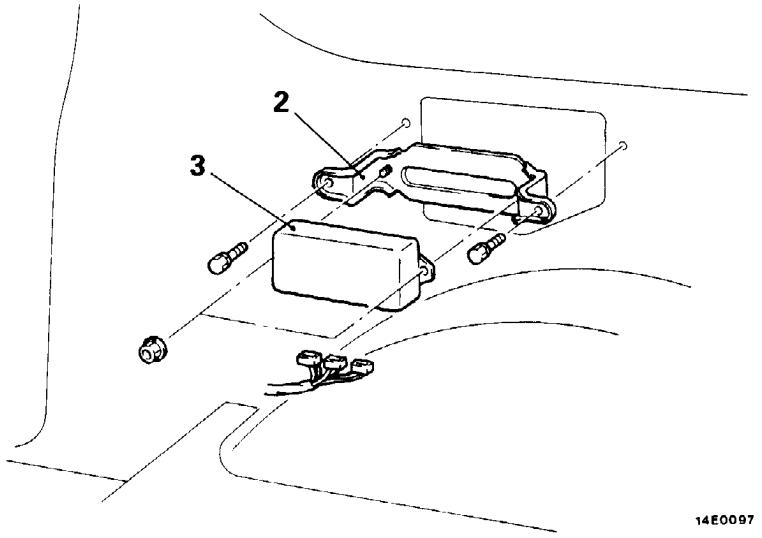
REMOVAL AND INSTALLATION

<2-door models>

Removal steps

- Quarter trim, lower (Refer to GROUP 52 – Trim.)

2. Bracket
3. Electronic control unit

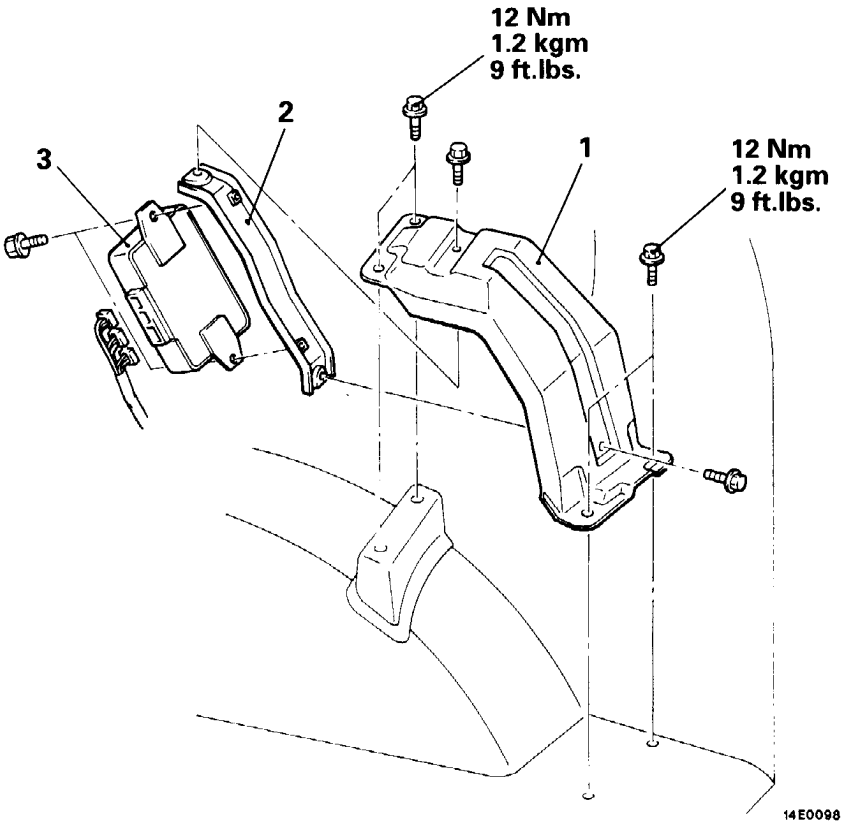


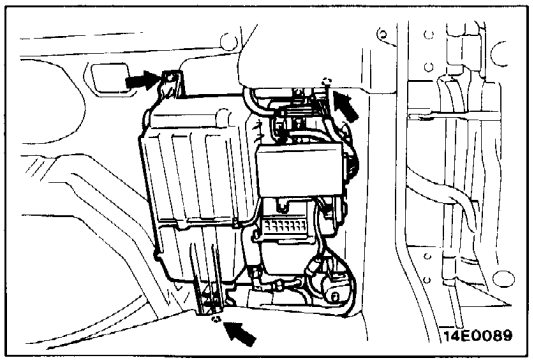
<4-door models>

Removal steps

- Quarter trim, lower (Refer to GROUP 52 – Trim.)

◆◆ 1. Third seat bracket (A) <vehicles with rear air conditioning>
2. Bracket
3. Electronic control unit





SERVICE POINTS OF REMOVAL

E35ZBAC

1. REMOVAL OF THIRD SEAT BRACKET (A) <VEHICLES WITH REAR AIR CONDITIONING>

(1) Remove the rear air conditioning unit mounting bolt.
(2) Remove the third seat bracket (A) mounting bolt, and pull the third seat bracket (A) forward.

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PARKING BRAKES

CONTENTS

E36AA--

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- Sealant 2

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PARKING BRAKE LEVER **4**

PARKING BRAKE CABLE **5**

PARKING BRAKE DRUM **7**

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SPECIFICATIONS

SERVICE SPECIFICATION

E36CB--

Items		Specifications
Standard value		
Parking brake lever stroke		4–6 notches
Brake lining thickness	mm (in.)	6.5 (0.256)
Brake drum inner diameter	mm (in.)	197 (7.76)
Limit		
Brake lining thickness	mm (in.)	4.5 (0.177)
Brake drum inner diameter	mm (in.)	198 (7.80)

LUBRICANTS

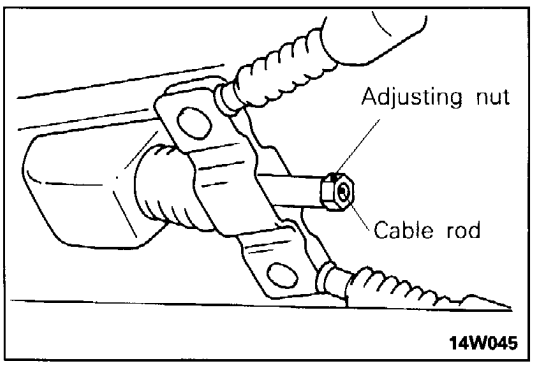
E36CD--

Items	Specified lubricant	Quantity
Backing plate Shoe and lining assembly Adjuster	Brake grease SAE J310, NLGI No.1	As required

SEALANT

E36CE--

Items	Specified sealant	Remarks
Both sides of sealer	3M ATD Part No. 8661, 8663 or equivalent	Semi-drying sealant
Shoe holddown pin Backing plate	3M ATD Part No. 8513 or equivalent	Drying sealant



SERVICE ADJUSTMENT PROCEDURES

PARKING BRAKE LEVER STROKE INSPECTION AND ADJUSTMENT

E36FAAU

Standard value: 4–6 notches

If the parking brake lever stroke is not within the standard value range, make adjustment by the following procedures.

(1) Loosen the adjuster to slacken the parking brake cable.
(2) Remove the adjustment hole plug, and then use a flat-tip (–) screwdriver to turn the adjuster in the direction of the arrow (the direction which expands the shoe) so that the disc will not rotate.

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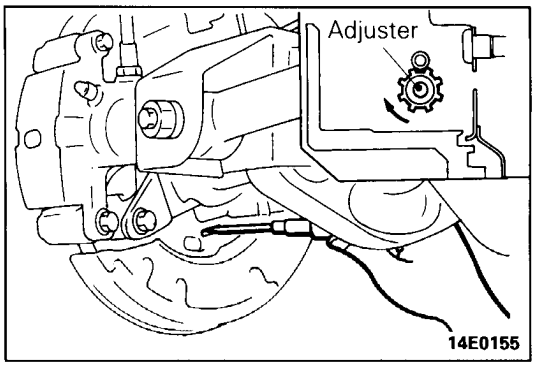
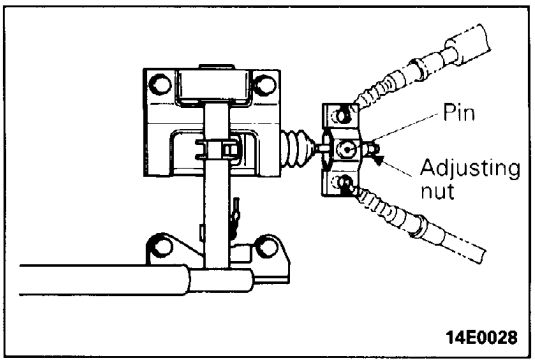
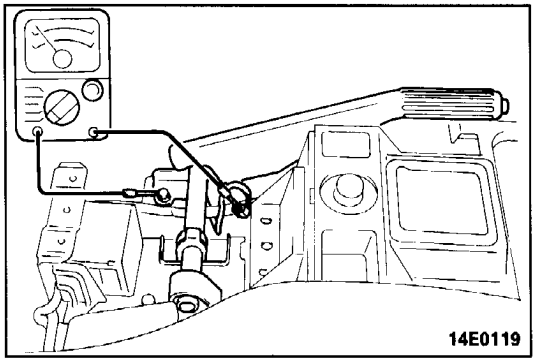


(3) Return the adjuster 3–4 notches in the direction opposite to the direction of the arrow.
(4) Turn the adjusting nut to adjust the parking brake lever stroke to within the standard value range.

Caution
If the number of brake lever notches engaged is less than the standard value, the cable has been pulled excessively. Be sure to adjust it to within the standard value.



(5) After making the adjustment, check to be sure that there is no play between the adjusting nut and the pin. Also check that the adjusting nut is securely held at the nut holder.
(6) After adjusting the lever stroke, jack up the rear of the vehicle.
(7) With the parking brake lever in the released position, turn the rear wheel to confirm that the rear brakes are not dragging.

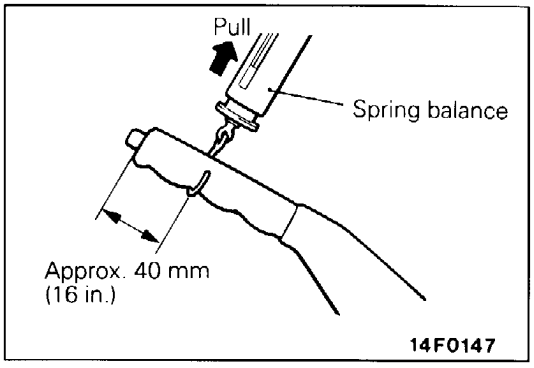


PARKING BRAKE SWITCH CHECK E36FCAH

(1) Disconnect the connector of the parking brake switch, and connect an ohmmeter to the parking brake switch and the switch installation bolt.
(2) The parking brake switch is good if there is continuity when the parking brake lever is pulled and there is no continuity when it is returned.

LINING RUNNING-IN

Carry out running-in by the following procedure when replacing the parking brake linings or the rear brake disc rotors, or when brake performance is insufficient.



(1) Adjust the parking brake stroke to the specified value. (Refer to P.36-2.)
(2) Hook a spring balance onto the the centre of the parking brake lever grip and pull it with a force of 100–150 N (10–15 kgf, 22–23 lbs.) in a direction perpendicular to the handle.
(3) Drive the vehicle at a constant speed of 35–50 km/h (22–30 mph) for 100 metres (330 ft.).
(4) Release the parking brake and let the brakes cool for 5–10 minutes.
(5) Repeat the procedure in steps (2) to (4) 4–5 times.

Caution
Carry out running-in in a place with good visibility, and pay careful attention to safety.

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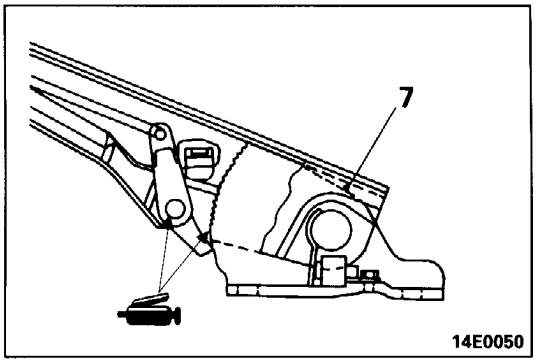
PARKING BRAKE LEVER

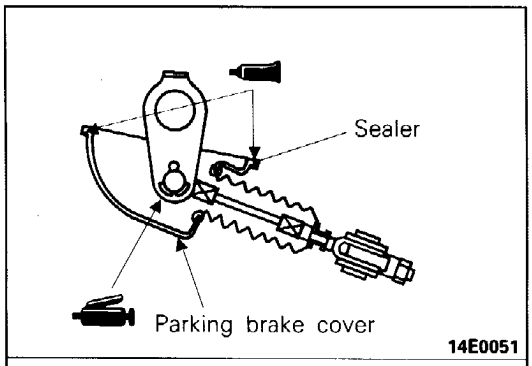
REMOVAL AND INSTALLATION

E36GA--

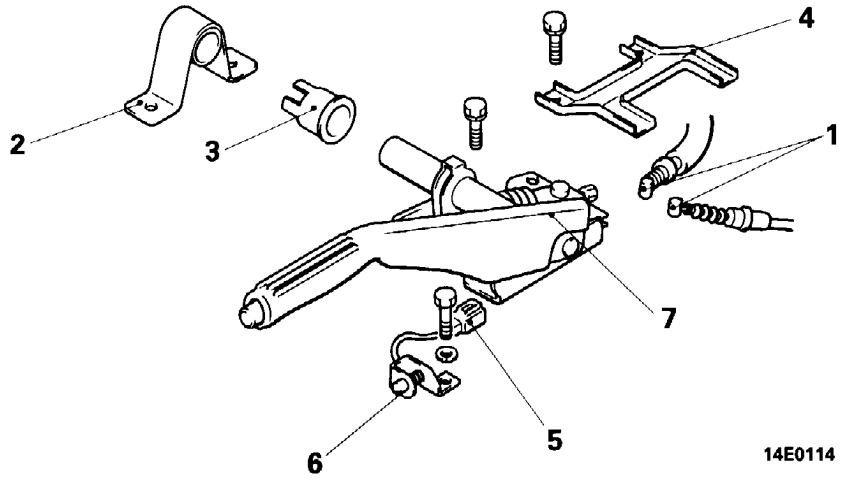
Pre-removal Operation
- Removal of Floor Console Assembly (Refer to GROUP 52 – Floor Console.)

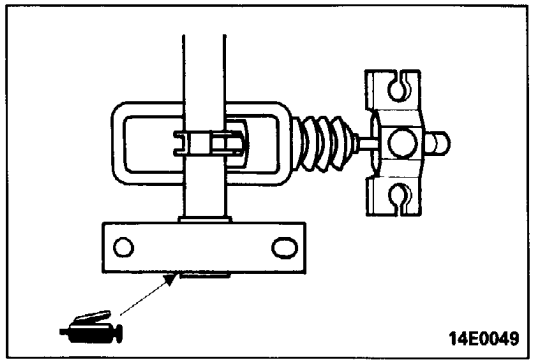
Post-installation Operation
- Adjustment of Parking Brake Lever Stroke (Refer to P.36-2.)
- Installation of Floor Console Assembly (Refer to GROUP 52 – Floor Console.)





Sealant: 3M ATD Part No. 8661, 8663 or equivalent





Removal steps
1. Connection for parking brake cable
2. Parking brake stay
3. Bushing
4. Parking brake shaft cover
5. Parking brake switch connector
6. Parking brake switch
7. Parking brake lever

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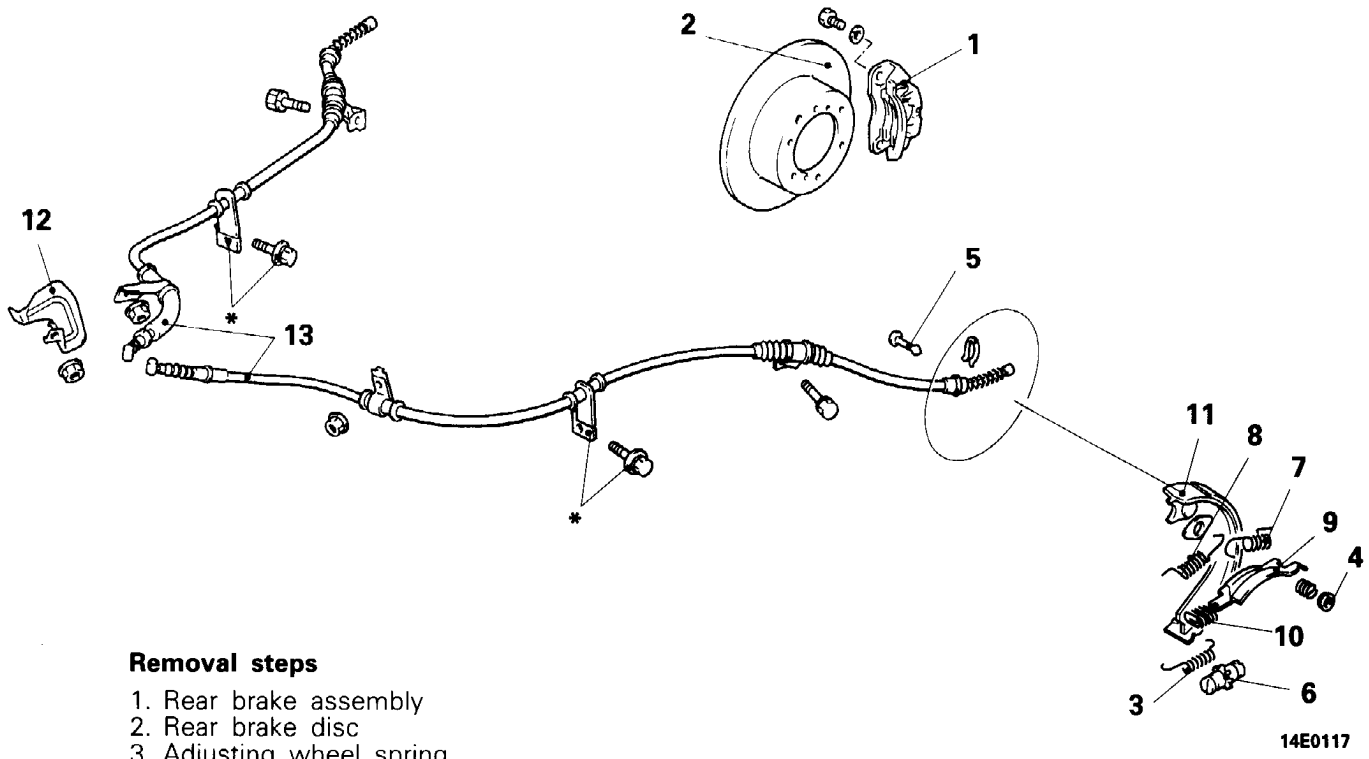
PARKING BRAKE CABLE

REMOVAL AND INSTALLATION

E36KA--

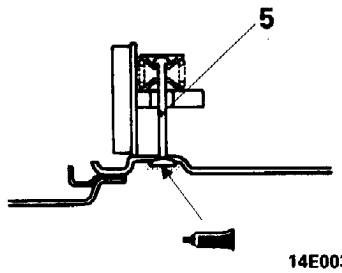
Post-installation Operation
- Adjustment of Parking Brake Lever Stroke (Refer to P.36-2.)



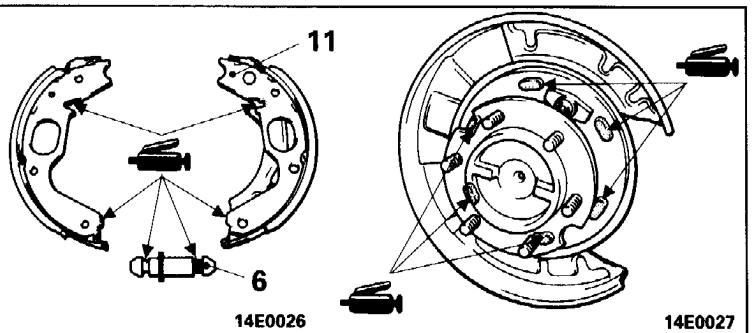
Removal steps

1. Rear brake assembly
2. Rear brake disc
3. Adjusting wheel spring
4. Shoe hold-down cup
5. Shoe hold-down pin
- ◆◆ 6. Adjuster
- ◆◆ 7. Anchor to shoe spring
- ◆◆ 8. Anchor to shoe spring
9. Strut
10. Strut to shoe spring
11. Shoe and lining assembly

NOTE
* indicates 4-door models.



Sealant: 3M ATD Part No. 8513 or equivalent



Brake grease: Brake grease SAE J310, NLGI No.1

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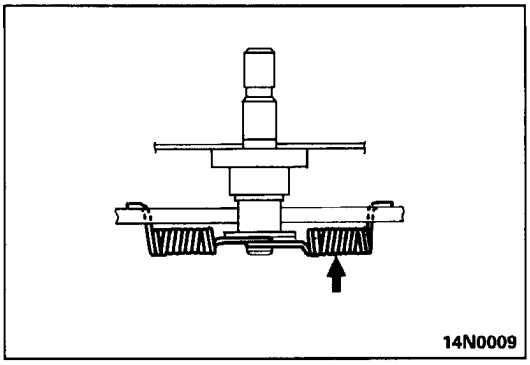
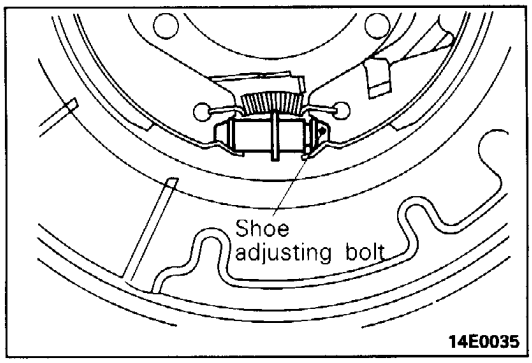

14N0009

SERVICE POINTS OF INSTALLATION E36KBAG

8./7. INSTALLATION OF ANCHOR TO SHOE SPRING

The load on the respective anchor-to-shoe springs is different, so the spring indicated by the arrow has been painted for identification.



14E0035

6. INSTALLATION OF ADJUSTER

Install the adjuster so that the shoe adjusting bolt for the left-hand wheel is towards the rear of the vehicle, and the shoe adjusting bolt for the right hand wheel is towards the front of the vehicle. Shoe adjusting bolt

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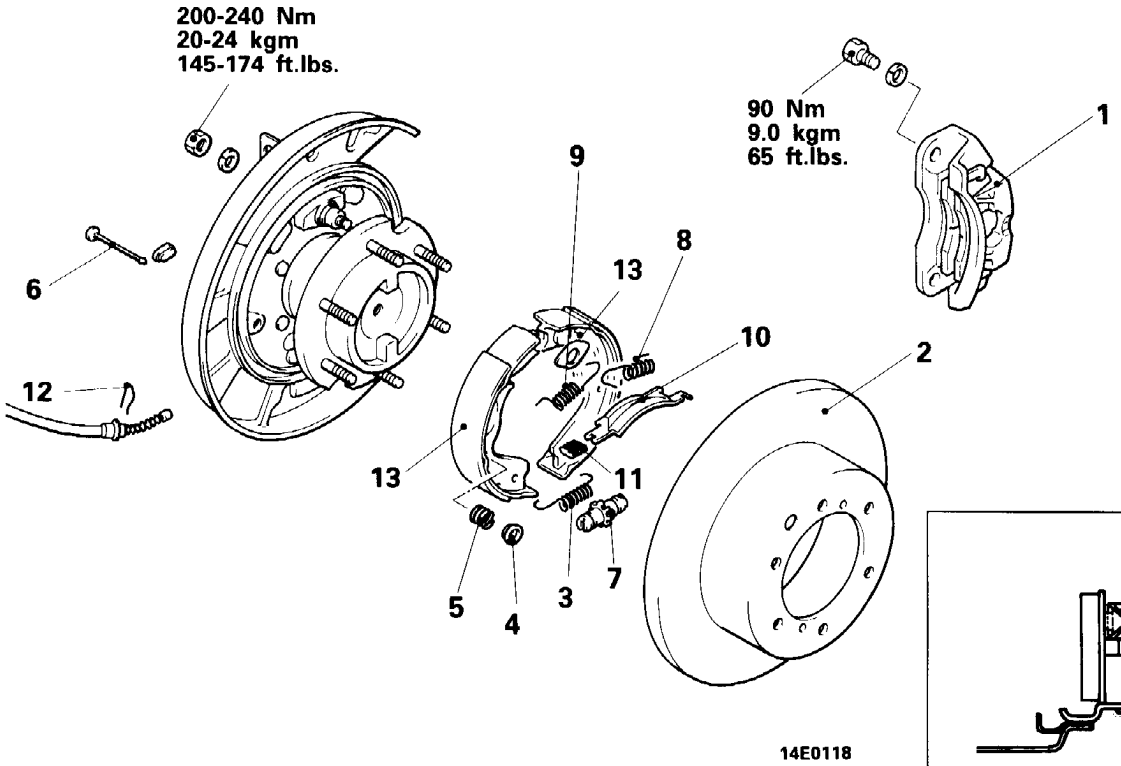
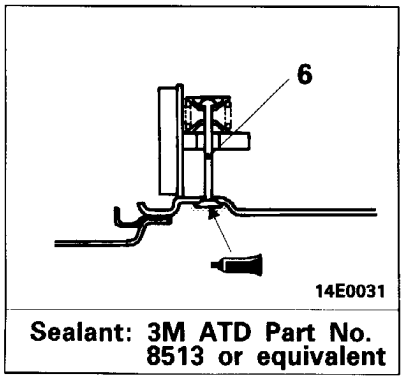
PARKING BRAKE DRUM

REMOVAL AND INSTALLATION

E36RA--

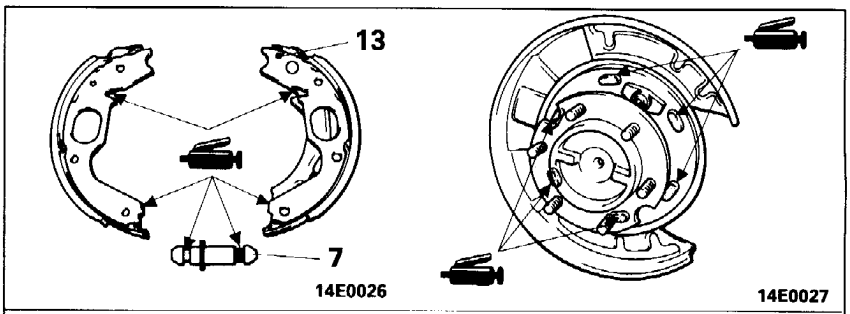
Post-installation Operation
- Lining running-in (Refer to P.36-3.)



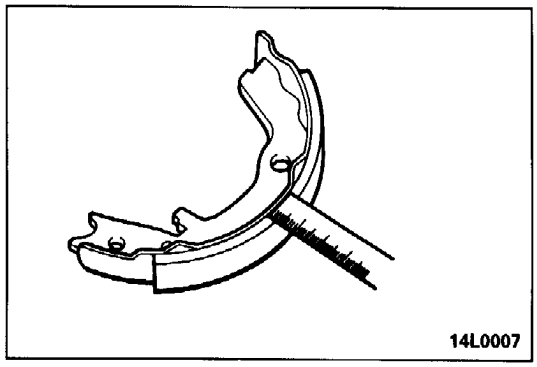


Sealant: 3M ATD Part No. 8513 or equivalent

Removal steps
1. Rear brake assembly
2. Rear brake disc
3. Adjusting wheel spring
4. Shoe hold-down cup
5. Shoe hold-down spring
6. Shoe hold-down pin
◆◆ 7. Adjuster
◆◆ 8. Anchor to shoe spring
◆◆ 9. Anchor to shoe spring
10. Strut
11. Strut to shoe spring
12. Clip
13. Shoe and lining assembly



Brake grease: Brake grease SAE J310, NLGI No.1



INSPECTION

E36RCAB

UNUSUAL WEAR OF THE BRAKE LINING AND BRAKE DRUM

(1) Measure the thickness of the brake lining at several places.

Standard value: 6.5 mm (0.256 in.)
Limit: 4.5 mm (0.177 in.)

Caution
Replace the brake shoes if the thickness of the brake lining is the limit value or less.

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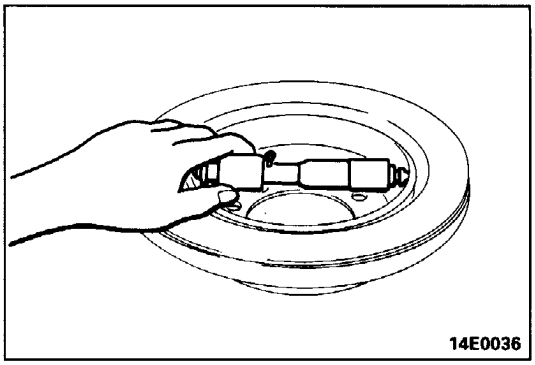
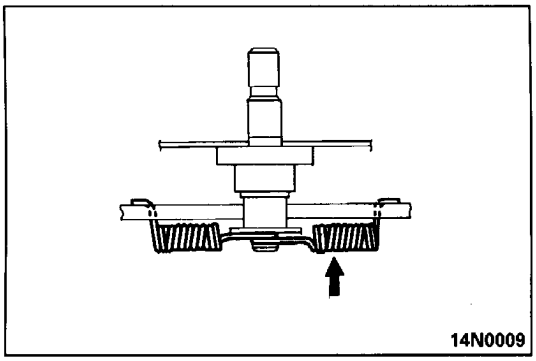

14E0036

(2) Measure the brake disc drum inner diameter at two or more places.

Standard value: 197 mm (7.76 in.)
Limit: 198 mm (7.80 in.)

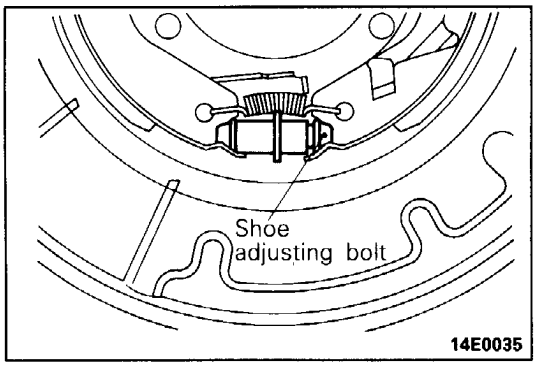
Caution
Replace if the brake disc drum inner diameter is the limit value or more.

SERVICE POINTS OF INSTALLATION E36RDAE


14N0009

9./8. INSTALLATION OF ANCHOR TO SHOE SPRING

The load on the respective anchor-to-shoe springs is different, so the spring indicated by the arrow has been painted for identification.



14E0035

7. INSTALLATION OF ADJUSTER

Install the adjuster so that the shoe adjusting bolt for the left-hand wheel is towards the rear of the vehicle, and the shoe adjusting bolt for the right hand wheel is towards the front of the vehicle.

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STEERING

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SUPPLEMENTAL RESTRAINT SYSTEM (SRS) – AIR BAG

(1) An SRS air bag for the driver's side seat is optional equipment in this vehicle.

(2) The SRS includes the following components: impact sensors, SRS diagnosis unit: SRS warning lamp, air bag module, clock spring, interconnecting wiring. Other SRS-related components (that may have to be removed/installed in connection with SRS service or maintenance) are indicated in the table of contents by an asterisk (*).

WARNING!

(1) Improper service or maintenance of any component of the SRS, or any SRS-related component, can lead to personal injury or death to service personnel (from inadvertent firing of the air bag) or to the driver (from rendering the SRS inoperative).

(2) Service or maintenance of any SRS component or SRS-related component must be performed only at authorized MITSUBISHI dealer.

(3) MITSUBISHI dealer personnel must thoroughly review this manual, and especially its GROUP 52B – Supplemental Restraint System (SRS), before beginning any service or maintenance of any component of the SRS or any SRS-related component.

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SPECIFICATIONS

SERVICE SPECIFICATIONS

E37CB--

Items		Specifications
Standard value		
Steeering angle		
Inner wheel		32°40′ $-\frac{0}{3}$
Outer wheel		29°45′
Steering gear oil level	mm (in.)	25 (0.98)
Stationary steering effort	N (kg, lbs.)	37 (3.7, 8.2)
Drive belt tension	mm (in.)	
2400		
When checked		6.0–10.0 (0.236–0.394)
When a new belt is installed		5.5 (0.217)
When an old belt is installed		7.0 (0.276)
3000 –12 VALVE		
When checked		9.0–14.5 (0.354–0.571)
When a new belt is installed		8.0 (0.315)
When an old belt is installed		10.0 (0.394)
3000–24 VALVE		
When checked		10.5–14.5 (0.413–0.571)
When a new belt is installed		9.5–11.5 (0.374–0.452)
When an old belt is installed		11.5–13.5 (0.452–0.531)
3500		
When checked		13.0–17.0 (0.511–0.669)
When a new belt is installed		11.0–13.0 (0.433–0.511)
When an old belt is installed		14.0–16.0 (0.551–0.630)
2500D		
<Vehicles built up to October, 1993>		
When checked		9.0–11.0 (0.354–0.433)
When a new belt is installed		7.0 (0.276)
When an old belt is installed		9.5 (0.374)
<Vehicles built from November, 1993>		
When checked		8.0–12.0 (0.315–03472)
When a new belt is installed		6.0–8.0 (0.236–0.315)
When an old belt is installed		9.0–11.0 (0.354–0.433)
Oil pump pressure	MPa (kg/cm^2, psi)	
<2400, 3000–12 VALVE, 2500D>		
Oil pump relief pressure		7.5–8.2 (75–82, 1,067–1,166)
Pressure under no-load conditions		0.8–1.0 (8–10, 114–142)
Steering gear retention hydraulic pressure		7.5–8.2 (75–82, 1,067–1,166)
<3000–24 VALVE, 3500, 2800D>		
Oil pump relief pressure		8.3–9.0 (83–90, 1,195–1,280)
Pressure under no-load conditions		0.8–1.0 (8–10, 114–142)
Steering gear retention hydraulic pressure		8.3–9.0 (83–90, 1,195–1,280)

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Items		Specifications
Pressure switch activation oil pressure	MPa (kg/cm^2, psi)	
OFF → ON		1.5–2.0 (15–20, 213–284)
ON → OFF		0.7–1.2 (7–12, 100–171)
Mainshaft starting torque (Manual steering)	Nm (kgcm, in.lbs.)	0.35–0.55 (3.5–5.5, 3–5)
Mainshaft axial play (Power steering)	mm (in.)	0.03–(0.0012)or less
Cross-shaft axial play	mm (in.)	
Manual steering		0.05 (0.0020)
Power steering		0.05 (0.0020)
Mainshaft total starting torque	Nm (kgcm, in.lbs.)	
Manual steering		0.65–0.85 (6.5–8.5, 5.7–7.3)
Power steering		0.45–1.25 (4.5–12.5, 4–11)
Ball joint starting torque	Nm (kgcm, in.lbs.)	
Tie rod end		1–3 (10–30, 8.9–26)
Idler arm		0.5–2.0 (5–20, 4–17)
Idler arm turning torque	Nm (kgcm, in.lbs.)	0.3–2.0 (3–20, 3–17)
Spring balance reading	N (kg, lbs)	2.3–15.4 (0.23–1.54, 0.5–33.9)
Limit		
Steering wheel free play	mm (in.)	
Manual steering		50 (1.97)
Power steering		50 (1.97)
Steering gear backlash	mm (in.)	0.5 (0.020)
Ball joint axia play	mm (in.)	1.5 (0.059)
Backlash between ball groove of rack piston and balls	mm (in.)	0.05 (0.0020)
Gap between vane and rotor groove	mm (in.)	0.06 (0.0024)
Clearance between oil pump drive shaft and pump body	mm (in.)	0.1 (0.004)

LUBRICANTS

E37CD--

Items	Specified lubricant	Quantity
Manual steering gear oil	Hypoid gear oil API GL-4 or higher SAE 80	210 cm^3 (12.81 cu.in.)
Power steering fluid		
L.H. drive vehicles		
<2800D>	Automatic transmission fluid DEXRON or DEXRON II	1.11 dm^3 (1.17 U.S.qts., 0.98 Imp.qts.)
<Except 2800D>		1.06 dm^3 (1.12 U.S.qts., 0.93 Imp.qts.)
R.H. drive vehicles		
<2800D>		1.02 dm^3 (1.08 U.S.qts., 0.90 Imp.qts.)
<Except 2800D>		0.97 dm^3 (1.02 U.S.qts., 0.85 Imp.qts.)
Power steering gear box		
Bearing, O-ring and oil seal	Automatic transmission fluid DEXRON or DEXRON II	As required
Oil pump		
Flow control valve and O-ring Friction surface of rotor, vane, cam ring and pump cover	Automatic transmission fluid DEXRON or DEXRON II	As required

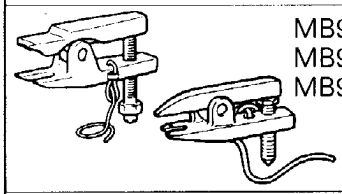
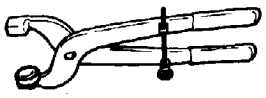
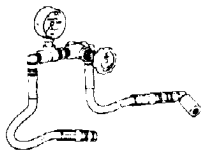
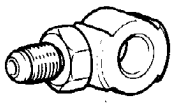
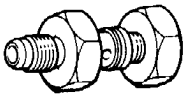
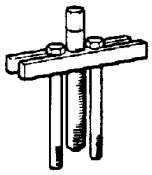
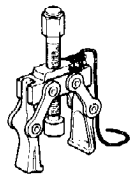
SEALANTS AND ADHESIVES

E37CE--

Items	Specified sealant and adhesive	Remarks
Steering column cover assembly installation hole Dash panel cover installed surface Manual steering gear box top cover packing Manual steering gear box cross-shaft adjusting and lock nut Manual steering gear box top cover bolt Manual steering gear box adjusting shim Tie-rod end dust cover installed surface	3M ATD Part No. 8661 or equivalent	Semi-drying sealant
Inside of steering column lower pipe bearing Connection of steering column upper and steering column lower (Nut side)	3M Stud Locking Part No. 4170 or equivalent	Semi-drying sealant
Steering column upper bearing	3M ATD Part No. 8001 or equivalent	Semi-drying sealant

SPECIAL TOOLS

E37DA--

Tool	Number	Name	Use
	MB990635, MB991113 or MB991406	Steering linkage puller	Disconnection of the steering linkage
	MB990948	Steering linkage joint gauge	Measurement of the ball joint axial play
	MB990662	Oil pressure gauge	Measurement of the oil pump pressure
	MB990993	Power steering oil pressure gauge adapter (pump side)	
	MB990994	Power steering oil pressure gauge adapter (hose side)	
	MB990803	Steering wheel puller	Removal of the steering wheel
	MB990826	Torx wrench	Removal and installation of the steering column
	MB990628	Snap ring pliers	Removal and installation of snap ring
	MB990915	Pitman arm puller	Removal of the pitman arm

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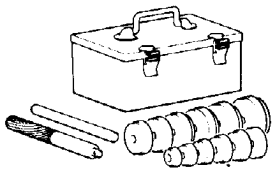
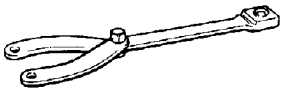
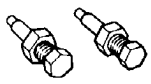
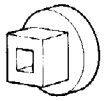
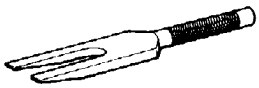
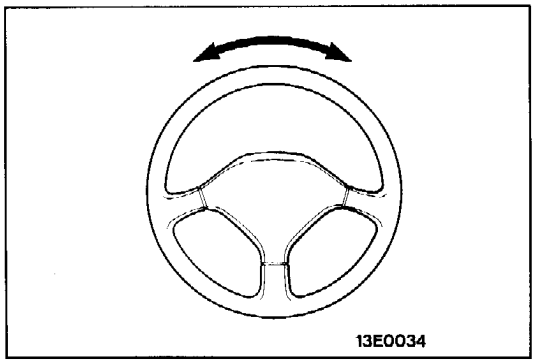
Tool	Number	Name	Use
	MB990925	Bearing and oil seal installer set	Installation of the oil seal and the ball bearing (Refer to GROUP 26.) MB990938, MB990928, MB990926, MB991203
	MB991151 MB990685	Torque wrench	Measurement of the mainshaft starting torque
	MB991006 or MB990228	Preload socket	Measurement of the mainshaft total starting torque
	MB991367	Special spanner	Removal and installation of the lock nut
	MB991394	Pin set	
	MB990326	Preload socket	Measurement of the ball joint starting torque
	MB990778	Ball joint remover	Disconnection of idler arm from relay rod



SERVICE ADJUSTMENT PROCEDURES

STEERING WHEEL FREE PLAY CHECK

MANUAL STEERING

E37FAAF

Standard value: **26.6 mm (1.05 in.) or less**
Limit: **50 mm (1.97 in.)**

If the measured value exceeds the repair limit, check the steering gear backlash and ball joint axial play.

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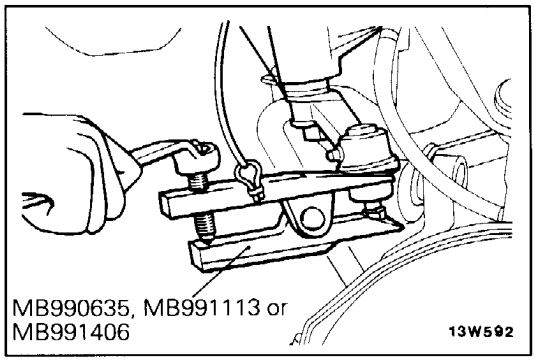
POWER STEERING

1. With the engine stationary and the steering wheel in the straight-ahead position, apply a force of 5 N (0.5 kg, 1.1 lbs.) to the steering wheel in the peripheral direction.

   Standard value: 26.6 mm (1.05 in.) or less
   Limit: 50 mm (1.97 in.)

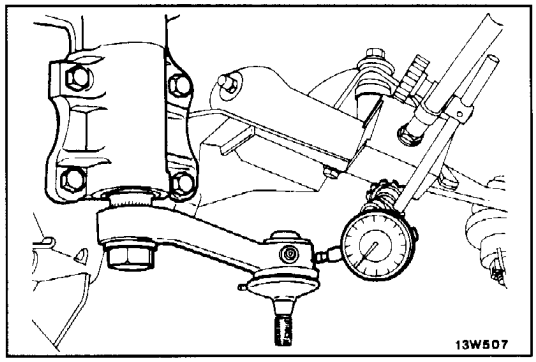
2. If the measured value exceeds the repair limit, check the steering gear backlash and ball joint axial play.



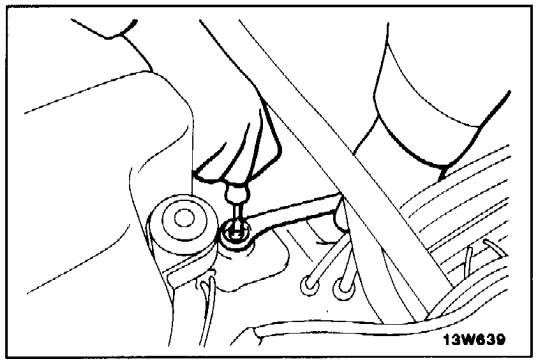
STEERING GEAR BACKLASH CHECK E37FBAC

1. Jack up to the vehicle front and hold the steering wheel in the straight ahead position.
2. Apart the pitman arm and the relay rod.

   Caution
   1. Use cord to bind the special tool closely so it will not become separated.
   2. The nut should be loosened only, not removed.



Limit: 0.5 mm (0.020 in.)



3. If the measured value exceeds the limit, screw in the steering gear box adjusting bolt until steering wheel free play is within the range of standard value.

   Caution
   1. Be sure to make the adjustment with the steering wheel in the straight-ahead position.
   2. If the adjusting bolt is overtightened, more steering effort will be required, and return of the wheel will be adversely affected.

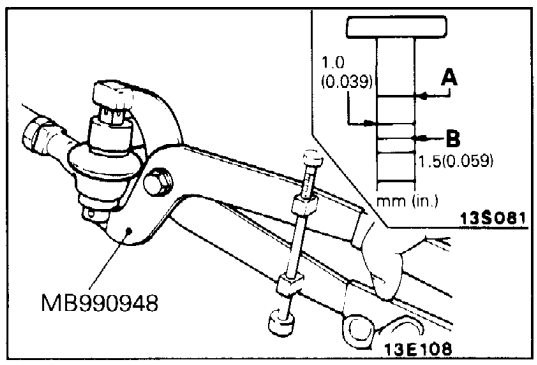
BALL JOINT AXIAL PLAY CHECK (TIE ROD END AND PITMAN ARM) E37FCAG

1. Hold the ball joint by using the special tool.
2. Set the scale of special tool to the upper limit (A), compress the ball stud, and measure the axial play. The measured displacement should be between the upper limit (A) and the centre graduation (B).

   Limit: 1.5 mm (0.059 in.)

3. If the measured displacement exceeds the centre graduation (B), replace the ball joint.

   Caution
   Even if the variation is within the limit, check ball joint starting torque.



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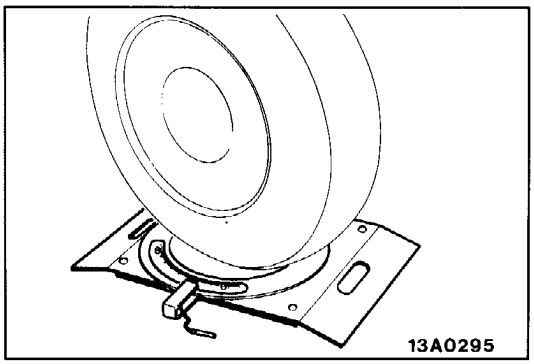
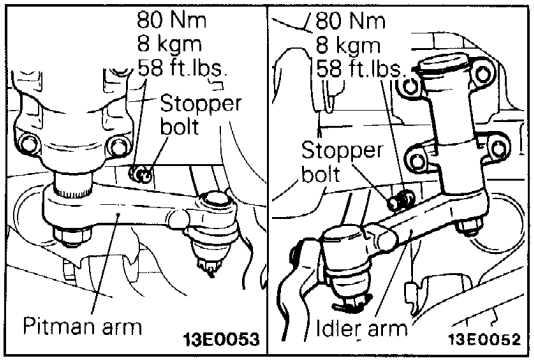


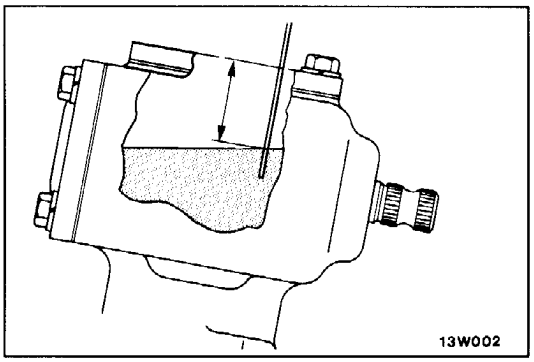
STEERING ANGLE CHECK E37FDAH

1. Place the front wheel on a turning radius gauge and measure the steering angle.

Standard value: **Inner wheel 32°40′ $^{0}_{-3}$′**
Outer wheel 29°45′



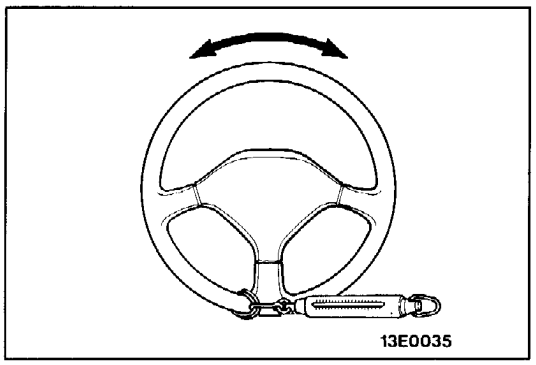
2. If the steering angle is outside the standard value, after checking the toe-in, (Refer to GROUP 33–Service Adjustment Procedures), adjust the steering angle with the stopper bolt.



STEERING GEAR OIL LEVEL CHECK (MANUAL STEERING) E37FEAAa

Remove the breather plug and check the oil level in the steering gear box by using a special gauge or a thin screwdriver.

Standard value: 25 mm (0.98 in.)



STATIONARY STEERING EFFORT CHECK (POWER STEERING) E37FFAG

1. Place the vehicle on a level surface and place the steering wheel in the straight-ahead position.
2. Set the engine speed to 1,000 r/min.

Caution
After checking the engine r/min., there must be a return to the standard idling r/min.

3. Measure the tangential force with a spring balance by turning the steering wheel clockwise and counterclockwise one and a half turns.

Standard value: 37 N (3.7 kg, 8.21 lbs.) or less

4. If the stationary steering effort exceeds the standard value, check for belt slackness, damage, insufficient oil, air mixed into oil, collapsed or twisted hoses, etc., and repair if found.

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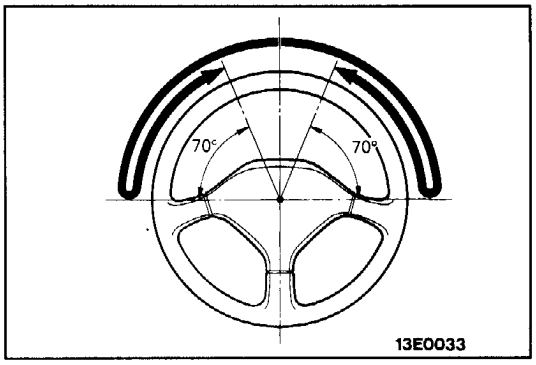
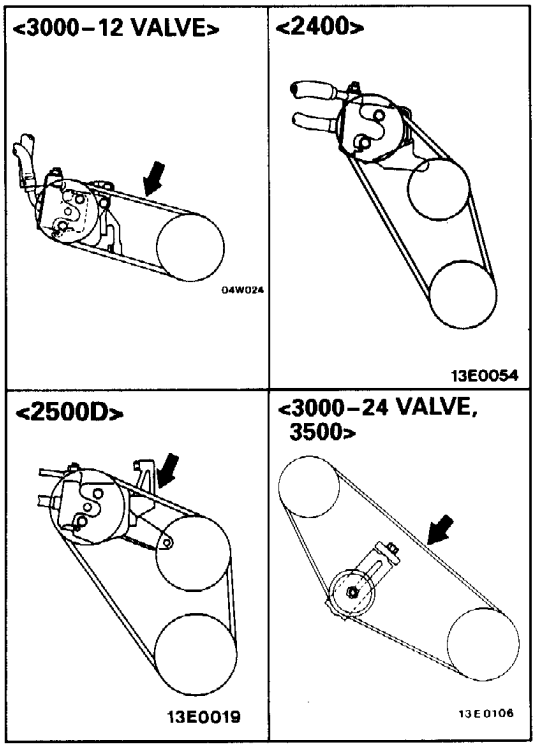


CHECKING OF THE STEERING WHEEL RETURN TO CENTRE (POWER STEERING) E37FGAA

To check for the return of steering wheel to centre, carry out drive test and check the following points.

1. Make gentle and sharp turns and check to get a feel for that there is no appreciable difference in steering effort and return to centre between right and left turns.
2. Drive at a speed of about 35 km/h (22 mph), turn the steering wheel 90° clockwise or counterclockwise, and release the wheel a second or two later. If the wheel returns more than 70°, the return may be considered good.

   NOTE
   When the steering wheel is turned abruptly, momentary hard steering might result, but this does not mean any problem. It is caused by low oil pump delivery during idling.



DRIVE-BELT TENSION CHECK (POWER STEERING) E37FHAI

1. Measure the flexion of the V belt when it is subjected to a force of 10 kg in the place shown.

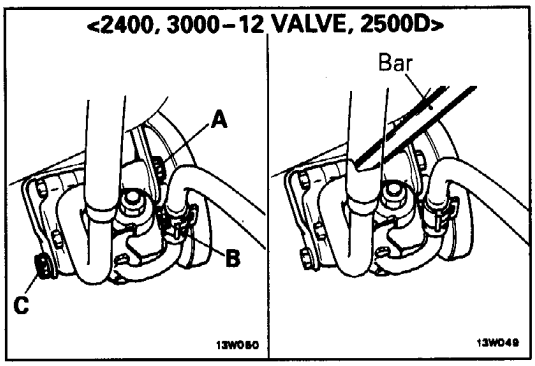
Standard value:

mm (in.)

	2400	3000-12 VALVE	3500
When checked	6.0–10.0 (0.236–0.394)	9.0–14.5 (0.354–0.571)	13.0–17.0 (0.511–0.669)
When a new belt is installed	5.5 (0.217)	8.0 (0.315)	11.0–13.0 (0.433–0.511)
When an old belt is installed	7.0 (0.276)	10.0 (0.394)	14.0–16.0 (0.551–0.630)

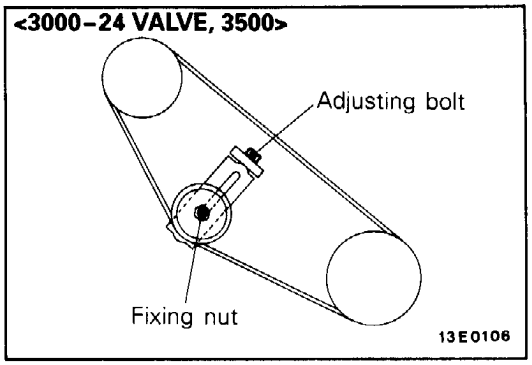
	3000 – 24 VALVE	2500D	
		V type	V-ribbed type
When checked	10.5–14.5 (0.413–0.571)	9.0–11.0 (0.354–0.433)	8.0–12.0 (0.315–0.472)
When a new belt is installed	9.5–11.5 (0.374–0.452)	7.0 (0.276)	6.0–8.0 (0.236–0.315)
When an old belt is installed	11.5–13.5 (0.452–0.531)	9.5 (0.374)	9.0–11.0 (0.354–0.433)

2. If the flexion value is outside the standard value, adjust by the following procedure.



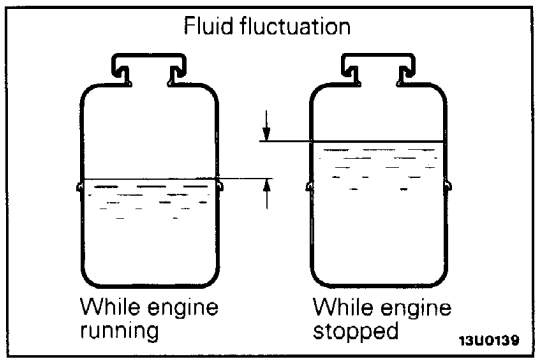
<2400, 3000–12 VALVE, 2500D>

(1) Loosen oil pump fixing bolts A, B and C.
(2) Adjust the amount of flexion in the belt by setting a bar against the body of the oil pump and tightening the belt by hand to the appropriate amount.
(3) Tighten the fixing bolts A, B and C in that order.



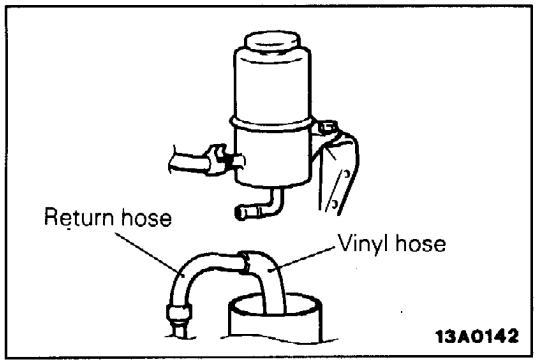
<3000–24 VALVE, 3500>

(1) Loosen tension pulley fixing nut.
(2) Adjust belt tension with adjusting bolt.
(3) Tighten fixing nut.



FLUID LEVEL CHECK (POWER STEERING) E37FIAD

1. Park the vehicle on a flat, level surface, start the engine, and then turn the steering wheel several times to raise the temperature of the fluid to approximately 50–60°C (122–140°F).
2. With the engine running, turn the wheel all the way to the left and right several times.
3. Check the fluid in the oil reservoir for foaming or milkiness.
4. Check the difference of the fluid level when the engine is stopped, and while it is running. If the fluid level changes considerably, air bleeding should be done.



FLUID REPLACEMENT (POWER STEERING) E37FJAG

1. Raise the front wheels on a jack, and then support them with rigid racks.
2. Disconnect the return hose.
3. Connect a vinyl hose to the return hose, and drain the oil into a container.
4. On vehicles with a petrol engine, disconnect the high-tension cable. On vehicles with a diesel engine, remove the fuel cut valve connector attached to the injection pump.
   While operating the starting motor intermittently, turn the steering wheel all the way to the left and right several times to drain all of the fluid.

   Caution
   Be careful not to position the high-tension cable near the carburettor or the delivery pipe.
5. Connect the return hoses securely, and then secure it with the clip.
6. Fill the oil reservoir with the specified fluid up to the lower position of the filter, and then bleed the air.

   Specified fluid: Automatic transmission fluid DEXRON or DEXRON II

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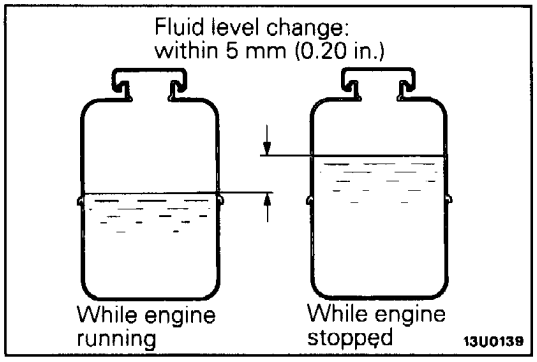
BLEEDING

E37FKAI

1. Jack up the front wheels and support them by using a rigid rack.
2. Manually turn the oil pump pulley a few times.
3. Turn the steering wheel all the way to the left and to the right five or six times.
4. On vehicles with a petrol engine, disconnect the high-tension cable. On vehicles with a diesel engine, remove the fuel cut valve connector attached to the injection pump. While operating the starting motor intermittently, turn the steering wheel all the way to the left and right five or six times (for 15 to 20 seconds).

   Caution
   1. **During air bleeding, refill the fluid supply so that the level never falls below the lower position of the filter.**
   2. **If air bleeding is done while engine is running, the air will be broken up and absorbed into the fluid; be sure to do the bleeding only while cranking.**
5. On vehicles with a petrol engine, connect the ignition cable. On vehicles with a diesel engine, connect the fuel cut valve connector attached to the injection pump. Start the engine (idling).
6. Turn the steering wheel to the left and right until there are no air bubbles in the oil reservoir.
7. Confirm that the fluid is not milky, and that the level is up to the specified position on the level gauge.
8. Confirm that there is very little change in the fluid level when the steering wheel is turned left and right.
9. Check whether or not the change in the fluid level is within 5 mm (0.20 in.) when the engine is stopped and when it is running.

   Caution
   1. **If the change of the fluid level is 5 mm (0.20 in.) or more, the air has not been completely bled from the system, and thus must be bled completely.**
   2. **If the fluid level rises suddenly after the engine is stopped, the air has not been completely bled.**
   3. **If air bleeding is not complete, there will be abnormal noises from the pump and the flow-control valve, and this condition could cause a lessening of the life of the pump, etc.**



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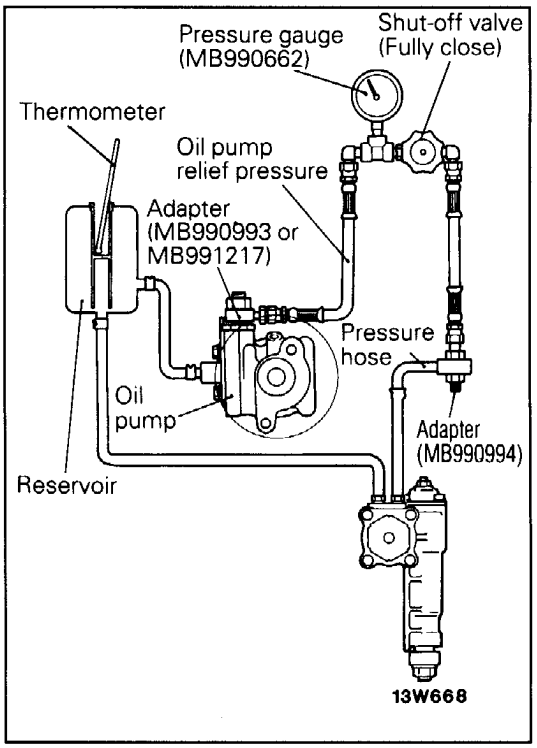


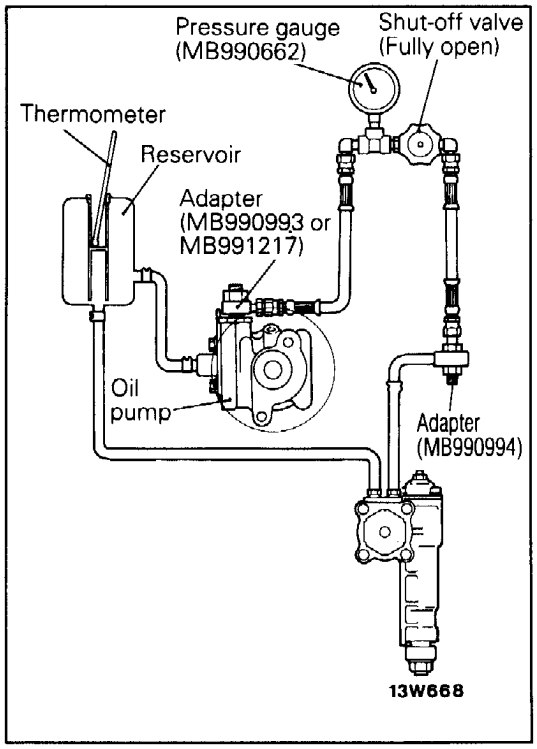
OIL PUMP PRESSURE TEST E37FLAE

CHECKING THE OIL PUMP RELIEF PRESSURE

1. Disconnect the pressure hose from the oil pump, and then connect the special tools.
2. Bleed the air, and then turn the steering wheel several times while the vehicle is not moving so that the temperature of the fluid rises to approximately 50–60°C (122–140°F).
3. Start the engine and idle it at 1,000 ± 100 r/min.
4. Fully close the shut-off valve of the pressure gauge and measure the oil pump relief pressure to confirm that it is within the standard value range.

   Standard value: <2400, 3000–12 VALVE, 2500D>
   7.5–8.2 MPa
   (75–82 kg/cm², 1,067–1,166 psi.)
   <3000–24 VALVE, 3500, 2800D>
   8.3–9.0 MPa
   (83–90 kg/cm², 1,195–1,280 psi.)

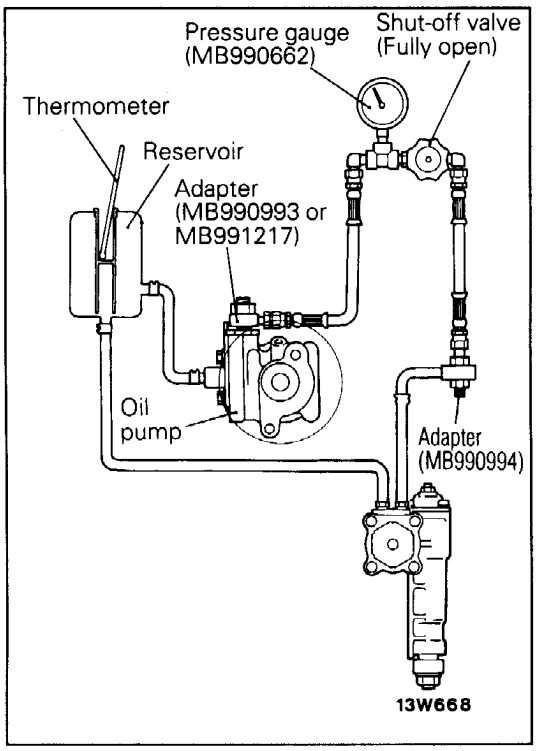
   Caution
   Pressure gauge shut off valve must not remain closed for more than 10 seconds.
5. If it is not within the standard value, overhaul the oil pump.
6. Remove the special tools, and then tighten the pressure hose to the specified torque.
7. Bleed the system.



CHECKING THE PRESSURE UNDER NO-LOAD CONDITIONS

1. Disconnect the pressure hose from the oil pump, and then connect the special tools.
2. Bleed the air, and then turn the steering wheel several times while the vehicle is not moving so that the temperature of the fluid raises to approximately 50–60°C (122–140°F).
3. Start the engine and idle it at 1,000 ± 100 r/min.
4. Check whether or not the hydraulic pressure is the standard value when no-load conditions are created by fully opening the shut-off valve of the pressure gauge.

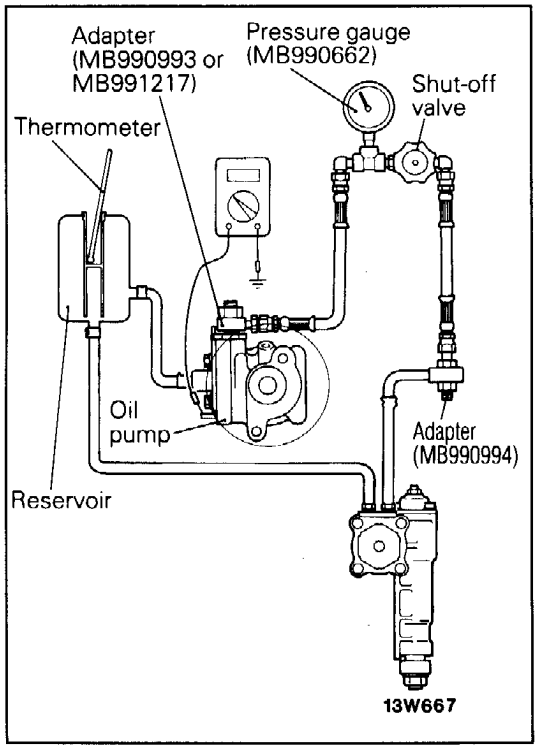
   Standard value: 0.8–1.0 MPa
   (8–10 kg/cm², 114–142 psi.)
5. If it is not within the standard value, the probable cause is a malfunction of the oil line or steering gear box, so check these parts and repair as necessary.
6. Remove the special tools, and then tighten the pressure hose to the specified torque.
7. Bleed the system.



CHECKING THE STEERING GEAR RETENTION HYDRAULIC PRESSURE

1. Disconnect the pressure hose from the oil pump, and then connect the special tools.
2. Bleed the air, and then turn the steering wheel several times while the vehicle is not moving so that the temperature of the fluid rises to approximately 50–60°C (122–140°F).
3. Start the engine and idle it at 1,000±100 r/min.
4. Fully close and fully open the shut-off valve of the pressure gauge.
5. Turn the steering wheel all the way to the left or right; then check whether or not the retention hydraulic pressure is the standard value.

   Standard value: **<2400, 3000–12 VALVE, 2500D>**
   7.5–8.2 MPa
   (75–82 kg/cm², 1,067–1,166 psi.)
   <3000–24 VALVE, 3500, 2800D>
   8.3–9.0 MPa
   (83–90 kg/cm², 1,195–1,280 psi.)
6. When not within the standard value, overhaul the steering gear box. Remeasure fluid pressure.
7. Remove the special tools, and then tighten the pressure hose to the specified torque.
8. Bleed the system.



POWER STEERING OIL PRESSURE SWITCH CHECK E37FQAA

1. Disconnect the pressure hose from the oil pump, and then connect the special tools.
2. Bleed the air, and then turn the steering wheel several times while the vehicle is not moving so that the temperature of the fluid rises to approximately 50–60°C (122–140°F).
3. The engine should be idling.
4. Disconnect the connector for the oil-pressure switch, and place an ohmmeter in position.
5. Gradually close the shut-off valve of the pressure gauge and increase the hydraulic pressure then check whether or not the hydraulic pressure that activates the switch is the standard value.

   Standard value: **1.5–2.0 MPa**
   (15–20 kg/cm², 213–284 psi.)
6. Gradually open the shut-off valve and reduce the hydraulic pressure; then check whether or not the hydraulic pressure that deactivates the switch is the standard value.

   Standard value: **0.7–1.2 MPa**
   (7–12 kg/cm², 100–171 psi.)
7. Remove the special tools, and then tighten the pressure hose to the specified torque.
8. Bleed the system.

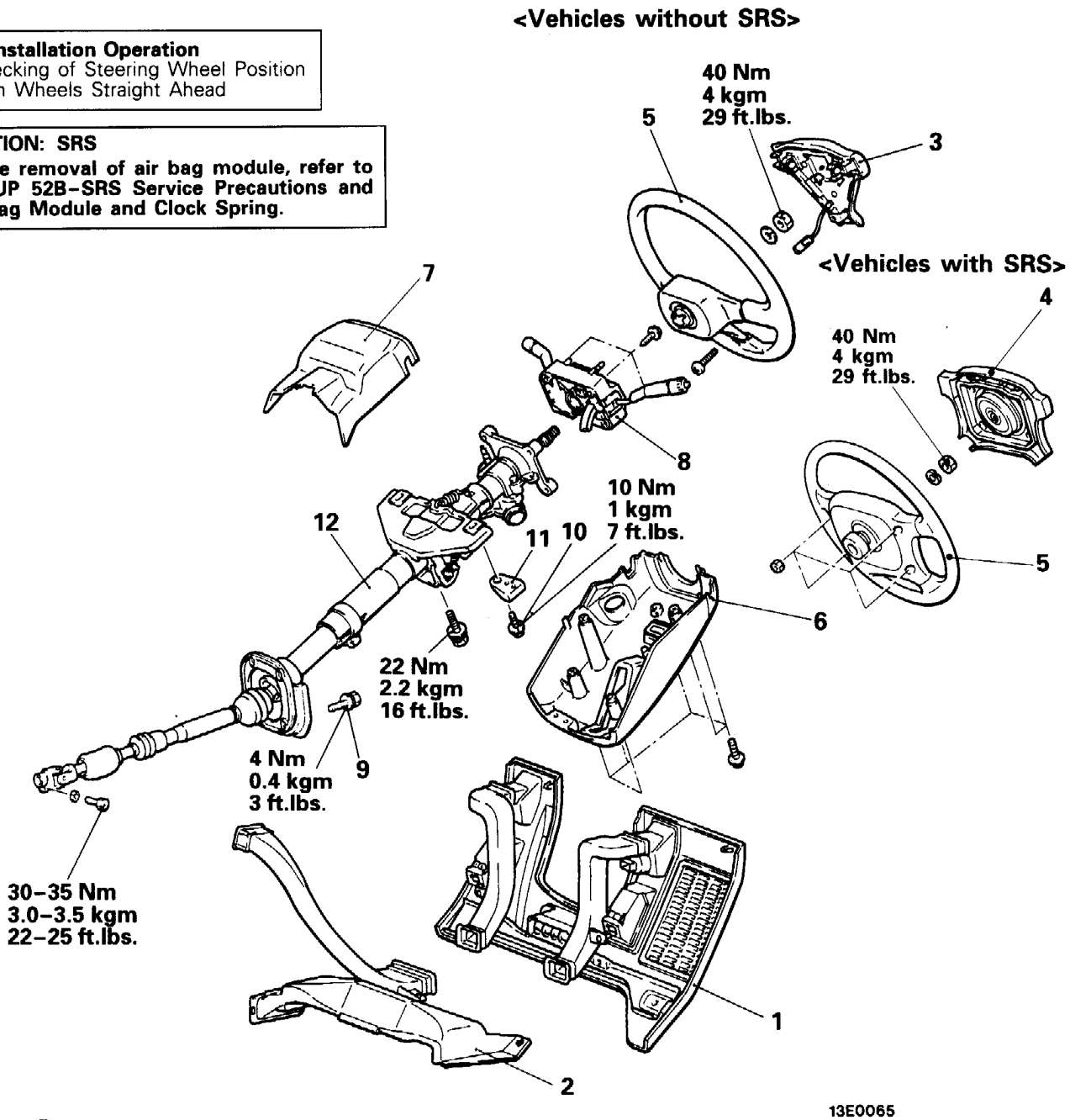
STEERING COLUMN AND SHAFT

REMOVAL AND INSTALLATION

E37HA--

Post-installation Operation
- Checking of Steering Wheel Position with Wheels Straight Ahead

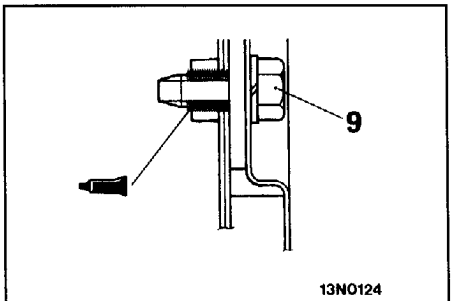
CAUTION: SRS
Before removal of air bag module, refer to GROUP 52B-SRS Service Precautions and Air Bag Module and Clock Spring.



13E0065

Removal steps

1. Instrument under cover (Refer to GROUP 52A-Instrument Panel.)
2. Lap cooler duct and foot shower duct (Refer to GROUP 55-Ventilators.)
3. Horn pad
4. Air-bag module (Refer to GROUP 52B-Air Bag Module and Clock Spring.)
5. Steering wheel assembly
6. Lower column cover
7. Upper column cover
8. Column switch
9. Cover attaching bolt
10. Special screw
11. Special washer
12. Steering column and shaft assembly



13N0124

Sealant: 3M ATD Part No. 8661 or equivalent

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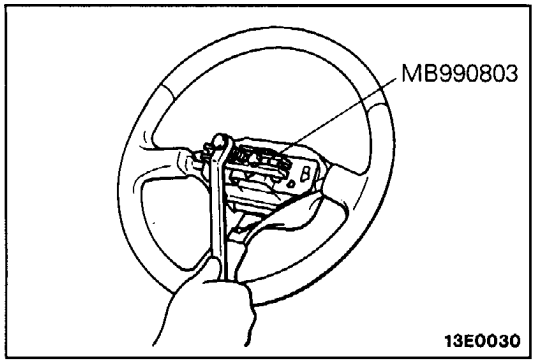
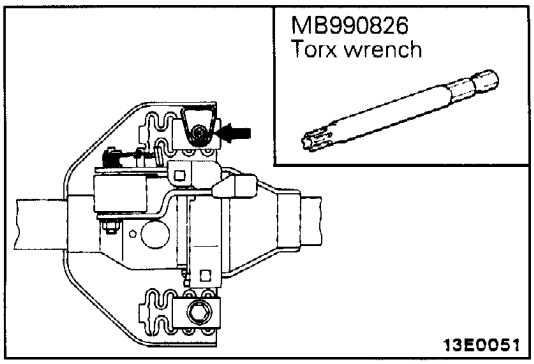


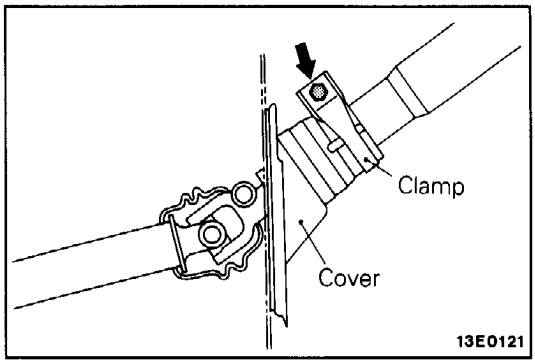
SERVICE POINTS OF REMOVAL E37HBAT

5. REMOVAL OF STEERING WHEEL ASSEMBLY



10. REMOVAL OF SPECIAL SCREW

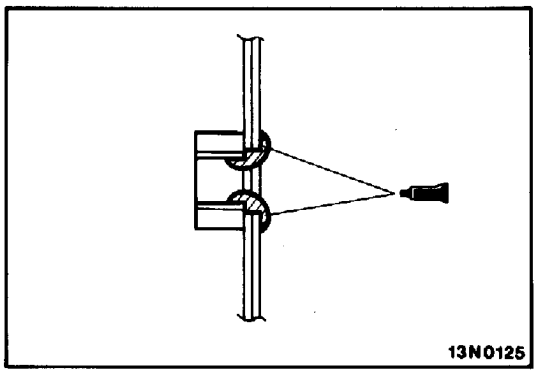
Remove the special screw by using the special tool.



SERVICE POINTS OF INSTALLATION E37HDAI

12. INSTALLATION OF STEERING COLUMN AND SHAFT ASSEMBLY

Never loosen the clamp bolt (arrow mak in the figure) when installing the steering column and shaft assembly to the body side.



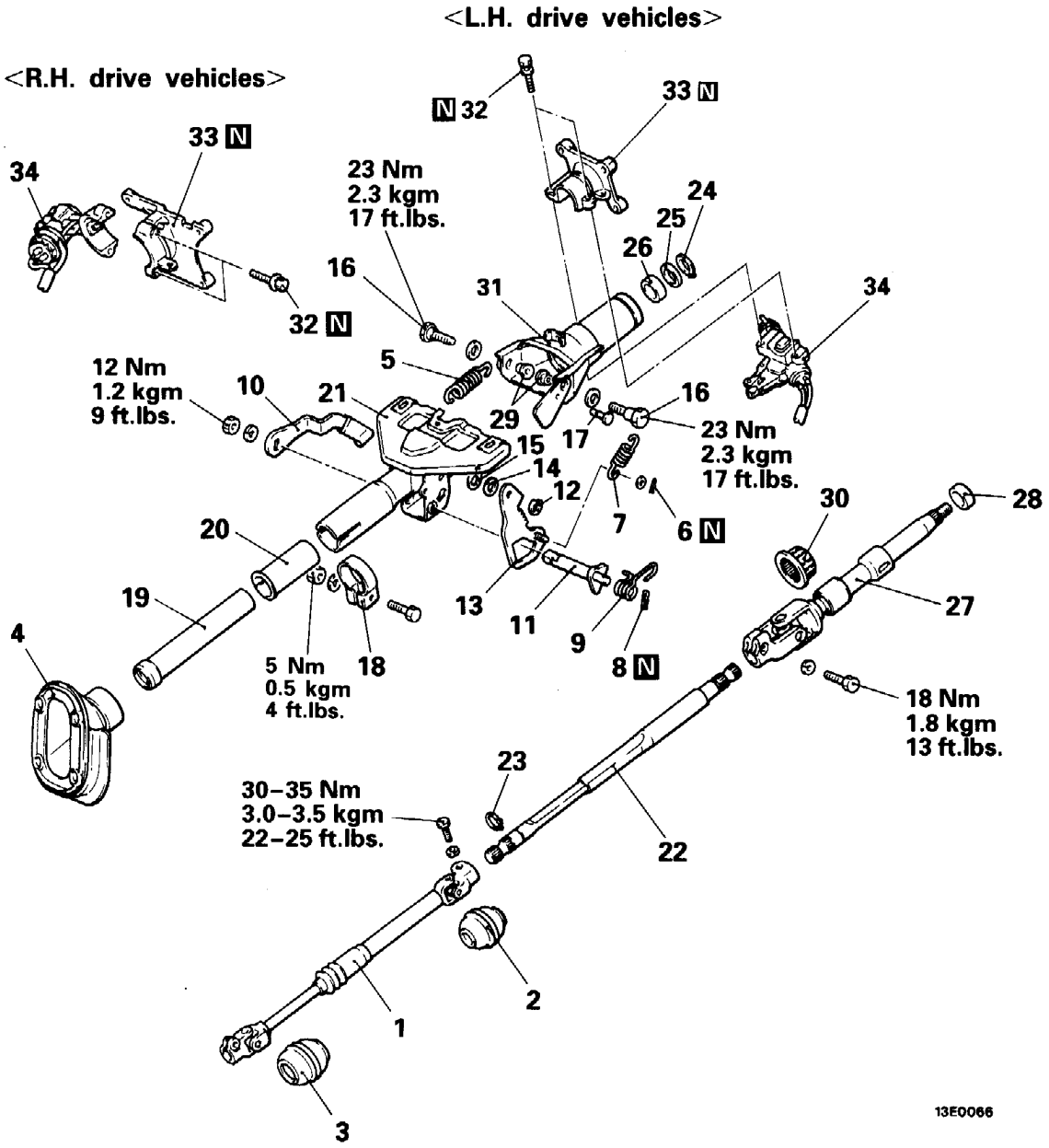
9. INSTALLATION OF COVER ATTACHING BOLT

Before installing the bolt, apply specified sealant to the toeboard mounting hole.

DISASSEMBLY AND REASSEMBLY

E37HE--

<Vehicles without SRS>



Disassembly steps

- 1. Joint assembly
- 2. Upper boot
- 3. Lower boot
- 4. Cover assembly
- 5. Return spring
- 6. Split pin
- 7. Return spring
- 8. Split pin
- 9. Return spring
- 10. Tilt lever
- 11. Shaft
- 12. Snap ring
- 13. Lock plate
- 14. Washer
- 15. Wave washer
- 16. Bolt
- 17. Clevis pin
- 18. Clamp
- 19. Lower pipe
- 20. Steering column bushing
- 21. Steering column, lower
- 22. Steering shaft, lower
- 23. Snap ring
- 24. Snap ring
- 25. Stopper
- 26. Bearing spacer
- 27. Steering shaft, upper
- 28. Bearing spacer
- 29. Bushing
- 30. Bearing
- 31. Steering column, upper
- 32. Special bolt
- 33. Steering lock bracket
- 34. Steering lock cylinder

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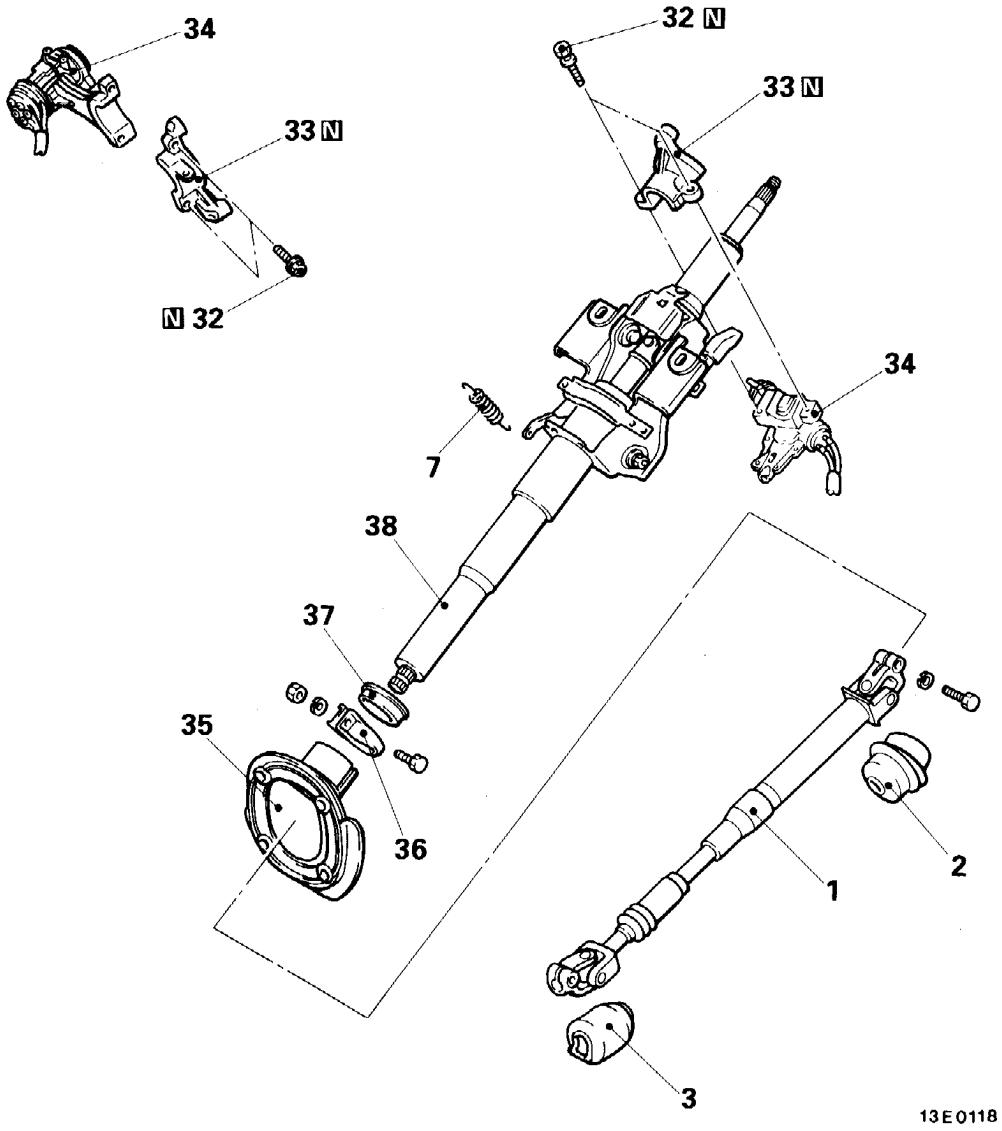
<Vehicles with SRS>

<R.H. drive vehicles> <L.H. drive vehicles>



Disassembly steps

- ◆◆ 1. Joint assembly
- 2. Upper boot
- 3. Lower boot
- 7. Return spring
- ◆◆ 32. Special bolt
- ◆◆ ◆◆ 33. Steering lock bracket
- ◆◆ ◆◆ 34. Steering lock cylinder
- ◆◆ 35. Cover assembly
- ◆◆ 36. Clamp
- 37. Bush
- 38. Steering column assembly

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NOTES

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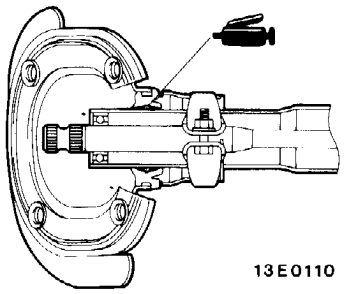
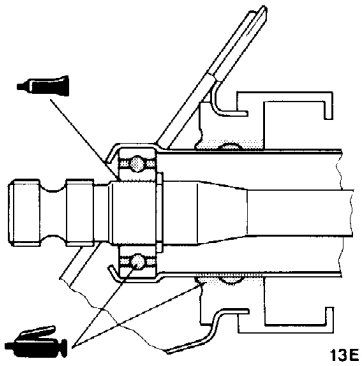
LUBRICATION, SEALING AND ADHESION POINTS

<Vehicles with SRS>



13E0110

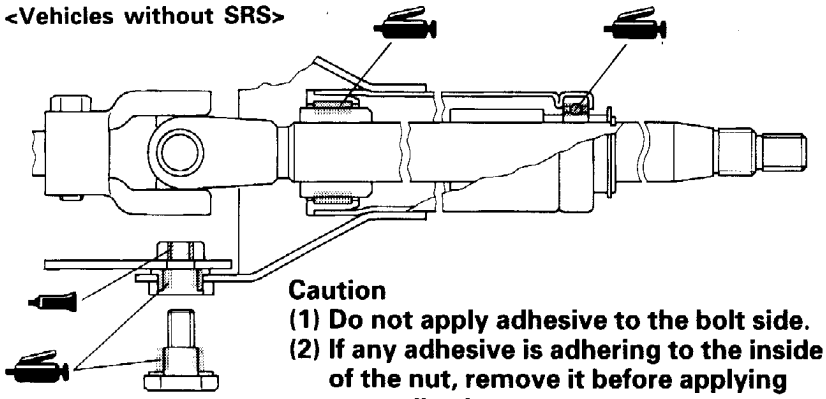
<Vehicles without SRS>



13E0018

Adhesive: 3M Stud Locking Part No. 4170 or equivalent

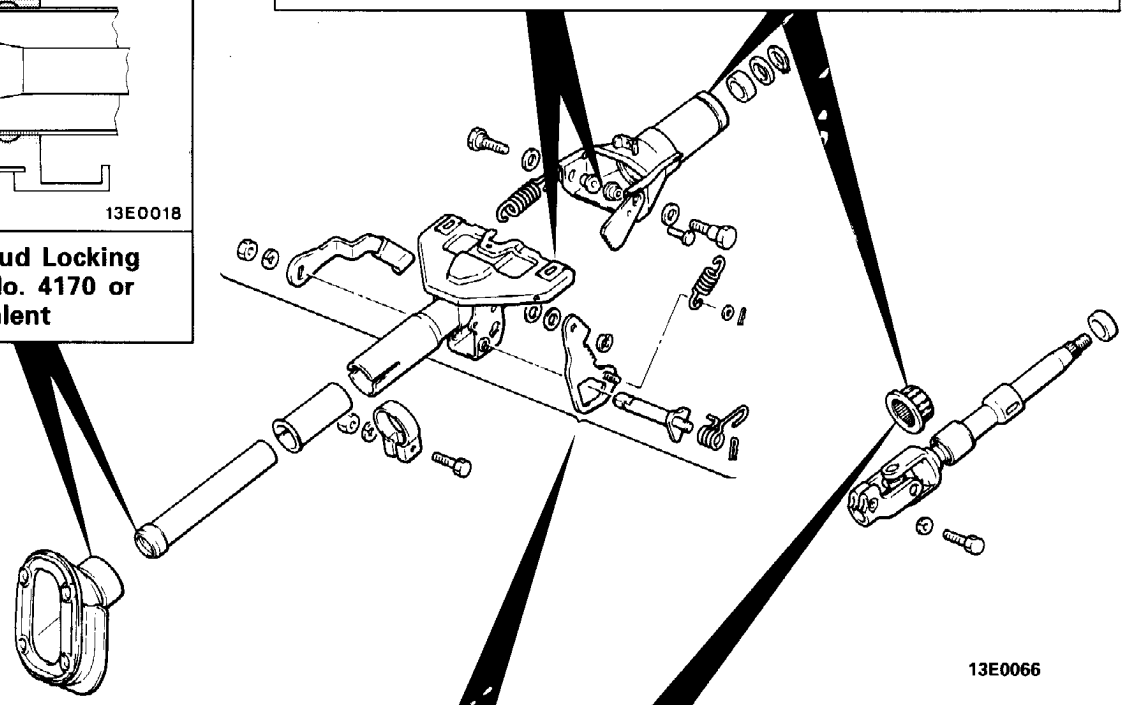
<Vehicles without SRS>



Caution
(1) Do not apply adhesive to the bolt side.
(2) If any adhesive is adhering to the inside of the nut, remove it before applying new adhesive.

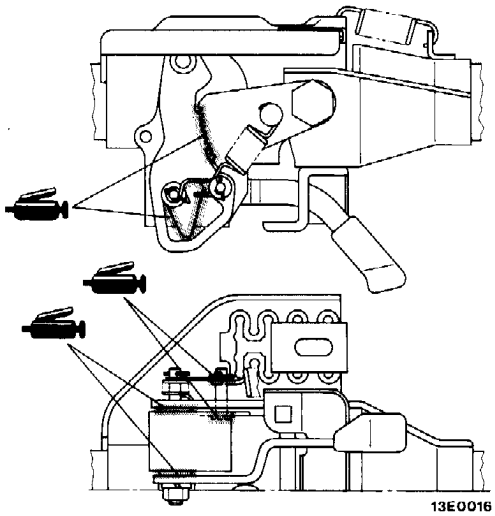
13E0017

Adhesive: 3M Stud Locking Part No. 4170 or equivalent



13E0066

<Vehicles without SRS>



13E0016

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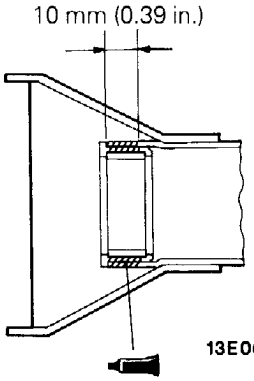
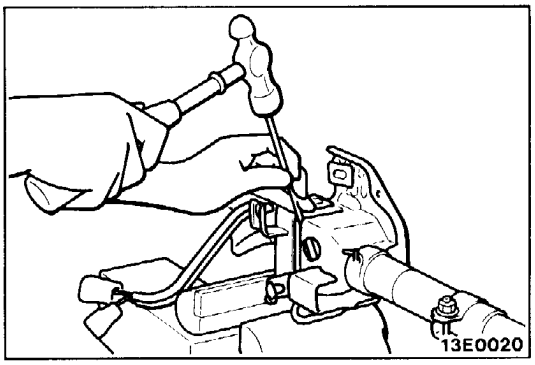


13E0041

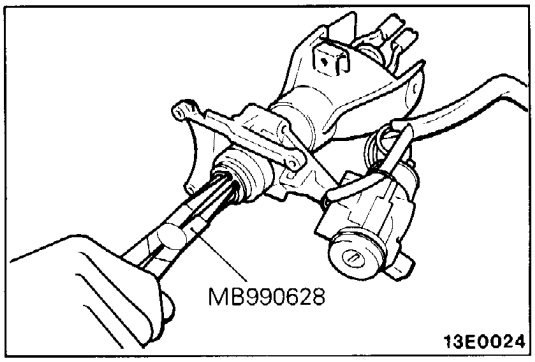
Adhesive: 3M ATD Part No. 8001 or equivalent



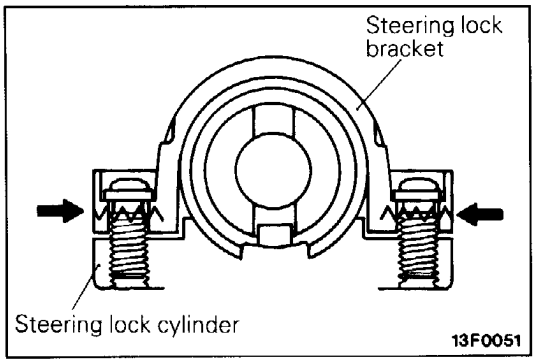
SERVICE POINTS OF DISASSEMBLY E37HFAR

17. REMOVAL OF CLEVIS PIN

Knock the clevis pin out from the inside of the steering column.



24. REMOVAL OF SNAP RING

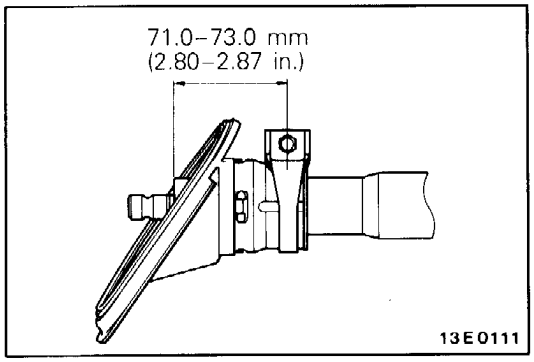


33. REMOVAL OF STEERING LOCK BRACKET/34. STEERING LOCK CYLINDER

If it is necessary to remove the steering lock cylinder, use a hacksaw to cut the special bolts at the steering lock bracket side.

INSPECTION E37HGAN

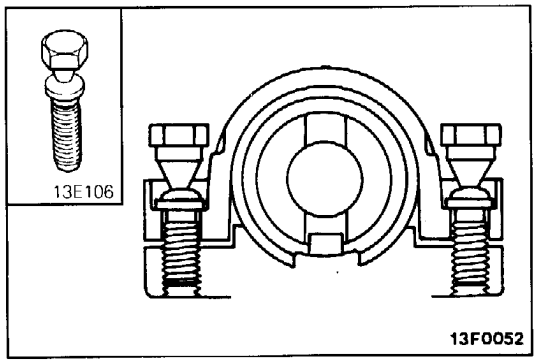
Check the steering shaft and joint for play or faulty operation.



SERVICE POINTS OF REASSEMBLY E37HHAP

36. INSTALLATION OF CLAMP/35. COVER ASSEMBLY

Install the clamp to the steering column assembly as shown in the illustration.



34. INSTALLATION OF STEERING LOCK CYLINDER/33. STEERING LOCK BRACKET/32. SPECIAL BOLT

(1) When installing the steering lock and steering lock bracket to the column tube, temporarily install the steering lock in alignment with the column boss.
(2) After checking that the lock works properly, tighten the special bolts until the head twists off.

Caution
The steering lock bracket and bolts must be replaced with new ones when the steering lock is installed.

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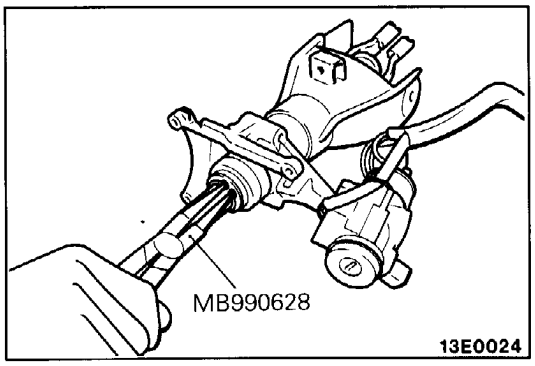
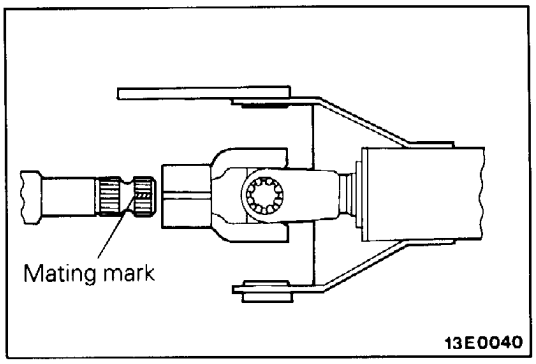
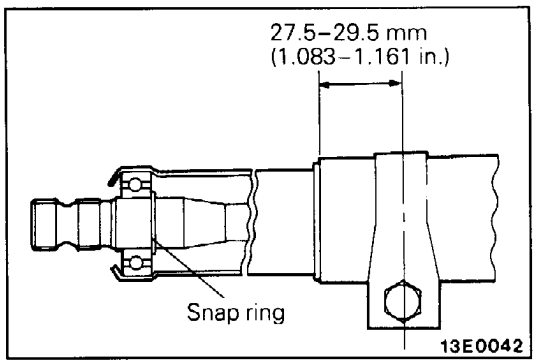


24. INSTALLATION OF SNAP RING



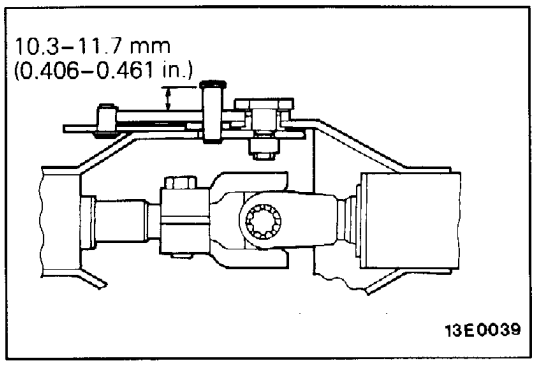
22. INSTALLATION OF STEERING SHAFT, LOWER

When installing, align the mating mark (yellow line) on the steering shaft lower with the groove on the steering shaft upper yoke.



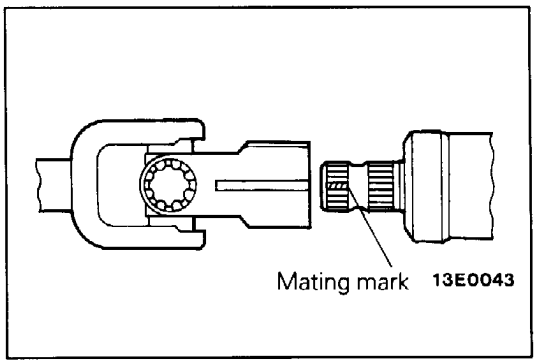
19. INSTALLATION OF LOWER PIPE/18. CLAMP

(1) Insert the lower pipe into the steering column lower until the bearing touches the snap ring on the steering shaft lower.
(2) Install the clamp in the position shown in the illustration.



17. INSTALLATION OF CLEVIS PIN

Insert the clevis pin by tapping it until the protruding length is as shown in the illustration.



1. INSTALLATION OF JOINT ASSEMBLY

When installing, align the groove on the joint yoke with the mating mark (yellow line) on the steering shaft lower.

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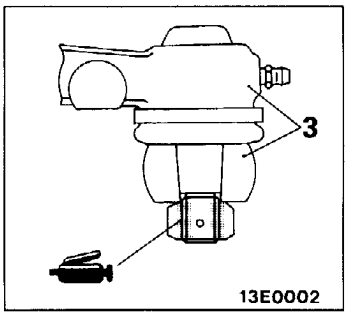
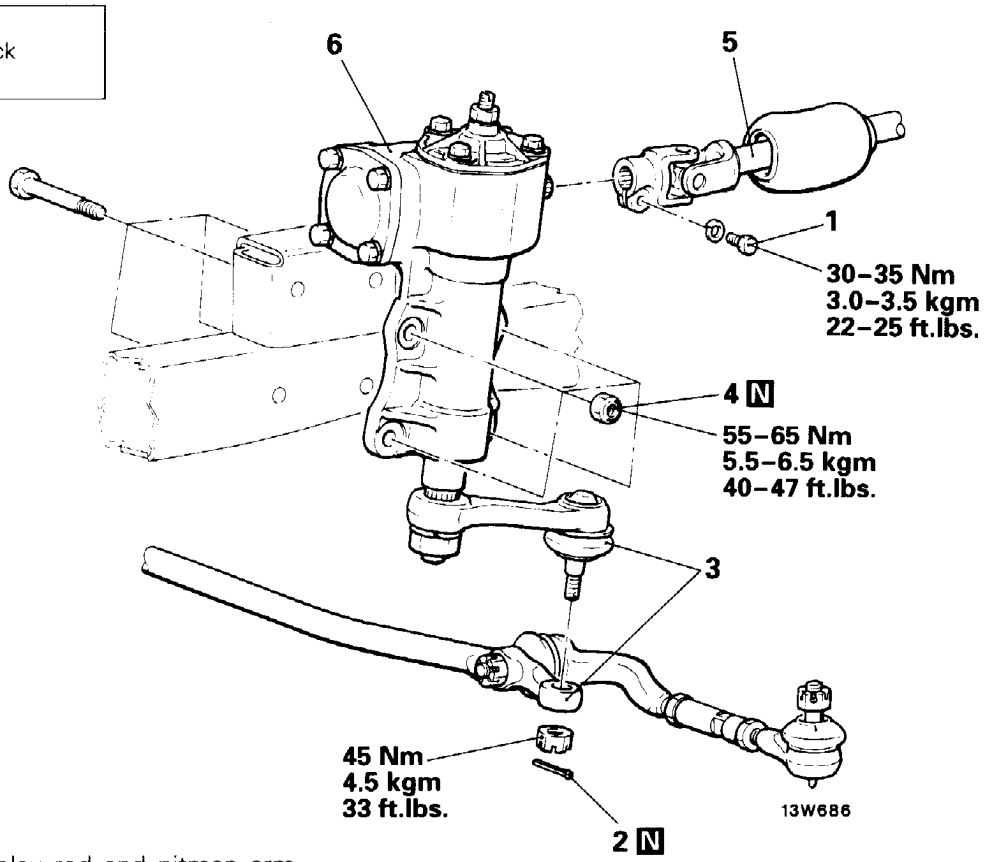
MANUAL STEERING GEAR BOX

E37JA--

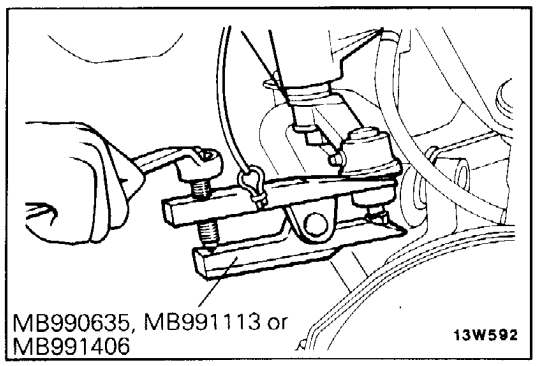
REMOVAL AND INSTALLATION

Pre-installation Operation
- Steering Gear Oil Level Check (Refer to P.37-8.)





Removal steps
1. Bolt
2. Split pin
3. Connection for relay rod and pitman arm
4. Self locking nuts
5. Joint assembly connection
6. Steering gear box



SERVICE POINTS OF REMOVAL

E37JBAD

3. DISCONNECTION OF RELAY ROD AND PITMAN ARM

Caution
1. **Use cord to bind the special tool closely so it will not become separated.**
2. **The nut should be loosened only, not removed.**

SERVICE POINTS OF INSTALLATION

E37JDAC

6. INSTALLATION OF STEERING GEAR BOX

Install the steering gear box to the frame after inserting the steering gear box mainshaft into the joint assembly.

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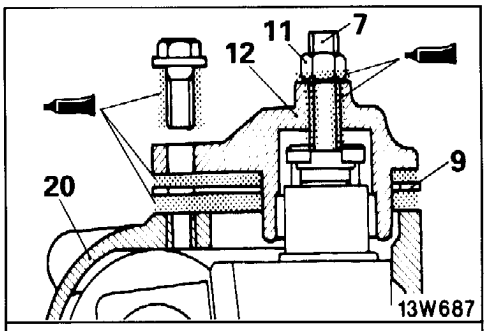
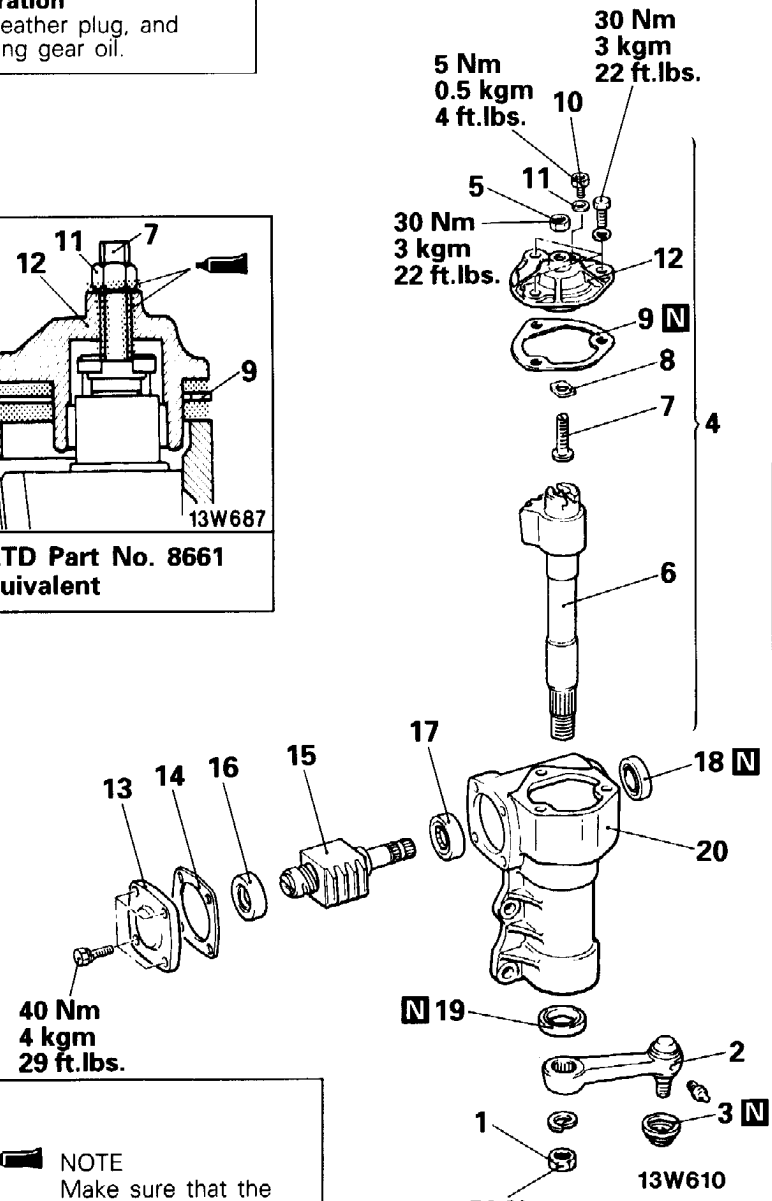
DISASSEMBLY AND REASSEMBLY

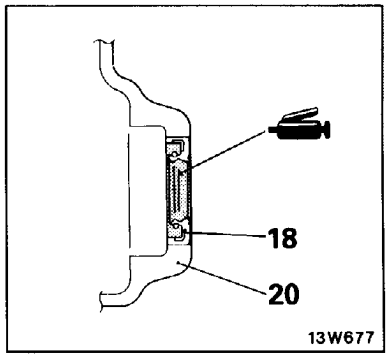
E37JE--

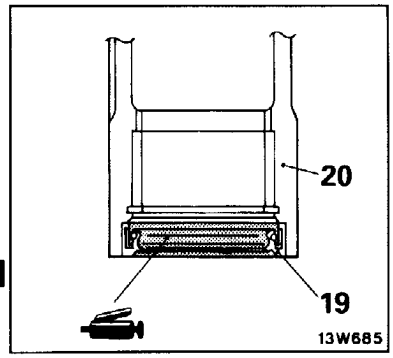
Pre-removal Operation
- Remove the breather plug, and drain the steering gear oil.

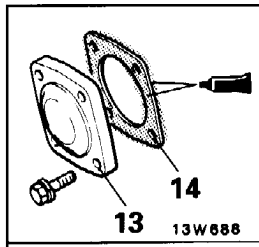


Sealant: 3M ATD Part No. 8661 or equivalent



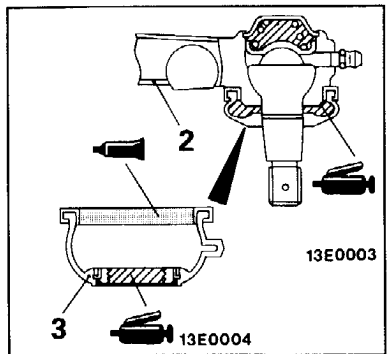






NOTE
Make sure that the adjusting shim(s) have the same thickness as the ones before disassembly.

Sealant: 3M ATD Part No. 8661 or equivalent



Sealant: 3M ATD Part No. 8661 or equivalent

Disassembly steps

1. Jam nut
2. Pitman arm
3. Dust cover
4. Top cover and cross-shaft assembly
5. Lock nut
6. Cross-shaft
7. Adjusting bolt
8. Adjusting spacer
9. Packing
10. Breather plug
11. Gasket
12. Top cover
13. End cover
14. Adjusting shim
15. Mainshaft assembly
16. Bearing
17. Bearing
18. Oil seal
19. Oil seal
20. Gear box housing

Caution
Do not disassemble the ball nut from the mainshaft.

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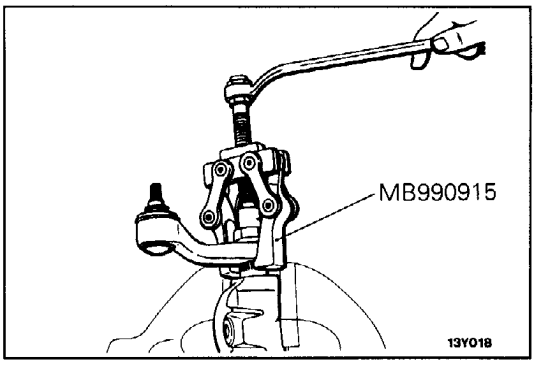
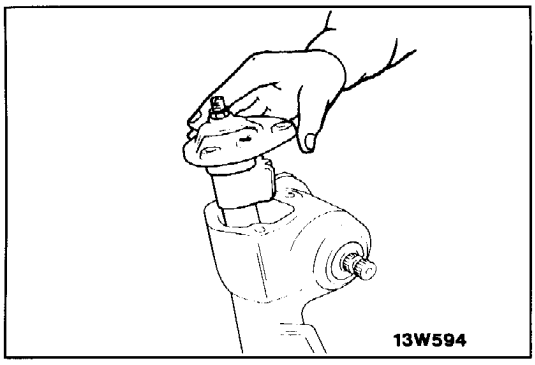


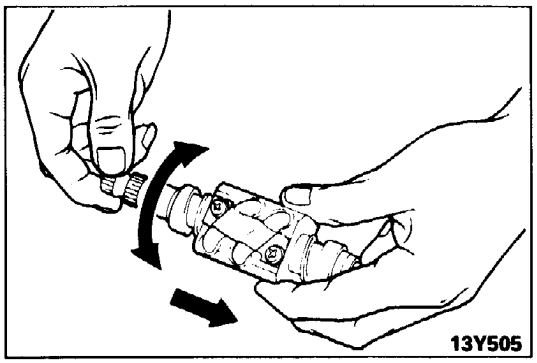
SERVICE POINTS OF DISASSEMBLY E37JFAE

2. REMOVAL OF PITMAN ARM



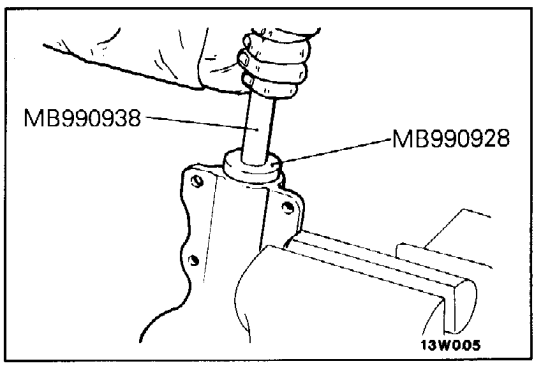
4. REMOVAL OF TOP COVER AND CROSS-SHAFT ASSEMBLY

With the mainshaft and cross-shaft placed in the straight ahead position, tap the bottom of cross-shaft with a plastic hammer to take out the cross-shaft together with the top cover.



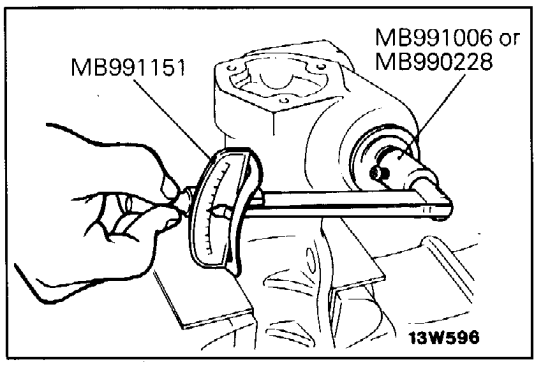
INSPECTION E37JGAB

- Check the ball nut for smooth rotation and axial play.
- Check the bearing for seizure and discolouration, and the rough rolling surface of ball nut raceway.



SERVICE POINTS OF REASSEMBLY E37JHAE

19./18. INSTALLATION OF OIL SEALS



13. INSTALLATION OF END COVER

Standard value: 0.35–0.55 Nm (3.5–5.5 kgcm, 3–5 in.lbs.)

(1) If the measured value is not within the standard value, make adjustment by changing the adjusting shim(s).
(2) Remove the shim(s) to increase starting torque. Add shim(s) to reduce starting torque.

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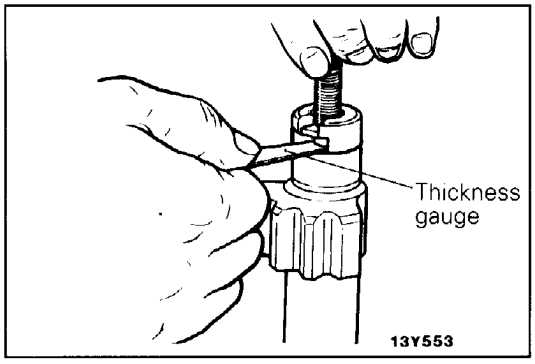


8. INSTALLATION OF ADJUSTING SPACER

(1) Install the adjusting spacer to the adjusting bolt and measure the cross-shaft axial play.

Standard value: 0.05 mm (0.0020 in.) or less

(2) If the measured value is not within the standard value, make adjustment by changing the adjusting spacer.

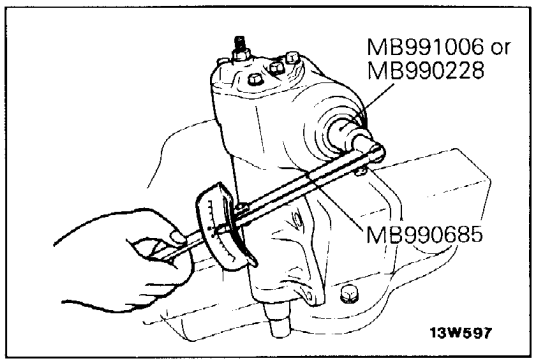
4. INSTALLATION OF TOP COVER AND CROSS-SHAFT ASSEMBLY

Lubricate the bearings and the gear teeth of each shaft.

(1) Move the ball nut of the mainshaft to the centre position (straight-ahead position).

Caution
Use care not to damage the cross-shaft oil seal.

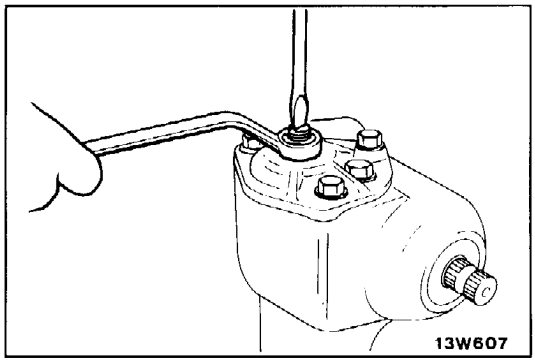
(2) Turn the adjusting bolt 2 or 3 times until the tooth surfaces are in contact.



(3) Measure the mainshaft total starting torque.
① Secure the flange part of the gear box housing in a vise.
② Measure the mainshaft total starting torque by using the special tools.

Standard value: 0.65–0.85 Nm (6.5–8.5 kgcm, 5.7–7.3 in.lbs.)

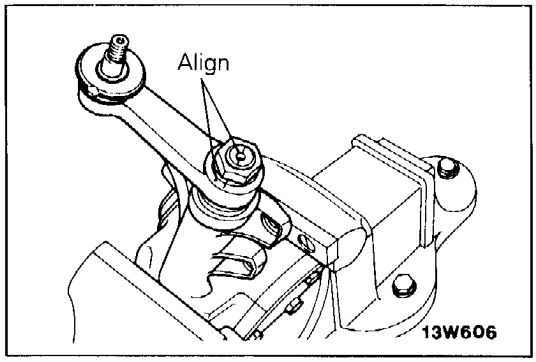
NOTE
The mainshaft should rotate smoothly across the entire range.



③ If the measured value is not within the standard value, adjust by turning the adjusting bolt in or out.
④ If it can not be adjusted to the standard value by turning the adjusting bolt, check the following points.
A. Cross-shaft eccentricity due to improperly installed top cover
B. Cross-shaft needle roller bearing damaged
C. End cover improperly installed

2. INSTALLATION OF PITMAN ARM

Install the pitman arm to the gear box with the mating marks aligned.



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POWER STEERING GEAR BOX

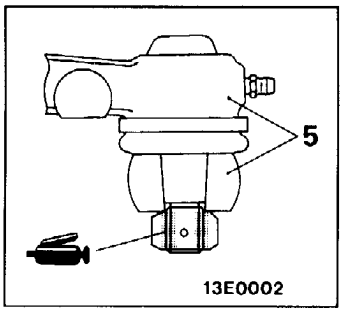
E37NA--

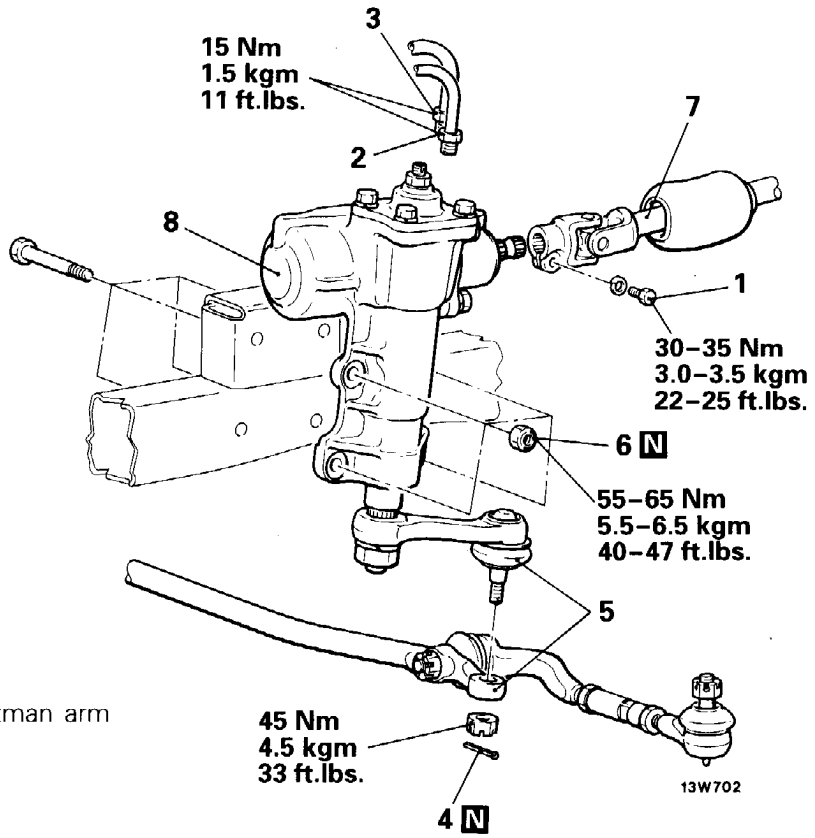
REMOVAL AND INSTALLATION

Pre-removal Operation
- Draining of the Power Steering Fluid (Refer to P.37-10.)

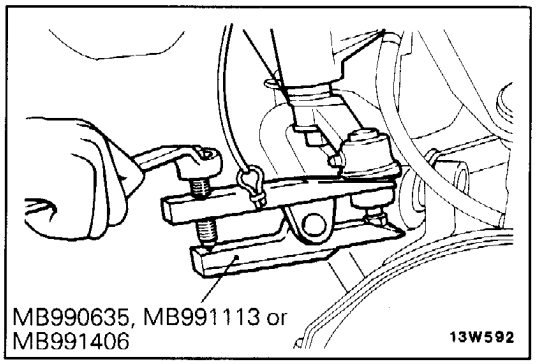
Pre-installation Operation
- Supplying of Power Steering Fluid (Refer to P.37-10.)
- Bleeding of the Power Steering Fluid Line (Refer to P.37-11.)

CAUTION: SRS
For vehicles with SRS, before removal of steering gear box, refer to GROUP 52B–SRS, center front wheels and remove ignition key. Failure to do so may damage SRS clock spring and render SRS system inoperative, risking serious driver injury.





Removal steps
1. Bolt
2. Connection for pressure hose
3. Connection for return hose
4. Split pin
◆◆ 5. Connection for relay rod and pitman arm
6. Self-locking nuts
7. Connection for joint assembly
◆◆ 8. Power steering gear box



SERVICE POINTS OF REMOVAL

E37NBAD

5. DISCONNECTION OF RELAY ROD AND PITMAN ARM

Caution
1. **Use cord to bind the special tool closely so it will not become separated.**
2. **The nut should be loosened only, not removed.**

SERVICE POINTS OF INSTALLATION

E37NDAAa

8. INSTALLATION OF POWER STEERING GEAR BOX

Install the power steering gear box to the frame after inserting the power steering gear box mainshaft into the joint assembly.

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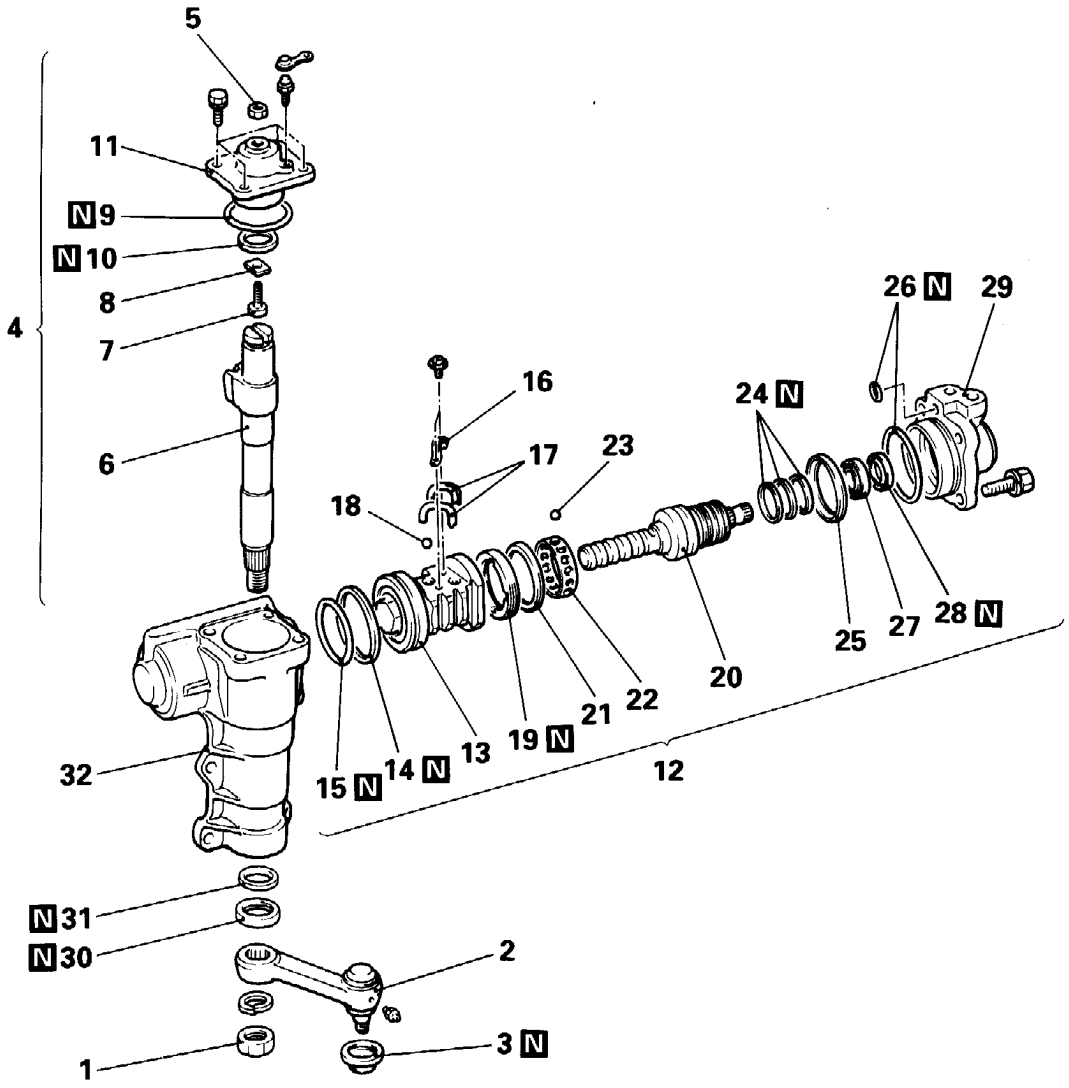
DISASSEMBLY

E37NF--



Disassembly steps

1. Jam nut
2. Pitman arm
3. Dust cover
4. Side cover and cross-shaft assembly
5. Adjusting bolt lock nut
6. Cross-shaft
7. Adjusting bolt
8. Adjusting plate
9. O-ring
10. Y-packing
11. Side cover
12. Main shaft and valve assembly
13. Rack piston
14. Seal ring
15. O-ring
16. Circulator holder
17. Circulator
18. Ball
19. Lock nut
20. Main shaft
21. Bearing race
22. Cage
23. Ball
24. Seal ring
25. Bearing race
26. O-ring
27. Bearing
28. Oil seal
29. Valve housing
30. Oil seal
31. Y-packing
32. Gear box housing

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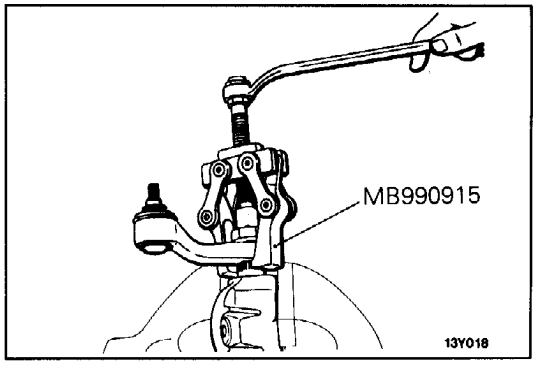
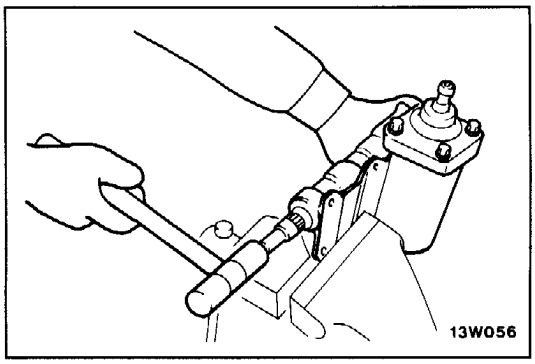


SERVICE POINTS OF DISASSEMBLY E37NGAE

2. REMOVAL OF PITMAN ARM

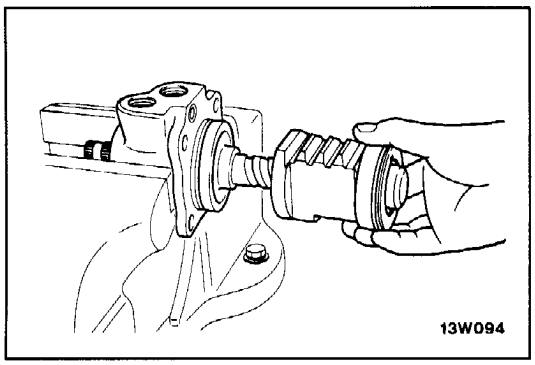


4. REMOVAL OF SIDE COVER AND CROSS-SHAFT ASSEMBLY

With the mainshaft and cross-shaft placed in the straight ahead position, tap the bottom of the cross-shaft with a plastic hammer to take out the cross-shaft together with the side cover.

10. REMOVAL OF Y-PACKING

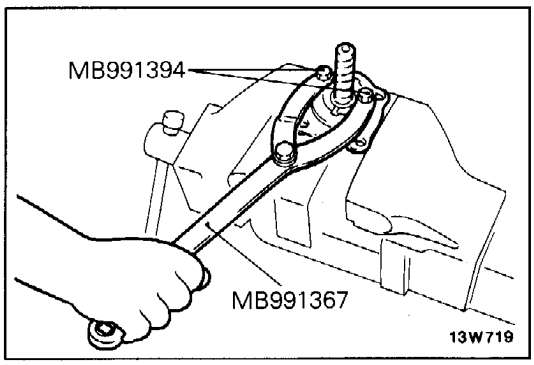
Do not remove the Y-packing at the rear of the needle bearing unless there is fluid leakage from the threads of the adjusting bolt. If there is leakage, replace the Y-packing with a new one.



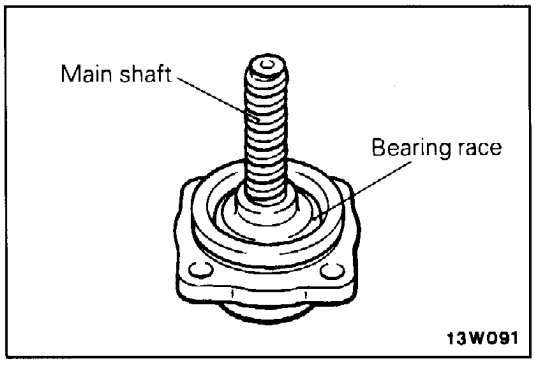
13. REMOVAL OF RACK PISTON

Remove the rack piston from the mainshaft by turning it counterclockwise.

Caution
Be careful not to lose the 26 balls inside the rack piston.



19. REMOVAL OF LOCK NUT



20. REMOVAL OF MAIN SHAFT/21. BEARING RACE/22. CAGE/23. BALL

When removing the main shaft, remove it while pressing the bearing race so that the balls do not come out.

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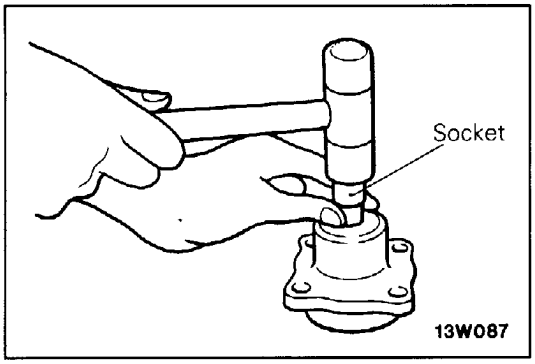
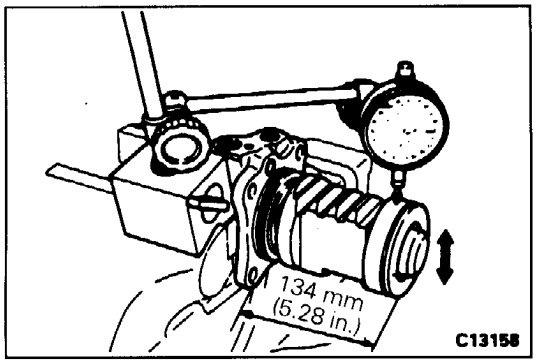


27. REMOVAL OF BEARING/28. OIL SEAL

Using a socket, remove the oil seal and the bearing from the valve housing simultaneously.

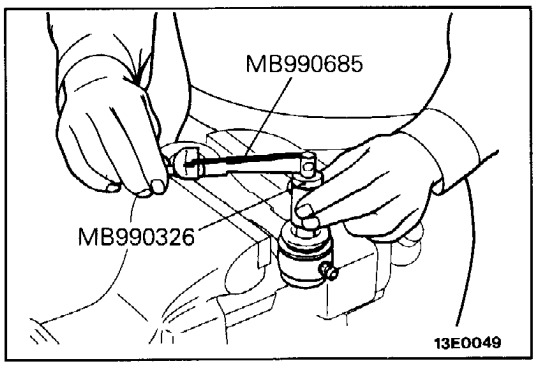


INSPECTION E37NHAD

BACKLASH BETWEEN BALL GROOVE OF RACK PISTON AND BALLS

Set the rack piston to the position shown in the figure, and then measure the backlash by using a dial gauge.

Limit: 0.05 mm (0.0020 in.)



PITMAN ARM BALL JOINT STARTING TORQUE

Standard value: 1–3 Nm (10–30 kgcm, 9–26 in.lbs.)

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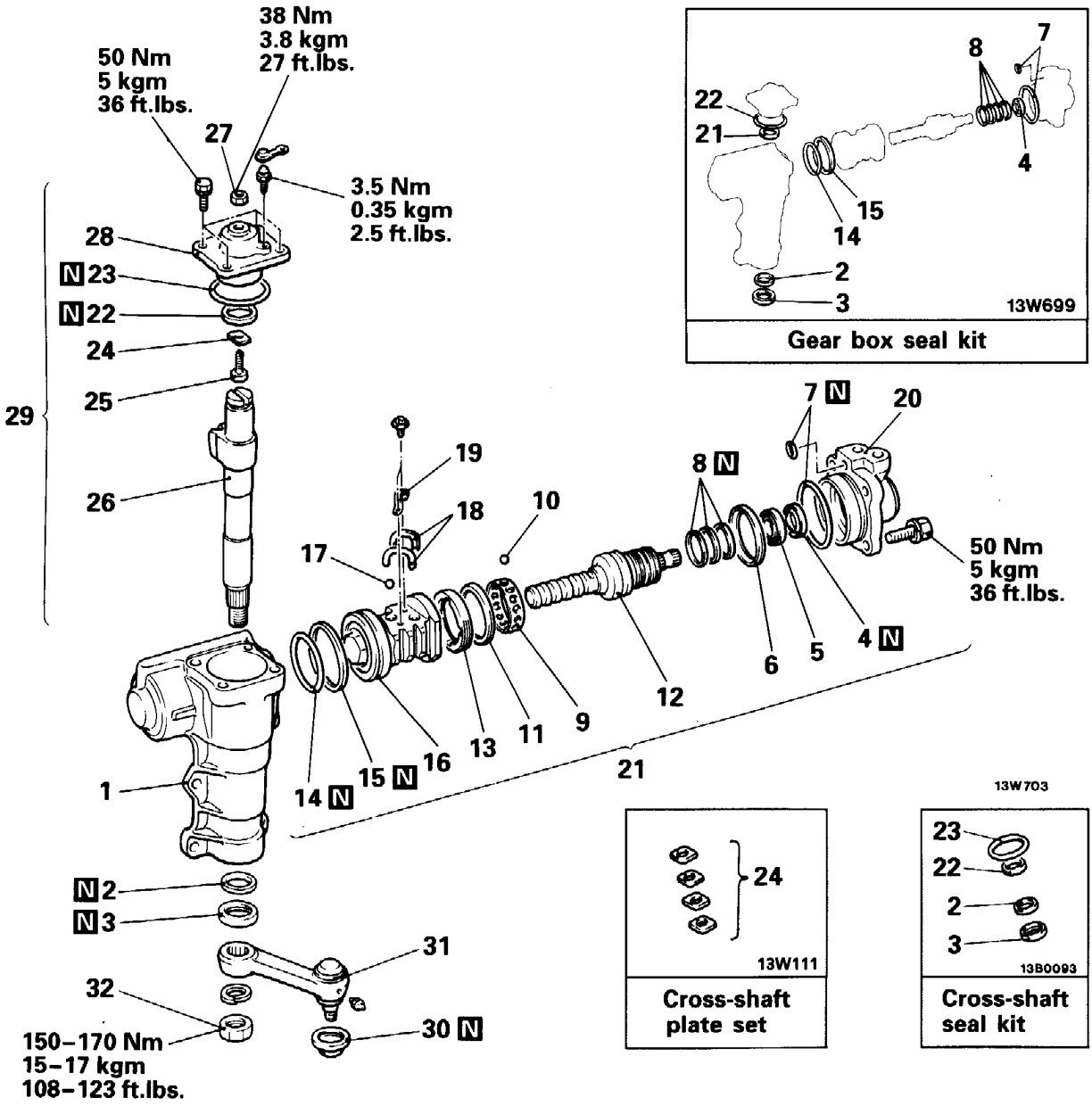
REASSEMBLY

E37NI--



Gear box seal kit

Cross-shaft plate set

Cross-shaft seal kit

Reassembly steps

1. Gear box housing
2. Y-packing
3. Oil seal
4. Oil seal
5. Bearing
6. Bearing race
7. O-ring
8. Seal ring
9. Cage
10. Ball
11. Bearing race
12. Main shaft
13. Lock nut
- Adjustment of main shaft axial play
14. O-ring
15. Seal ring
16. Rack piston
17. Ball
18. Circulator
19. Circulator holder
20. Valve housing
21. Main shaft and valve assembly
22. Y-packing
23. O-ring
24. Adjusting plate
25. Adjusting bolt
26. Cross-shaft
27. Adjusting bolt lock nut
28. Side cover
29. Side cover and cross-shaft assembly
- Adjustment of main shaft total starting torque
30. Dust cover
31. Pitman arm
32. Jam nut

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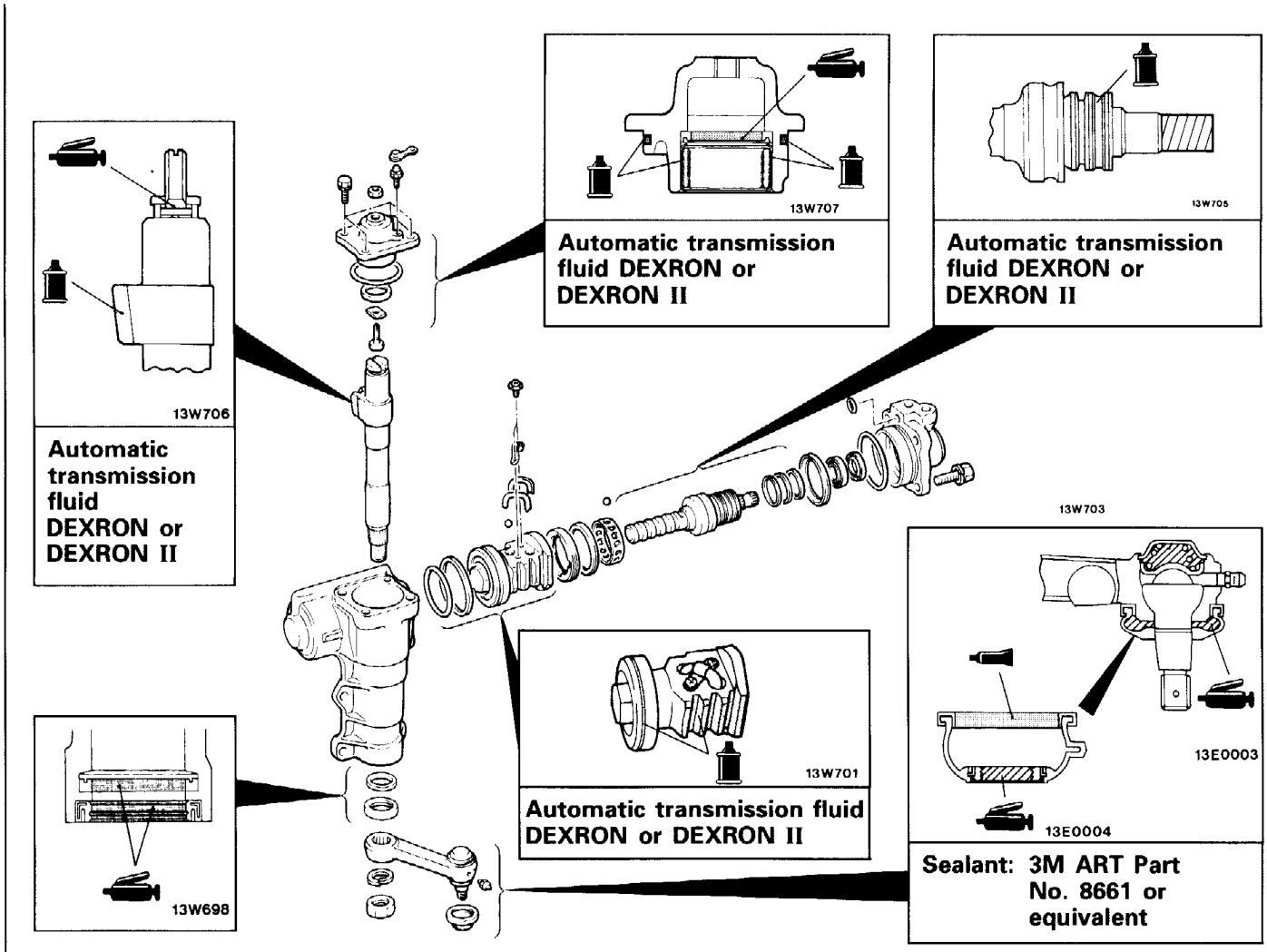
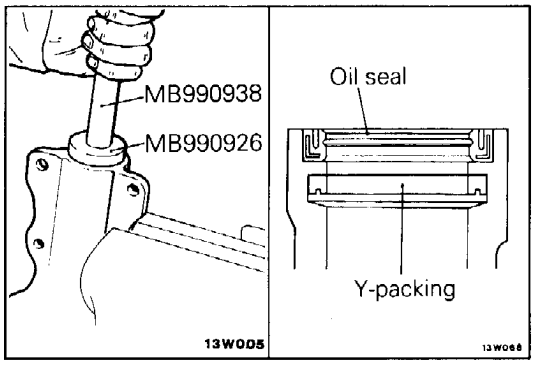
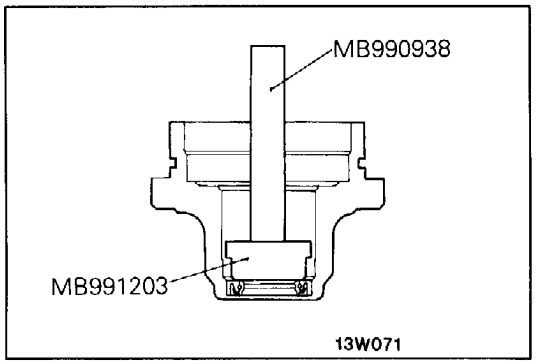
LUBRICATION AND SEALING POINTS







SERVICE POINTS OF REASSEMBLY E37NJAE

2. INSTALLATION OF Y-PACKING/3. OIL SEAL

(1) Install the Y-packing facing the direction shown in the illustration.
(2) Use the special tool to press-fit the oil seal to the gearbox housing so that it faces in the direction shown in the illustration.

4. INSTALLATION OF OIL SEAL

Apply a coating of the specified fluid to the outside of the oil seal. Using the special tools, press the oil seal into the valve housing.

Specified fluid: Automatic transmission fluid DEXRON or DEXRON II

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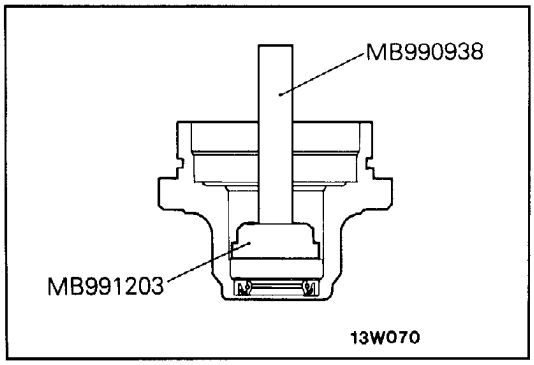
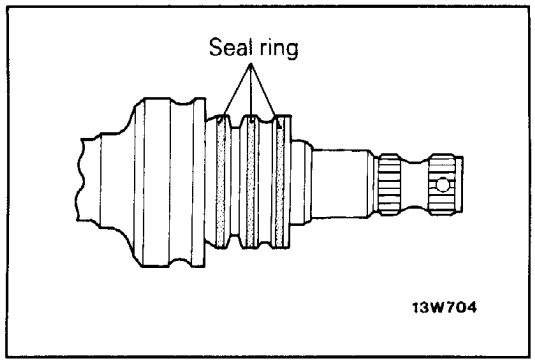


5. INSTALLATION OF BEARING

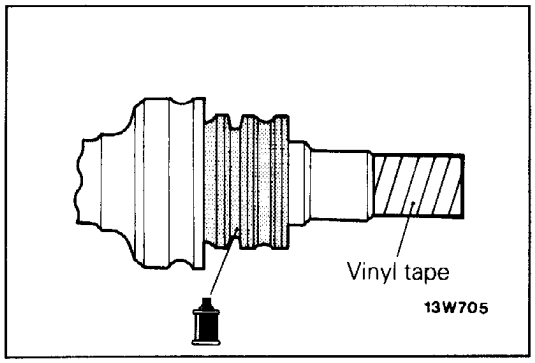
Apply a coating of the specified fluid to the outside of the bearing. Using the special tools, press the oil seal into the valve housing.

Specified fluid: Automatic transmission fluid DEXRON or DEXRON II



8. INSTALLATION OF SEAL RING

When installing seal ring, press firmly into valve groove.

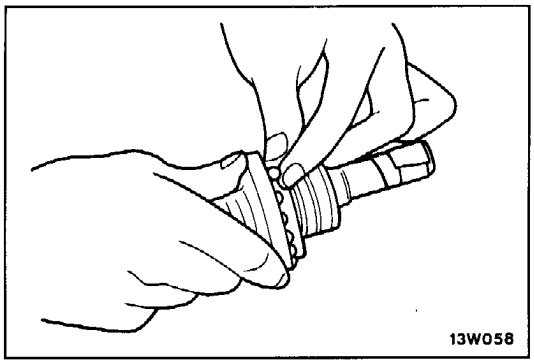


9. INSTALLATION OF CAGE/10. BALL/11. BEARING RACE/12. MAIN SHAFT

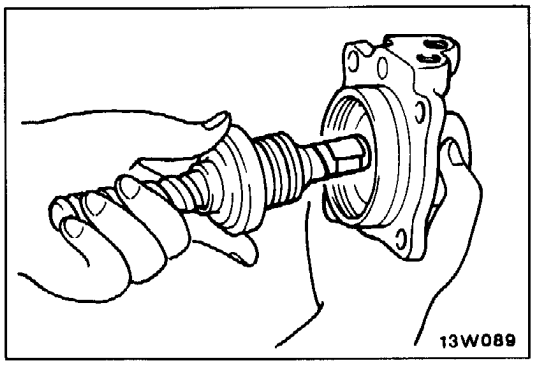
(1) Apply specified fluid to valve body.

Specified fluid: Automatic transmission fluid DEXRON or DEXRON II

(2) Wrap vinyl tape around the serrated part so that the oil seal won't be damaged when the valve body is installed to the valve housing.
(3) Mount the valve body to the valve housing.



(4) Align the cage's hole and the channel in the main shaft, and insert two or three balls.
(5) Insert the remainder of the balls into the cage's hole while pressing the ball with the bearing race.



(6) When installing the main shaft, connect it to the valve housing while pressing the bearing race so that the balls do not come out.

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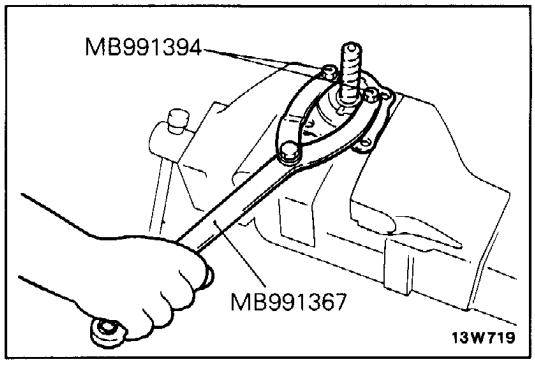
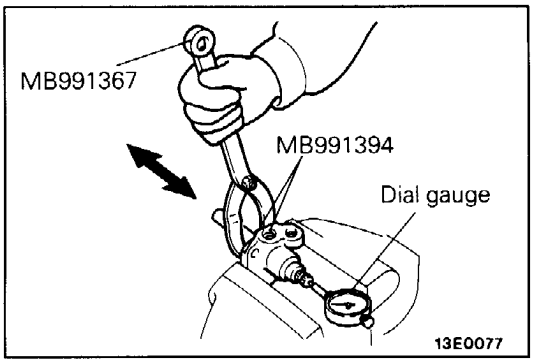


13. INSTALLATION OF LOCK NUT

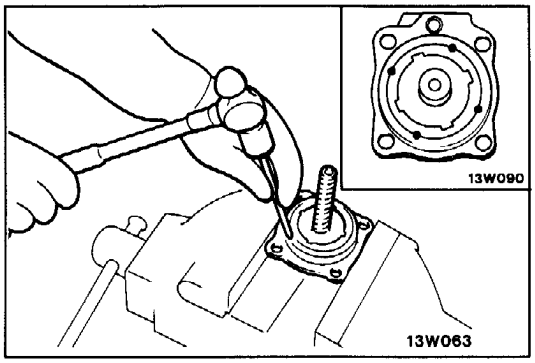
Using the special tool, tighten carefully until the lock nut contacts the bearing race.



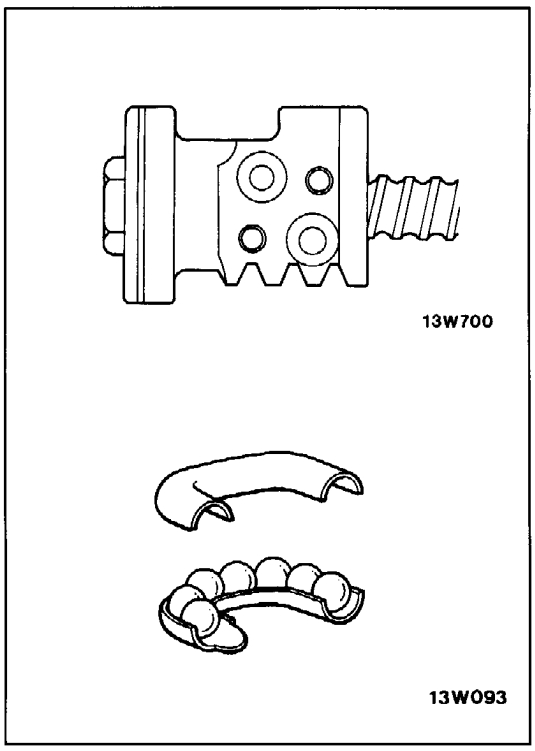
- **ADJUSTMENT OF MAIN SHAFT AXIAL PLAY**

(1) Adjust the play by tightening the lock nut gradually so that the mainshaft axial play will meet the range of standard value.

Standard value: 0.03 mm (0.0012 in.) or less



(2) Use a punch to crimp the circumference of the lock nut so as to secure the lock nut.
(3) Check to be sure that the mainshaft rotates smoothly.



16. INSTALLATION OF RACK PISTON

(1) Install the rack piston until it comes in contact with the edge of the main shaft.
(2) Rotate the main shaft to align the ball raceway with the 19-ball insertion hole.

NOTE
The balls must be inserted so that there is no clearance between the balls.

(3) Set the remaining seven balls in the circulator, and install the circulator to the rack piston.

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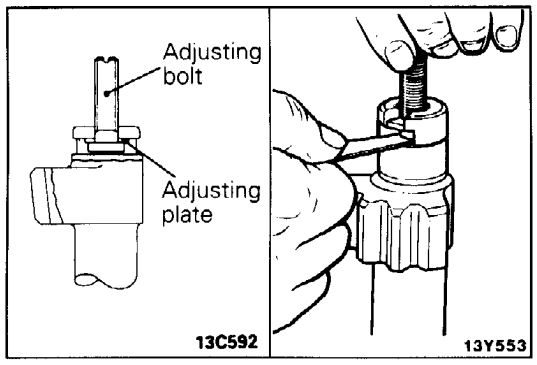
20. INSTALLATION OF VALVE HOUSING

(1) Apply specified automatic transmission fluid to the seal ring of the rack piston.

Specified fluid: Automatic transmission fluid DEXRON or DEXRON II

(2) Insert the valve housing.
(3) Rotate the main shaft until the rack piston moves to the neutral position (center).



24. INSTALLATION OF ADJUSTING PLATE/25. ADJUSTING BOLT

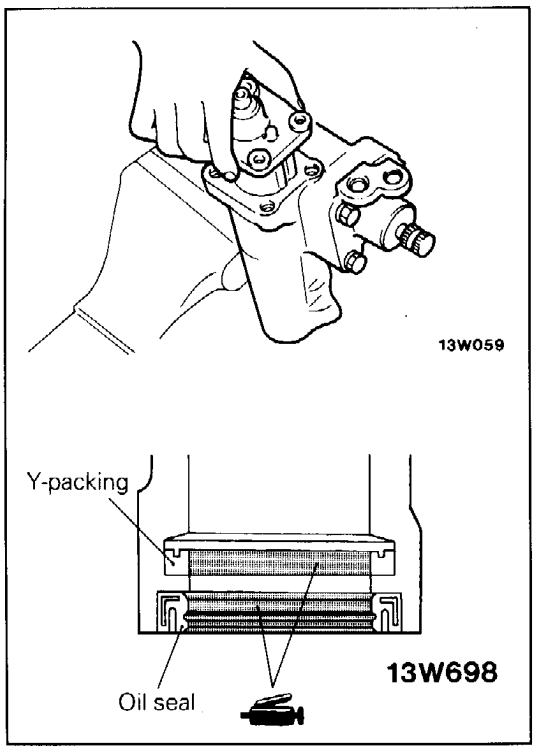
(1) Install the adjusting plate so that the beveled part is facing downward.
(2) Using a thickness gauge, measure the clearance between the adjusting bolt and cross-shaft.

Standard value: 0–0.05 mm (0–0.002 in.)

(3) If the clearance is exceeded the standard value, replace with a suitable adjusting plate.

26. INSTALLATION OF CROSS-SHAFT/27. ADJUSTING BOLT LOCK NUT

Install the cross-shaft to the side cover, and then temporarily tighten the adjusting bolt lock nut.



29. INSTALLATION OF SIDE COVER AND CROSS-SHAFT ASSEMBLY

Install the side cover assembly (with the cross-shaft) to the gear box.

NOTE
Apply specified automatic transmission fluid to the teeth and shaft areas of the rack piston, and apply multipurpose grease to the oil seal lip.

Specified fluid: Automatic transmission fluid DEXRON or DEXRON II

Caution
Do not rotate the side cover during installation. Take care not to damage the cross-shaft oil seal.

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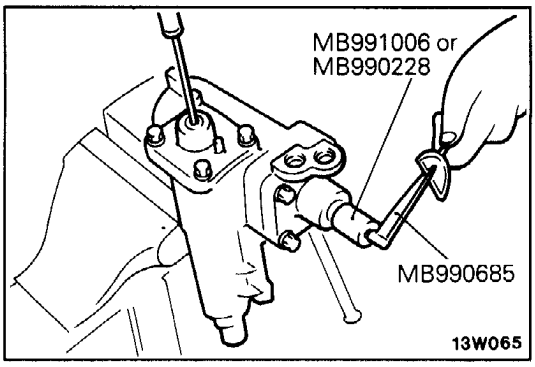

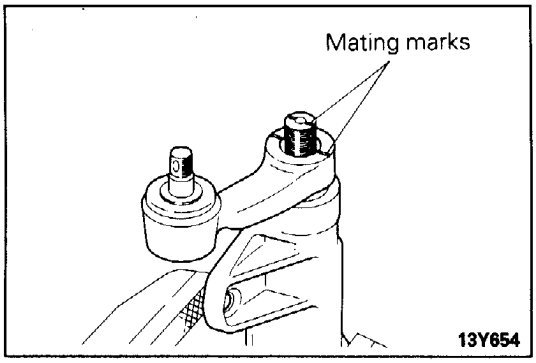

- **ADJUSTMENT OF MAIN SHAFT TOTAL STARTING TORQUE**

(1) While turning the adjusting bolt, measure the main shaft total starting torque by using the special tool.

Standard value: 0.45–1.25 Nm (4.5–12.5 kgcm, 4–11 in.lbs.)

Caution
Adjust by turning the adjusting bolt so that the starting torque at the centre position of the rack piston is approximately 0.2 Nm (2 kgcm, 2 in.lbs.) higher than the values at the both ends of the rack piston.

(2) Tighten the adjusting bolt lock nut to the specified torque.

31. INSTALLATION OF PITMAN ARM

Install the pitman arm to the gear box with the mating marks aligned.

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POWER STEERING OIL PUMP

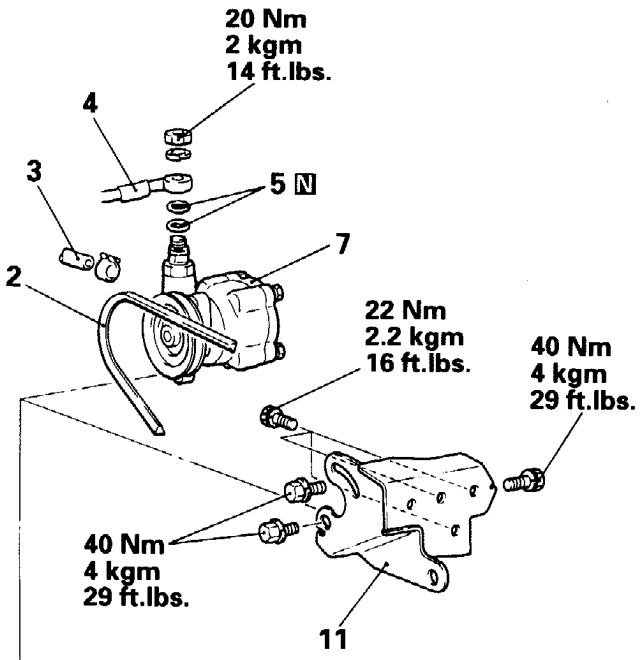
E37RA--

REMOVAL AND INSTALLATION

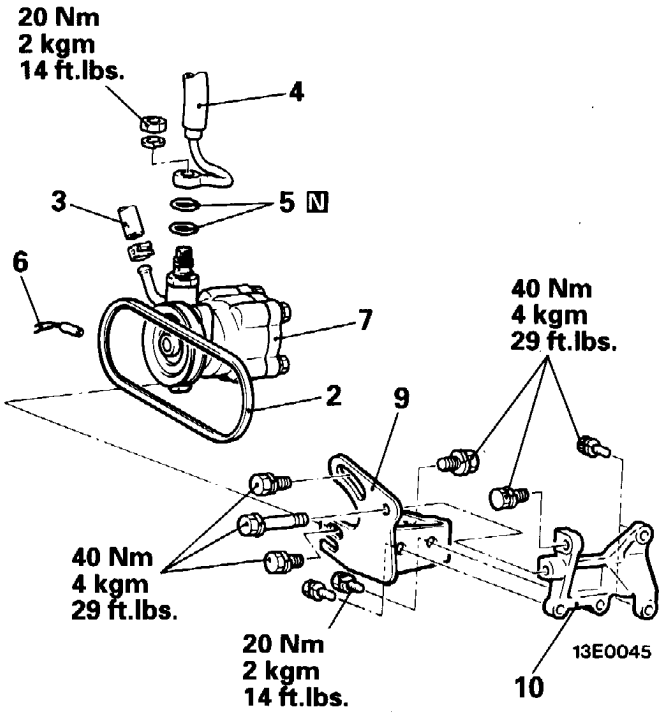
Pre-removal Operation
- Draining of the Power Steering Fluid (Refer to P.37-10.)

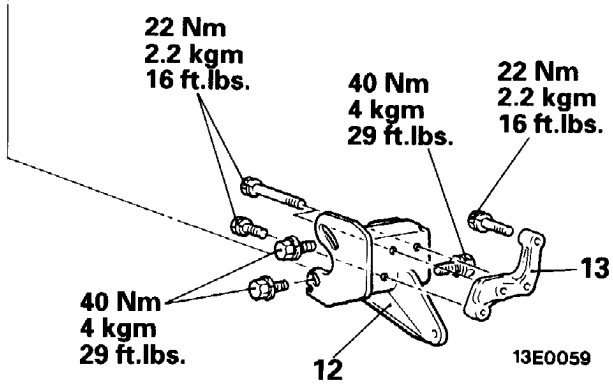
Post-installation Operation
- Supplying of the Power Steering Fluid (Refer to P.37-10.)
- Adjusting V-belt Tension (Refer to P.37-9.)
- Bleeding of the Power Steering Fluid Line (Refer to P.37-11.)
- Check the Oil Pump Pressure (Refer to P.37-12.)

<2400,2500D>



<3000-12 VALVE>





Removal steps

1. Oil pump pulley cover
2. V-belt
3. Suction hose
4. Pressure hose
5. O-ring
6. Pressure switch connector <A/T>
7. Oil pump
8. Oil pump stay
9. Oil pump bracket
10. Oil pump mounting bracket
11. Oil pump bracket <2400>
12. Oil pump bracket <2500D>
13. Oil pump bracket stay <2500D>
14. Oil pump belt tensioner bracket
15. Oil pump belt tension pulley
16. Oil pump O-ring

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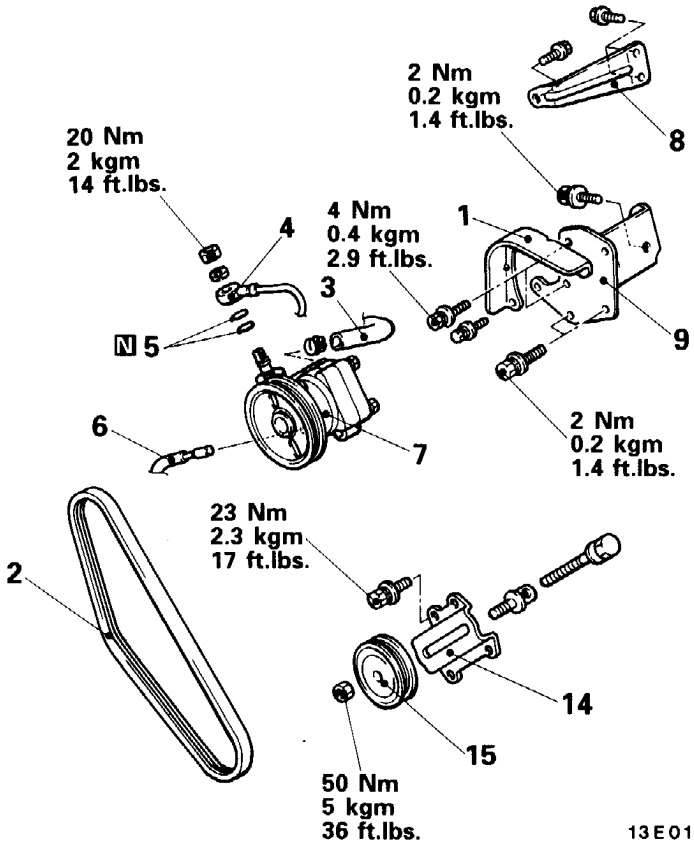
<3000–24 VALVE, 3500>



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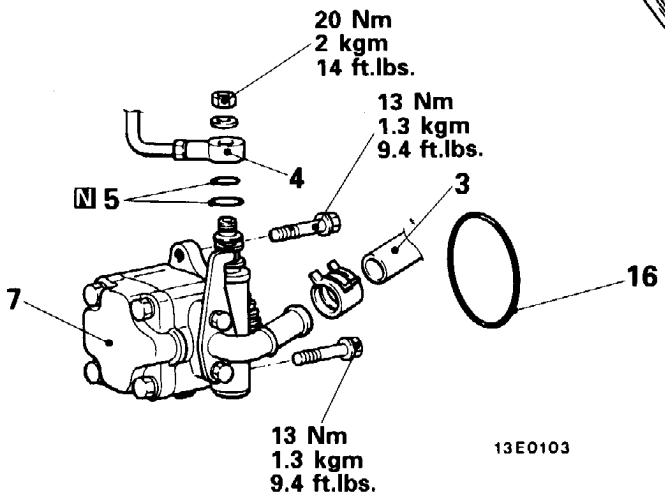

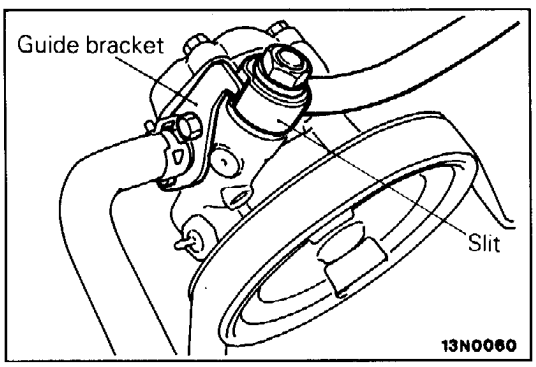

SERVICE POINTS OF INSTALLATION E37RDAJ

4. INSTALLATION OF PRESSURE HOSE

Connect the pressure hose so that its slit part contacts the oil pump's guide bracket.

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NOTES

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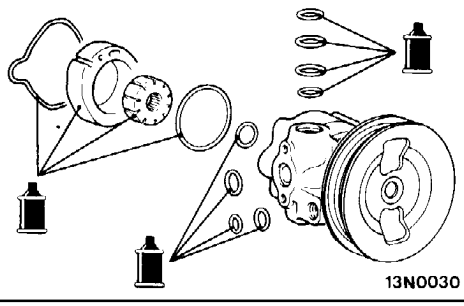
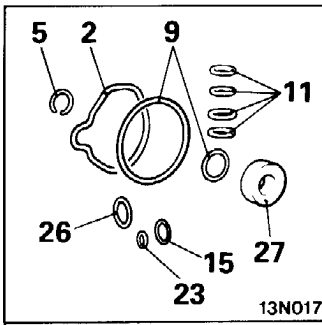
DISASSEMBLY AND REASSEMBLY <Except 2800D>

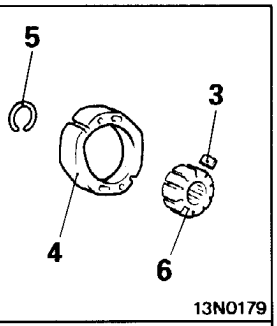
E37RE--



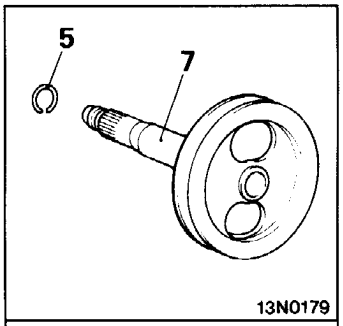
Fluid: Automatic transmission fluid DEXRON or DEXRON II



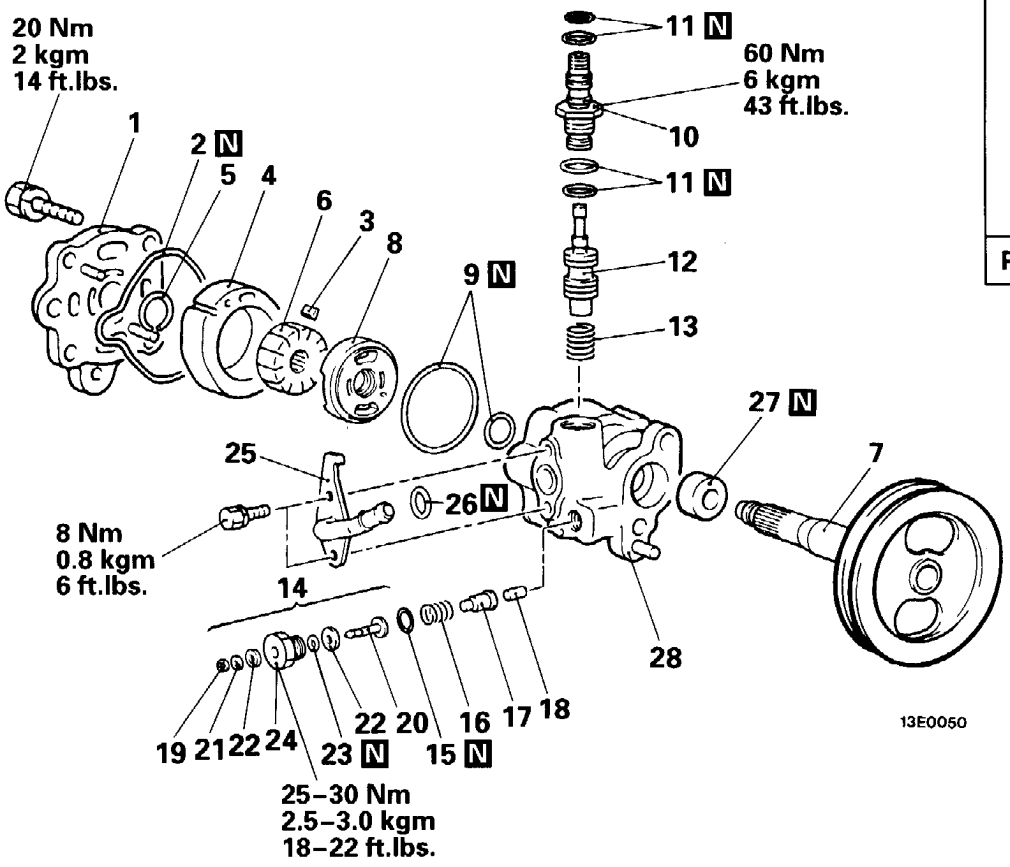
Oil pump seal kit



Oil pump cartridge kit



Pulley and shaft kit



Disassembly steps

1. Pump cover
2. O-ring
3. ◆◆ Vanes
4. ◆◆ Cam ring
5. ◆◆ ◆◆ Snap ring
6. ◆◆ Rotor
7. Pulley assembly
8. ◆◆ Side plate
9. ◆◆ O-ring
10. Connector
11. ◆◆ O-ring
12. flow control valve
13. Flow control spring
14. Terminal assembly
15. ◆◆ O-ring } 3000-A/T, 3500-A/T
16. ◆◆ Spring
17. Plunger
18. Piston rod
19. Snap ring
20. Terminal
21. Washer
22. Insulator
23. ◆◆ O-ring } 3000-A/T, 3500-A/T
24. Plug
25. Suction connector
26. ◆◆ O-ring
27. ◆◆ Oil seal
28. Oil pump body

Caution
Do not disassemble the flow control valve.

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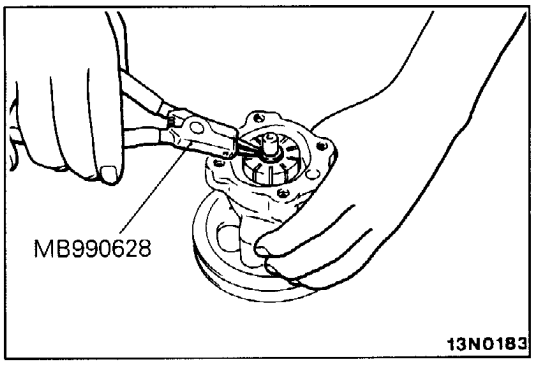
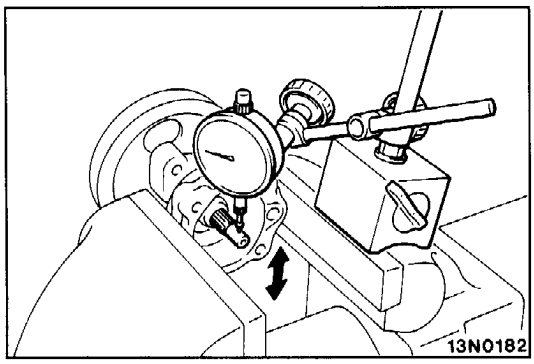


SERVICE POINTS OF DISASSEMBLY E37RFAH

5. REMOVAL OF SNAP RING

INSPECTION E37RGAH

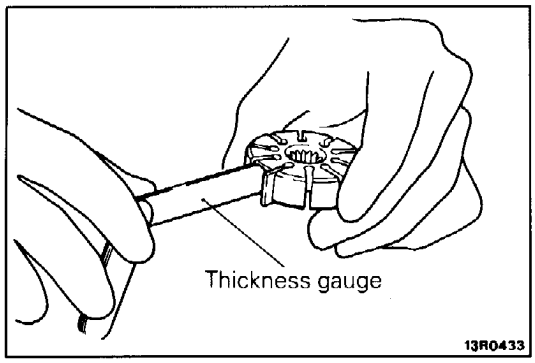
- Check the flow control valve for clogging.
- Check the pulley assembly for wear or damage.
- Check the groove of rotor and vane for "Stepped" wear.
- Check the contact surface of cam ring and vanes for "Stepped" wear.
- Check the vanes for damage.



CLEARANCE BETWEEN SHAFT AND PUMP BODY

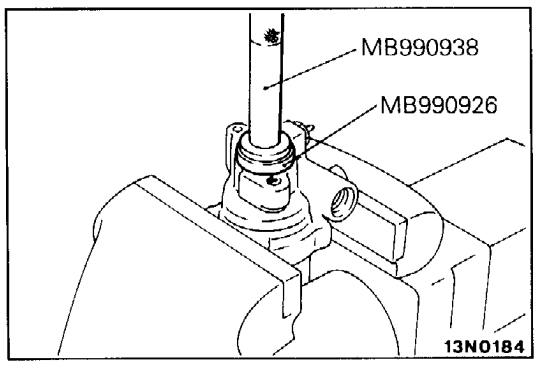
(1) Place the dial gauge against the end of the pulley assembly's shaft.
(2) Move the pulley assembly up and down and measure the play.

Limit: 0.1 mm (0.004 in.)



GAP BETWEEN VANE AND ROTOR GROOVE

Limit: 0.06 mm (0.0024 in.)



SERVICE POINTS OF REASSEMBLY E37RHAL

27. INSTALLATION OF OIL SEAL

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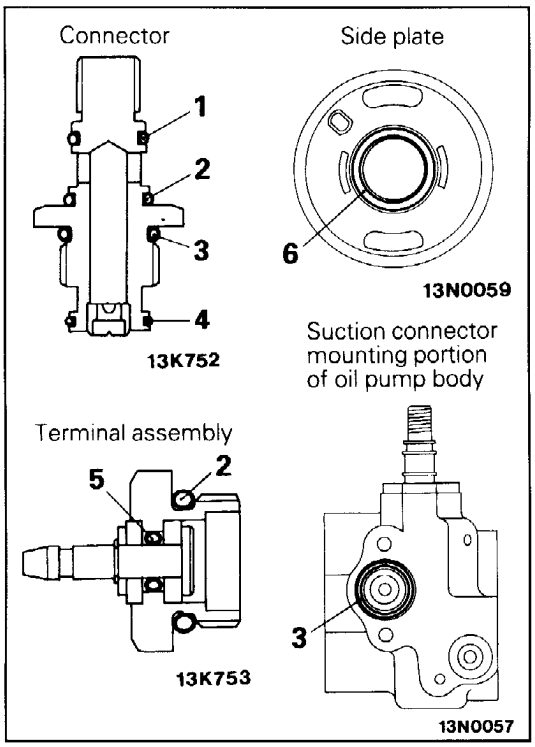
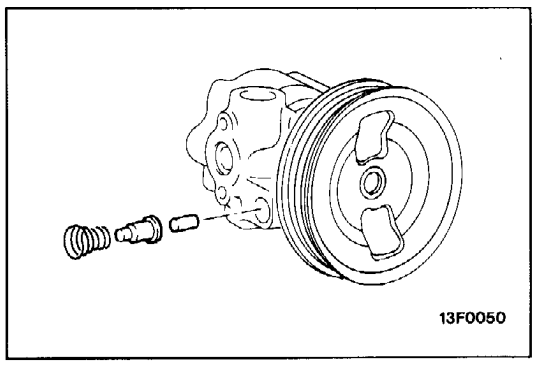


26./23./15./11./9. INSTALLATION OF O-RINGS

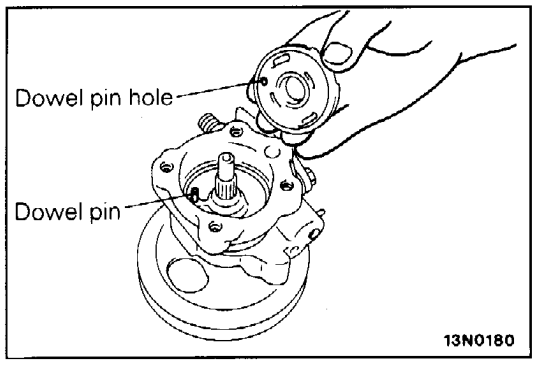
Apply specified fluid on O-rings to install.

No.	I.D.×Width	mm (in.)
1	11×1.9	(0.433×0.075)
2	13×1.9	(0.512×0.075)
3	17.8×2.4	(0.701×0.094)
4	13.5×1.5	(0.531×0.059)
5	3.8×1.9	(0.150×0.075)
6	16.8×2.4	(0.661×0.094)



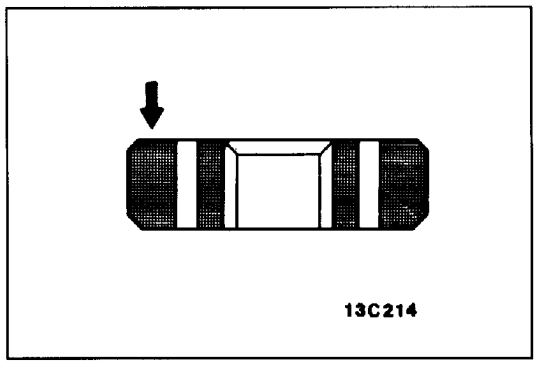
16. INSTALLATION OF SPRING

Fit the spring to the oil pump body with the larger-diameter end at the terminal assembly side.



8. INSTALLATION OF SIDE PLATE

Line up the dowel pin hole of the side plate with the dowel pin of the pump body when installing the side plate.



6. INSTALLATION OF ROTOR

Install the rotor to the pulley assembly so that the rotor's punch mark is at the pump cover side.

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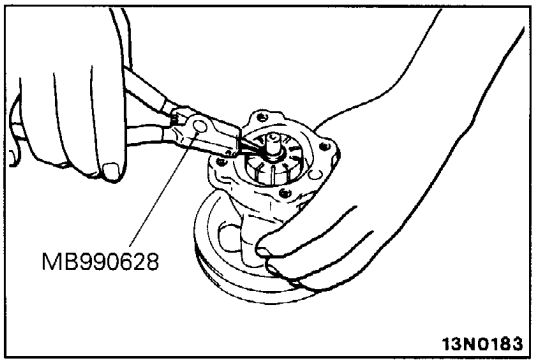
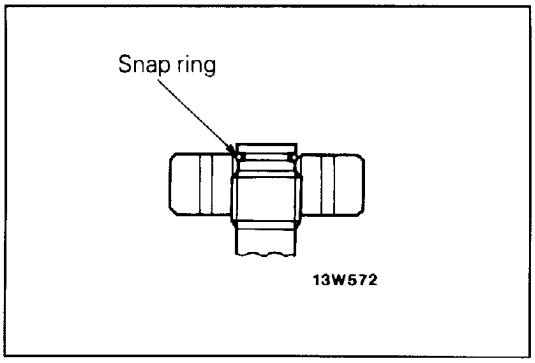
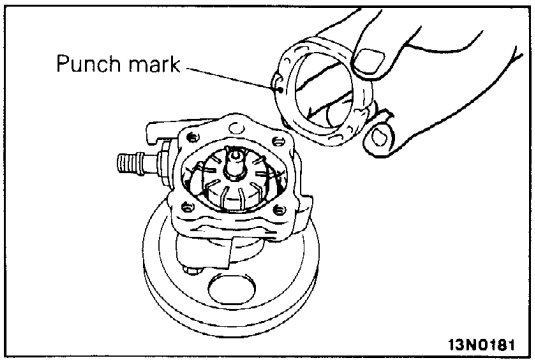


5. INSTALLATION OF SNAP RING

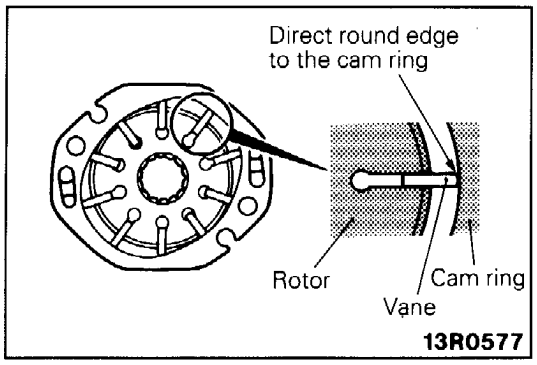


After installation of the snap ring, lift the rotor and check that the snap ring has entered the countersunk part.



4. INSTALLATION OF CAM RING

Install the cam ring with the punch mark facing the side plate.



3. INSTALLATION OF VANES

Install the vanes on the rotor, paying close attention to the installation direction.

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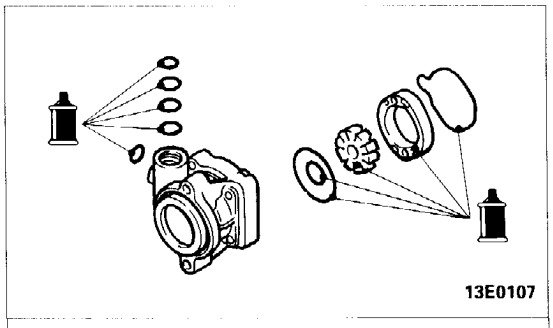
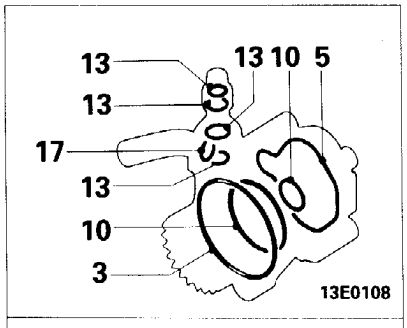
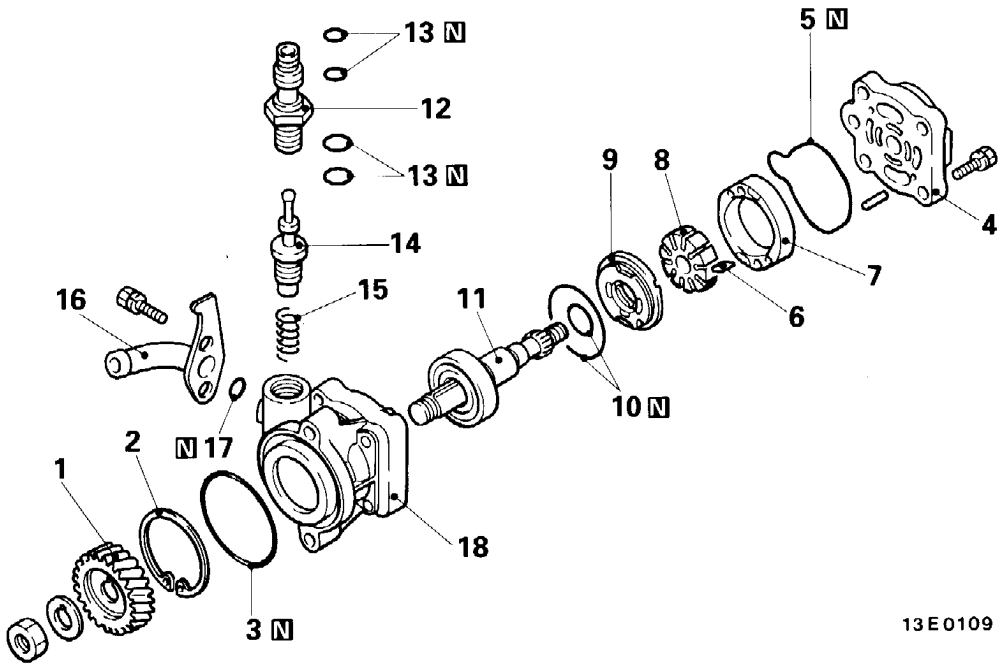
DISASSEMBLY AND REASSEMBLY <2800D>



Fluid: Automatic transmission fluid DEXRON or DEXRON II



Oil pump seal kit



Disassembly steps

1. Drive gear
2. Snap ring
3. O-ring
4. Pump cover
5. O-ring
6. Vanes
7. Cam ring
8. Rotor
9. Side plate
10. O-ring
11. Propeller shaft
12. Connector
13. O-ring
14. Flow control valve
15. Flow control spring
16. Suction connector
17. O-ring
18. Oil pump body

Caution
Do not disassemble the flow control valve.

NOTES

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STEERING HOSES

E37TA--

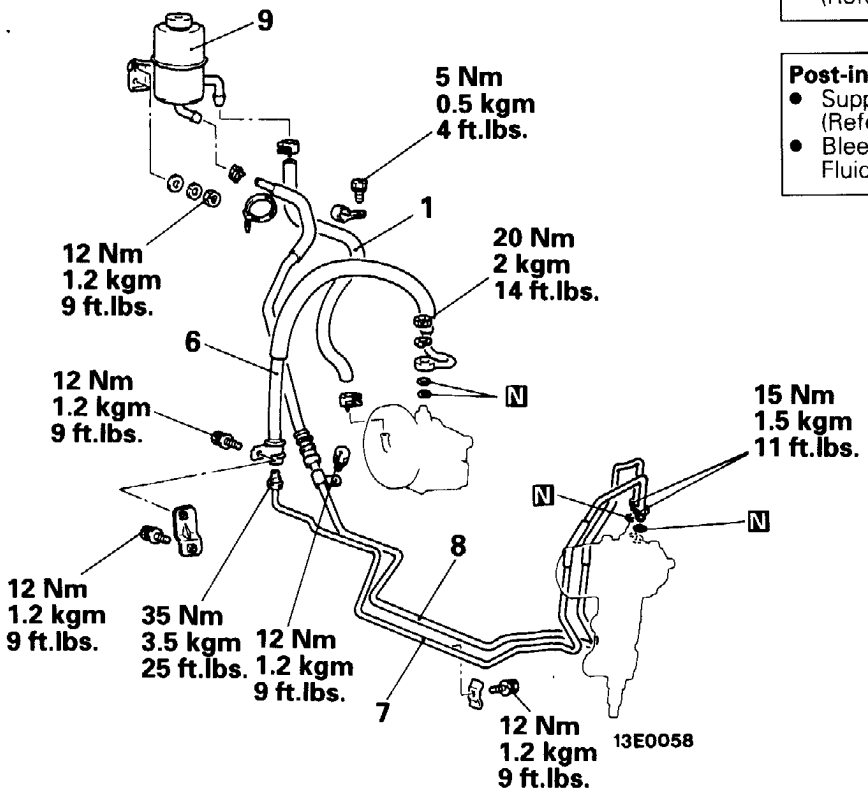
REMOVAL AND INSTALLATION

<L.H. driver vehicles>

Pre-removal Operation
- Draining of the Power Steering Fluid (Refer to P.37-10.)

Post-installation Operation
- Supplying of Power Steering Fluid (Refer to P.37-10.)
- Bleeding of the Power Steering Fluid Line (Refer to P.37-11.)

<3000–12 VALVE>



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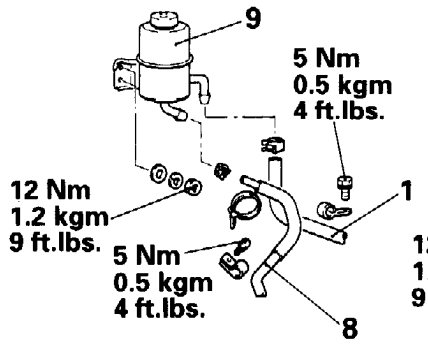

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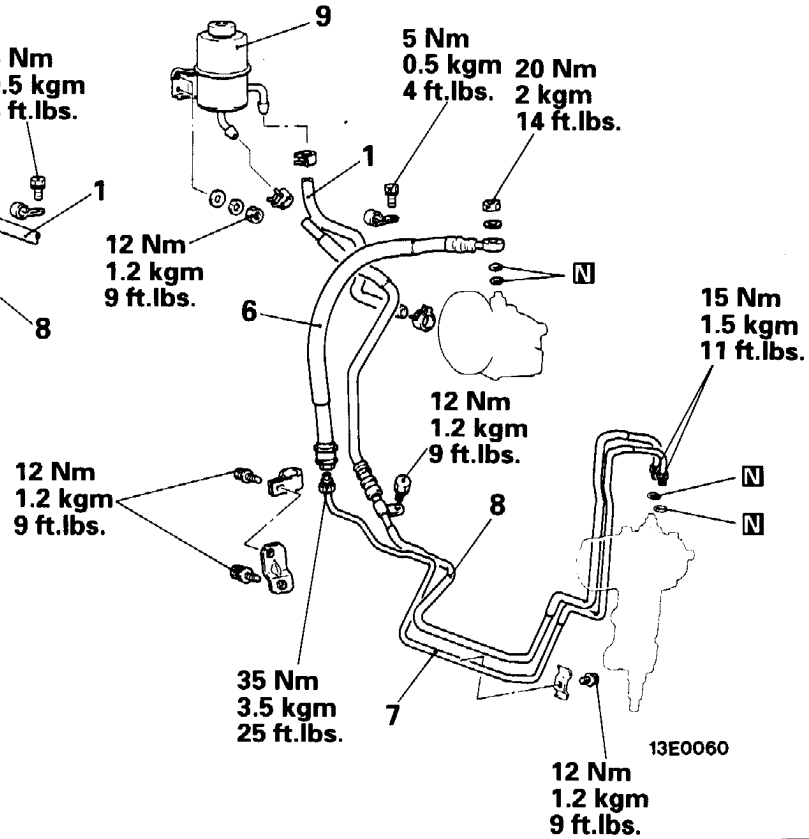
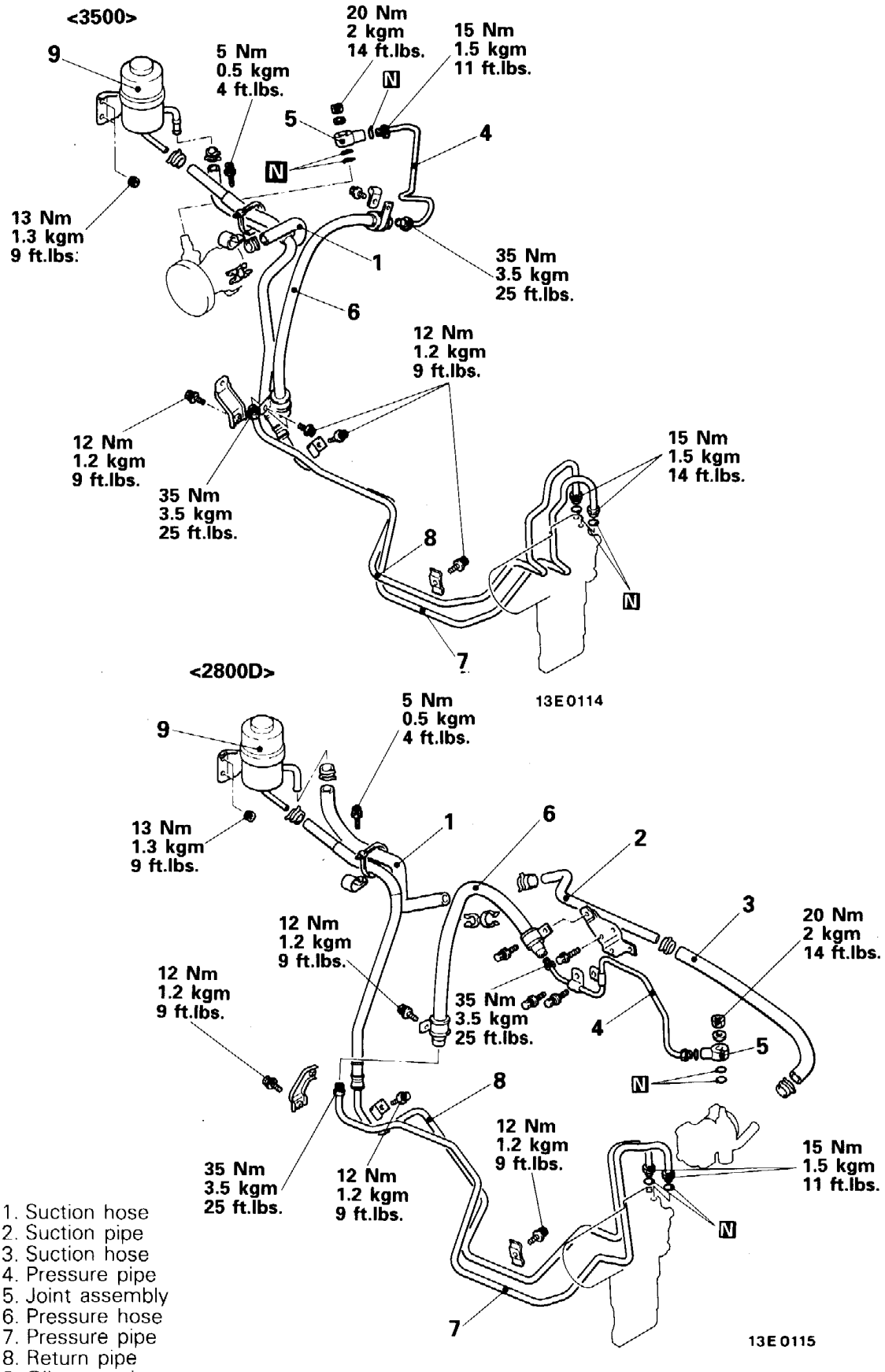
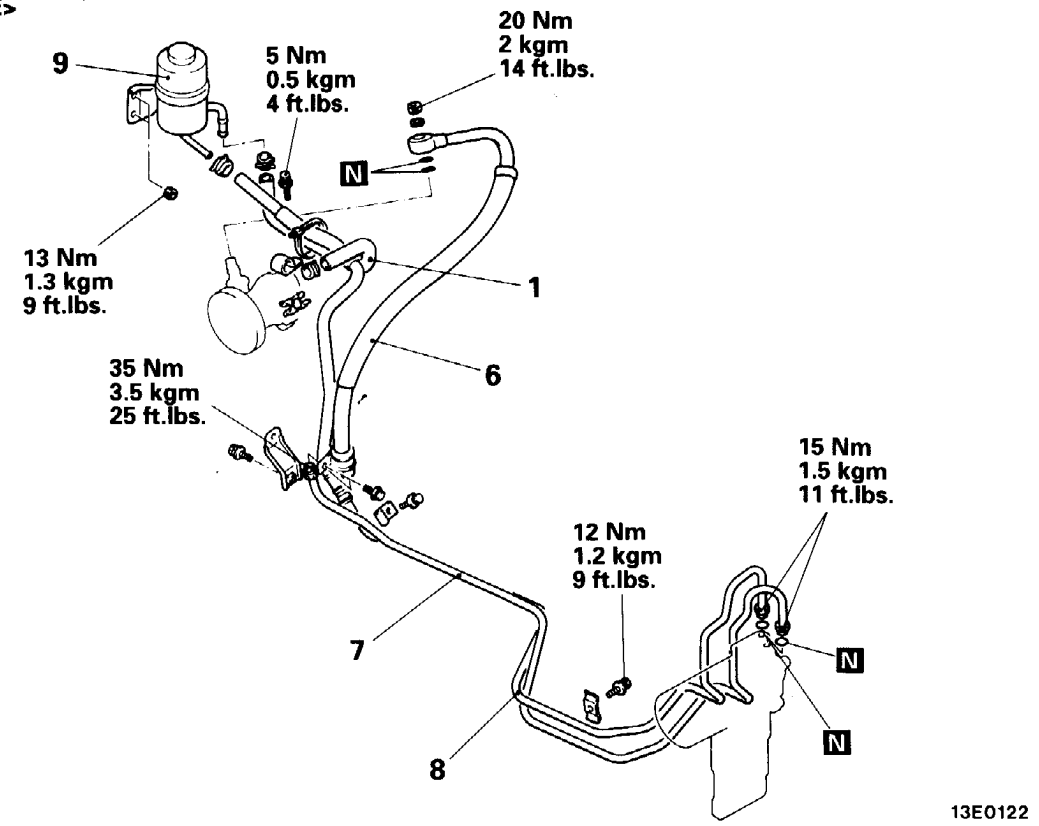


1. Suction hose
6. Pressure hose
7. Pressure pipe
8. Return pipe
9. Oil reservoir



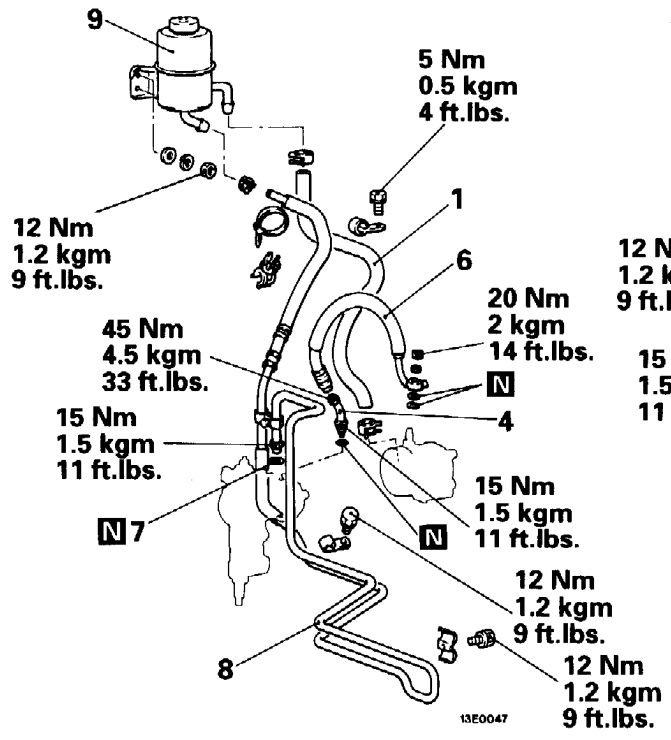
1. Suction hose
2. Suction pipe
3. Suction hose
4. Pressure pipe
5. Joint assembly
6. Pressure hose
7. Pressure pipe
8. Return pipe
9. Oil reservoir

<3000 – 24VALVE>



<R.H. drive vehicles>

<3000 – 12VALVE>



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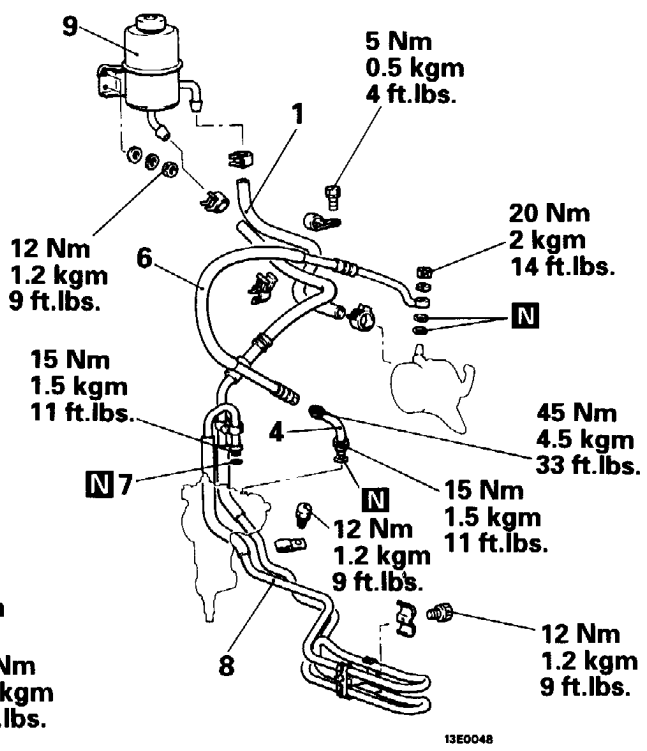

1. Suction hose
2. Suction pipe
3. Suction hose
4. Pressure pipe
5. Joint assembly
6. Pressure hose
7. Pressure pipe
8. Return pipe
9. Oil reservoir

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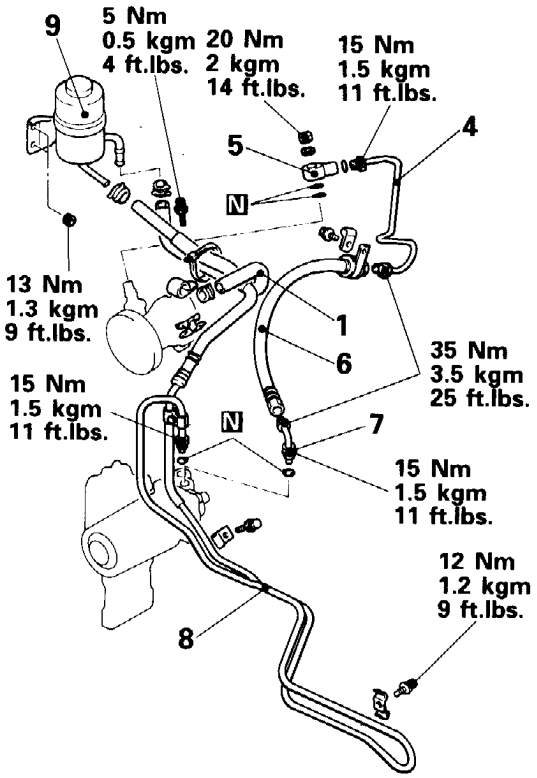
<3500>



13E0113

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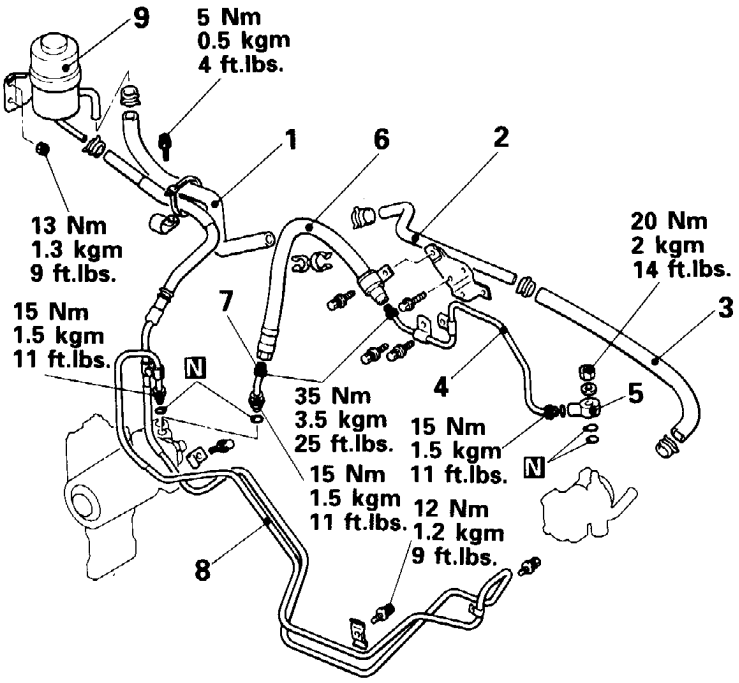

13E0112

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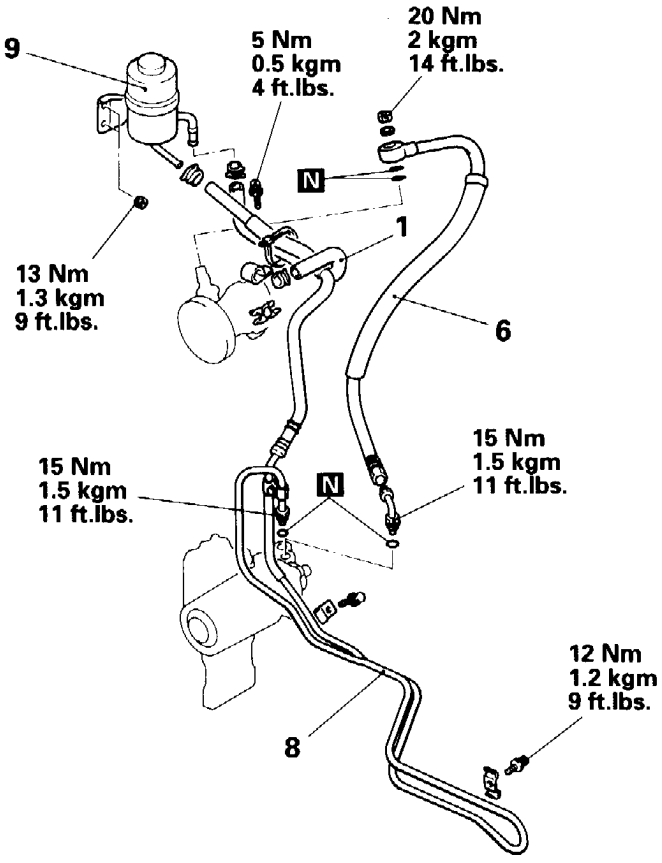
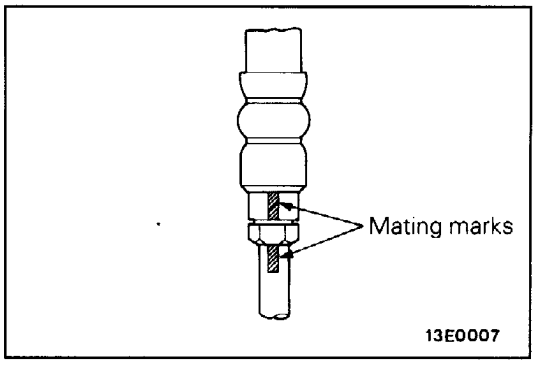


13E0123

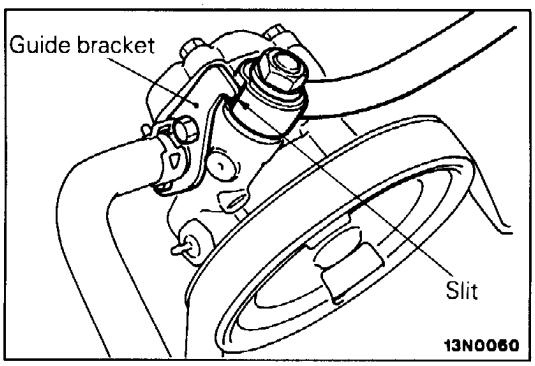
1. Suction hose
2. Suction pipe
3. Suction hose
4. Pressure pipe
5. Joing assembly
6. Pressure hose
7. Pressure pipe
8. Return pipe
9. Oil reservoir



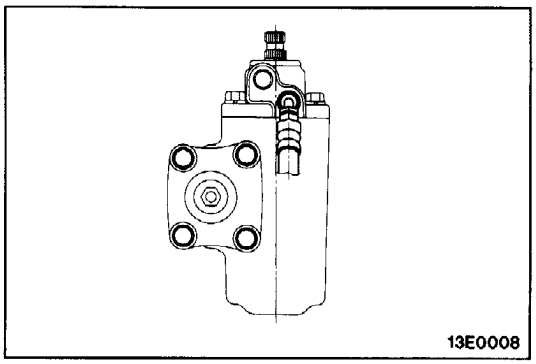
SERVICE POINT OF INSTALLATION E37TDAG

7. INSTALLATION OF PRESSURE PIPE/6. PRESSURE HOSE/5. JOINT ASSEMBLY/4. PRESSURE PIPE

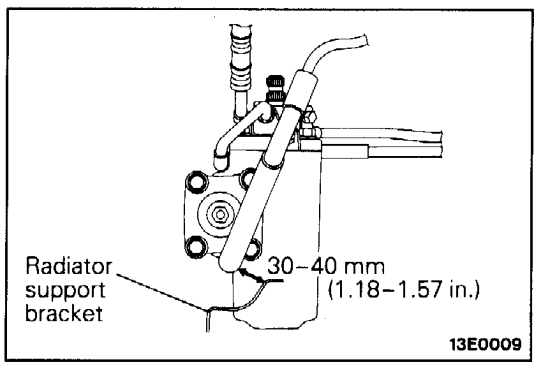
(1) Install so that the pressure pipe and pressure hose mating marks are aligned.



(2) Connect the pressure hose so that its slit part contacts the oil pump's guide bracket.



(3) <R.H. drive vehicles-3000>
Install the pressure pipe to the gearbox so that the pressure pipe is parallel to the centre line of the gearbox.



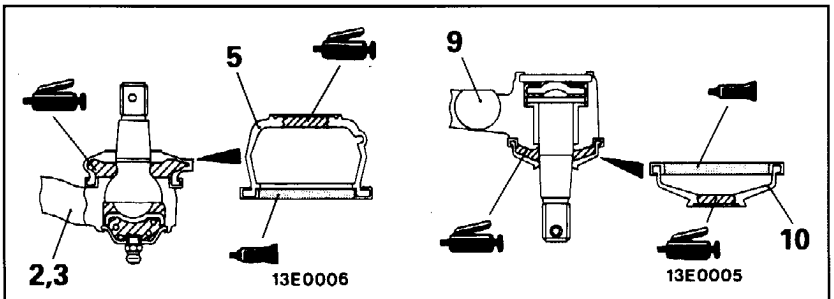
<R.H. drive vehicles-2500D>
Install the pressure hose to the gearbox so that the clearance between the pressure hose and the radiator support bracket is at the distance shown in the illustration.

STEERING LINKAGE

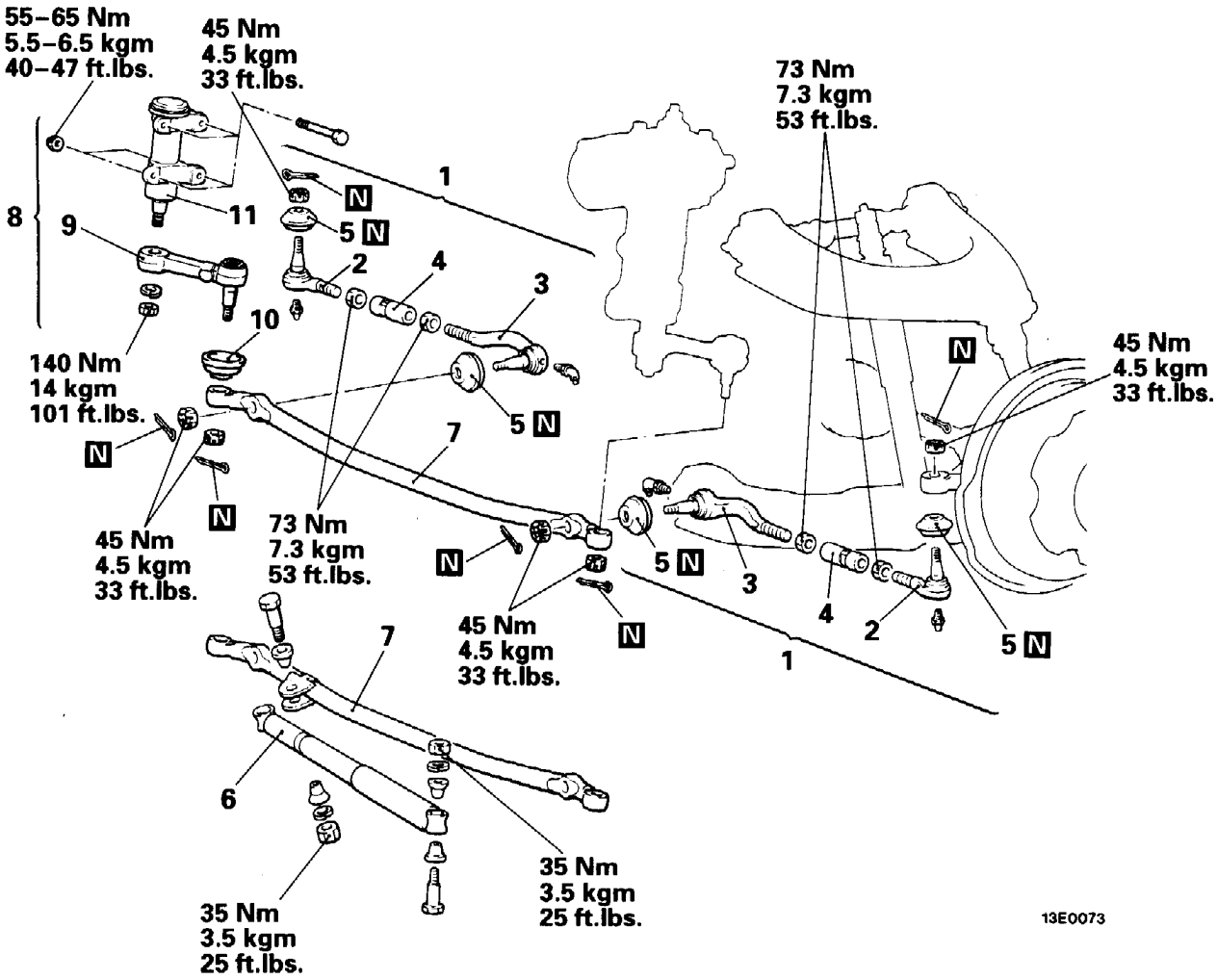
E37VA--

REMOVAL AND INSTALLATION

Post-installation Operation
- Adjustment of the Front Wheel Alignment (Toe-in)
(Refer to GROUP 33–Service Adjustment Procedures.)



Sealant: 3M ATD Part No. 8661 or equivalent



Removal steps

- ◆◆ 1. Tie rod assembly
- ◆◆ 2. Tie rod end, outer
- ◆◆ 3. Tie rod end, inner
- ◆◆ 4. Pipe
- 5. Dust cover
- 6. Damper
- ◆◆ 7. Relay rod
- 8. Idler arm (complete)
- ◆◆ 9. Idler arm
- 10. Dust cover
- 11. Idler arm support

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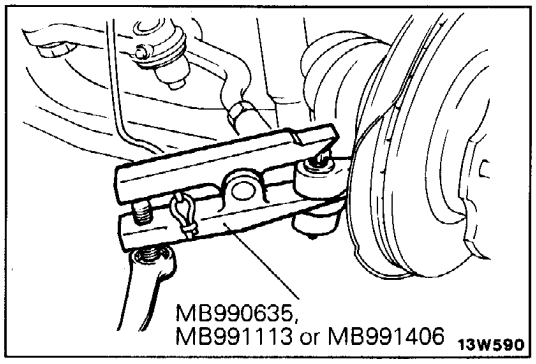
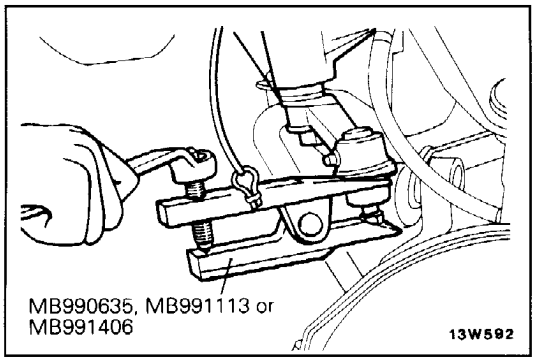


SERVICE POINTS OF REMOVAL E37VBAD

1. DISCONNECTION OF TIE ROD ASSEMBLY

Caution

1. Use cord to bind the special tool closely so it will not become separated.
2. The nut should be loosened only, not removed.

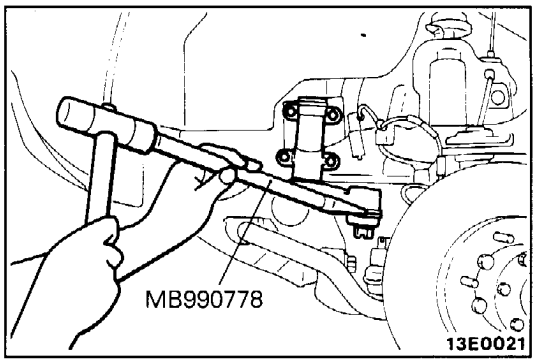


7. REMOVAL OF RELAY ROD

<Pitman arm side>

Caution

1. Use cord to bind the special tool closely so it will not become separated.
2. The nut should be loosened only, not removed.

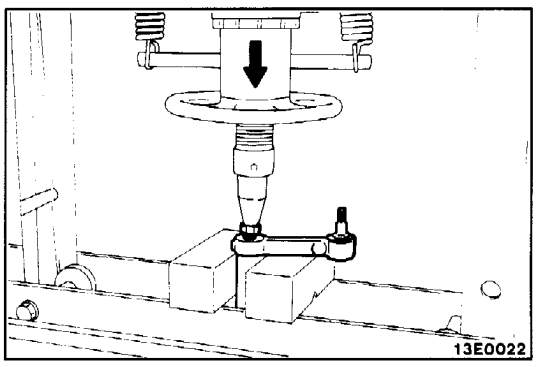


<Idler arm side>

Hammer the special tool to remove the relay rod from the idler arm.

Caution

The nut should be loosened only, not removed.

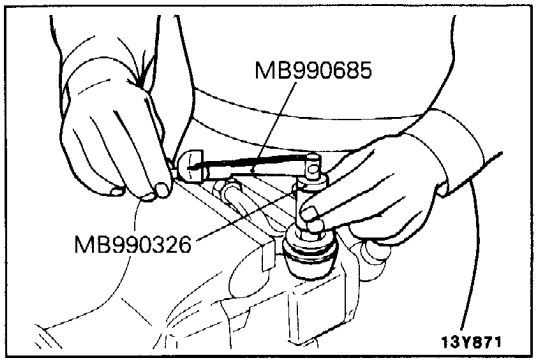


9. REMOVAL OF IDLER ARM

Use a bench press to remove the idler arm.

Caution

The nut should be loosened only, not removed.



INSPECTION E37VCAB

BALL JOINT STARTING TORQUE

Standard value:

Tie rod end 1–3 Nm (10–30 kgcm, 9–26 in.lbs.)
Idler arm 0.5–2.0 Nm (5–20 kgcm, 4–17 in.lbs.)

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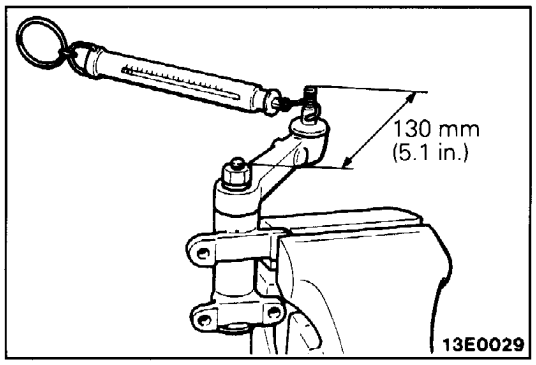
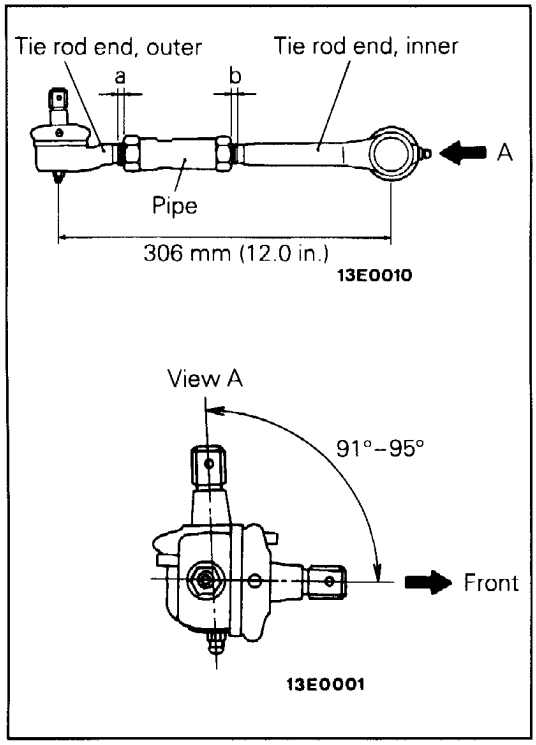


IDLER ARM STARTING TORQUE

Standard value: 0.3–2.0 Nm (3–20 kgcm, 3–17 in.lbs.)
[2.3–15.4 N (0.23–1.54 kg, 0.5–33.9 lbs.)]



SERVICE POINTS OF INSTALLATION E37VFAD

4. INSTALLATION OF PIPE/3. TIE ROD END, INNER/2. TIE ROD END, OUTER

(1) Install the tie rod assembly so that the dimension is as shown in the diagram.

NOTE
The illustration at left shows the left-side tie rod assembly. The right-side tie rod assembly is symmetrical to the left-side assembly.

(2) Adjust the pipe so that the difference in dimensions a and b is 1.5 mm (0.059 in.) or less, and then provisionally tighten the lock nut.

NOTE
Fully tighten the lock nut after the tie rod assembly is installed to the body and the toe-in has been adjusted.

BODY

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ROLL BAR 48

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SPECIFICATIONS

GENERAL SPECIFICATIONS

E42CA--

Items		Specifications
Hood		
Type		Rear hinged, front opening type
Front door		
Construction		Front hinged, sash construction
Regulator system		Wire type
Locking system		Pin-fork type
Rear door		
Construction		Front hinged, sash construction
Regulator system		Wire type
Locking system		Pin-fork type
Back door		
Construction		Right hinged, sash construction
Locking system		Pin-fork type
Glass installation method		
Windshield glass		Adhesive type
Back door window glass		Adhesive type
Glass thickness		
Windshield glass	mm (in.)	5.3 (0.21)
Quarter window glass	mm (in.)	3.5 (0.14)*1, 4.0 (0.16)*2
Front door glass	mm (in.)	3.5 (0.14)
Rear door glass	mm (in.)	3.5 (0.14)
Back door window glass	mm (in.)	3.5 (0.14)
Sunroof glass	mm (in.)	5.0 (0.20)
Frame type		Ladder type
Power window motor		
Type		Permanent magnet type (built-in circuit breaker)
Revolutions under no load	r/min.	75 or more
Revolutions under load	r/min.	
At 1 Nm (0.1 kgm, 0.72 ft.lbs.)		65–95
At 2 Nm (0.2 kgm, 1.45 ft.lbs.)		50–80
Bound current	A	34 or less
Direction of rotation		Clockwise and anti-clockwise
Sunroof motor		
Type		DC ferrite (with built-in circuit breaker)
Speed at no load	r/min.	155–195, 130–160*3
Speed at load	r/min.	
At 1 Nm (0.1 kgm, 0.72 ft.lbs.)		115–145*3
At 2 Nm (0.2 kgm, 1.45 ft.lbs.)		110–150
Bound current	A	35 or less
Turning direction		Both clockwise and anti-clockwise

NOTE
(1) *1: Sliding type (2) *2: Fixed type (3) *3: Canvas Top

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Items		Specifications
Power window relay		
Maximum contact current	A	20
Rated coil current	A	0.2 or less
Voltage drop between terminals (At 12 V and the rated load current)	V	0.3 or less
Door control unit		
Operating voltage range	V	10–16
Current consumption (when not in operation)	mA	3 or less
Front door lock actuator		
Bound current (at 12 V)	A	2.5–4.5
Operating voltage range	V	9–15
*Tripping time (at 12 V)	Second	5–30
Rear door lock actuator		
Bound current (at 12 V)	A	2.5–4.5
Operating voltage range	V	9–15
*Tripping time (at 12 V)	Second	5–30

NOTE
* Tripping time is the time consumed until current reaches 0.5 A after power connection.

SERVICE SPECIFICATIONS

E42CB--

Items		Standard value
Door inside handle play mm (in.)		4–10 (0.16–0.39)
Door outside handle play mm (in.)	Front and rear door	3–12 (0.12–0.47)
	Back door	2–8 (0.08–0.31)
Slipping force of motor clutch N (kg, lbs.)	Power slide type sunroof	40–50 (4.0–5.0, 9–11)
	Canvas top	45–55 (4.5–5.5, 10–12)
Sunroof sliding resistance N (kg, lbs.)		200 (20, 44)

SEALANTS AND ADHESIVES

E42CE--

Items	Specified sealant and adhesive	Remarks
Intercooler weatherstrip Screen drip Sunroof glass weatherstrip Roof cover weatherstrip	3M ATD Part No. 8001 or 3M ATD Part No. 8011, or equivalent	Drying adhesive
Fender panel Splush shield Waterproof film	3M ATD Part No. 8625 or equivalent	Ribbon sealer
Windshield glass Rear window glass	3M Super Fast Urethan Auto Glass sealant Part No. 8609 or equivalent	–
	3M Super Fast Urethan Primer Part No. 8608 or equivalent	–

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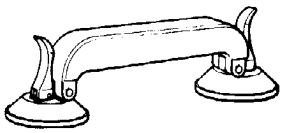
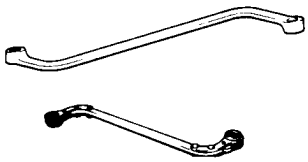
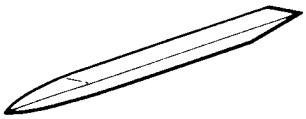
Items	Specified sealant and adhesive	Remarks
Sunroof glass weatherstrip	3M ATD Part No. 8513 or equivalent	Drying sealant
	3M ATD Part No. 8509 or equivalent	Non-drying sealant
Rail end cover	3M ATD Part No. 8531 or 3M ATD Part No. 8646, or equivalent	Body sealant

SPECIAL TOOLS

E42DA--

Tool	Number	Name	Use
	MB990480	Glass holder	Removal and installation of windshield
	MB990449	Window moulding remover	Removal of the window moulding
	MB990900 or MB991164	Door adjusting wrench	Adjustment of door fit
	MB990784	Ornament remover	Removal of the window moulding and interior parts

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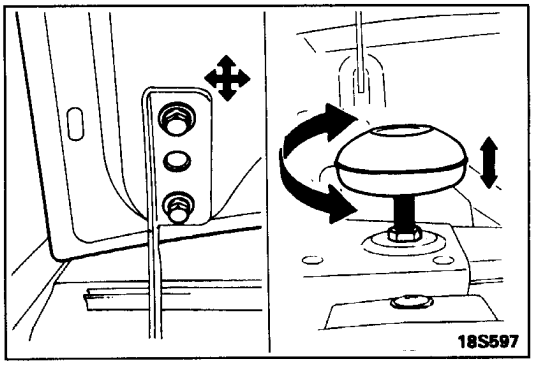
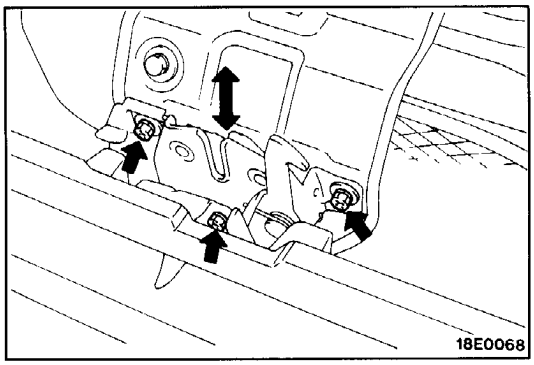


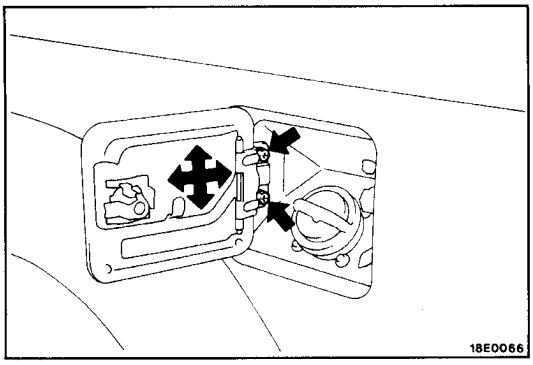
SERVICE ADJUSTMENT PROCEDURES

HOOD ADJUSTMENT E42FBAE

1. Loosen the hood mounting bolts, and then adjust the hood by moving it so that the clearance is equal on all sides.
2. Turn the hood bumpers, adjust the height of the hood.

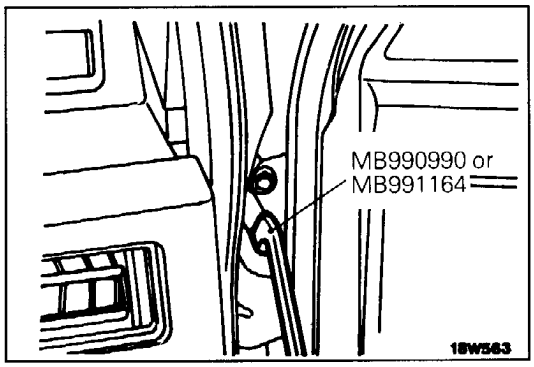


3. Loosen the hood latch mounting bolts, and move the hood, latch to adjust the attachment between the hood latch and hood striker.



FUEL FILLER DOOR ADJUSTMENT E42FCAF

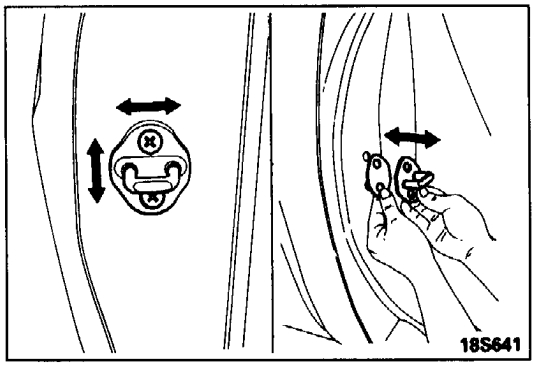
Loosen the fuel filler door mounting screw and adjust the fuel filler door so that the clearance around the fuel filler door is even without any height differences.



FRONT AND REAR DOOR ADJUSTMENT E42FDAH

1. Use the special tool to loosen the hinge mounting bolts on the body side, and then adjust the clearance around the door so that it is uniform on all sides.

   Caution
   Attach protection tape to the fender edges where the hinge is installed.



2. When the door is replaced, loosen hinge mounting bolts on door side and adjust alignment of fender panel with front door panel.
3. Loosen door striker mounting screws to adjust alignment of door panel.
4. Increase or decrease the number of shims and move striker to adjust engagement of striker with door latch.

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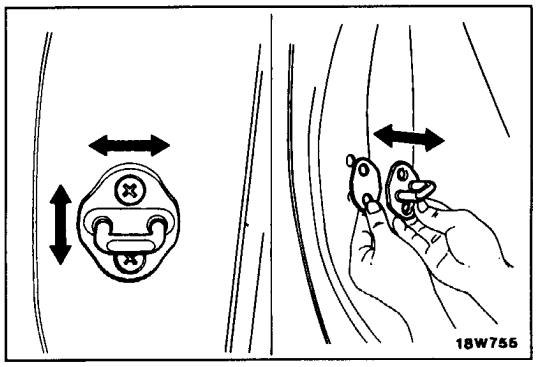
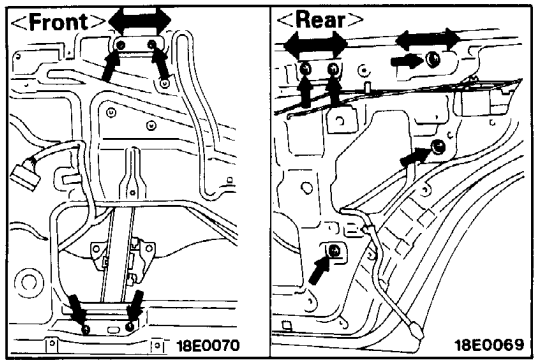


BACK DOOR ADJUSTMENT E42FMAF

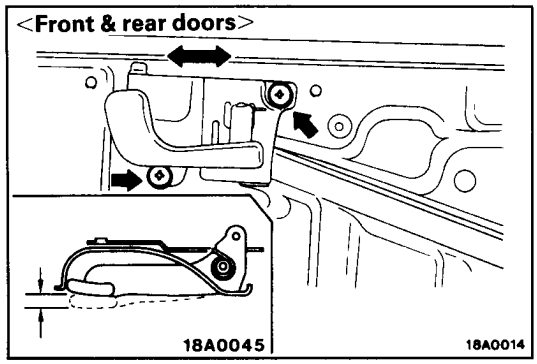
1. Adjust the fit of the door panel to the body by loosening the striker mounting screws and moving the striker.
2. Adjust the linking of the striker and the door latch by increasing or decreasing the thickness of the striker shim.



DOOR WINDOW GLASS ADJUSTMENT E42FEAN

Check that the door window glass runs smoothly in the door glass channel when the glass is fully raised and lowered. If it does not, adjust by the following procedure.

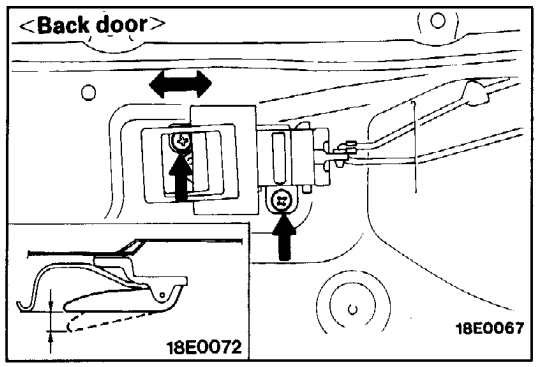
1. Remove the door trim and waterproof film. (Refer to P.42-25.)
2. Loosen the window regulator assembly mounting bolts and move the uupper attachment back and forward to adjust the tilt of the glass.
3. Loosen the rear door centre sash mounting bolt, and adjust the front-to-back position of the glass.

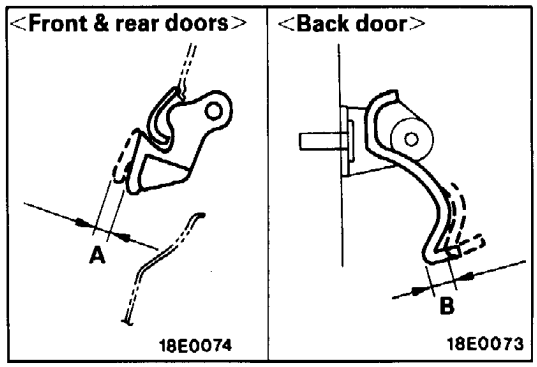


DOOR INSIDE HANDLE PLAY ADJUSTMENT E42FGAC

1. Remove the door trim and waterproof film. (Refer to P.42-25, 35.)
2. Move the door inside handle installation position back and forth to adjust so that the inside handle play allowance agress with the standard value.

Standard value: 4–10 mm (0.16–0.39 in.)





DOOR OUTSIDE HANDLE PLAY CHECK E42FHAG

If the door outside handle play does not conform to the standard value, check the door outside handle or door latch assembly, and replace if necessary.

Standard value: (A) 3–12 mm (0.12–0.47 in.)
(B) 2–8 mm (0.08–0.31 in.)

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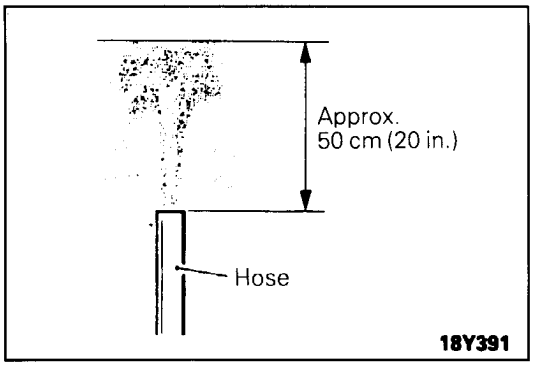
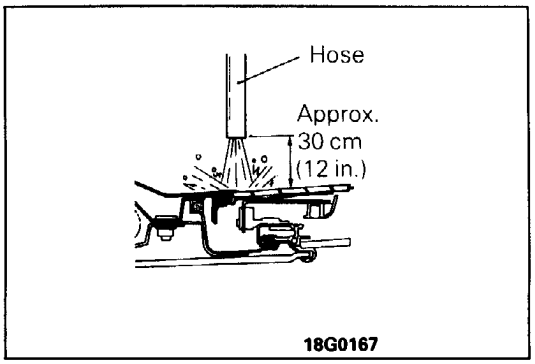


WATER TEST

E42FOAB

1. Fully close the sunroof or canvas.
2. Hold hose upward and adjust water fountain to about 50 cm (20 in.) high.



3. Pour water over the roof from about 30 cm (12 in.) above roof for more than 5 minutes.
4. While pouring water, check for leak around the sunroof or canvas.
5. In the event of leakage, check drain hose, weatherstrip contact and others.

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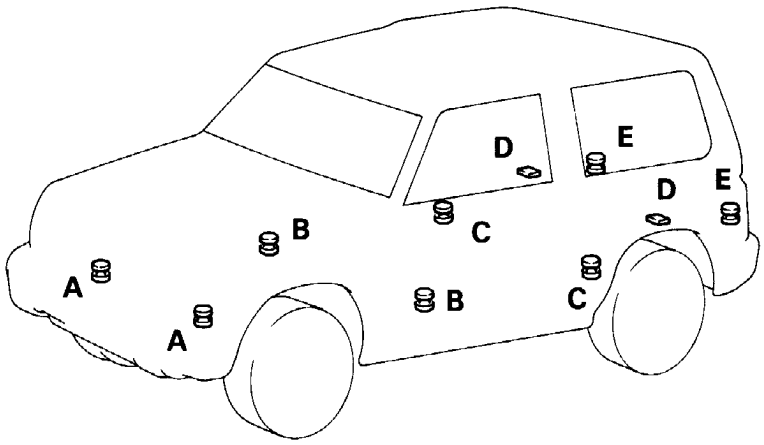
BODY MOUNTING

E42GAAE

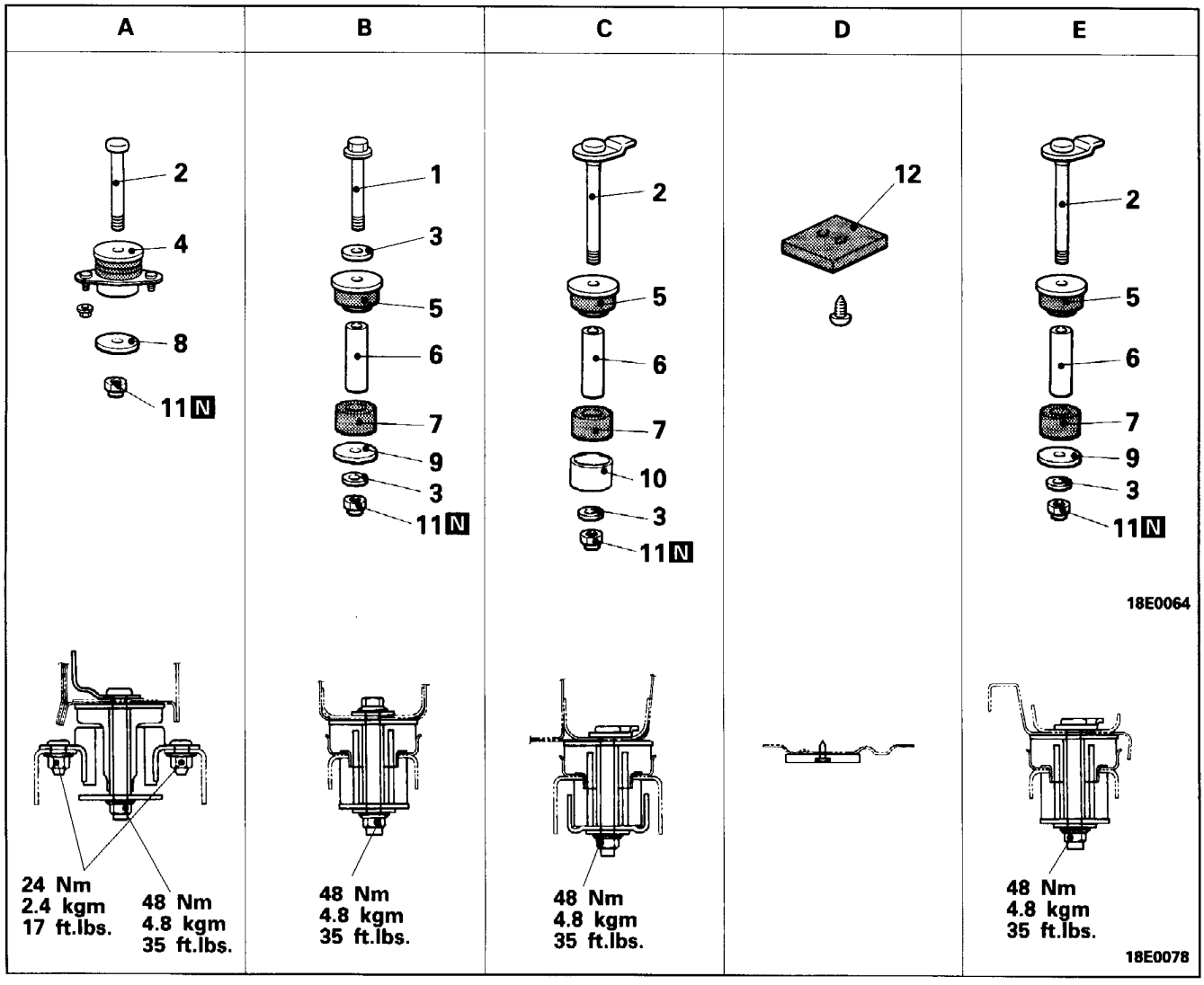
REMOVAL AND INSTALLATION

<2-door models>

1. Special bolt
2. Mounting bolt
3. Plain washer
4. Body mounting rubber
5. Body mounting rubber A
6. Spacer
7. Body mounting rubber B
8. Plate
9. Washer
10. Body mount stopper
11. Self locking nut
12. Body shim



18E0076



18E0064

18E0078

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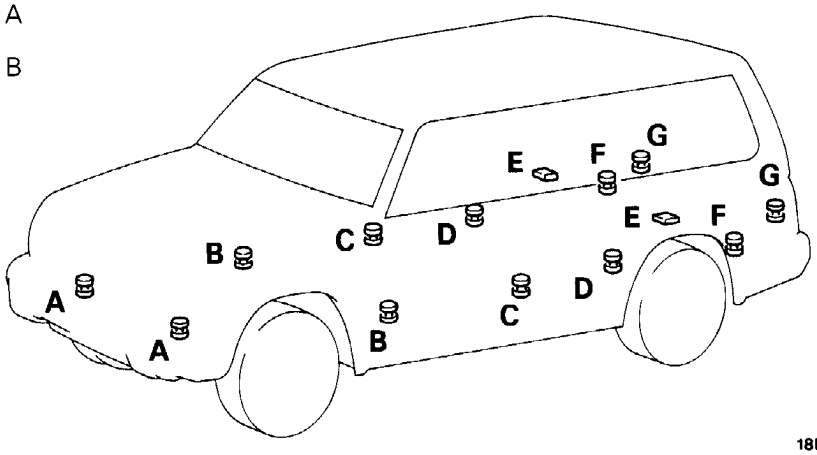
<4-door models>

E42GAAE

1. Special bolt
2. Mounting bolt
3. Plain washer
4. Body mounting rubber
5. Body mounting rubber A
6. Spacer
7. Body mounting rubber B
8. Plate
9. Washer
11. Self locking nut
12. Body shim



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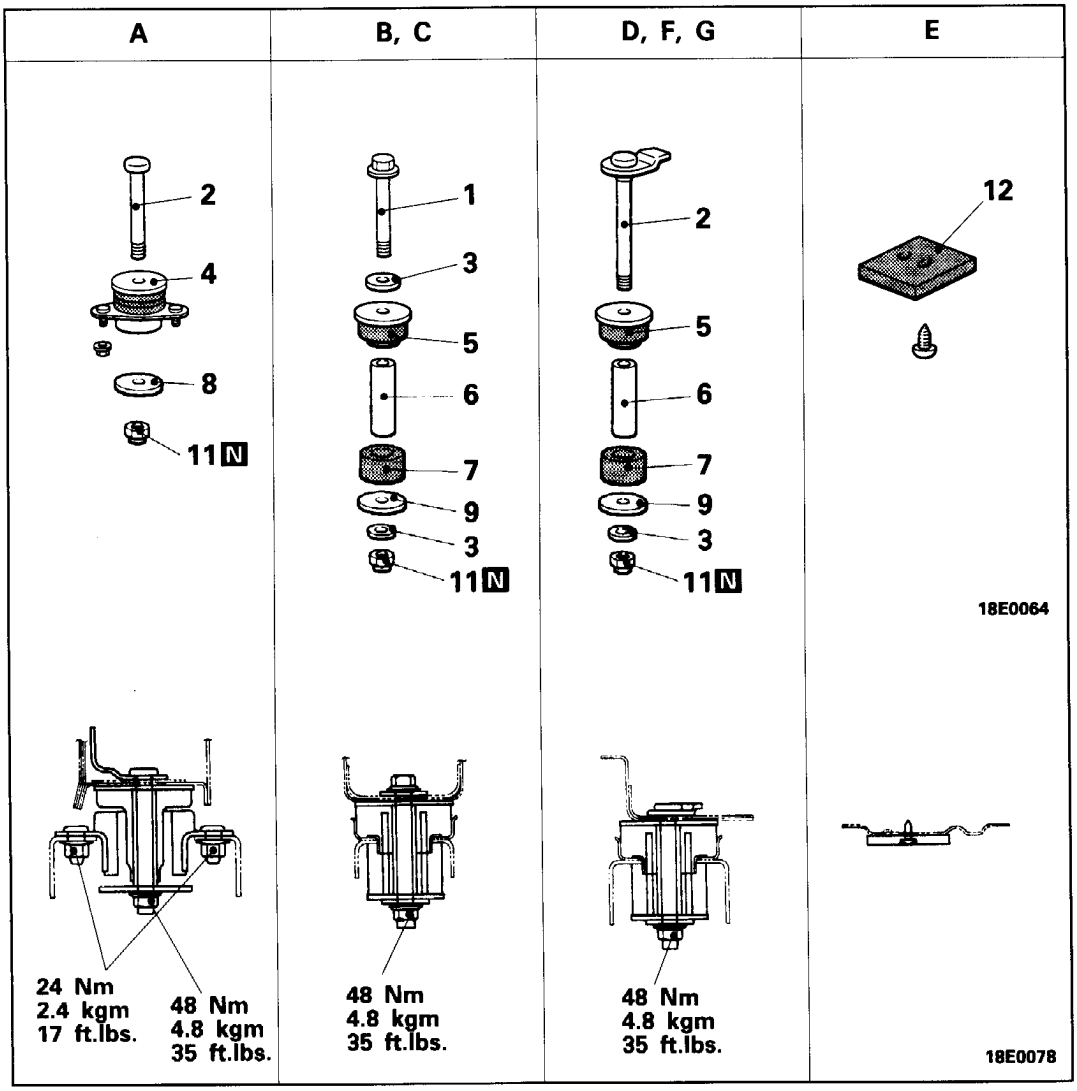

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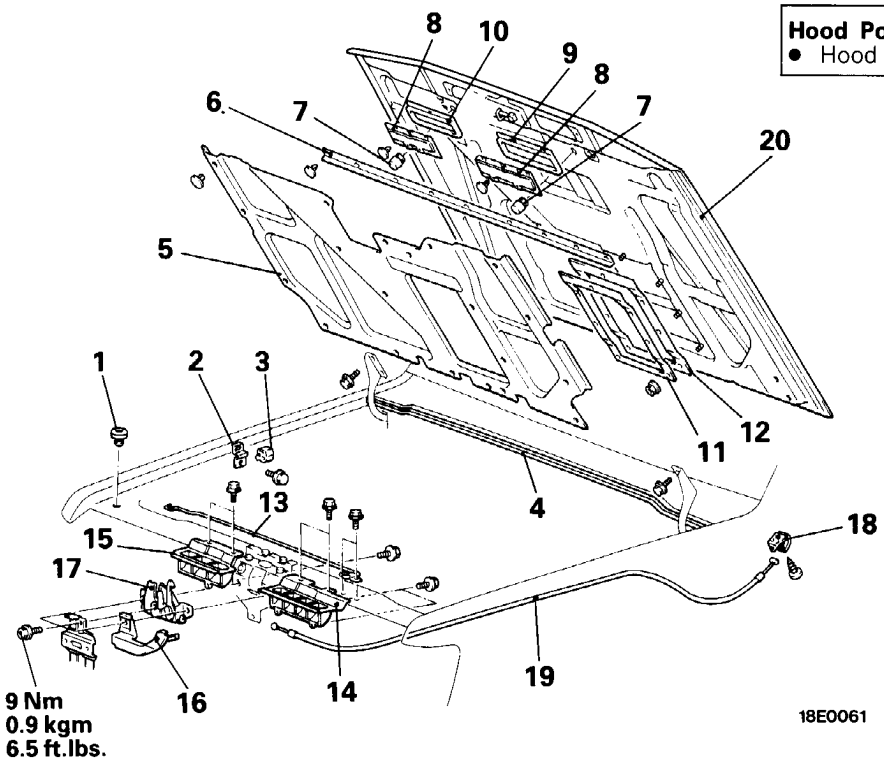
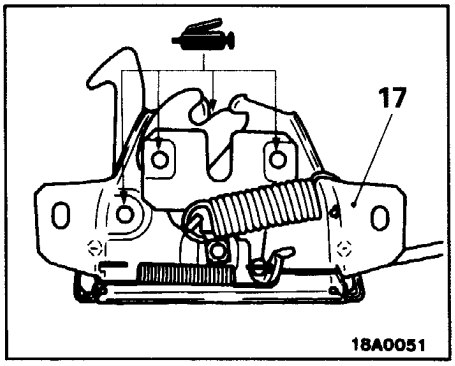
HOOD

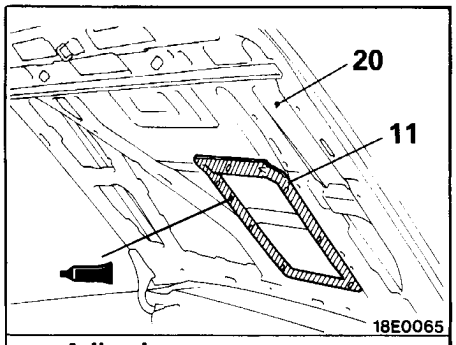
E42HAAK

REMOVAL AND INSTALLATION



Hood Post-installation Operation
- Hood Adjustment (Refer to P.42-5.)





Adhesive:
3M ATD Part No. 8001 or 3M ATD Part No. 8011 or equivalent

- 1. Hood bumper
- 2. Hood bumper bracket
- 3. Damper
- 4. Hood rear weatherstrip
- 5. Hood heat protector <Except for 2400>
- 6. Hood front weatherstrip
- 7. Bumper
- 8. Plate <2400>
- 9. Intercooler duct weatherstrip (LH)*
- 10. Intercooler duct weatherstrip (RH)*
- 11. Intercooler weatherstrip plate*
- 12. Intercooler weatherstrip*
- 13. Hood support rod

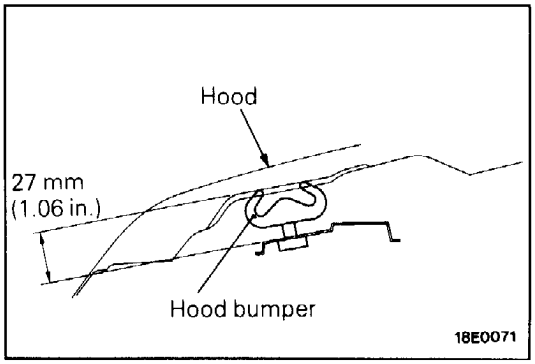
Hood latch, intercooler duct and hood lock release cable removal steps

- Radiator grille
- 14. Intercooler duct (LH)*
- 15. Intercooler duct (RH)*
- 16. Hood cable protector
- 17. Hood latch
- 18. Hood lock release handle
- 19. Hood lock release cable

Hood removal steps

- Washer tube (Refer to GROUP 51 – Front Wiper and Washer)
- 20. Hood

NOTE
*: Vehicles with intercooler



SERVICE POINT OF INSTALLATION

1. INSTALLATION OF HOOD BUMPER

Install the hood bumper as shown in the figure.

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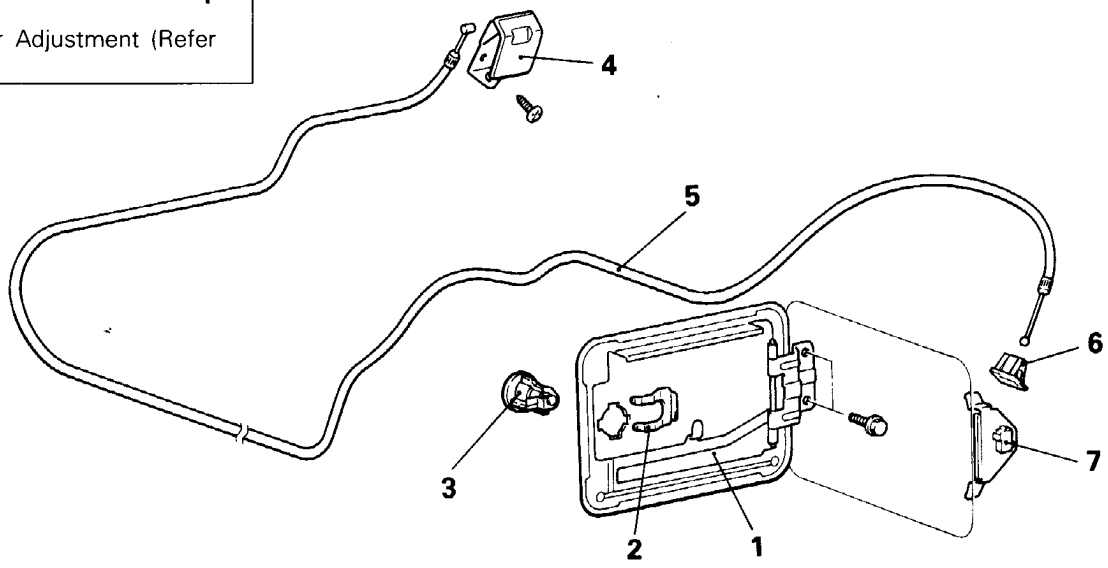
FUEL FILLER DOOR

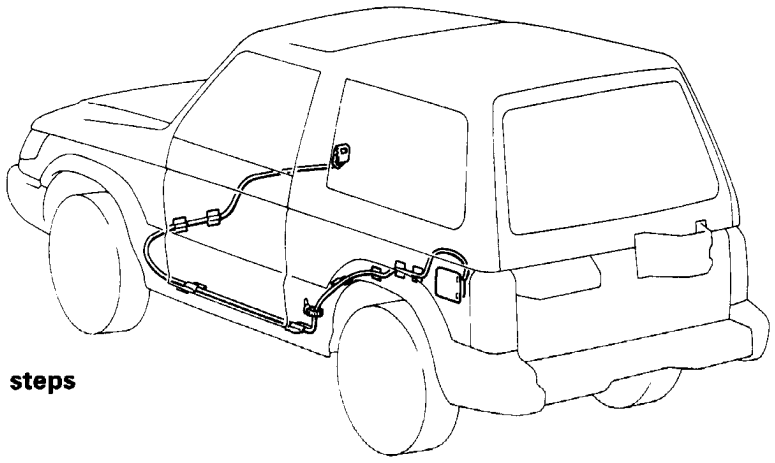
E42JBAM

REMOVAL AND INSTALLATION

Fuel Filler Door Post-installation Operation
- Fuel Filler Door Adjustment (Refer to P.42-5.)



18E0059



18E0058

1. Fuel filler door

Lock cylinder assembly removal steps

2. Retainer
3. Lock cylinder assembly

Fuel filler door lock release cable removal steps

<2-door models>
- Scuff plate (LH)
- Quarter trim (LH) (Refer to GROUP 52 – Trims.)

4. Fuel filler door lock release handle
5. Fuel filler door lock release cable
6. Cable holder

<4-door models>
- Center piller trim (LH)
- Front rail cover (LH)
- Rear rail cover (LH)
- Quarter trim (LH)

(Refer to GROUP 52–Trims.)

4. Fuel filler door lock release handle
5. Fuel filler door lock release cable
6. Cable holder

Fuel filler door hook removal steps

5. Connection for fuel filler door lock release cable
7. Fuel filler door hook

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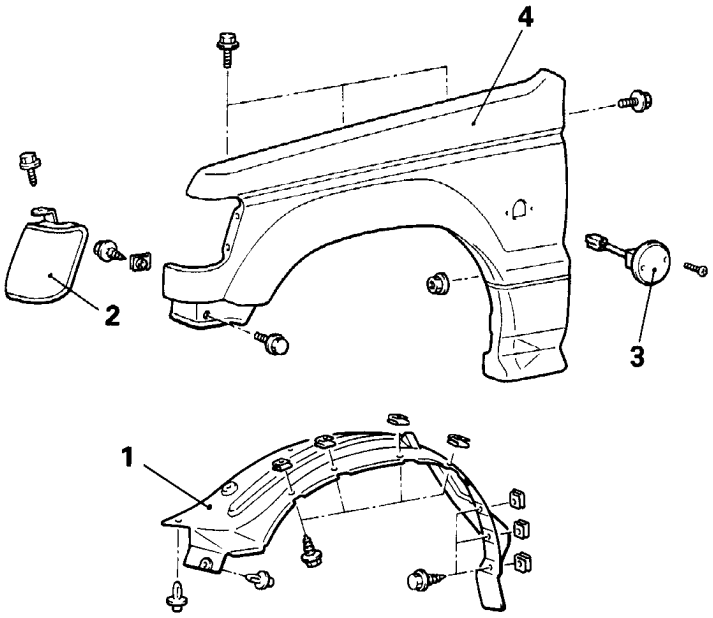
FENDER

E42KAAT

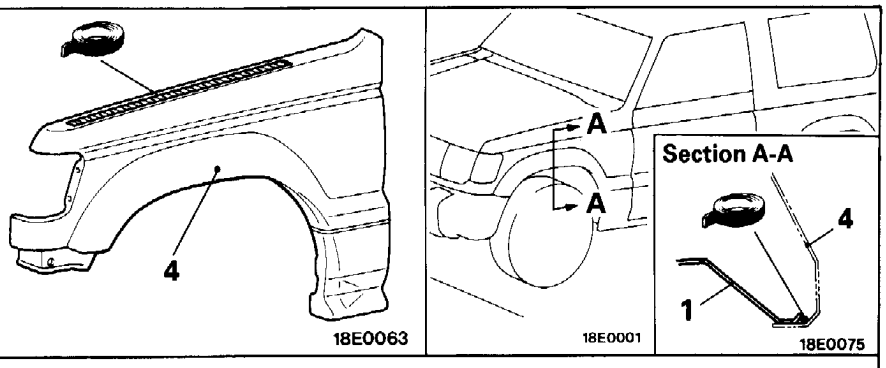
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
Removal and Installation
- Side Step Front Cover (Refer to GROUP 51 – Exterior Parts.)
- Front Mud Gard and Wide Fender (Refer to GROUP 51 – Garnish and Moulding.)

Removal steps
1. Splush shield
2. Front turn signal lamp
- Front bumper
3. Side turn signal lamp
4. Front fender panel



18E0062



Sealant:
3M ATD Part No. 8625 or equivalent

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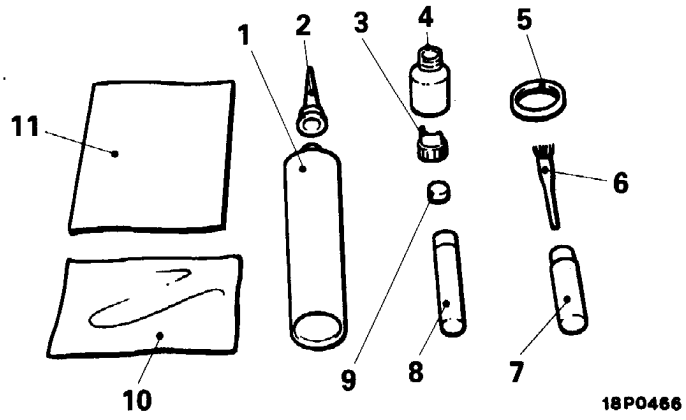
WINDSHIELD GLASS

WINDSHIELD REPAIR

E42LABN

- Adhesive: 3M Super Fast Urethan Auto Glass Sealant Part No. 8609 or equivalent
  Primer: 3M Super Fast Urethan Primer Part No. 8608 or equivalent
- Auto Window Sealer Kit TEROSON-127, 37V

1. Sealer
2. Nozzle
3. Primer container
4. Primer container cap
5. Piano wire
6. Bush
7. Cleaner
8. Primer
9. Filter
10. Gauge
11. Instruction manual



NOTE
When using TEROSON-127, 37V, follow the instructions of the manual included in the kit.

Additional material required	
Spacers	Available as service part
Dam	Available as service part
Anti-rust solvent (or Tectyl 506T .... Valvoline Oil Company)	For rust prevention
Isopropyl alcohol	For grease removal from bonded surface
Steel piano wire	Dia × length .... 0.6 mm × 1 m (0.024 in. × 3 ft.) For cutting adhesive
Adhesive gun	For pressing-out adhesive

HANDLING OF AUTO WINDOW SEALER

Keep the sealant in a cool place, not exposed to the direct rays of the sun.
Do not place any heavy article on the sealant nor press it, otherwise it will become deformed.
Avoid storing the sealant for more than 6 months, because it will lose its sealing effect.

BODY PINCH-WELD FLANGE SERVICING

Before servicing the body pinch-weld flange, remove old adhesive completely.
If the flange requires painting, bake it after painting is completed.

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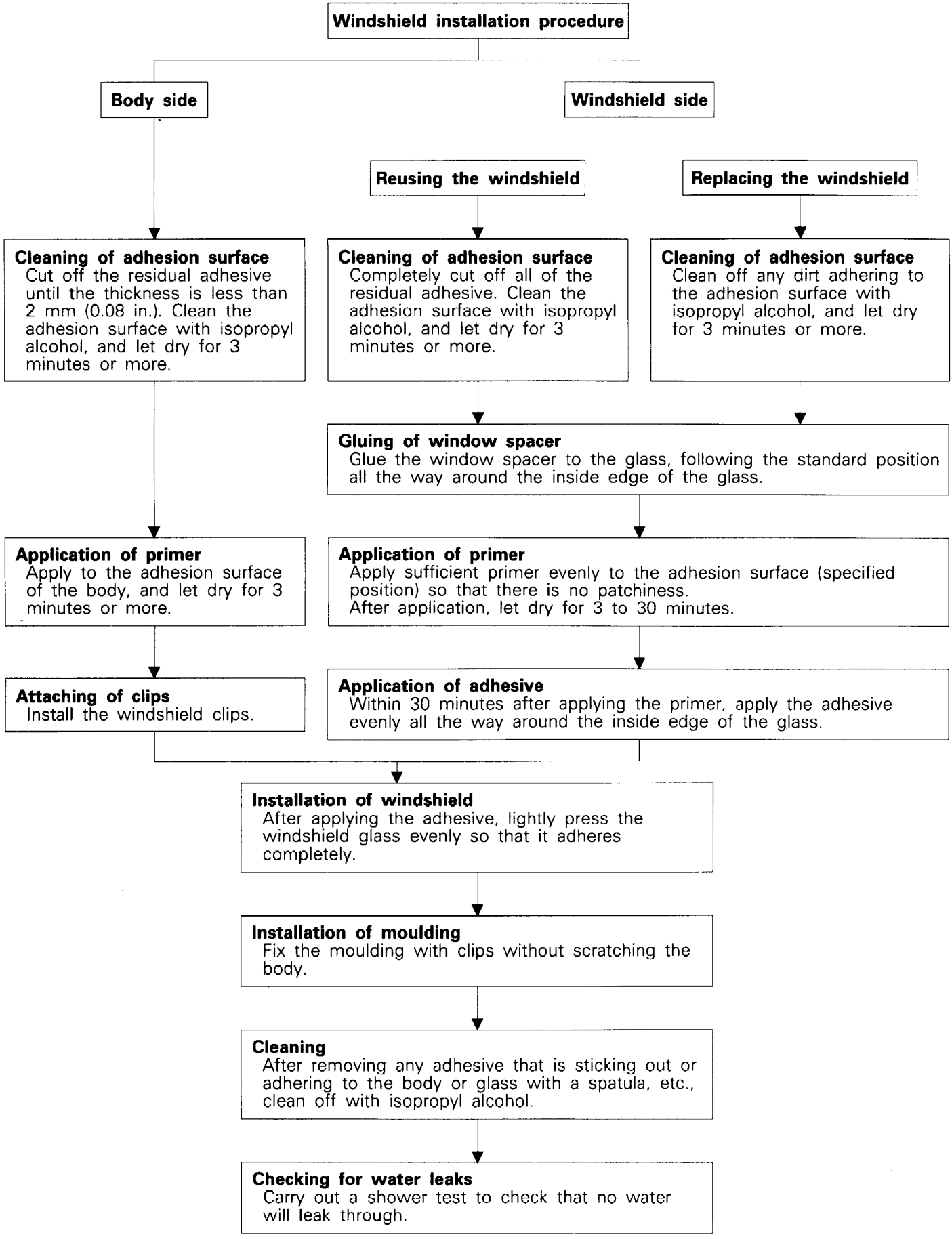
WORKING PROCESS



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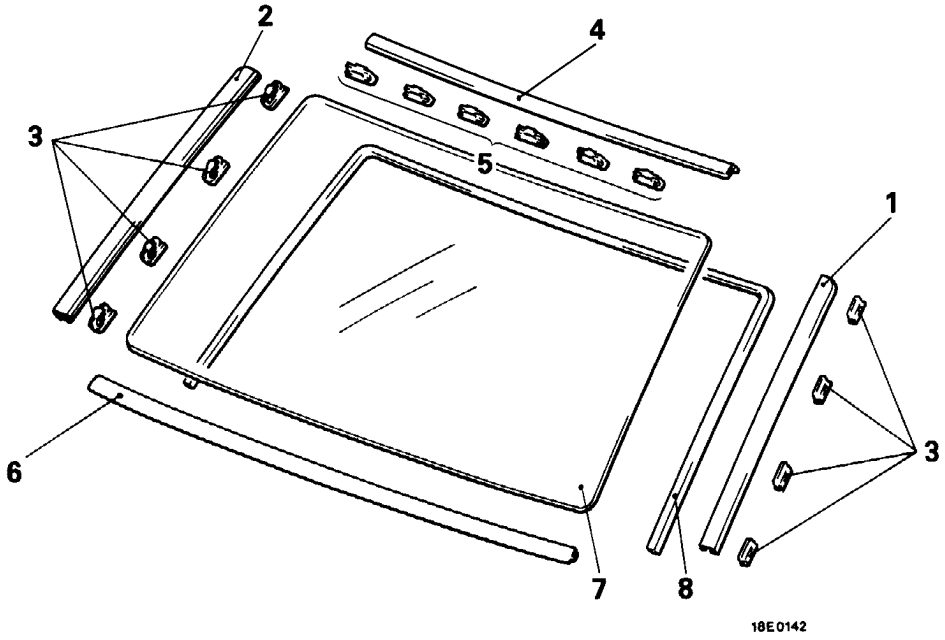
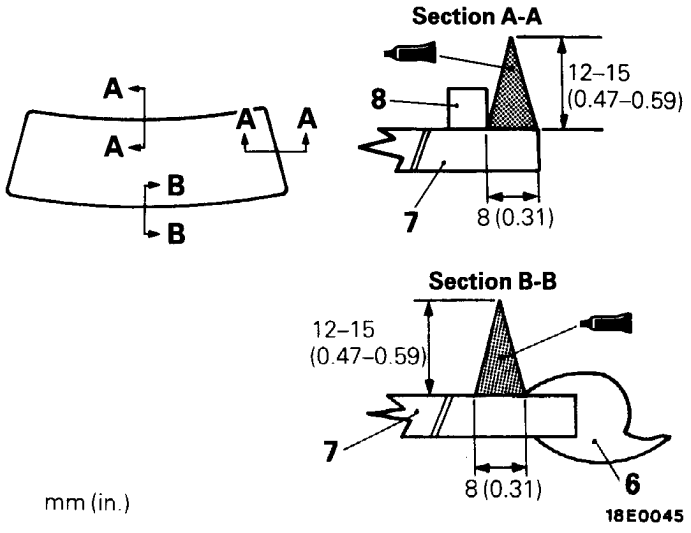
REMOVAL AND INSTALLATION

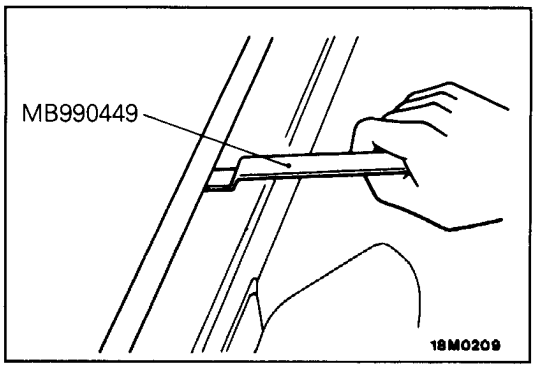


Pre-removal and Post-installation Operation
Removal and Installation
- Instrument Panel <Vehicles with Wiper Deicer> (Refer to GROUP 52 - Instrument Panel.)
- Front Pillar Trim (Refer to GROUP 52 - Trims.)
- Front Deck Garnish (Refer to GROUP 51 - Garnish and Moulding.)
- Roof Drip Moulding <2-door models> (Refer to GROUP 51 - Garnish and Moulding.)



Adhesive:
3M Super Fast Urethan Auto Glass Sealant Part No. 8609 or equivalent

Removal steps
- 1. Windshield side moulding (LH) <4-door models>
- 2. Windshield side moulding (RH) <4-door models>
- 3. Windshield clip
- 4. Windshield upper moulding
- 5. Windshield clip
- 6. Windshield lower moulding
- 7. Windshield glass
- 8. Window spacer

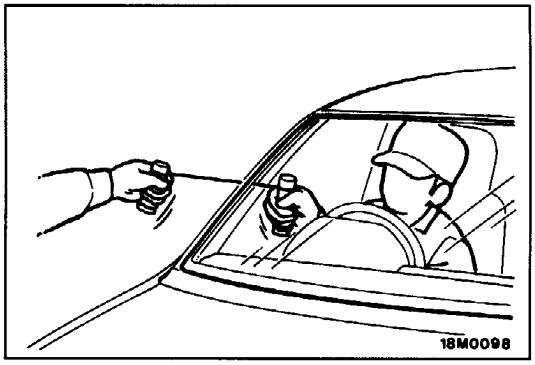


SERVICE POINTS OF REMOVAL

1. REMOVAL OF WINDSHIELD SIDE MOULDING (LH)/2. WINDSHIELD SIDE MOULDING (RH)/4. WINDSHIELD UPPER MOULDING

Remove by using the special tool to lever out each moulding.

Caution
Mouldings that become warped should not be re-used.

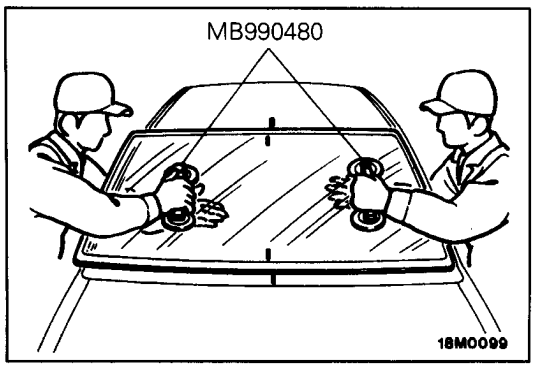


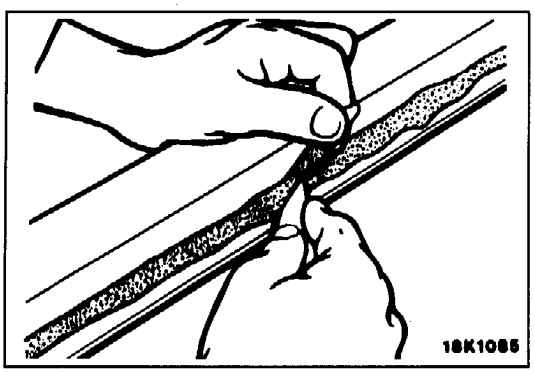
7. REMOVAL OF WINDSHIELD GLASS

(1) In order to protect the body (paint surface), apply cloth tape to all body areas around the installed windshield glass.
(2) Using a sharp-point drill, make a hole in the windshield glass edhesive.
(3) Pass piano wire from the inside of the vehicle through the hole.
(4) Pull the piano wire alternately from the inside and outside along the windshield glass to cut the adhesive.

Caution
Do not let the piano wire touch the edge of the windshield glass.

(5) Make mating marks on the windshield glass and body.
(6) Use the special tool to remove the windshield glass.





(7) Use a knife to cut away the remaining adhesive so that the thickness can be within 2 mm (0.08 in.) around the entire circumference of the body flange.
(8) Finish the flange surfaces so that they are smooth.

Caution
1. **Be careful not to remove more adhesive than is necessary.**
2. **Be careful also not to damage the paintwork on the body surface with the knife. If the paintwork is damaged, repair the damaged area with repair paint or anti-rust agent.**

(9) When reusing the glass, remove the adhesive and window spacer chips still adhering to the window glass, and clean with isopropyl alcohol.
(10) Clean the body side in the same way.

Caution
Let the cleaned places stand for 3 minutes or more, and carry out the next procedures after they have dried. Also, do not touch any surface that has been cleaned.

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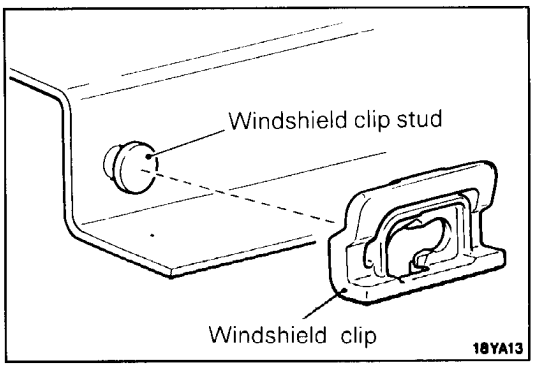
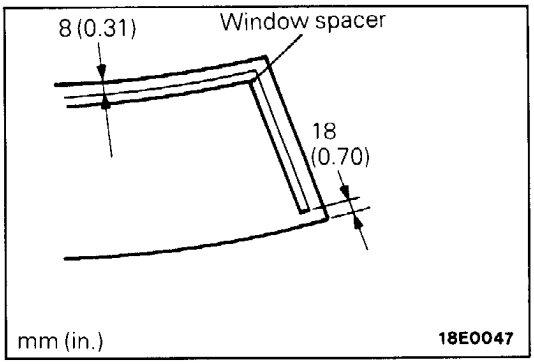


WINDSHIELD CLIP STUD REPAIR

If the T-studs are broken, use a drill to make holes in the T-studs 3 mm (0.12 in.) in diameter, fill the holes with adhesive, and then use screws to mount the window moulding clips.

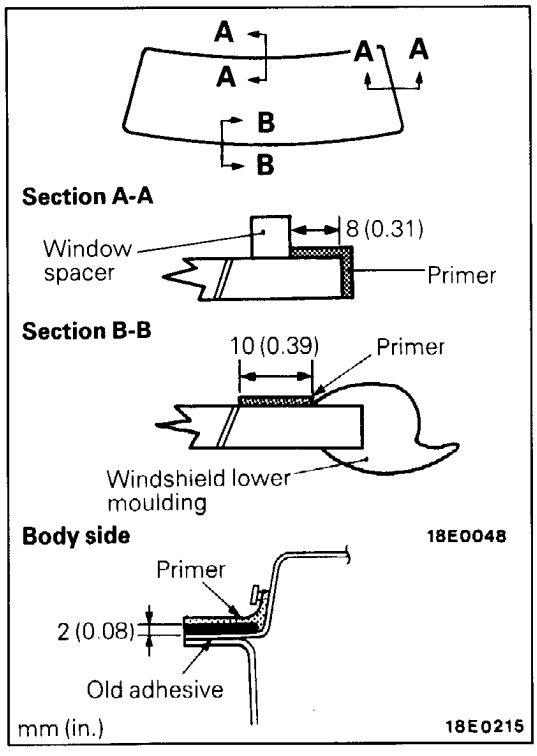
Caution
After installing the clip, apply antirust solvent to the screw head to protect them from rust.



SERVICE POINTS OF INSTALLATION

8. INSTALLATION OF WINDOW SPACER

After cleaning the window spacer adhesion surface of the windshield glass with isopropyl alcohol to remove all grease, etc., attach the window spacer as shown in the figure.



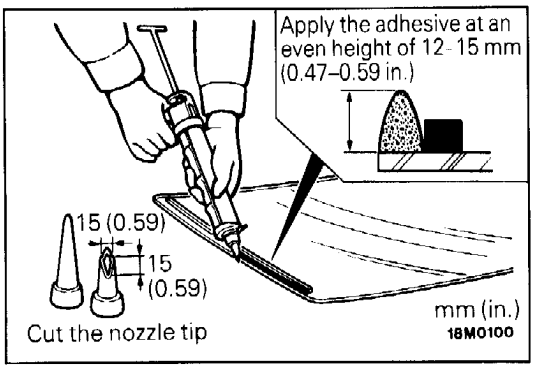
7. INSTALLATION OF WINDSHIELD GLASS/6. WINDSHIELD LOWER MOULDING

(1) When replacing the glass, temporarily set the glass against the body, and put mating marks on the glass and body where they match.
(2) Install the windshield lower moulding onto the windshield glass.
(3) Soak a sponge in the primer, and apply evenly to the glass and the body in the places shown in the figure.

Specified primer: 3M Super Fast Urethan Primer Part No. 8608 or equivalent

Caution
1. **The primer strengthens the adhesive strength, so be sure to apply it evenly around the entire circumference. Also, a too thick application will cause lowering of the adhesive strength.**
2. **Do not touch the coated surface.**

(4) After applying the primer, let it dry for 3 to 30 minutes.



(5) Within 30 minutes after applying the primer, fill the sealant gun with adhesive and apply the adhesive evenly around the entire circumference of the windshield.

Specified adhesive: 3M Super Fast Urethan Auto Glass Sealant Part No. 8609 or equivalent

NOTE
Cut the nozzle tip of the sealant gun into a V shape to facilitate adhesive application.

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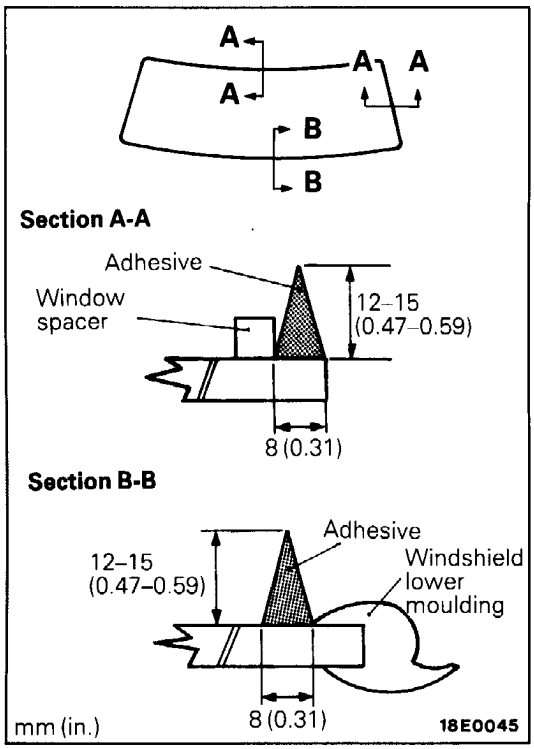

(6) After applying the adhesive, match up the mating marks on the glass and the body, and lightly press the windshield glass evenly so that it adheres completely.

(7) After removing any adhesive that is sticking out or adhering to the body or glass with a spatula, etc., clean off with isopropyl alcohol.
After completion of this operation (after installing the glass), place it somewhere where it will not be disturbed, until the adhesive sets.

Caution
If heat is applied with an infra-red lamp to shorten the setting time, keep the surface temperature of the adhesive below 100°C.

(8) After attaching the windshield glass to the body, let it stand for 30 minutes or more, and then test for water leakage.

Caution
1. **If moving the vehicle, it should be done gently.**
2. **When testing for water leakage, do not pinch the end of the hose to spray the water.**

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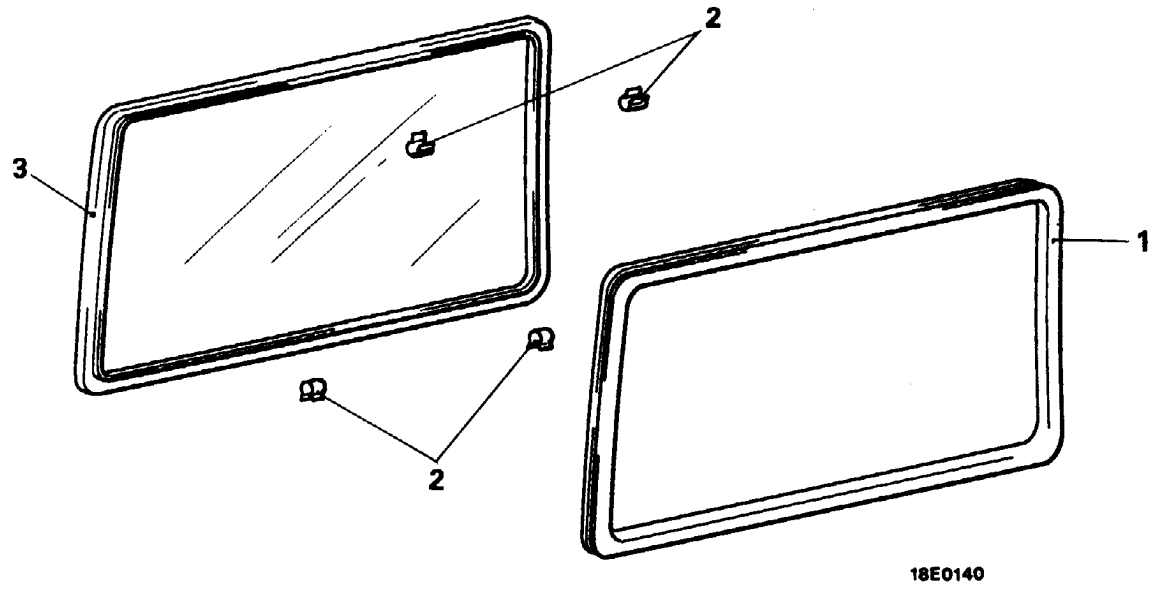
QUARTER WINDOW GLASS

E42LBAE

REMOVAL AND INSTALLATION

<Fixed type>



18E0140

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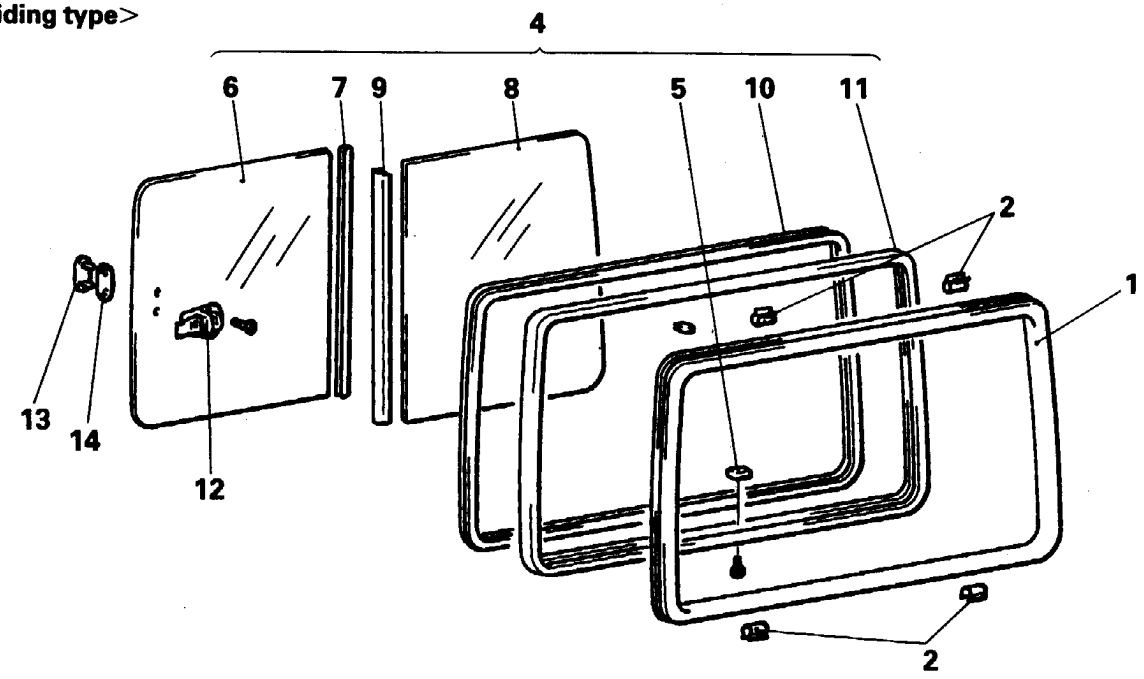

18E0141

Quarter window glass removal steps

- Quarter upper trim (Refer to GROUP 52 – Trims.)

1. Opening trim
2. Clip
3. Quarter window glass assembly
4. Quarter window glass and frame assembly
5. Glass stopper

◆◆ 6. Quarter window glass (A)

7. Edge trim

◆◆ 8. Quarter window glass (B)

9. Seal rubber
10. Runchannel
11. Quarter window frame assembly

Slide glass lock removal steps

12. Slide glass lock
13. Connector
14. Packing

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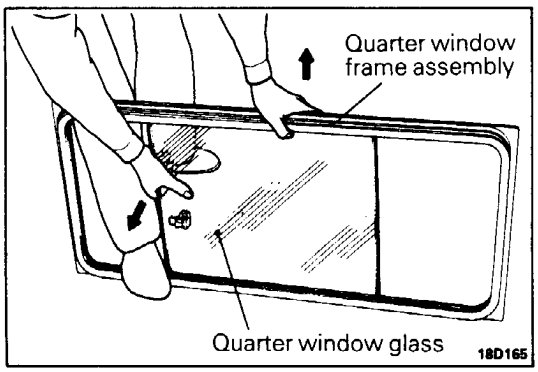


SERVICE POINTS OF REMOVAL

6. REMOVAL OF QUARTER WINDOW GLASS (A)/8. QUARTER WINDOW GLASS (B)

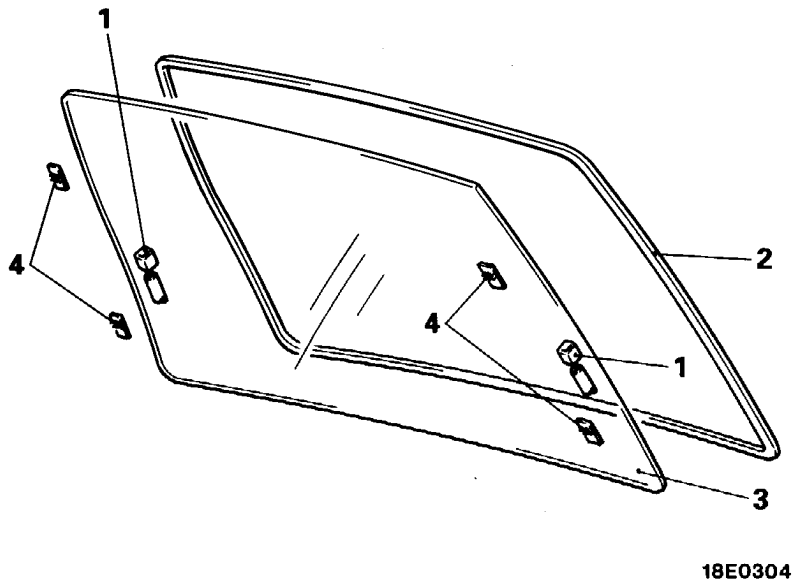
Remove the glass by moving the glass to the centre and widening the middle section of the quarter window frame assembly.

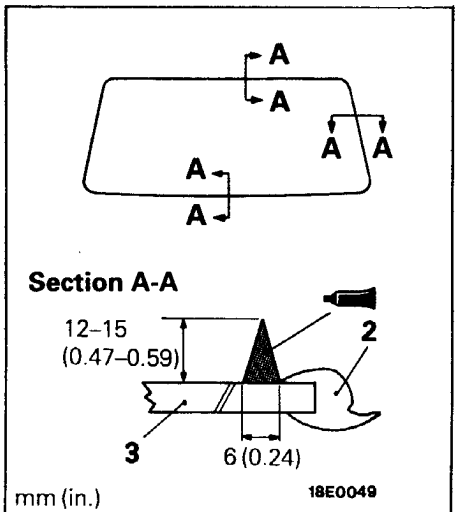
BACK DOOR WINDOW GLASS

E42LDAG

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Removal and Installation of Back Door Upper Trim (Refer to P.42-35.)





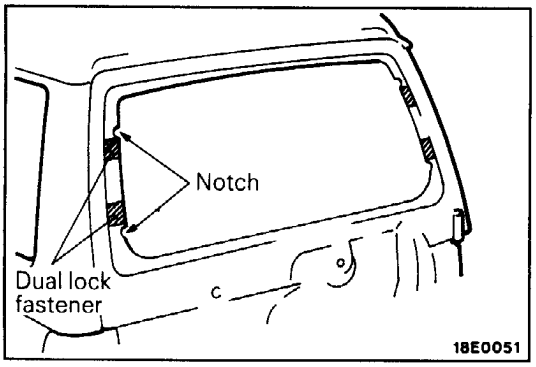
Adhesive:
3M Super Fast Urethan Auto Glass Sealant Part No. 8609 or equivalent

Removal steps
1. Defogger terminal
2. Back door window glass moulding
3. Back door window glass
4. Dual lock fastener

SERVICE POINT OF REMOVAL

3. REMOVAL OF BACK DOOR WINDOW GLASS

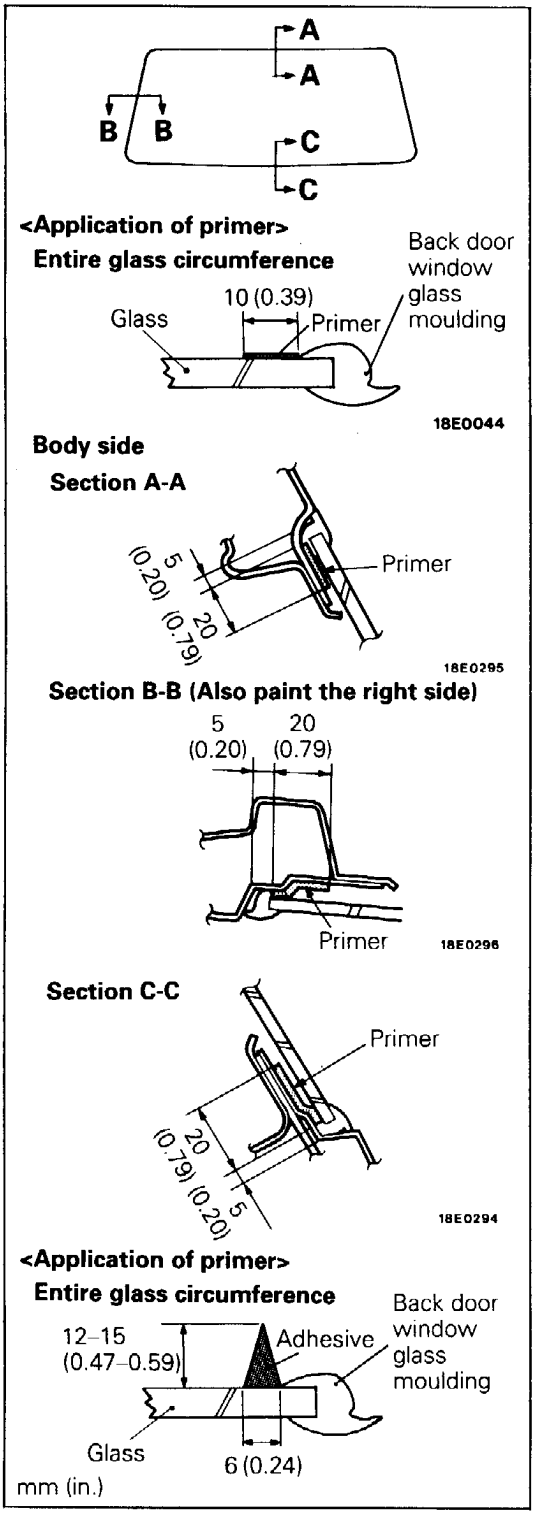
Remove in the same way as for the windshield glass. (Refer to P.42-16.)



SERVICE POINTS OF INSTALLATION

4. INSTALLATION OF DUAL LOCK FASTENER

Attach the dual lock fasteners so that the fastener ends are aligned with the notches on the body.



3. INSTALLATION OF BACK DOOR WINDOW GLASS/2. BACK DOOR WINDOW GLASS MOULDING

Install in the same way as for the windshield glass. (Refer to P.42-17.)

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NOTES

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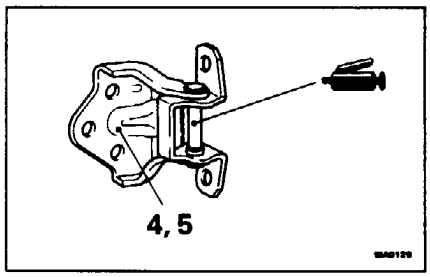
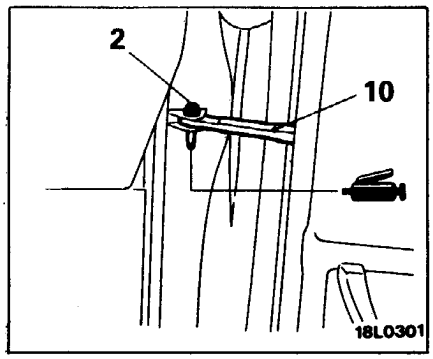
DOOR ASSEMBLY

E42MAAO

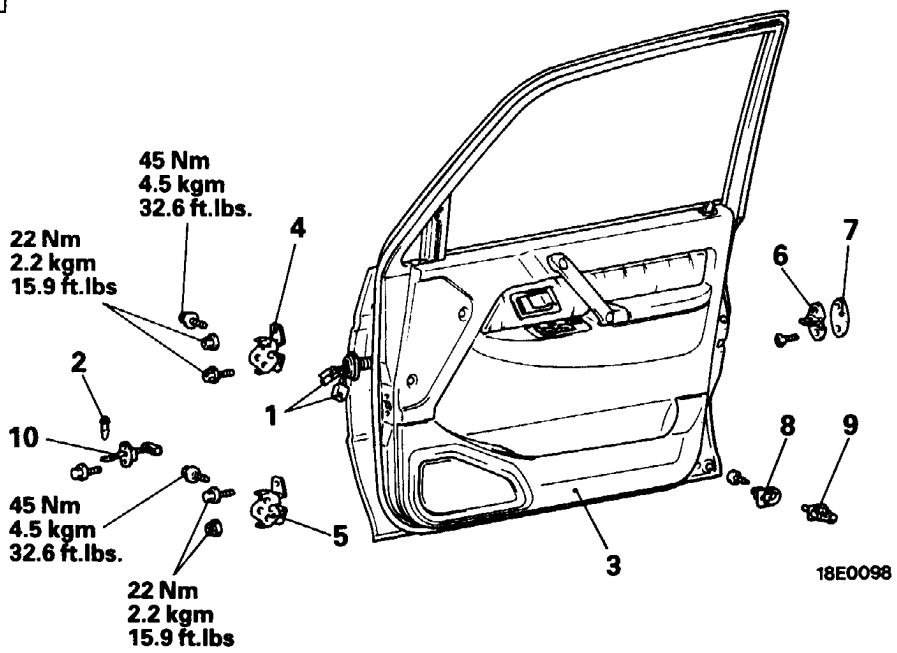
REMOVAL AND INSTALLATION

Door Post-installation Operation
- Door Adjustment (Refer to P.42-5.)

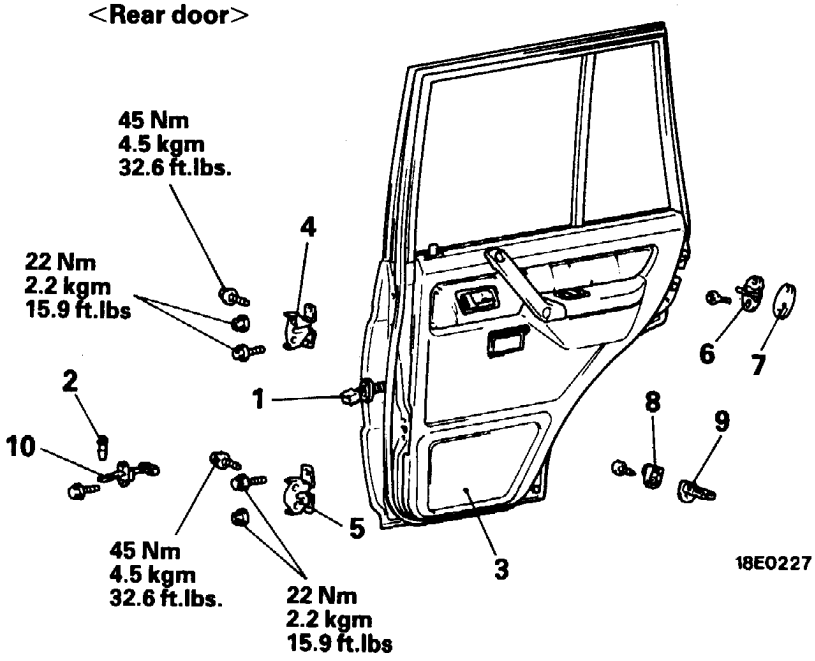




<Front door>



<Rear door>



Door removal steps
1. Door harness connector
2. Spring pin
3. Door assembly
◆◆ 4. Door upper hinge
◆◆ 5. Door lower hinge

Striker removal steps
6. Striker
7. Striker shim

Door switch removal steps
8. Door switch cap
9. Door switch

Door check strap removal steps
- Door trim
- Waterproof film (Refer to P.42-25.)

2. Spring pin
◆◆ 10. Door check strap

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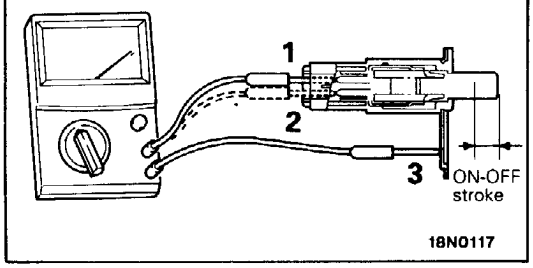
<Type 1>



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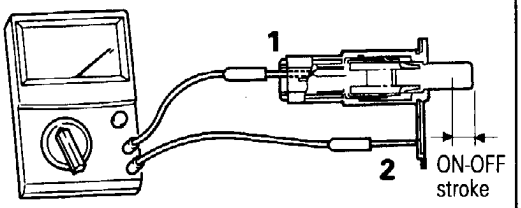
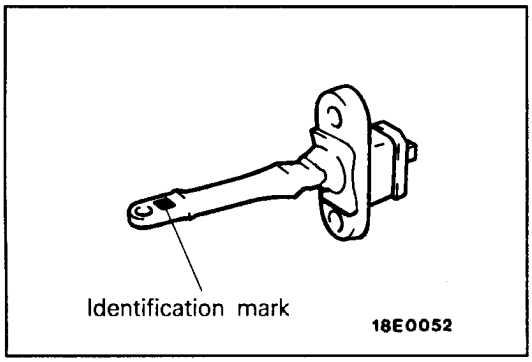
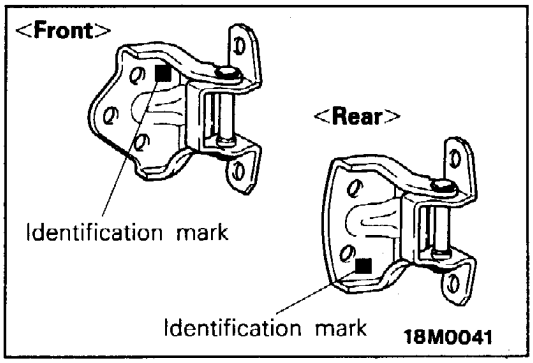




<Front>

<Rear>



INSPECTION

DOOR SWITCH

Operate the switch, and check the continuity between the terminals.

<Type 1>

Switch position \ Terminal	1	2	3
Open (ON)	○	○	○
Depressed (OFF)			

<Type 2>

Switch position \ Terminal	1	2
Open (ON)	○	○
Depressed (OFF)		

NOTE
○–○ indicates that there is continuity between the terminals.

SERVICE POINTS OF INSTALLATION

10. INSTALLATION OF DOOR CHECK STRAP

Install the door check so that the identification marks shown below are facing upwards.

Place of application		Identification mark
RH	Front door	PR
	Rear door	QR
LH	Front door	PL
	Rear door	QL

5. INSTALLATION OF DOOR LOWER HINGE/4. DOOR UPPER HINGE

The door hinges differ according to where they are used, so check the identification marks before installation.

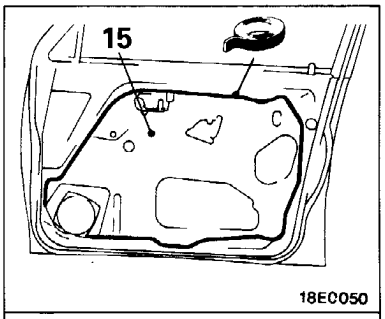
Place of application			Identification mark
Front door		Upper hinge	F
		Lower hinge	E
Rear door	RH	Upper hinge	X
		Lower hinge	Z
	LH	Upper hinge	W
		Lower hinge	Y

DOOR TRIM AND WATERPROOF FILM

E42MBAY

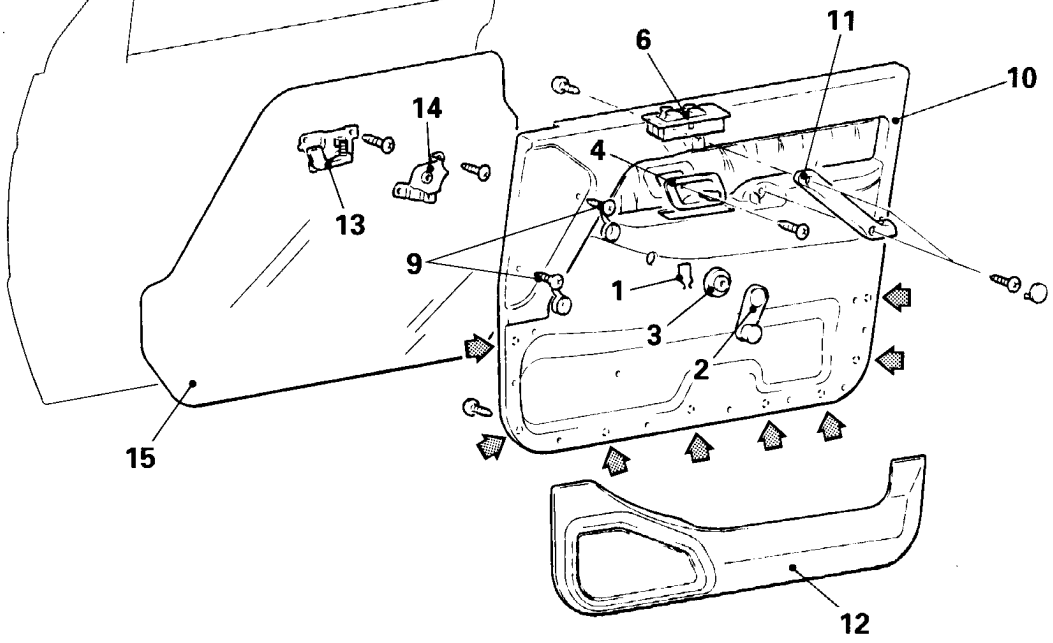
REMOVAL AND INSTALLATION

<Front door>

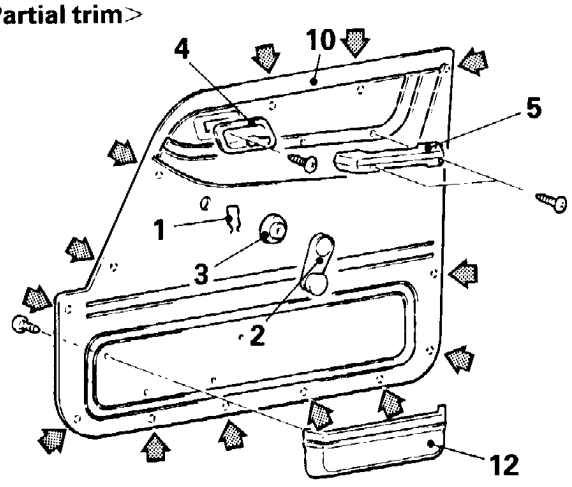


Sealant:
3M ATD Part No. 8625 or equivalent

<Full trim>



<Partial trim>

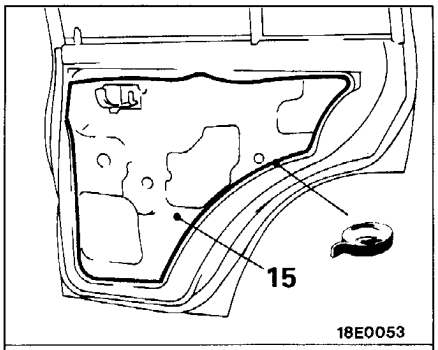


Removal steps

- ◀▶ 1. Clip
- 2. Regurator handle
- 3. Escutcheon
- 4. Inside handle cover
- 5. Armrest
- 6. Power window switch
- ◀▶ ▶◀ 9. Screw or clip
- 10. Door trim
- 11. Door grip
- 12. Door pocket
- 13. Inside handle
- 14. Armrest bracket
- 15. Waterproof film

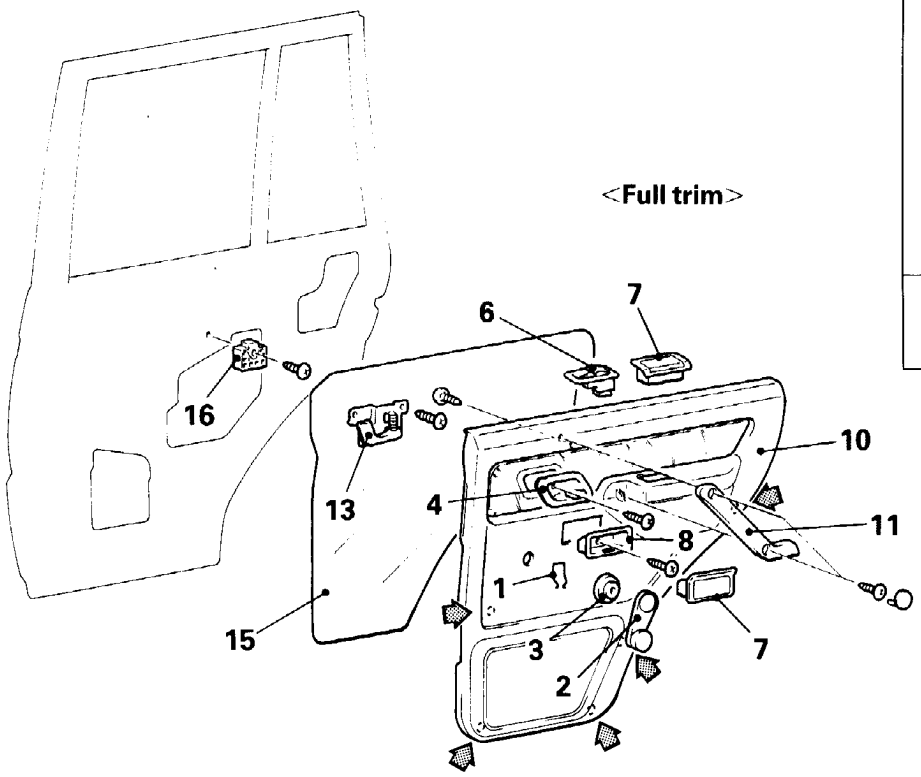
NOTE
◀ : Indicates the clip positions

<Rear door>

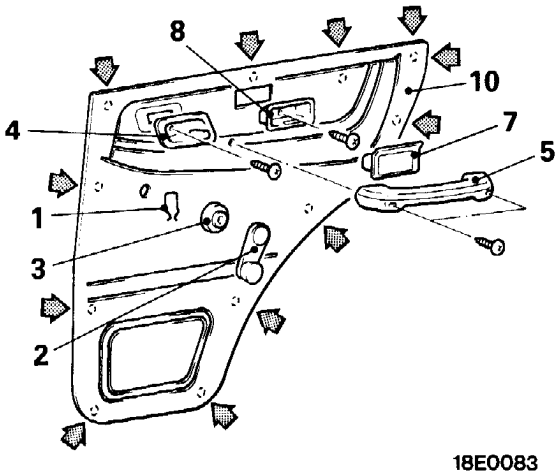


Sealant:
3M ATD Part No. 8625 or equivalent

<Full trim>



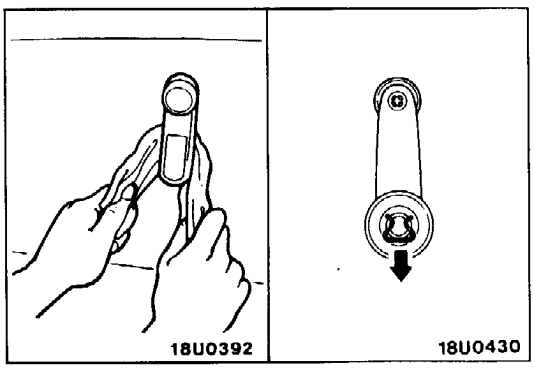
<Partial trim>



Removal steps

1. Clip
2. Regurator handle
3. Escutcheon
4. Inside handle cover
5. Armrest
6. Power window switch
7. Ashtray
8. Ashtray bracket
10. Door trim
11. Door grip
13. Inside handle
15. Waterproof film
16. Screw grommet

NOTE
◀ : Indicates the clip positions



SERVICE POINT OF REMOVAL

1. REMOVAL OF CLIP

Remove the clip by using a rag, and then remove the regulator handle.

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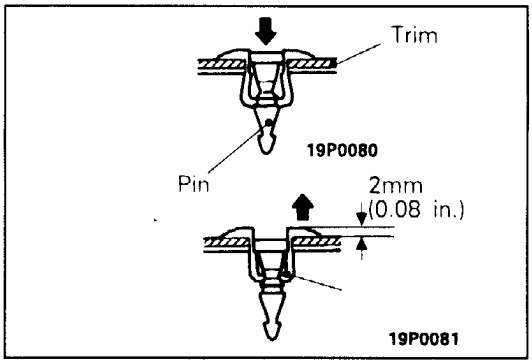
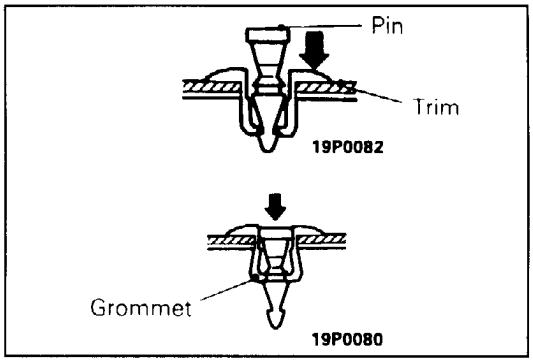


9. REMOVAL OF CLIP

(1) Use a cross-tip (+) screwdriver to push inward the pin (at the centre of the trim clip) to a depth of about 2 mm (0.08 in.).
(2) Pull the trim clip outward to remove it.

Caution
Do not push the pin inward more than necessary because it may damage the grommet, or the pin may fall in, if pushed too far.



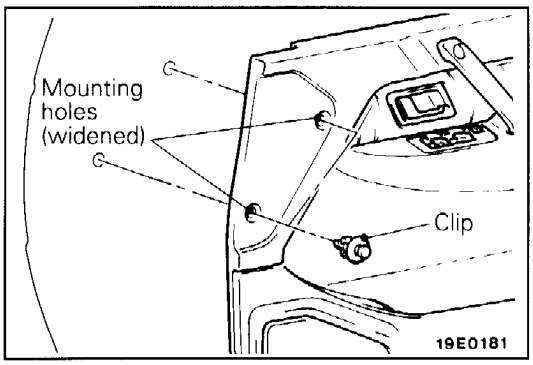
SERVICE POINT OF INSTALLATION

9. INSTALLATION OF SCREW OR CLIP

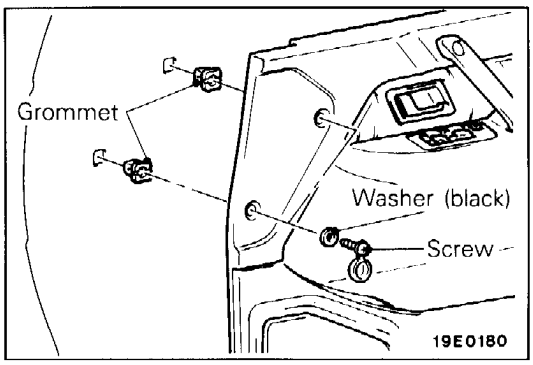
(1) With the pin pulled out, insert the trim clip into the hole in the trim.
(2) Push the pin inward until the pin's head in flush with the grommet.
(3) Check whether the trim is secure.

NOTE
Two types of door panel and door trim are available. Identify the type from the table below, and install by the following procedure.

	Type A	Type B
Door panel	Round hole 8 mm (0.31 in.)	Square hole 10×12 mm (0.39×0.47 in.)
Door trim	Round hole 11 mm (0.43 in.)	Round hole 6 mm (0.24 in.)
Securing method	Clip	Cap assembled screw



- When installing the type B door trim to the type A door panel
  1) Use a drill or similar tool to widen the mounting holes (6 mm dia.) in the door trim to 11 mm in diameter.
  2) Secure using clips.



- When installing the type A door trim to the type B door panel
  1) Insert grommets into the square mounting holes in the door panel.
  2) Tighten using black washers and screws, and then cover the screws with the caps.

NOTES

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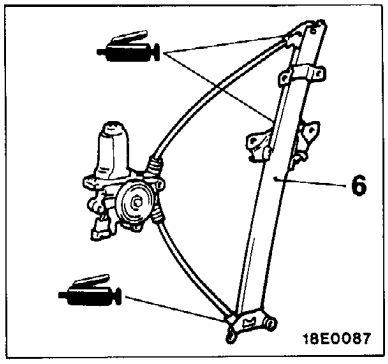
DOOR GLASS AND REGULATOR

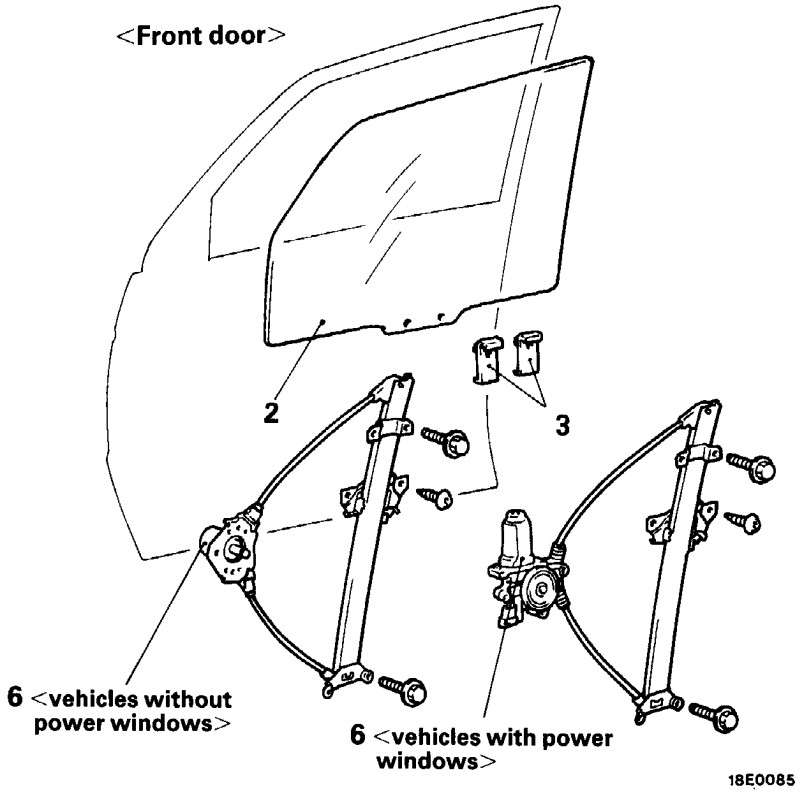
E42MCAN

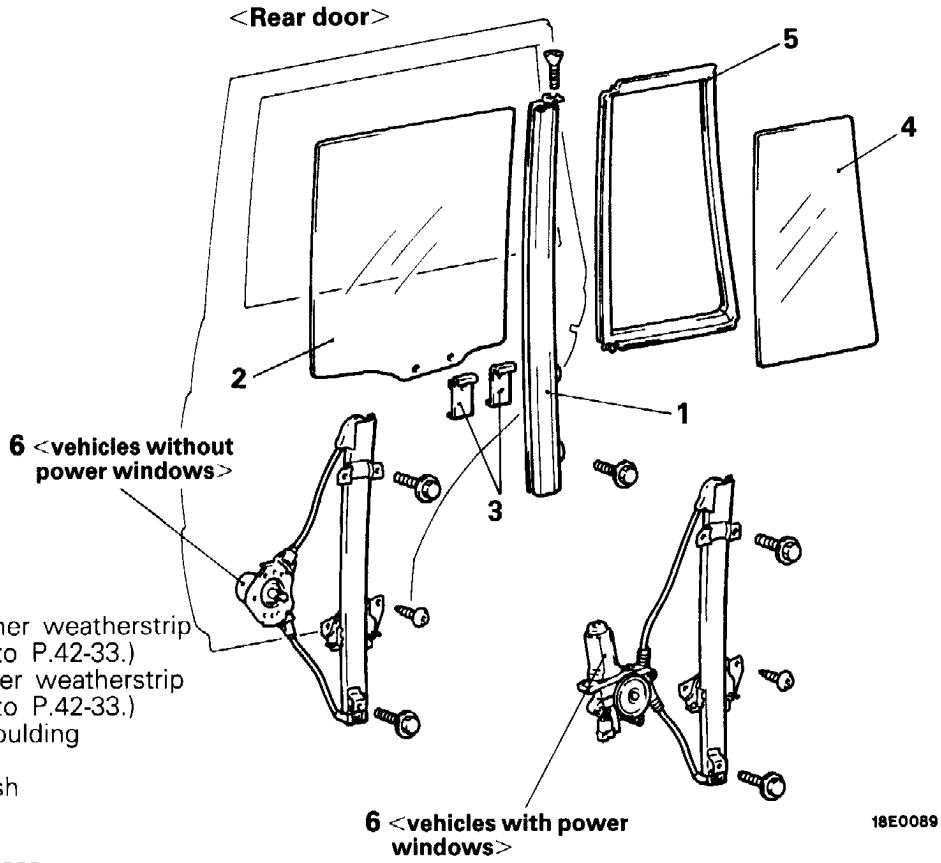
REMOVAL AND INSTALLATION

Pre-removal Operation
- Removal of Door Trim and Waterproof Film (Refer to P.42-25.)

Post-installation Operation
- Door Window Glass Adjustment (Refer to P.42-6.)
- Installation of Door Trim and Waterproof Film (Refer to P.42-25.)







Removal steps
- Front door window inner weatherstrip <Partial trim> (Refer to P.42-33.)
- Rear door window inner weatherstrip <Partial trim> (Refer to P.42-33.)
- Rear door belt line moulding (Refer to P.42-33.)

1. Rear door center sash
2. Door window glass
3. Door glass holder
4. Stationary window glass
5. Stationary window weatherstrip
6. Window regulator assembly

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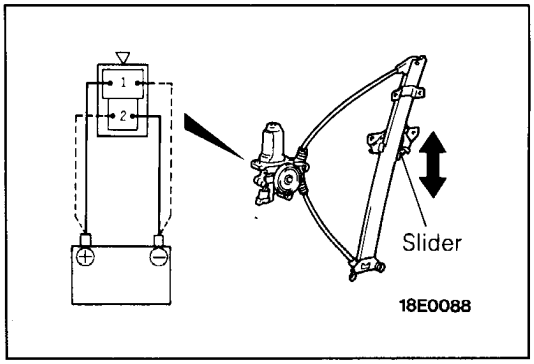


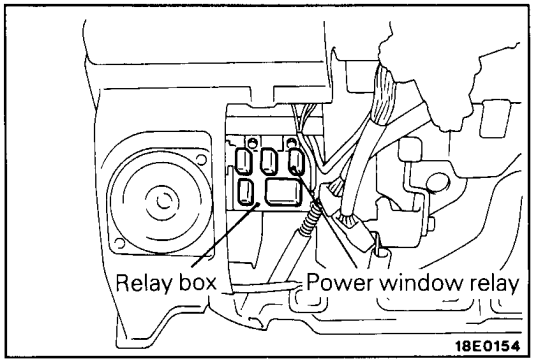
INSPECTION

POWER WINDOW MOTOR

(1) Check if the slider moves smoothly when the battery is directly connected to the motor terminals.
(2) Check if the slider moves in the opposite direction when the battery is connected with the polarities reversed.

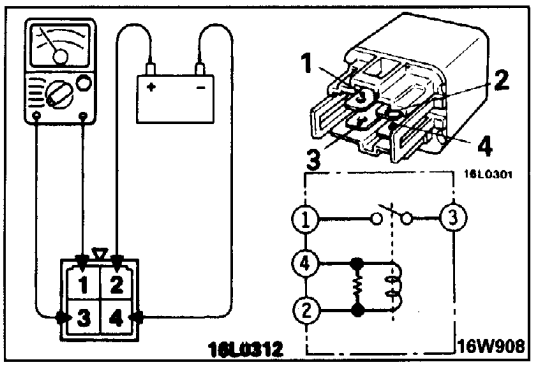
CIRCUIT BREAKER (INCORPORATED IN THE POWER WINDOW MOTOR)

(1) Press the UP switch to fully close the window glass, and continue to press the switch for 10 seconds.
(2) At the moment that the UP switch is released, press the DOWN switch. The circuit breaker can be considered good if at this time the door window glass begins to open within 60 seconds.



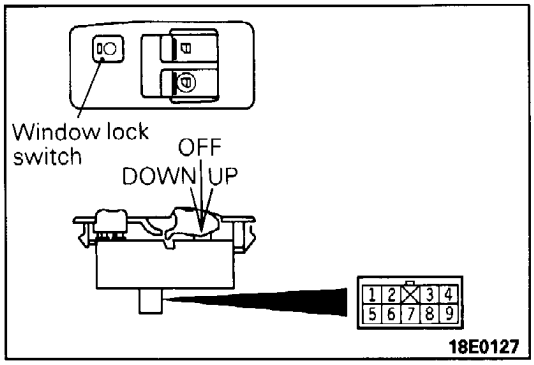
POWER WINDOW RELAY

(1) Remove the power window relay from the relay box.



(2) Check for continuity between the terminals.

When there is no current	Between terminals ② - ④	Continuity
	Between terminals ① - ③	No continuity
When there is current (Between terminals ② - ④	Between terminals ① - ③	Continuity



POWER WINDOW SWITCH

Operate the switch and check for continuity between the terminals.

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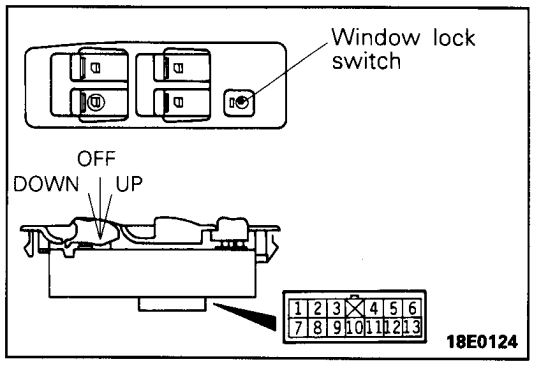
Terminal \ Switch position			Power window switch		
			UP	OFF	DOWN
Power window switch	Driver's side	6	○		○
		3 (1)	○	○	○
		8 (5)	○	○	○
		9	○	○	○
	Passenger's side	6	○		○
		1 (3)	○	○	○
		5 (8)	○	○	○
		9	○	○	○

Terminal \ Switch position		Power window lock switch	
		NORMAL	LOCK
Power window lock switch	6	○	
	4	○	

NOTE
(1) ○—○ indicates that there is continuity between the terminals.
(2) ( ) indicates RH drive vehicles.



Main switch <4-door models>

Terminal \ Switch position		Power window switch (normal)			Power window switch (lock)		
		UP	OFF	DOWN	UP	OFF	DOWN
Front (Driver's side)	9	○		○	○		○
	2(1)	○	○	○	○	○	○
	8(7)	○	○	○	○	○	○
	13	○	○	○	○	○	○
Front (Passenger's side)	9	○		○	○		○
	1(2)	○	○	○	○	○	○
	7(8)	○	○	○	○	○	○
	13	○	○	○	○	○	○
Rear (RH)	9	○		○			
	5(4)	○	○	○		○	○
	12(11)	○	○	○	○	○	
	13	○	○	○	○	○	○
Rear (LH)	9	○		○			
	4(5)	○	○	○		○	○
	11(12)	○	○	○	○	○	
	13	○	○	○	○	○	○

NOTE
(1) ○—○ indicates that there is continuity between the terminals.
(2) ( ) indicates RH drive vehicles.

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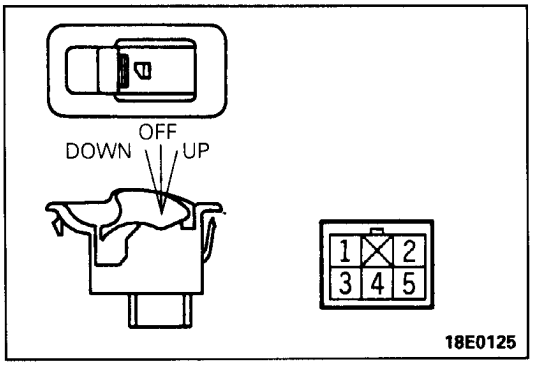


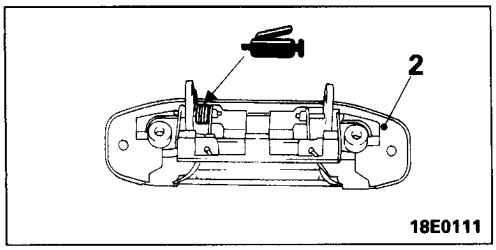
Sub switch

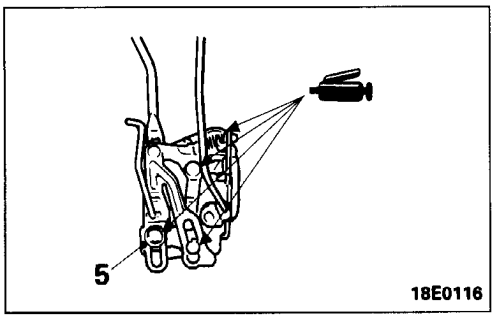
Switch position / Terminal		Sub-switch		
		UP	OFF	DOWN
Sub-switch	1	○	○	
	2	○	○	○
	3	○	○	○
	4	○		○
	5		○	○

NOTE
○–○ indicates that there is continuity between the terminals.

DOOR HANDLE AND LATCH

REMOVAL AND INSTALLATION



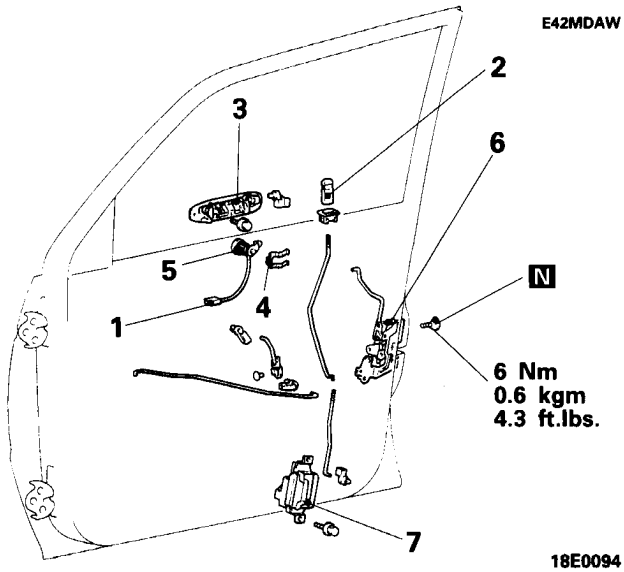


Removal steps
- Door trim
- Waterproof film } (Refer to P. 42-25.)
- Door outside handle play inspection (Refer to P. 42-6.)

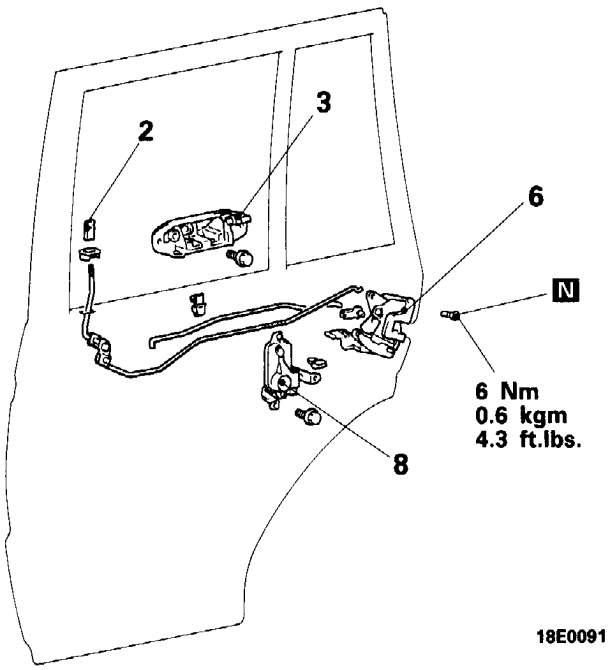
1. Door lock key cylinder switch connector <Passenger's side>
2. Inside lock knob
3. Door outside handle
4. Retainer
5. Door lock key cylinder
6. Door latch assembly
7. Front door lock actuator
8. Rear door lock actuator

<Front door>

E42MDAW



<Rear door>



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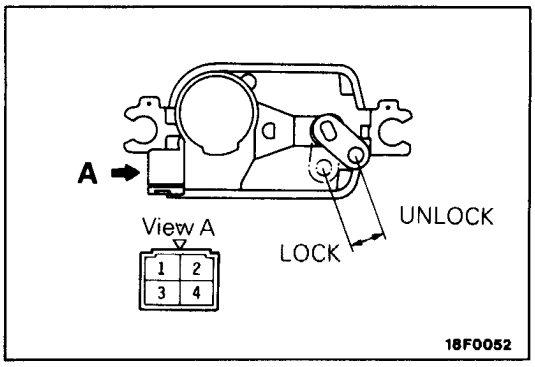
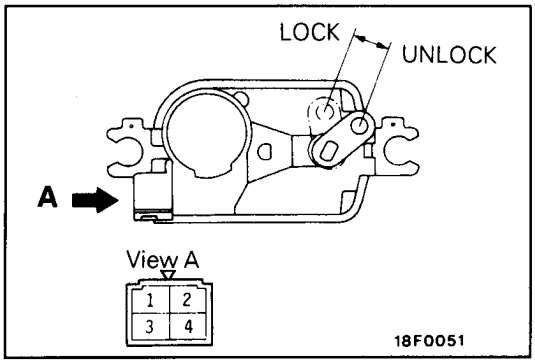


INSPECTION

FRONT DOOR LOCK ACTUATOR

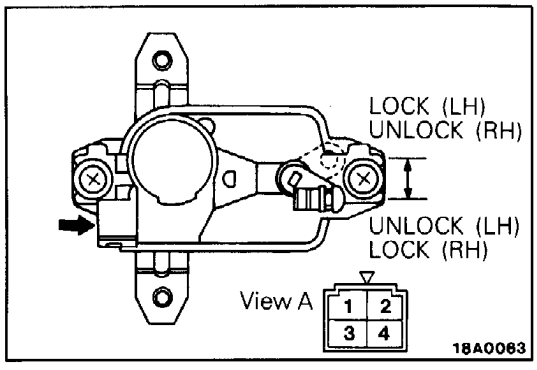
<LH>

(1) After setting the rod to the LOCK position, apply battery voltage to terminal ① and check if the rod moves to the UNLOCK position when terminal ③ is earthed.
(2) After setting the rod to the UNLOCK position and applying battery voltage to terminal ③, check if the rod moves to the LOCK position when terminal ① is earthed.
(3) For left-hand drive vehicles, when the actuator rod is set to the UNLOCK position, check if there is continuity between terminal ② and terminal ④, and when the rod is set to the LOCK position, check if there is no continuity.



<RH>

(1) After setting the rod to the LOCK position and applying battery voltage to terminal ③, check if the rod moves to the UNLOCK position when terminal ① is earthed.
(2) After setting the rod to the UNLOCK position and applying battery voltage to terminal ①, check if the rod moves to the LOCK position when terminal ③ is earthed.
(3) For right-hand vehicles, when the actuator rod is set to the UNLOCK position, check if there is continuity between terminal ② and terminal ④, and when the rod is set to the LOCK position, check if there is no continuity.



REAR DOOR LOCK ACTUATOR

<LH>

(1) After setting the rod to the LOCK position and applying battery voltage to terminal ③, check if the rod moves to the UNLOCK position when terminal ① is earthed.
(2) After setting the rod to the UNLOCK position and applying battery voltage to terminal ①, check if the rod moves to the LOCK position when terminal ③ is earthed.

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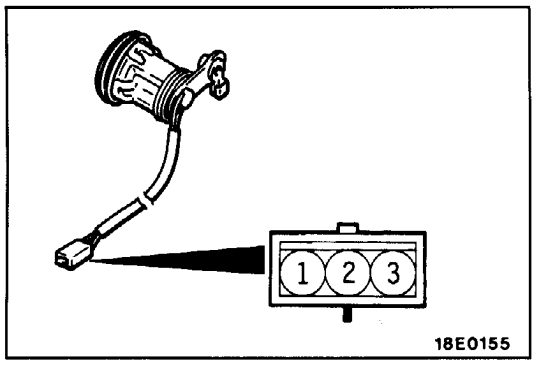
<RH>
(1) After setting the rod to the LOCK position, apply battery voltage to terminal ① and check if the rod moves to the UNLOCK position when terminal ③ is earthed.
(2) After setting the rod to the UNLOCK position and applying battery voltage to terminal ③, check if the rod moves to the LOCK position when terminal ① is earthed.

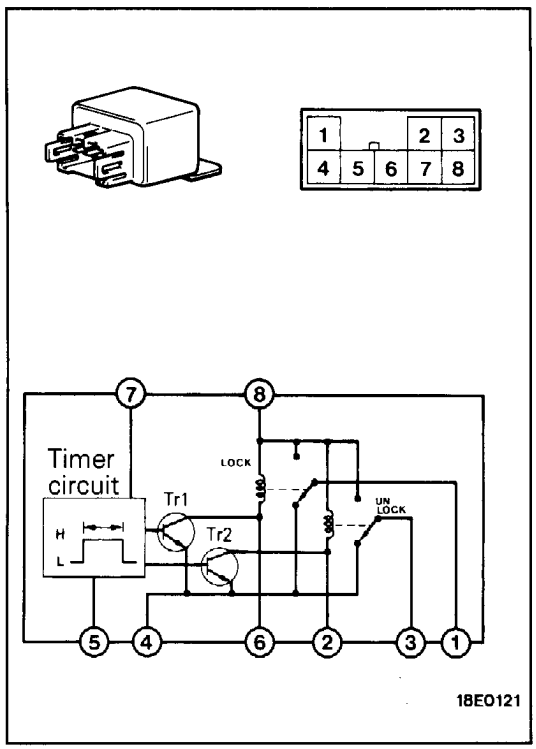


DOOR LOCK KEY CYLINDER SWITCH

Operate the switch and check for continuity between the terminals.

Switch position \ Terminal	1	2	3
LOCK		○——	——○
Neutral (OFF)			
UNLOCK	○——	——○	

NOTE
○—○ indicates that there is continuity between the terminals.



DOOR LOCK CONTROL UNIT

(1) Apply battery power to terminals ⑦ and ⑧, and earth terminals ④ and ⑤.
(2) Connect a needle-type circuit tester between terminal ① and the earth, and after switching it to the DC V range, and check if the needle moves at the instant when the connection at terminal ⑤ is removed.
(3) Next, connect the needle-type circuit tester between terminal ③ and the earth, and check if the needle moves at the instant when the connection at terminal ⑤ that was removed in (2) above is reconnected.
(4) Also, check if there is a voltage of 12V between terminal ⑥ and the earth, and between terminal ② and the earth.

NOTE
The reason why the needle of the circuit tester moves in (2) and (3) above is because battery voltage appears between terminals ① and ③ and the earth for approximately 0.5 seconds.

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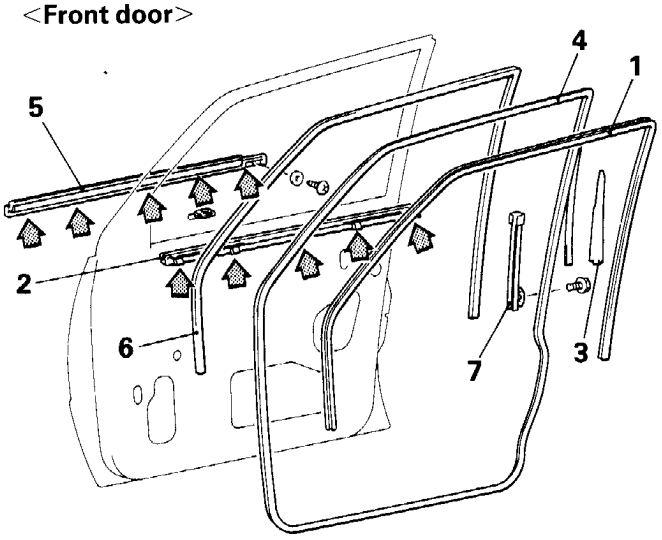
WINDOW GLASS RUNCHANNEL AND DOOR OPENING WEATHERSTRIP

E42MEAG

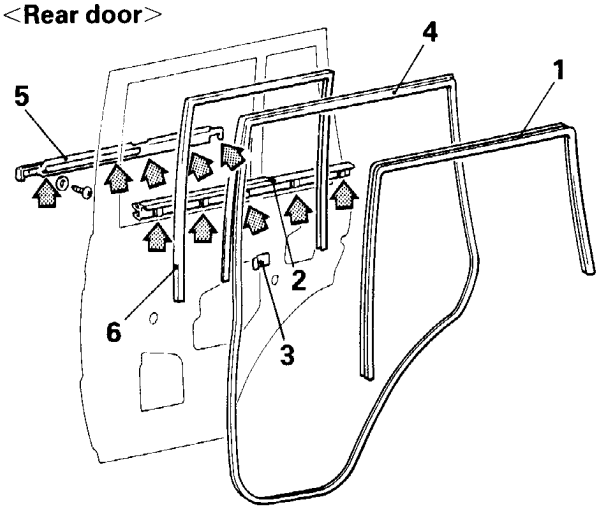
REMOVAL AND INSTALLATION

<Front door>



18E0082

<Rear door>



18E0081

NOTE

◁ : Indicates the clip positions

1. Door inner opening weatherstrip <3000 (excluding canvas top)>
2. Belt line inner weatherstrip <Partial trim>

Door outer opening weatherstrip removal steps

3. Weatherstrip protector
4. Door outer opening weatherstrip

Belt line moulding removal steps

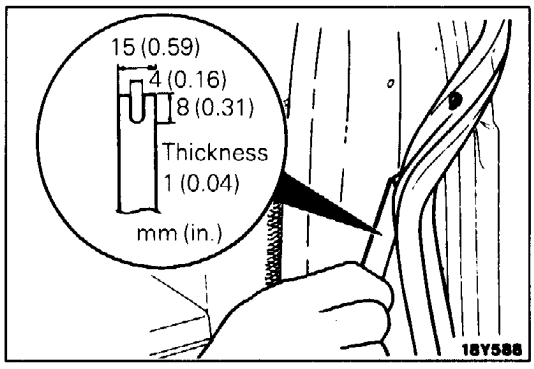
- Door mirror (Refer to GROUP 51 – Outside Mirror.)

5. Belt line moulding

Window glass runchannel removal steps

- Door window glass (Refer to P.42-27.)

6. Window glass runchannel
7. Lower rear sash



18Y588

SERVICE POINT OF REMOVAL

4. REMOVAL OF DOOR OUTER OPENING WEATHERSTRIP

Make a tool as shown in the illustration to remove the door opening weatherstrip.

SERVICE POINT OF INSTALLATION

4. INSTALLATION OF DOOR OUTER OPENING WEATHERSTRIP

The clip colour identifies the left and right weatherstrips, so be sure to use the colours so as to install correctly.

Identification colour	Applicable side
White	Left door
Brown	Right door

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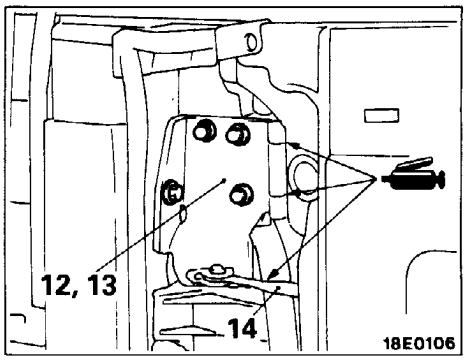
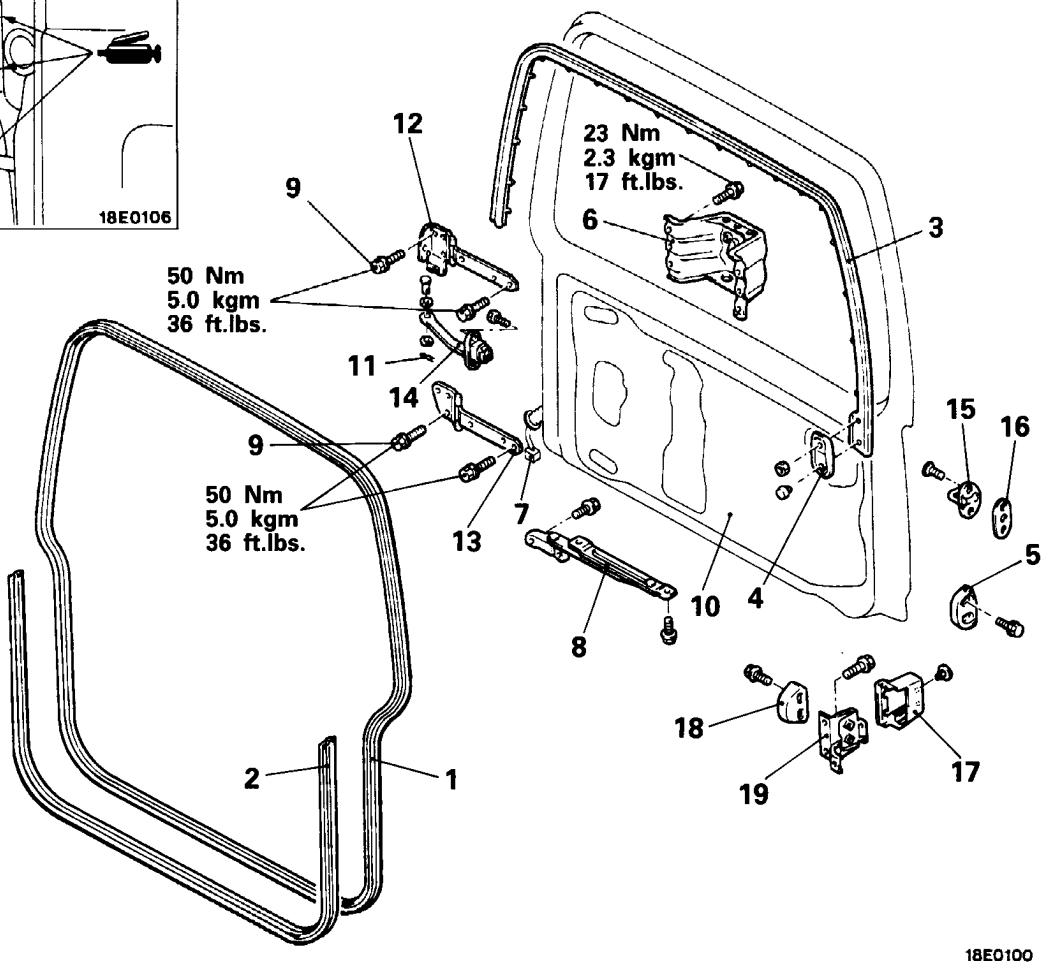
BACK DOOR ASSEMBLY

E420AAL

REMOVAL AND INSTALLATION



Back Door Post-installation Operation
- Back Door Adjustment (Refer to P.42-6.)



18E0100

1. Inner opening weatherstrip <excluding canvas top>
2. Inner opening weatherstrip <canvas top>
3. Outer opening weatherstrip <excluding canvas top>
4. Weatherstrip plate <excluding canvas top>
5. Bumper rubber
6. Spare tyre carrier

Back door removal steps

7. Harness connector
8. Back door stopper
9. Hinge attaching bolt
10. Back door

Hinge removal steps

- Back door trim
- Waterproof film

(Refer to P.42-35.)

10. Back door
11. Split pin
12. Upper hinge
13. Lower hinge

Door check strap removal steps

- Back door trim
- Waterproof film

(Refer to P.42-35.)

11. Split pin
14. Door check strap

Striker removal steps

15. Striker
16. Shim

Back door bumper bracket removal steps

17. Back door bumper cover
18. Back door bumper female
    - Rear combination lamp
19. Back door bumper bracket

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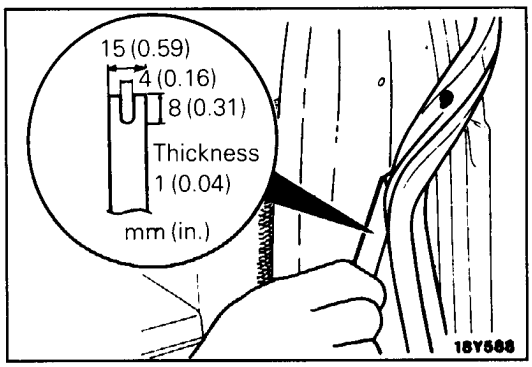


SERVICE POINT OF REMOVAL

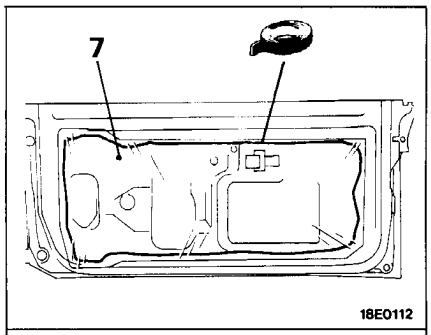
3. REMOVAL OF OUTER OPENING WEATHERSTRIP

Make a tool as shown in the illustration to remove the outer opening weatherstrip.

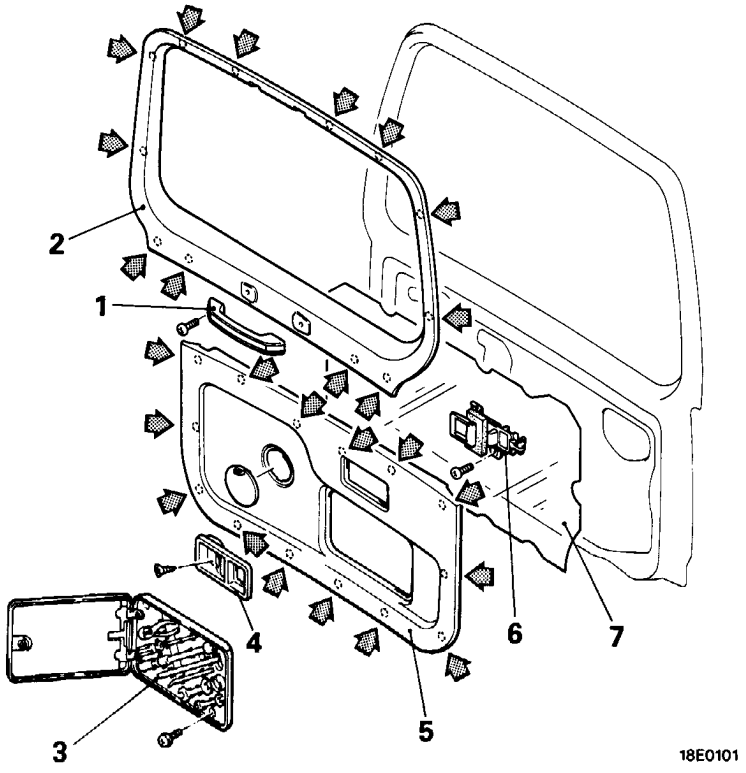
BACK DOOR TRIM AND WATERPROOF FILM

E42OBAG

REMOVAL AND INSTALLATION



Sealant:
3M ATD Part No. 8625 or equivalent



Removal steps

1. Door pull handle
2. Back door upper trim <Full trim>
3. Tool box lid assembly
4. Inside handle cover
5. Back door trim
6. Inside handle
7. Waterproof film

NOTE
◀ : Indicates the clip positions

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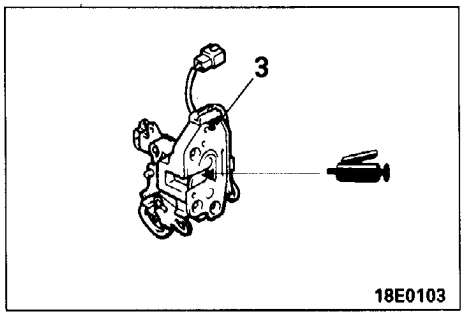
BACK DOOR HANDLE AND LATCH

E42OCAH

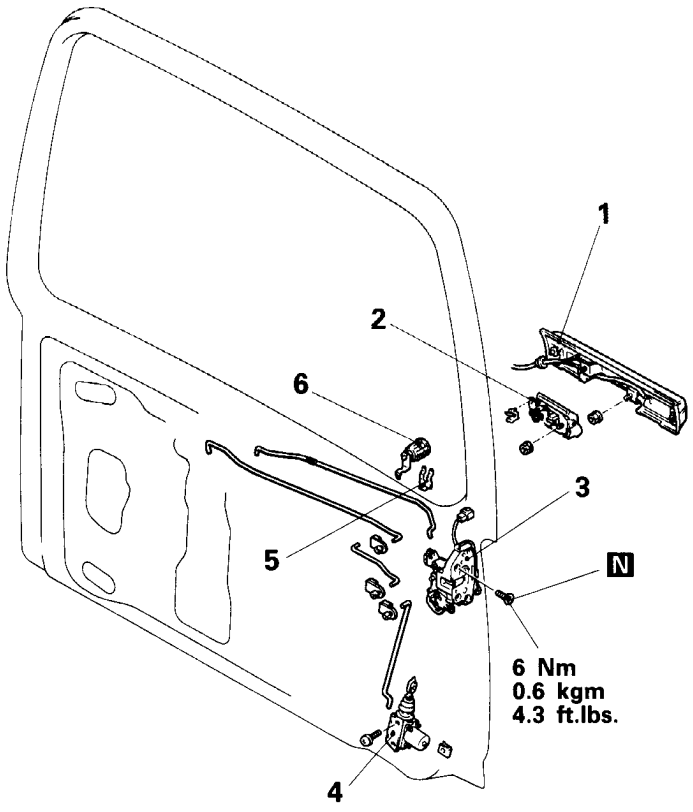
REMOVAL AND INSTALLATION

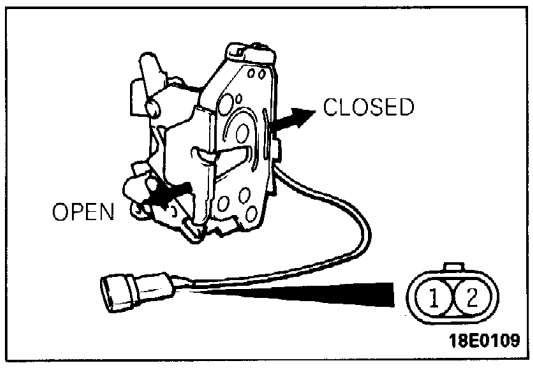


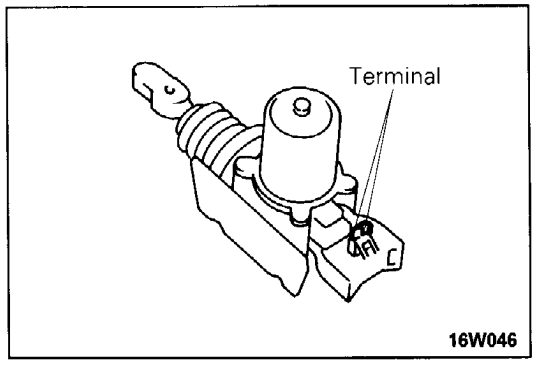
Removal steps

- Back door trim } (Refer to P.42-35.)
- Waterproof film }
- Door outside handle play inspection (Refer to P.42-6.)

1. License plate lamp garnish
2. Door outside handle
3. Back door latch assembly
4. Back door lock actuator
5. Retainer
6. Back door key cylinder







INSPECTION

LATCH SWITCH

Check the continuity between the terminals when the latch is moved.

Terminal \ Latch position	1	2
OPEN	○———	———○
CLOSED		

NOTE
○—○ indicates that there is continuity between the terminals.

BACK DOOR LOCK ACTUATOR

Connect the battery source to the actuator terminal, and check the shaft for operation. If the shaft moves in opposite direction when the connection polarity is changed, the actuator should be considered to be in normal condition.

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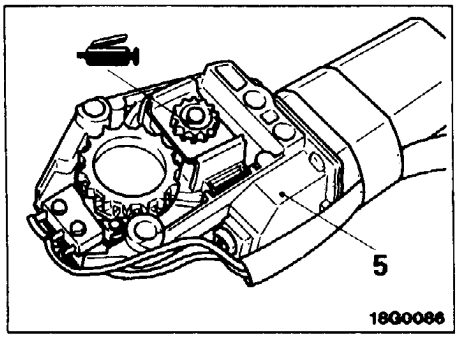
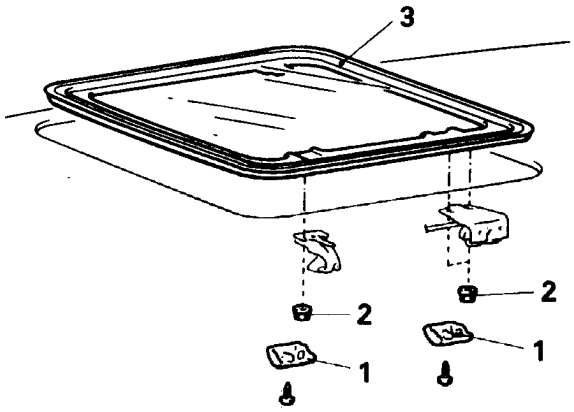
SUNROOF <Power Slide Type>

REMOVAL AND INSTALLATION

Post-installation Operation
- Water Test (Refer to p.42-7.)



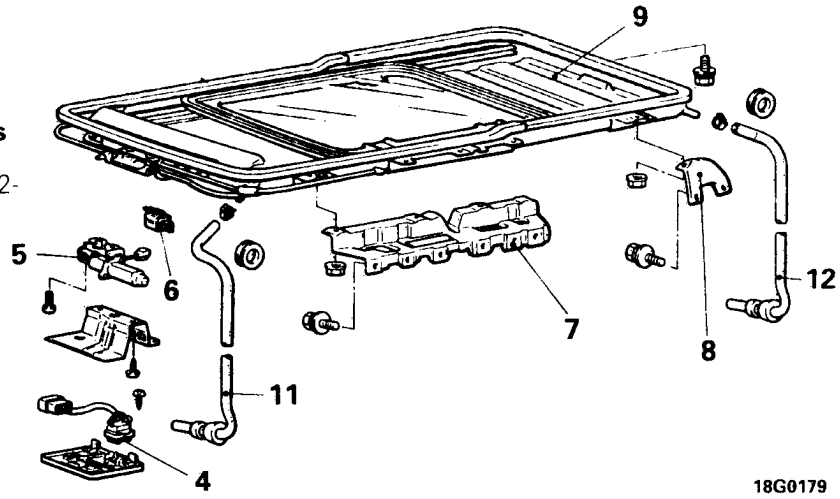
E42TAAM



Sunroof glass removal steps
1. Decoration cover
2. Nuts
3. Sunroof glass assembly

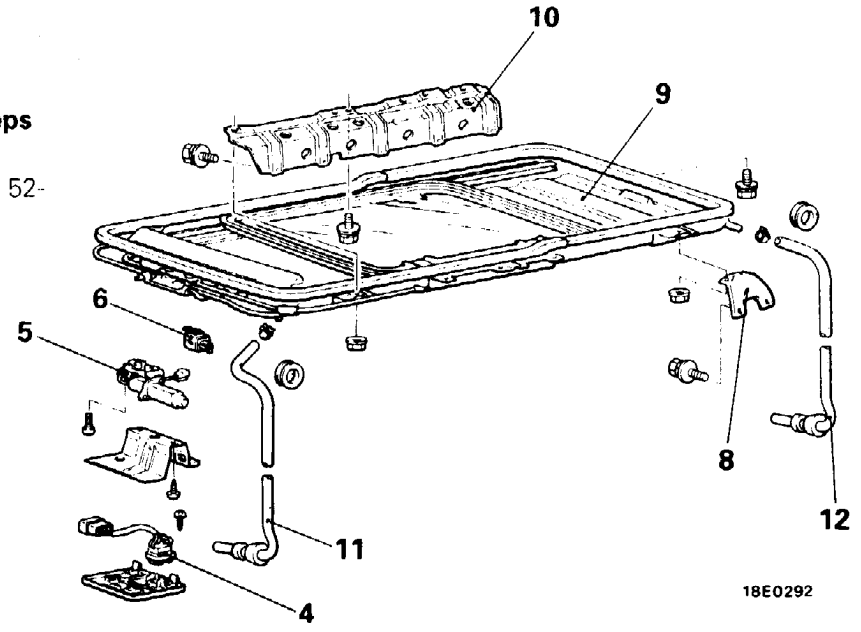
Vehicles built up to May 1991

Sunroof assembly removal steps
- 4. Sunroof switch
- • Headlining (Refer to GROUP 52-Headlining)
- ◆◆ ◆◆ 5. Motor assembly
- 6. Control unit
- 7. Front set bracket
- 8. Rear set bracket
- 9. Sunroof assembly
- ◆◆ ◆◆ 11. Front drain hose
- ◆◆ ◆◆ 12. Rear drain hose



Vehicles built from June 1991

Sunroof assembly removal steps
- 4. Sunroof switch
- • Headlining (Refer to GROUP 52-Headlining)
- ◆◆ ◆◆ 5. Motor assembly
- 6. Control unit
- 8. Rear set bracket
- 9. Sunroof assembly
- 10. Front set bracket
- ◆◆ ◆◆ 11. Front drain hose
- ◆◆ ◆◆ 12. Rear drain hose



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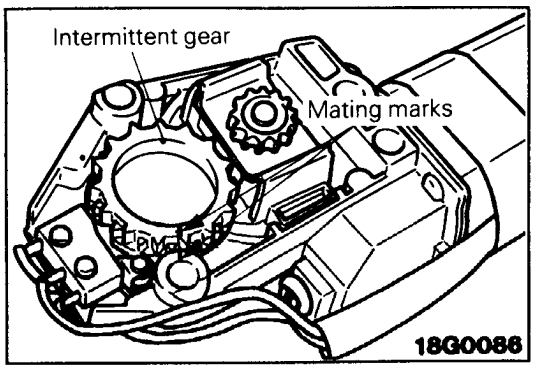


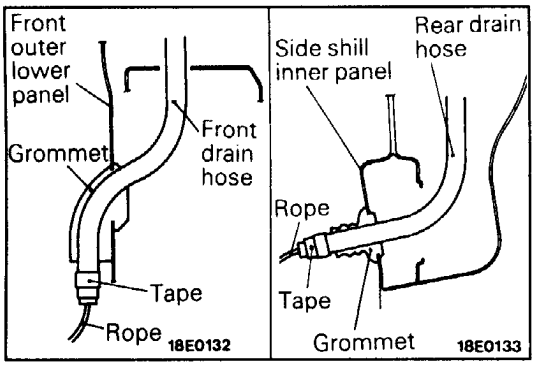
SERVICE POINTS OF REMOVAL

5. REMOVAL OF MOTOR ASSEMBLY

(1) Close sunroof fully. Remove motor.

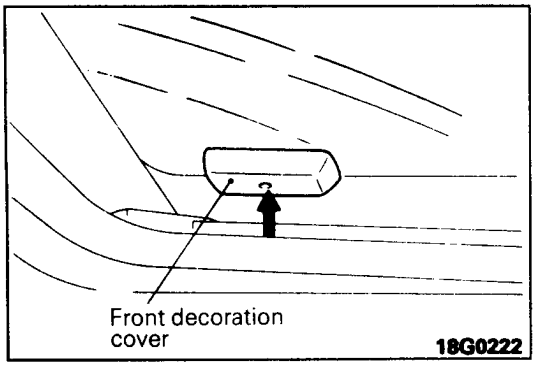
NOTE
When sunroof does not move, place match marks on roof lid and guide rail.

(2) Place match marks on motor intermittent gear and bracket.



11. REMOVAL OF FRONT DRAIN HOSE/12. REAR DRAIN HOSE

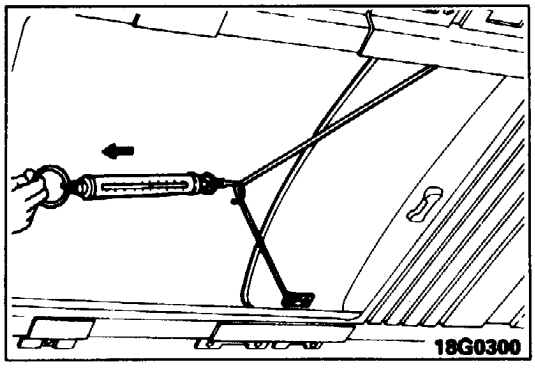
Tie a rope to the end of the drain hose, wind a tape around it so that there is no unevenness, and pull the drain hose into the inside of the passenger compartment.



INSPECTION

SUNROOF SLIDING RESISTANCE

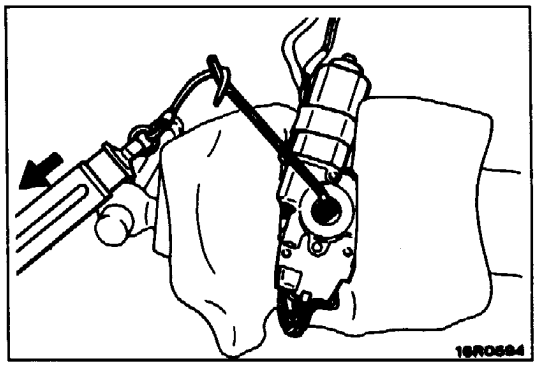
(1) Remove front decoration covers.
(2) Remove front guide front nut.
(3) Remove motor assembly.
(4) Fasten string.



(5) Measure sunroof drive resistance with spring scale.

Standard value: 200 N (20 kg, 44 lbs.) or less

(6) When the resistance exceeds the standard value, check the following.
① Guide rail installation
② Defective or worn guide bracket
③ Seized drive cable
④ Defective drive tube



CLUTCH SLIP FORCE

Inspect the sliding force of the clutch by the following procedure.

(1) Place the hexagonal wrench from the special tools into the hexagonal socket of the motor drive shaft, and use a spring balance to measure the force when the motor clutch starts to slip.

Standard value: 40–50 N (4.0–5.0 kg, 9–11 lbs.)

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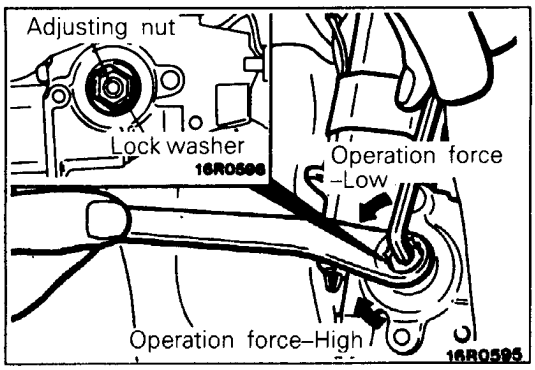

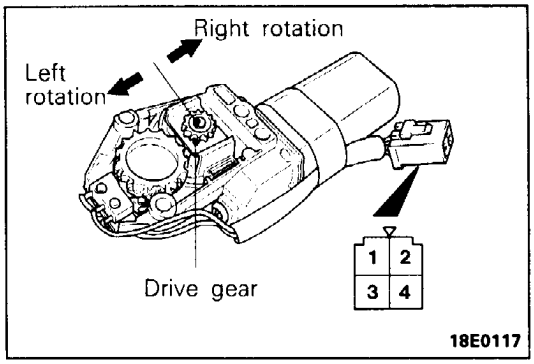

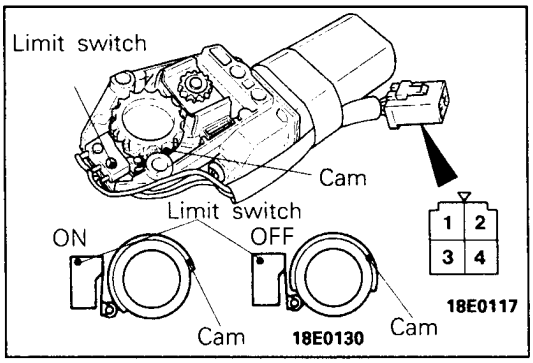

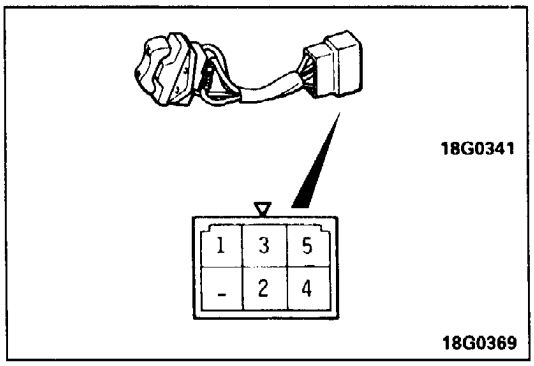

Caution

1. **The spring balance should be kept a right angle to the wrench.**
2. **If a wrench other than that in the special tools is used, the value for the clutch sliding force will be different, so only the special tool should be used.**

(2) If the clutch sliding force is not within the standard value, turn the motor adjusting nut to the left or right to adjust.
(3) After adjusting, tighten the adjusting nut securely with the lock washer.

MOTOR

Check the direction of rotation of the drive gear when the connector is connected to the battery.

Terminal 1	Terminal 3	Drive gear rotation direction
+	–	Right
–	+	Left

LIMIT SWITCH

Turn over the motor and check the continuity at each of the limit switch terminals.

Switch \ Terminal	2	4
ON		
OFF	O	O

NOTE

O–O Indicates that there is continuity between the terminals.

SUNROOF SWITCH

Operate the sunroof switch and check the continuity between each of the terminals.

Switch \ Terminal	1	2	3	5	6
OPEN	O	O		O	O
OFF		O	O	O	O
CLOSED	O	O	O	O	

NOTE

O–O Indicates that there is continuity between the terminals.

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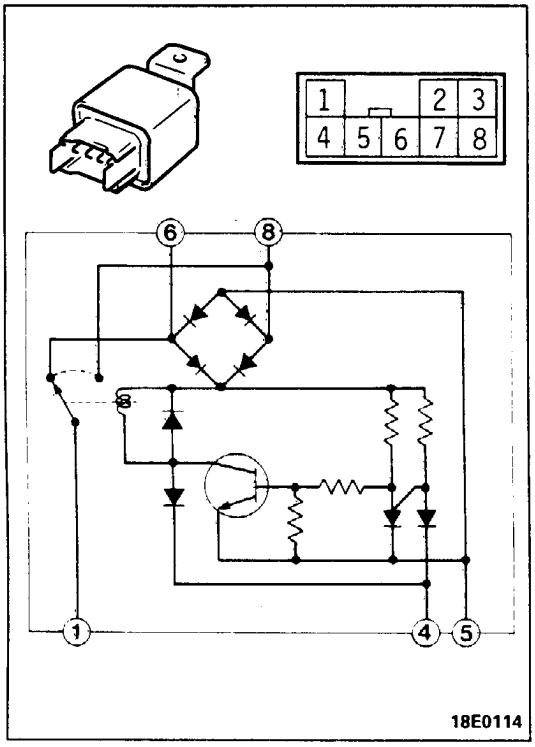
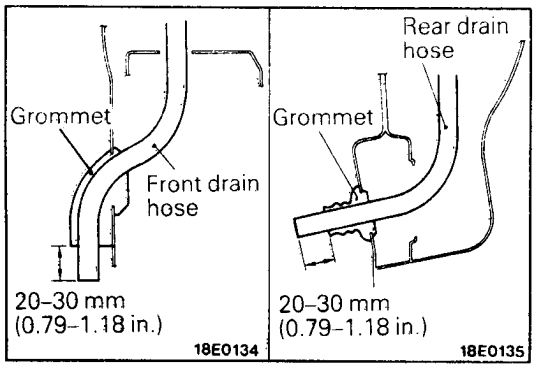


CONTROL UNIT

Check for continuity between terminals under the conditions described below.

Battery voltage / Terminal	1	8	6	5	4
When there is no current	○ ⊕ ⊖	⊕ ⊖	○ ⊕ ⊖	⊖	⊕
When there is current	○	○ ⊕ ⊖	⊖ ⊕		

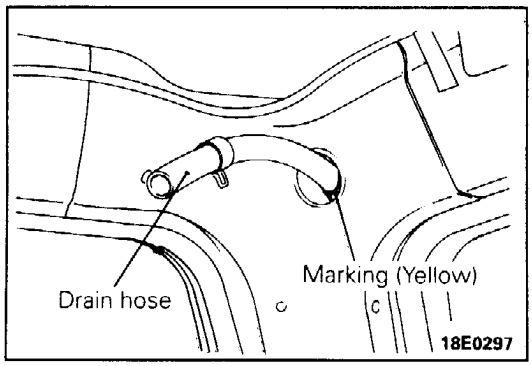
NOTE
(1) ○ ○ indicates that there is continuity between the terminals.
(2) ⊕ ○ indicates that there is continuity when the (+) is connected to the tester plus terminal, and the (-) is connected to the tester minus terminal.
(3) ⊕ ○ indicates terminals to which battery voltage is applied.



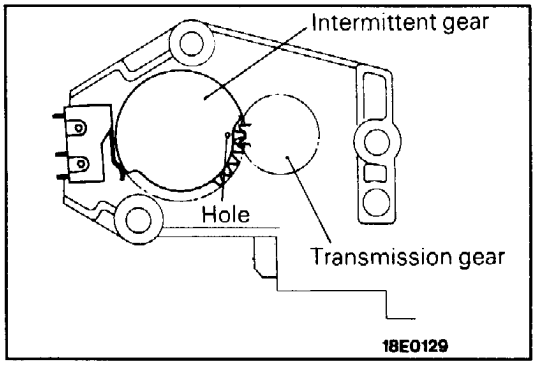
SERVICE POINTS OF INSTALLATION

12. INSTALLATION OF REAR DRAIN HOSE/11. FRONT DRAIN HOSE

(1) Tie the rope that was used during removal to the end of the drain hose, and wind tape around it so that there is no unevenness.
(2) Pull the rope to pull the drain hose through.
(3) Pull the drain hose until the protruding length from the grommet is as shown in the figure.



(4) Align the rear drain hose (RH) with the body hole with the marking at the bottom.
(Vehicles built from June 1991)



5. INSTALLATION OF MOTOR ASSEMBLY

When replacing the motor assembly, open the sunroof glass approximately 200 mm (7.9 in.), set the hole of the intermittent gear so that it is aligned between the teeth of the motor assembly transmission gear, and then install the motor assembly.

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NOTE

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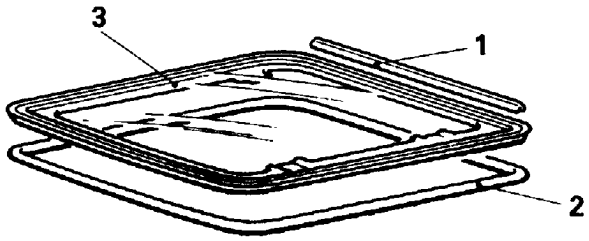
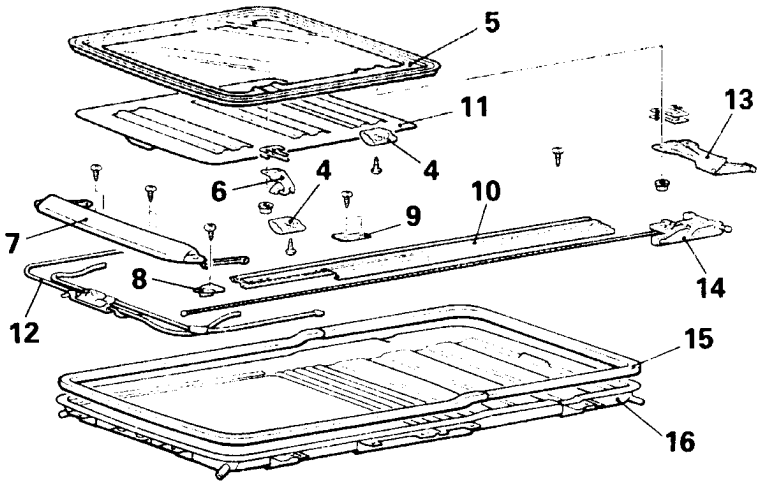
DISASSEMBLY AND REASSEMBLY



18W937



18E0251

Sunroof glass disassembly steps

1. Screen drip
2. Weatherstrip
3. Sunroof glass

Sunroof assembly disassembly steps

4. Decoration cover
5. Sunroof glass assembly
6. Front guide bracket
7. Deflector assembly
8. Rail end cover
9. Set plate
10. Guide rail assembly
11. Sun shade
12. Drive tube
13. Lifter assembly
14. Slider assembly
15. Sealing tape
16. Housing assembly

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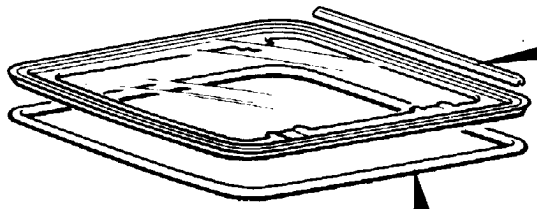
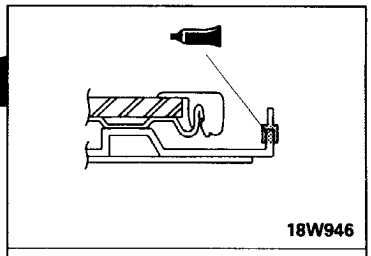
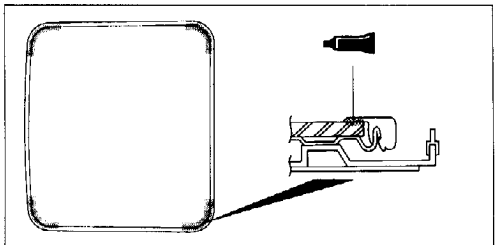
LUBRICATION AND SEALING POINTS


18W937

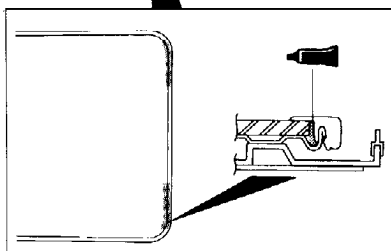

18W946

Adhesive:
3M ATD Part No. 8001 or 3M ATD Part No. 8011, or equivalent


18W942

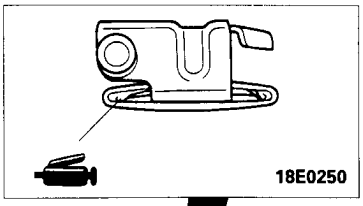
▒: Adhesive application locations

Adhesive:
3M ATD Part No. 8001 or 3M ATD Part No. 8011, or equivalent


18W943

▒ :Sealant application locations

Sealant: 3M ATD Part No. 8513 or 3M ATD Part No. 8509, or equivalent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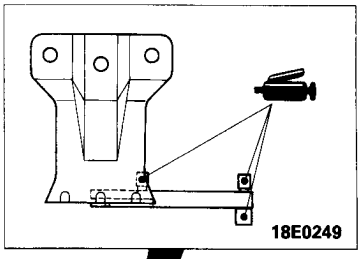
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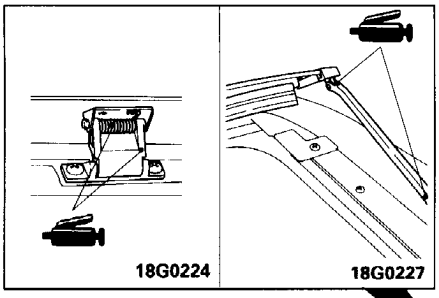
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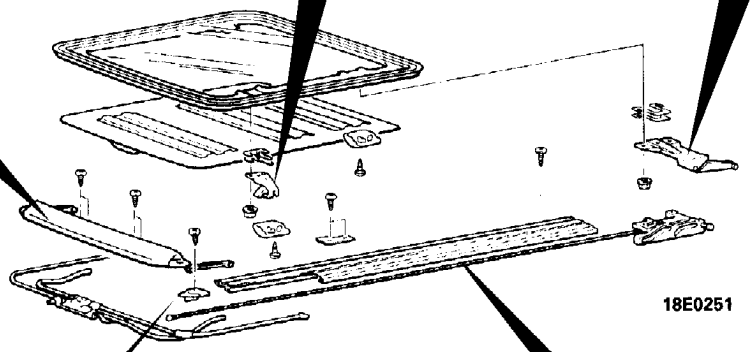
18G0227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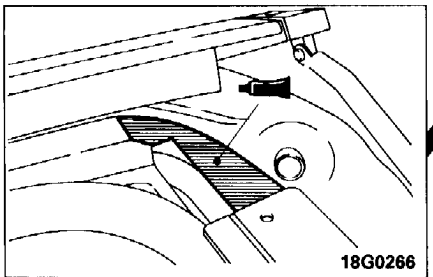
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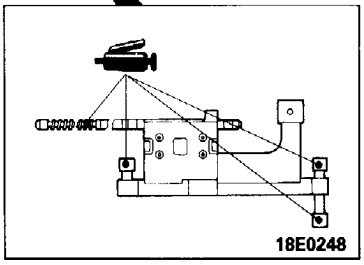
Sealant: 3M ATD Part No. 8531 or 3M ATD Part No. 8646, or equivalent


18E0248

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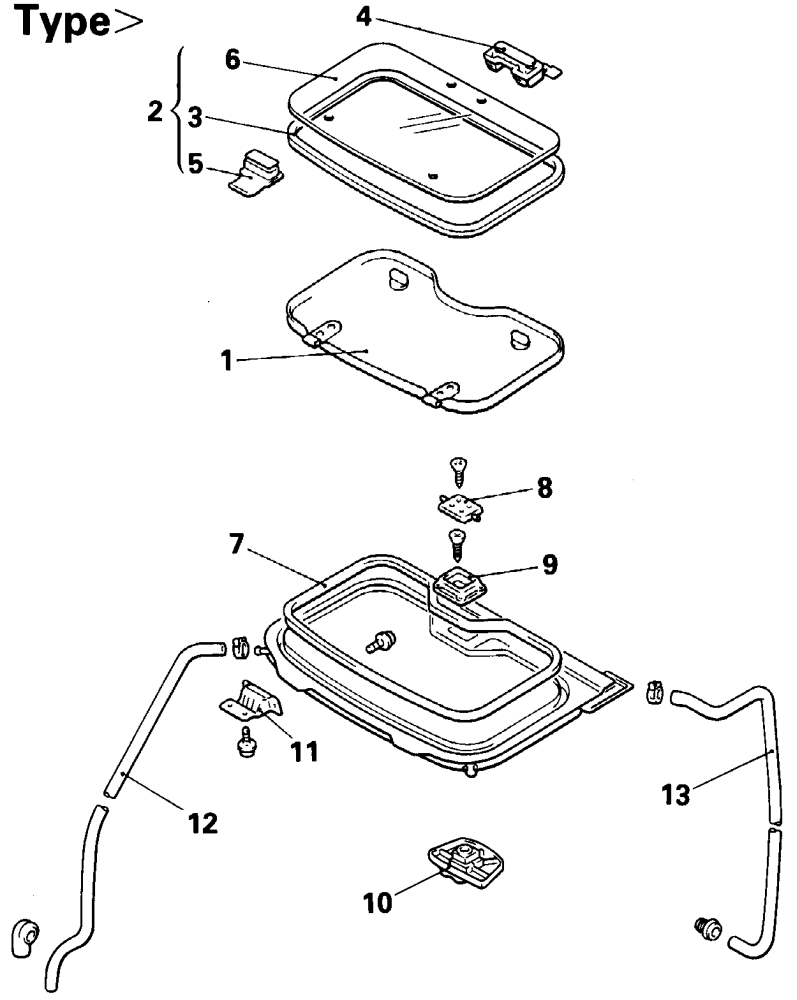
Sunroof <Removable Tilt-Up Type>

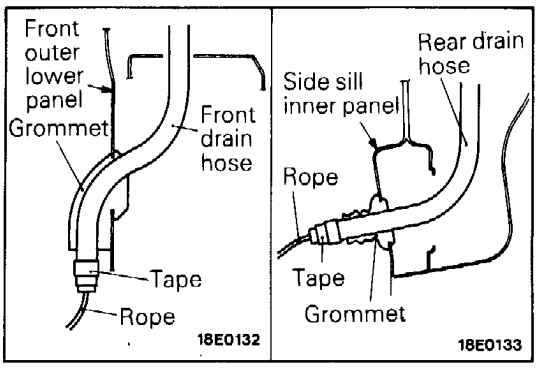
REMOVAL AND INSTALLATION

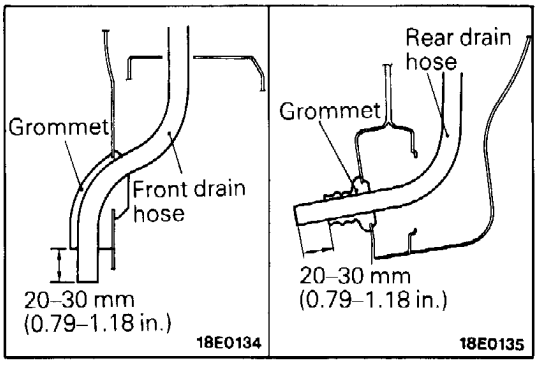
Post-installation Operation
- Water Test (Refer to P.42-7.)



Removal steps
1. Sunroof trim assembly
2. Sunroof glass assembly
3. Weatherstrip
4. Slide lock assembly
5. Sunroof male hinge
6. Sunroof glass
7. Sunroof inner weatherstrip
8. Sunroof latch catch
9. Retainer
10. Sunroof regulator assembly
11. Sunroof female hinge
- Headlining (Refer to GROUP 52 – Headlining.)

◀■▶ ▶■◀ 12. Front drain hose
◀■▶ ▶■◀ 13. Rear drain hose





SERVICE POINTS OF REMOVAL

12. REMOVAL OF FRONT DRAIN HOSE/13. REAR DRAIN HOSE

Tie a rope to the end of the drain hose, wind a tape around it so that there is no unevenness, and pull the drain hose into the inside of the passenger compartment.

SERVICE POINTS OF INSTALLATION

13. INSTALLATION OF REAR DRAIN HOSE/12. FRONT DRAIN HOSE

(1) Tie the rope that was used during removal to the end of the drain hose, and wind tape around it so that there is no unevenness.
(2) Pull the rope to pull the drain hose through.
(3) Pull the drain hose until the protruding length from the grommet is as shown in the figure.

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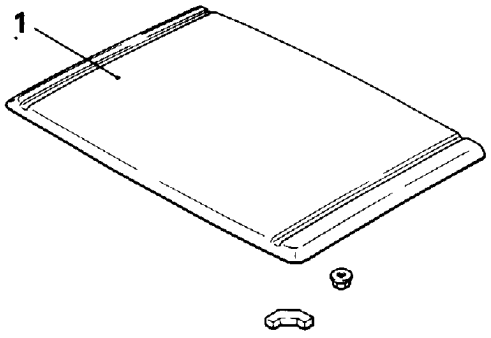
CANVAS TOP

E42SAAD

REMOVAL AND INSTALLATION <FRONT CANVAS>

<Resin Top>



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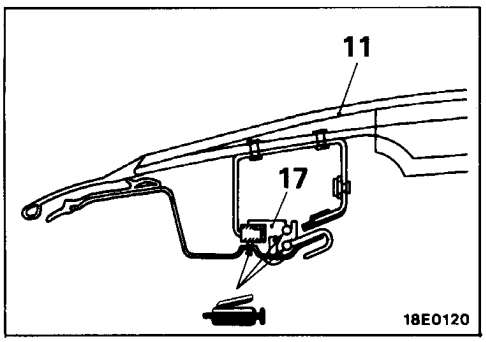
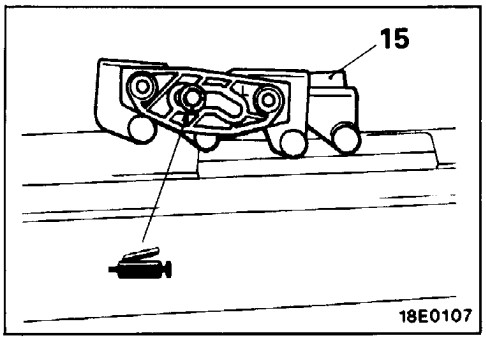
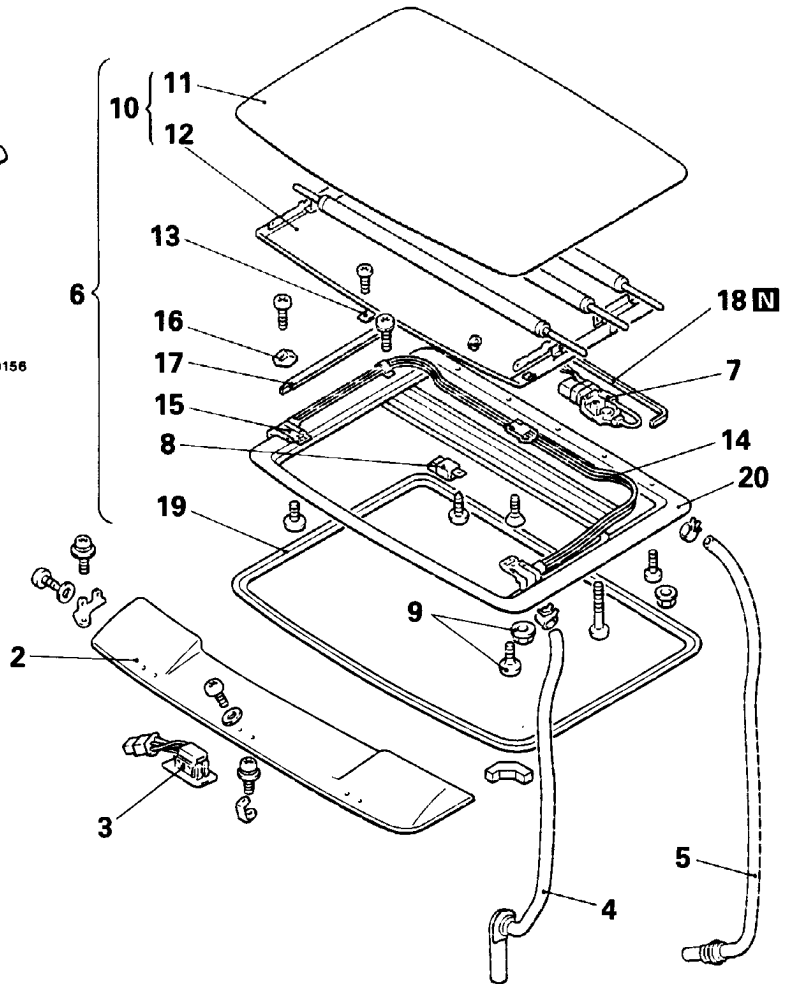


18E0120



18E0107

<Power canvas>



18E0162

Resin top removal steps

- Headlining (Refer to GROUP 52 – Headlining)

1. Roof panel

Power canvas removal steps

2. Deflector
3. Canvasroof switch
- Headlining (Refer to GROUP 52 – Headlining)

4. Front drain hose
5. Rear drain hose
6. Folding top assembly
7. Motor assembly
8. Control unit
9. Front guide assembly installation nut and screw
10. Leather top and inner leather assembly
11. Leather top assembly
12. Inner leather assembly
13. Set plate
14. Drive unit assembly
15. Front guide assembly
16. Side rail cover
17. Guide rail assembly
18. Dam tape
19. Weatherstrip
20. Frame assembly

Post-installation Operation

- Water Test (Refer to P.42-7.)

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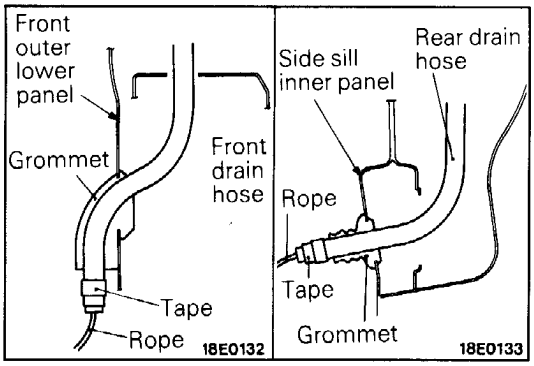
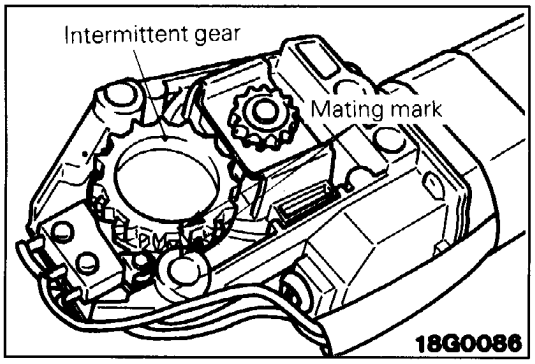


SERVICE POINTS OF REMOVAL

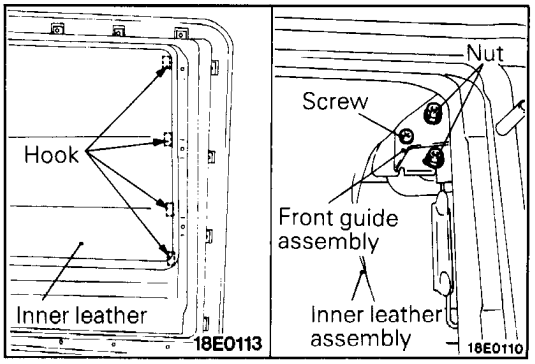
4. REMOVAL OF FRONT DRAIN HOSE/5. REAR DRAIN HOSE

Tie a rope to the end of the drain hose, wind a tape around it until there is no unevenness, and pull the drain hose into the inside of the passenger compartment.



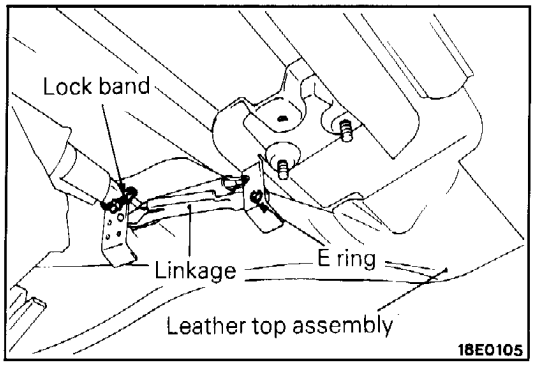
7. REMOVAL OF MOTOR ASSEMBLY

(1) Fully close the canvas and remove the motor assembly.
(2) Make mating marks on the transmission gear and bracket of the motor assembly.



9. REMOVAL OF FRONT GUIDE ASSEMBLY INSTALLATION NUT AND SCREW

Remove the hook of the inner leather assembly and remove the nuts and screw while rolling up the inner leather.



11. REMOVAL OF LEATHER TOP ASSEMBLY/12. INNER LEATHER ASSEMBLY

After removing the E ring and lock band, remove the inner leather assembly from the leather top assembly.

INSPECTION

CHECKING THE SLIDING FORCE OF THE MOTOR CLUTCH

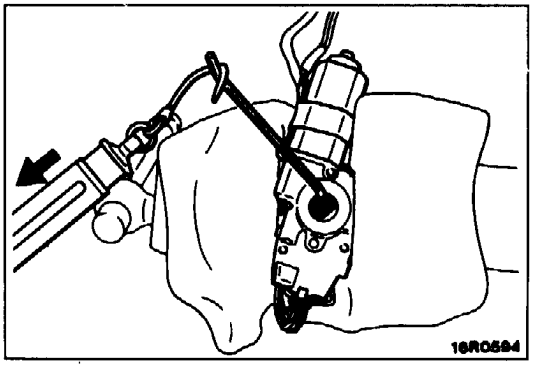
Inspect the sliding force of the clutch by the following procedure.

(1) Place the hexagonal wrench from the special tools into the hexagonal socket of the motor drive shaft, and use a spring balance to measure the force when the motor clutch starts to slip.

Standard value: 45–55 N (4.5–5.5 kg, 10–12 lbs.)

Caution

1. **The spring balance should be kept a right angle to the wrench.**
2. **If a wrench other than that in the special tools is used, the value for the clutch sliding force will be different, so only the special tool should be used.**



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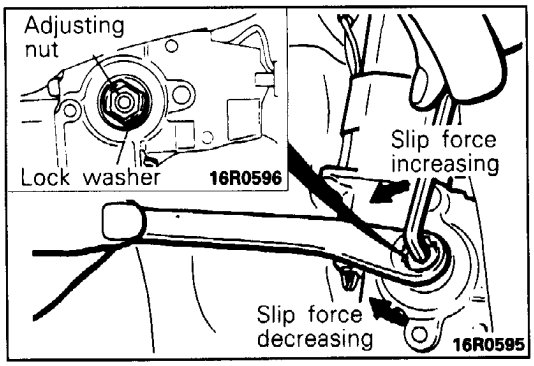
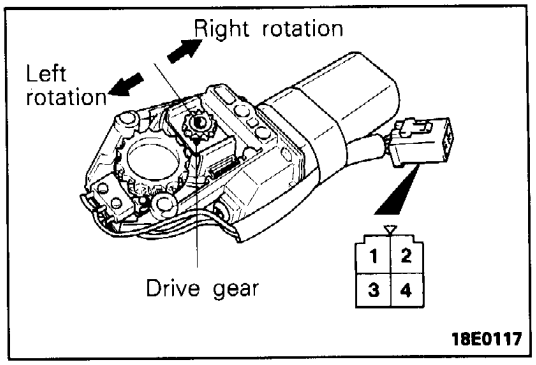


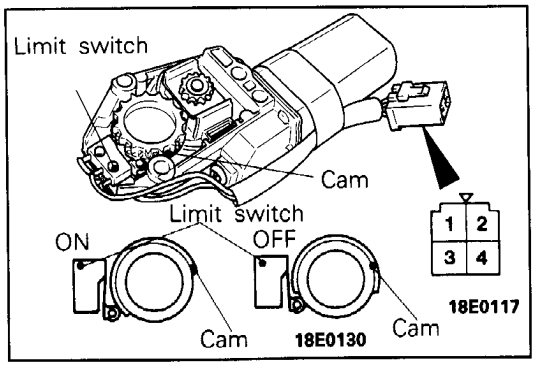
(2) If the clutch sliding force is not within the standard value, turn the motor adjusting nut to the left or right to adjust.
(3) After adjusting, tighten the adjusting nut securely with the lock washer.



MOTOR

Check the direction of rotation of the drive gear when the connector is connected to the battery.

Terminal 1	Terminal 3	Drive gear rotation direction
+	–	Right
–	+	Left

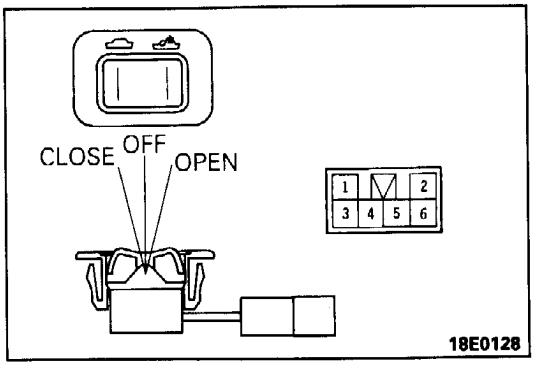


LIMIT SWITCH

Turn over the motor and check the continuity at each of the limit switch terminals.

Terminal \ Switch	2	4
ON		
OFF	○———	———○

NOTE
○—○ indicates that there is continuity between the terminals



CANVAS ROOF SWITCH

Operate the canvas roof switch and check the continuity between each of the terminals.

Terminal \ Switch	1	2	4	5
OPEN	○	○———	———○	○
OFF		○———	———○	○
CLOSE	○———	○———	———○	○

NOTE
○—○ indicates that there is continuity between the terminals

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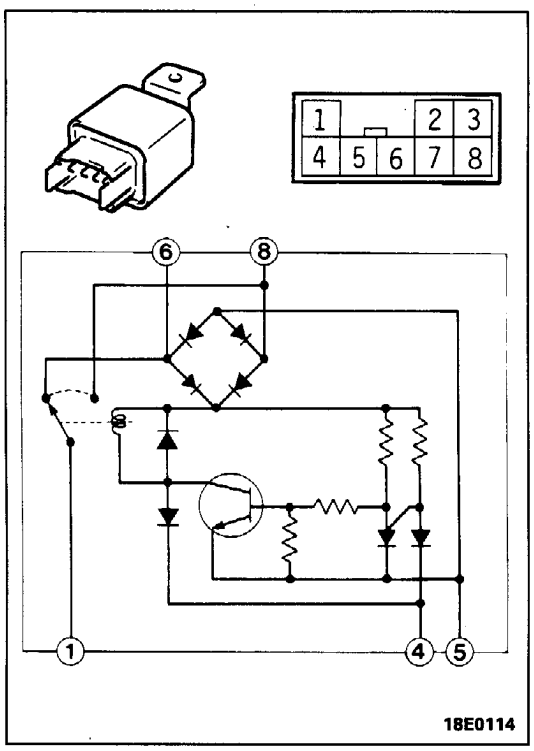
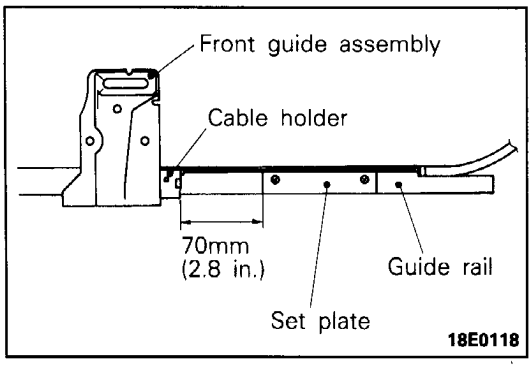


CONTROL UNIT

Check for continuity between terminals under the conditions described below.

Battery voltage \ Terminal	1	8	6	5	4
When there is no current	○	⊕	⊕	⊖	⊕
	⊕	⊖	⊖		
	⊖				
When there is current	○	○			
		⊕ - - - ⊖			
		⊖ - - - ⊕			

NOTE
(1) ○–○ indicates that there is continuity between the terminals
(2) ⊕–⊖ indicates that there is continuity when the (+) is connected to the tester plus terminal, and the (-) is connected to the tester minus terminal.
(3) ⊕ ⊖ indicates terminals to which battery voltage is applied.

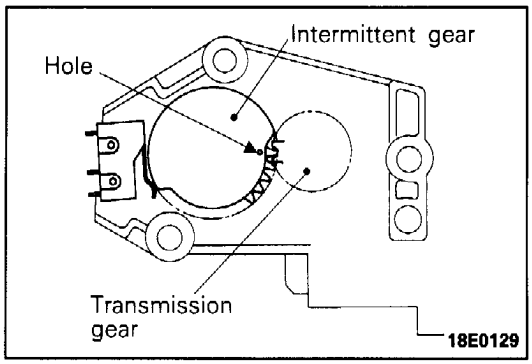


SERVICE POINTS OF INSTALLATION

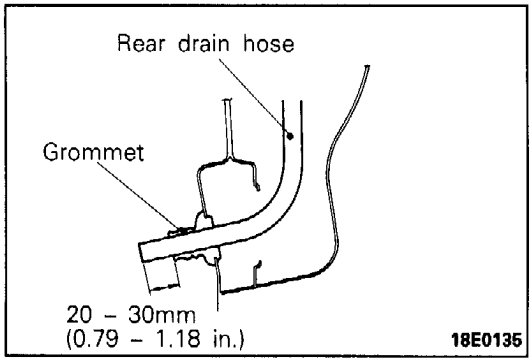
7. INSTALLATION OF MOTOR ASSEMBLY

When replacing the motor assembly, install by the following procedure.

(1) After installing the front guide assembly, set the distance between the front guide assembly cable holder and set plate to 70 mm (2.8 in.). (Canvas stopping position)



(2) Set the hole of the intermittent gear so that it is aligned between the teeth of the motor assembly transmission gear, and then install the motor assembly.



5. INSTALLATION OF REAR DRAIN HOSE/4. FRONT DRAIN HOSE

(1) Tie the rope that was used during removal to the end of the drain hose, and wind tape around it so that there is no unevenness.
(2) Pull the rope to pull the drain hose through.
(3) Pull the drain hose until the protruding length from the grommet is as shown in the figure.

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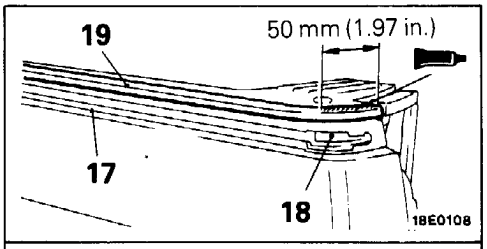
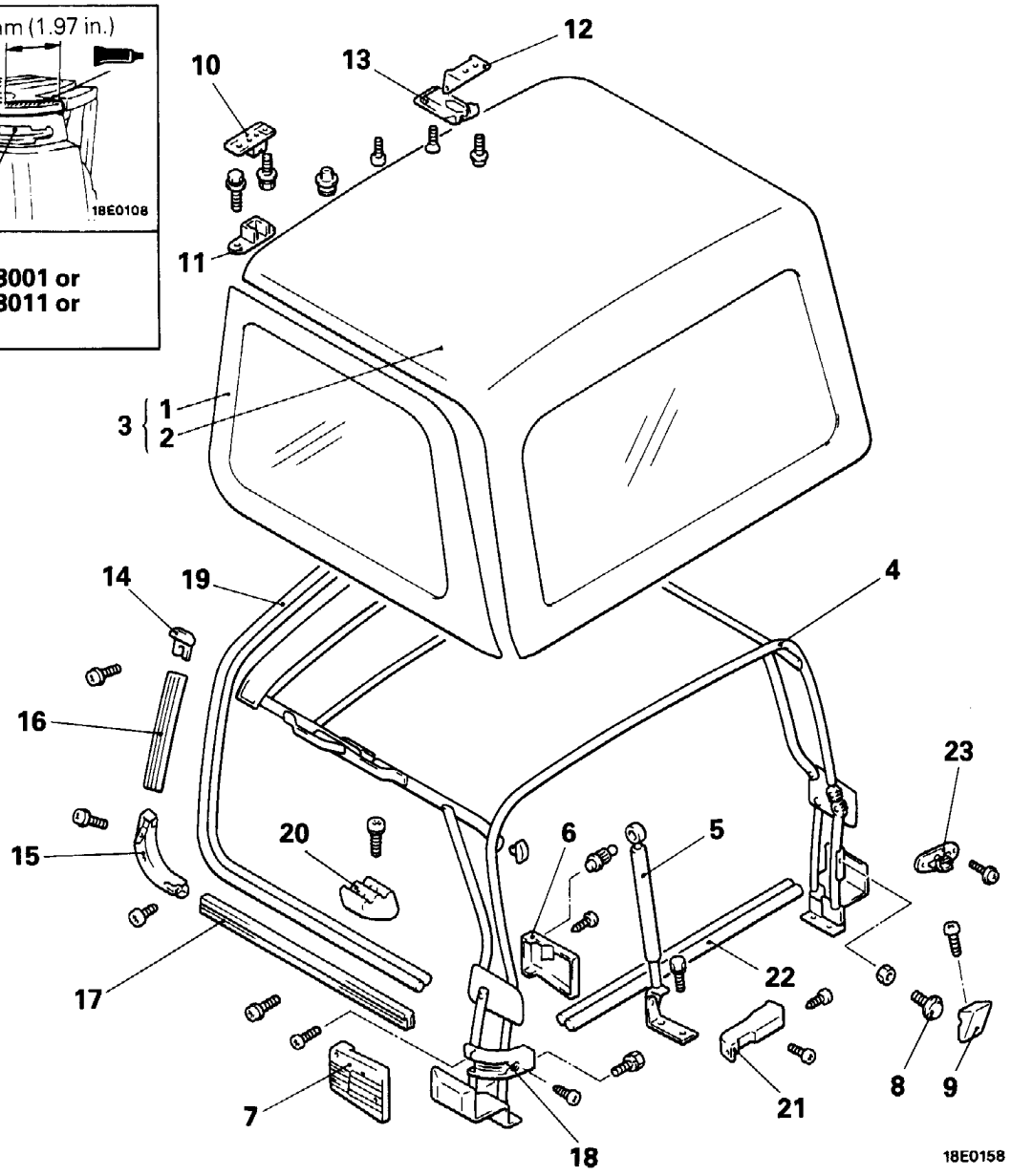
REMOVAL AND INSTALLATION <REAR CANVAS>



Adhesive:
3M ATD part No. 8001 or
3M ATD Part No. 8011 or
equivalent



Removal steps

1. Side cover
2. Top cover
3. Roof cover
4. Roof cover assembly
◆◆ 5. Roof cover gas spring
6. Inside cover
7. Outside cover
◆◆ 8. Male stopper
9. Female stopper
10. Upper damper
11. Lower damper
12. Folding top hook
13. Folding top lock assembly
14. Rail end cap
15. Holder
16. Front rail
17. Side rail
18. Rear corner rail
19. Weatherstrip
20. Link damper
21. Back door opening weatherstrip
22. Back door weatherstrip
23. Rod holder

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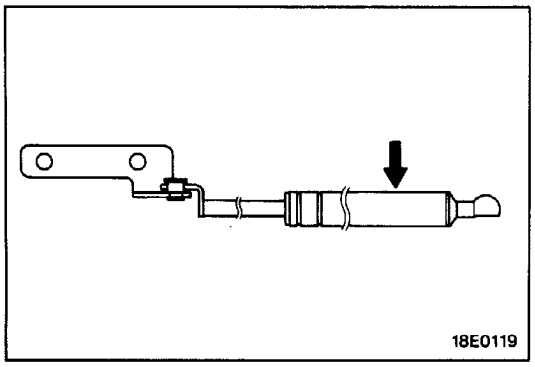
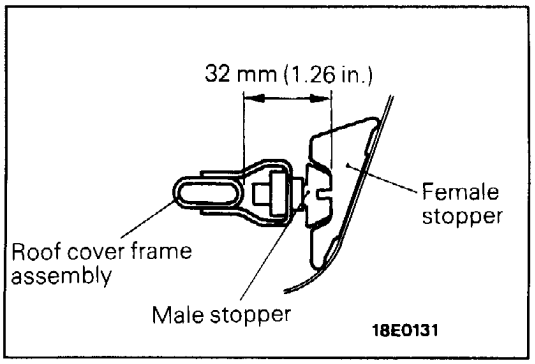




SERVICE POINT OF REMOVAL

5. REMOVAL OF ROOF COVER GAS SPRING

When discarding the roof cover gas spring, place it horizontally with the piston rod extended, and make a 3 mm (0.12 in.) hole at the position shown in the figure to release the gas.

Caution
The gas is non-toxic, but there is a danger when the gas escapes together with the metal powder from the drill, so protective goggles should always be worn.

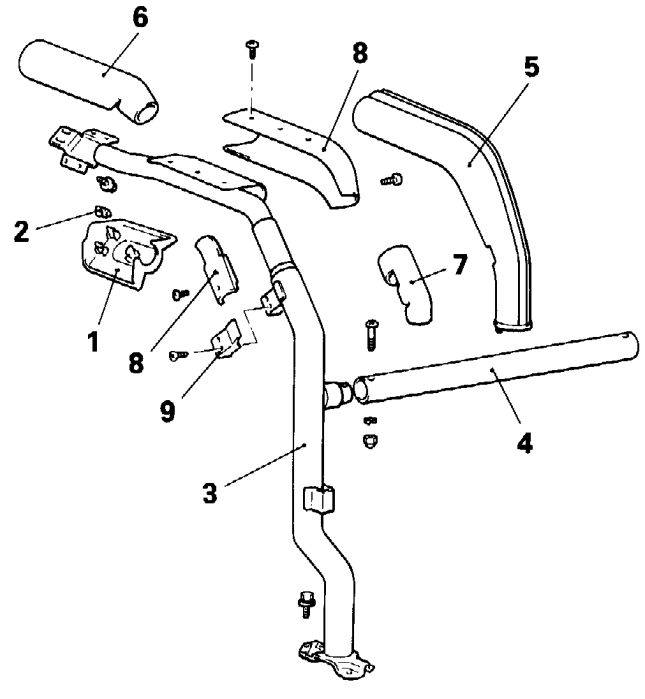
SERVICE POINT OF INSTALLATION

8. INSTALLATION OF MALE STOPPER

Install the male stopper as shown in the figure.

ROLL BAR
REMOVAL AND INSTALLATION

E42ZAAA



Removal steps
1. Roll bar bracket cover
2. Clip
3. Side bar assembly
4. Rear roll bar assembly
5. Protector cover A assembly
6. Upper protector pad
7. Lower protector pad
8. Protector pad
9. Anchor cover

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EXTERIOR

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SPECIFICATIONS

GENERAL SPECIFICATIONS

E51CA--

Items		Specifications
Windshield wiper motor		
Revolution speed at load of 1 Nm (0.1 kgm, 0.72 ft.lbs.)	r/min.	
Low speed		48 ± 4
High speed		70 ± 7
Nominal torque	Nm (kgm, ft.lbs.)	24 (2.4, 17)
No-load current	A	4.0 or less
Windshield wiper blade		
Wiping angle		
Driver's side		85°
Passenger's side		109°
Wiper blade length	mm (in.)	
Driver's side		475 (18.7)
Passenger's side		475 (18.7)
Windshield washer motor and pump		
Motor type		Direct current ferrite magnet type
Pump type		Centrifugal type
Power consumption	A	4 or less
Time of continuous use	sec.	
With washer fluid		Max. 60
Empty operation		Max. 20
Nozzle jet pressure	kPa (kg/cm^2, psi)	110 (1.1, 15.6) or more
Tank capacity	dm^3 (U.S.qts., Imp.qts.)	3.0 (3.1, 2.6) or more
Rear wiper motor		
Revolution speed at load of 0.6 Nm (0.06 kgm, 0.43 ft.lbs.)	r/min.	38 ± 5
Nominal torque	Nm (kgm, ft.lbs.)	10 (1.0, 7)
Rear wiper blade		
Wiping angle		102°
Wiper blade length	mm(in.)	375 (14.8)
Rear window washer motor and pump		
Motor type		Direct current ferrite magnet type
Pump type		Centrifugal type
Power consumption	A	3.8 or less
Time of continuous use	sec.	
With washer fluid		Max. 60
Empty operation		Max. 20
Nozzle jet pressure	kPa (kg/cm^2, psi)	120 (1.2, 17) or more
Tank capacity	dm^3 (U.S.qts., Imp.qts.)	1.4 (1.5, 1.2) or more
Intermittent wiper relay		
Intermittent interval	sec.	8 ± 2

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Items		Specifications
Headlamp washer motor and pump		
Motor type		Direct current ferrite magnet type
Pump type		Centrifugal type
Rated current	A	21 or less
Nozzle injection pressure	kPa (kg/cm^2, psi)	180 (1.8, 25.6) or more
Tank capacity	dm^3 (U.S.qts., Imp.qts.)	3.7 (3.9, 3.3) or more
Check valve		
Valve opening and closing pressure	kPa (kg/cm^2, psi)	50–110 (0.5–1.1, 7.1–15.6)
Headlamp washer relay		
Timer operation time	sec.	0.33

SERVICE SPECIFICATIONS

E51CB--

Items		Specifications
Standard value		
Windshield wiper blade installation position	mm (in.)	
Driver's side		25–35 (0.98–1.38)
Passenger's side		35–45 (1.38–1.77)
Rear wiper blade installation position	mm (in.)	65–75 (2.56–2.95)
P.T.O. output shaft axial play	mm (in.)	0–0.2 (0–0.008)
Clearance between snap ring and snap ring groove of drive shaft universal joint	mm(in.)	0–0.06 (0–0.0024)
Limit		
Number of broken strands in main wire rope		11
Outside diameter of wire rope	mm (in.)	7.45 (0.2933)
Thickness of winch brake shoe lining	mm (in.)	4.0–4.5 (0.157–0.177)
Inside diameter of lower roller bushing of winch rope guide	mm (in.)	19.5 (0.768)
Drive shaft runout	mm (in.)	
Front shaft assembly		1.0 (0.04)
Rear shaft assembly		0.5 (0.02)

LUBRICANTS

E51CD--

Items	Specified lubricants	Quantity dm^3 (U.S.qts., Imp.qts.)
Winch gear case	Hypoid gear oil API classification GL-4 or higher SAE viscosity No. 75W–90 or 75W–85W	0.75 (0.79, 0.66)
Transfer case (P.T.O. oil)	Hypoid gear oil API classification GL-4 or higher SAE viscosity No. 75W–90 or 75W–85W	2.7 (2.85, 2.38) [including 0.4 (0.42, 0.35) of P.T.O. oil]

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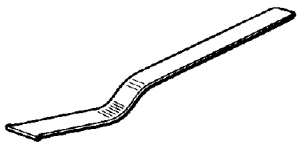
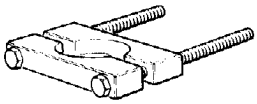
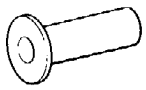
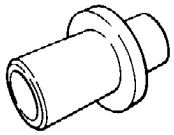
SEALANTS AND ADHESIVES

E51CE--

Items	Specified sealant and adhesive	Remarks
Between roof rail and packing	3M ATD Part No. 8513 or equivalent	Non-drying sealant
Between roof rail packing and body Roof spoiler and body mounting section	3M ATD Part No. 8531, 8646 or equivalent	Body sealant
P.T.O. stud bolt Both surfaces of P.T.O. gasket Gear case cover	3M ATD Part No. 8661, 8663 or equivalent	Semi-drying sealant
Winch inner set screw	3M ATD Part No. 8121, 8155 or equivalent	Quick fix adhesive

SPECIAL TOOLS

E51DA--

Tool	Number	Name	Use
	MB990784	Ornament remover	Removal of rear wiper and washer switch, door mirror control mirror switch
	MB990449	Window moulding remover	Removal of roof drip moulding
	MB990560	Rear axle shaft bearing remover	P.T.O. Pressing in and out output shaft front ball bearing Removal of output shaft rear ball bearing Winch Removal of bearing inner race
	MB991152	Dust cover installer	P.T.O. Pressing in output shaft rear ball bearing Pressing in dust seal
	MB990699	Differential oil seal installer	P.T.O. Pressing in oil seal
	MB991007	Bearing installer	Winch Removal of shift lock bracket bushing Pressing in gear case oil seal, bearing inner race

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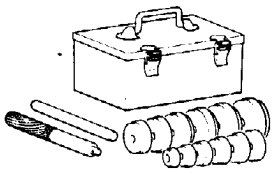
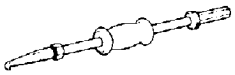
Tool	Number	Name	Use
	MB990925	Bearing and oil seal installer (Refer to GROUP 26–Special Tools.)	Drive shaft Pressing in bearing bracket oil seal MB990938, MB990929 Winch Removal of gear case bushing MB990939 Pressing in gear case bushing, gear case oil seal, side cover bushing, drum bushing and shift lock bracket bushing MB990938, MB990927 Pressing in bearing inner race MB990927
	MB990590	Rear axle shaft oil seal remover	Winch Removal of drum bushing and side cover bushing

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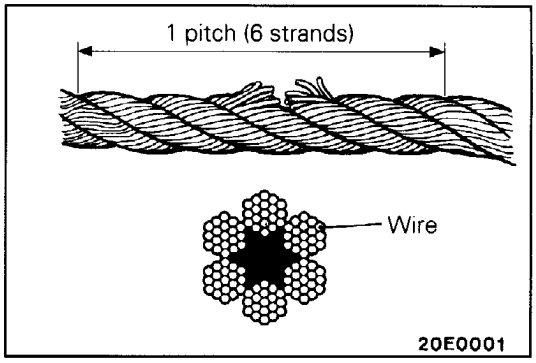


SERVICE ADJUSTMENT PROCEDURES

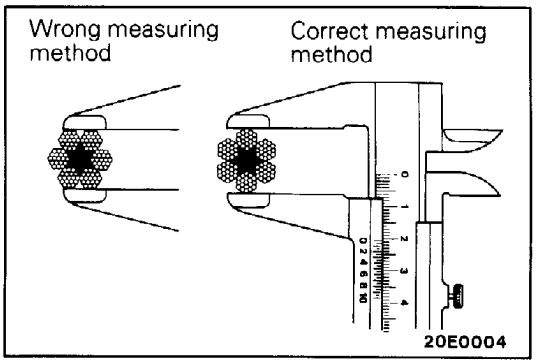
WINCH INSPECTION

WIRE ROPE AND HOOK INSPECTION E51FAAB

Inspect the following items, and if an abnormality is found, replace the item concerned.

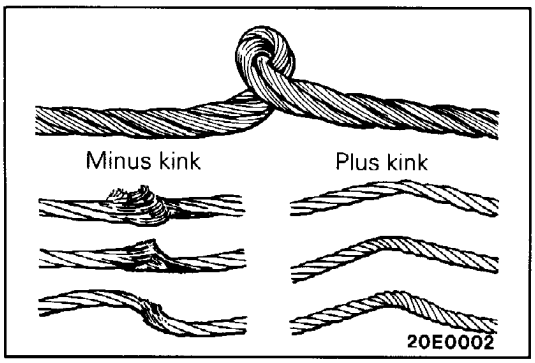
(1) In one pitch of the wire rope (6 strands), 10 percent or more of the wires are broken.

Limit: 11 wires



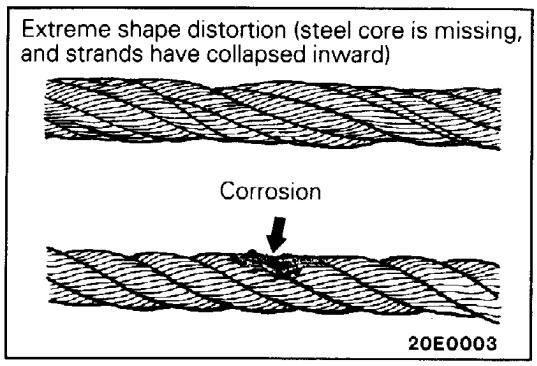
(2) Perpendicular decrease in diameter exceeds 7 percent of the rated diameter.
Using the measurement method shown in the illustration, measure the values for three sides and take an average.

Limit: 7.45 mm (0.2933 in.)

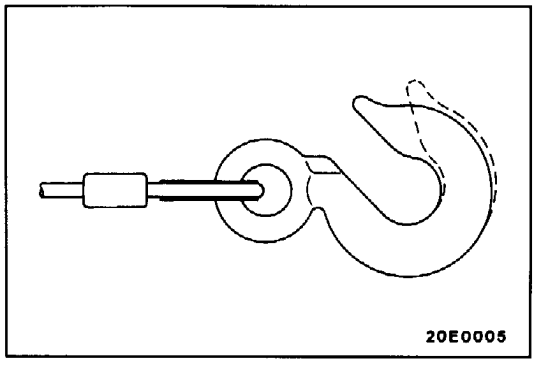


(3) Rope with kinks.
Rate of decrease in load due to kinks.

Condition of rope	Rate of decrease %
Rope with no kinks	0
Rope with minus kink (strands unravelling direction)	20–40
Rope with plus kink (strands tightening direction)	50–80



(4) Extreme shape distortion (dents in strands, steel core protruding, twists tightening), or corrosion.



(5) Abnormality in caulked section and connection of hook and wire rope.
(6) Warped (bent hook), cracked or severely eroded item.

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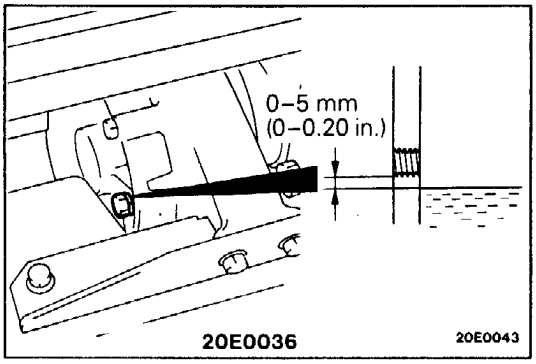
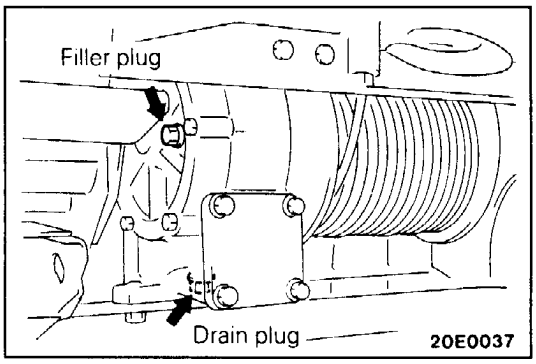


WINCH OIL INSPECTION E51FEAB

(1) Remove the filler plug and check that there is oil in the place shown in the illustration.
(2) Check that the oil is not excessively dirty, and that it has sufficient viscosity.
(3) Install the filler plug.

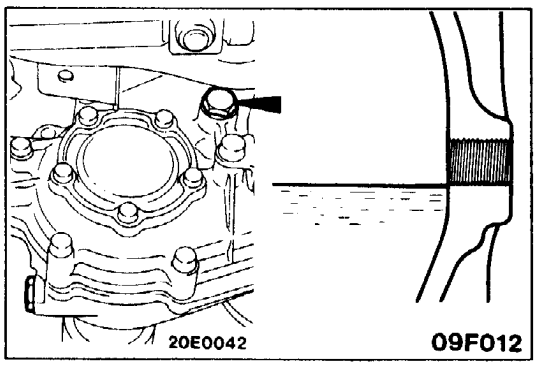


WINCH OIL REPLACEMENT E51FFAA

(1) Remove the drain plug and filler plug to drain the oil.
(2) Install the drain plug and pour in the oil.

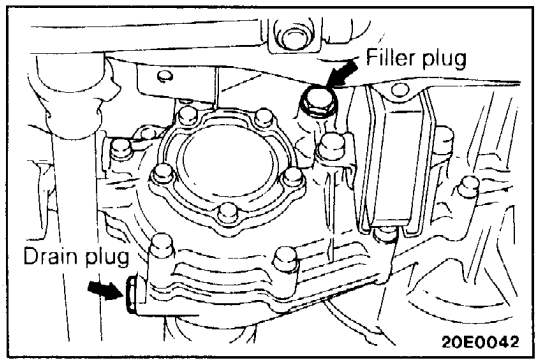
Specified lubricants: Hypoid gear oil API classification GL-4 or higher SAE viscosity No. 75W–90 or 75W–85W
Quantity: 0.75 dm³ (0.79 U.S. qts., 0.66 Imp. qts.)

(3) Install the filler plug.



P.T.O. OIL INSPECTION E51FBAB

(1) Remove the transfer filler plug and check that there is oil in the place shown in the illustration.
(2) Check that the oil is not excessively dirty, and that it has sufficient viscosity.
(3) Install the filler plug.

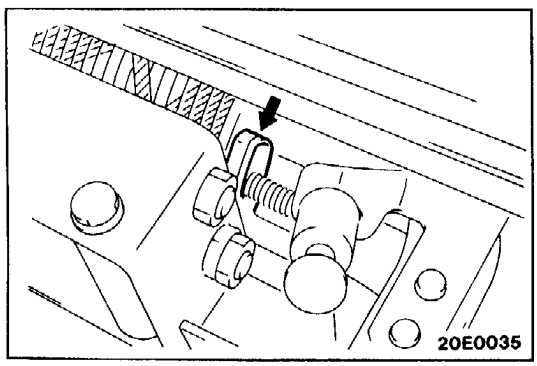


P.T.O OIL REPLACEMENT E51FGAA

(1) Remove the transfer drain plug and filler plug to drain the oil.
(2) Install the drain plug and pour in the oil.

Specified lubricants: Hypoid gear oil API classification GL-4 or higher SAE viscosity No. 75W–90 or 75W–85W
Quantity: 2.7 dm³ (2.85 U.S. qts., 2.38 Imp. qts.) [including 0.4 dm³ (0.42 U.S. qts., 0.35 Imp. qts.) for P.T.O.]

(3) Install the filler plug.



WINCH BRAKE SHOE LINING INSPECTION E51FDAB

Remove the brake shoe from the clutch and check that the thickness of the lining is at the limit or higher.

Limit: 4.0–4.5 mm (0.157–0.177 in.)

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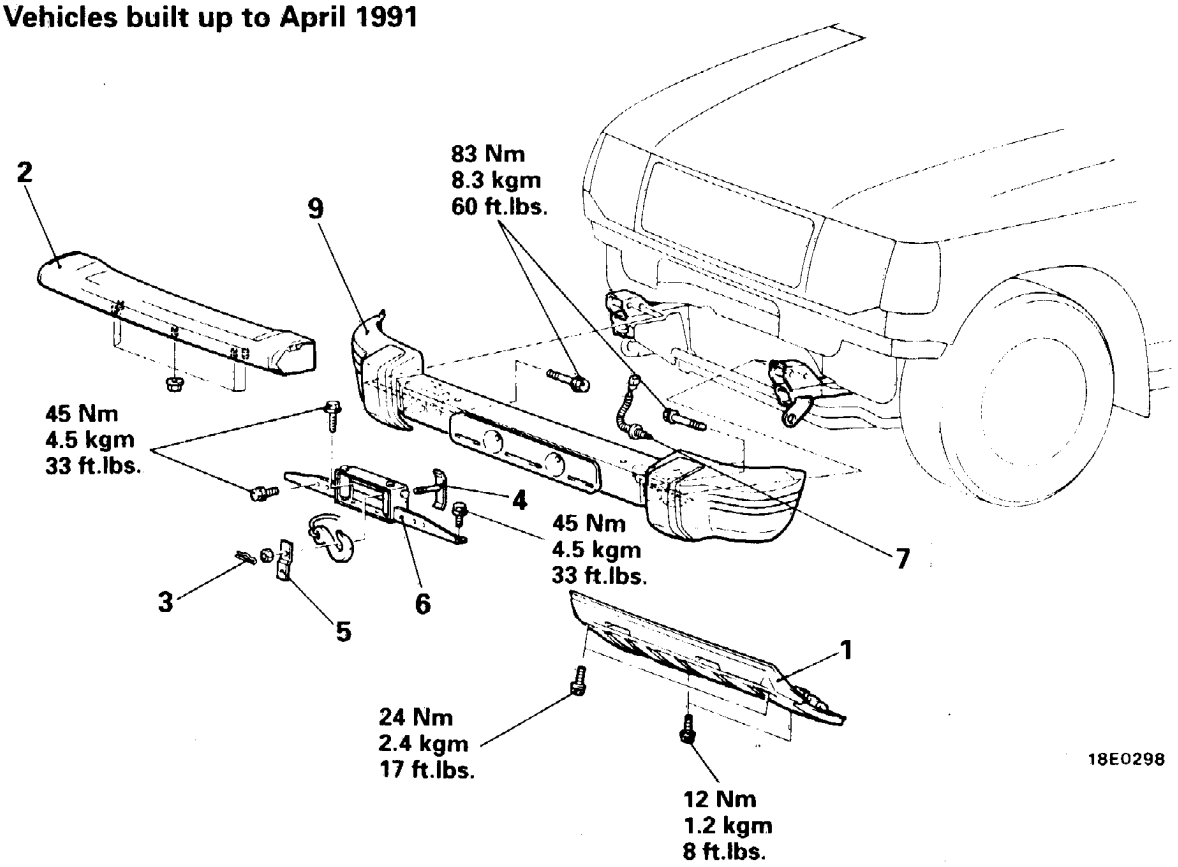
FRONT BUMPER

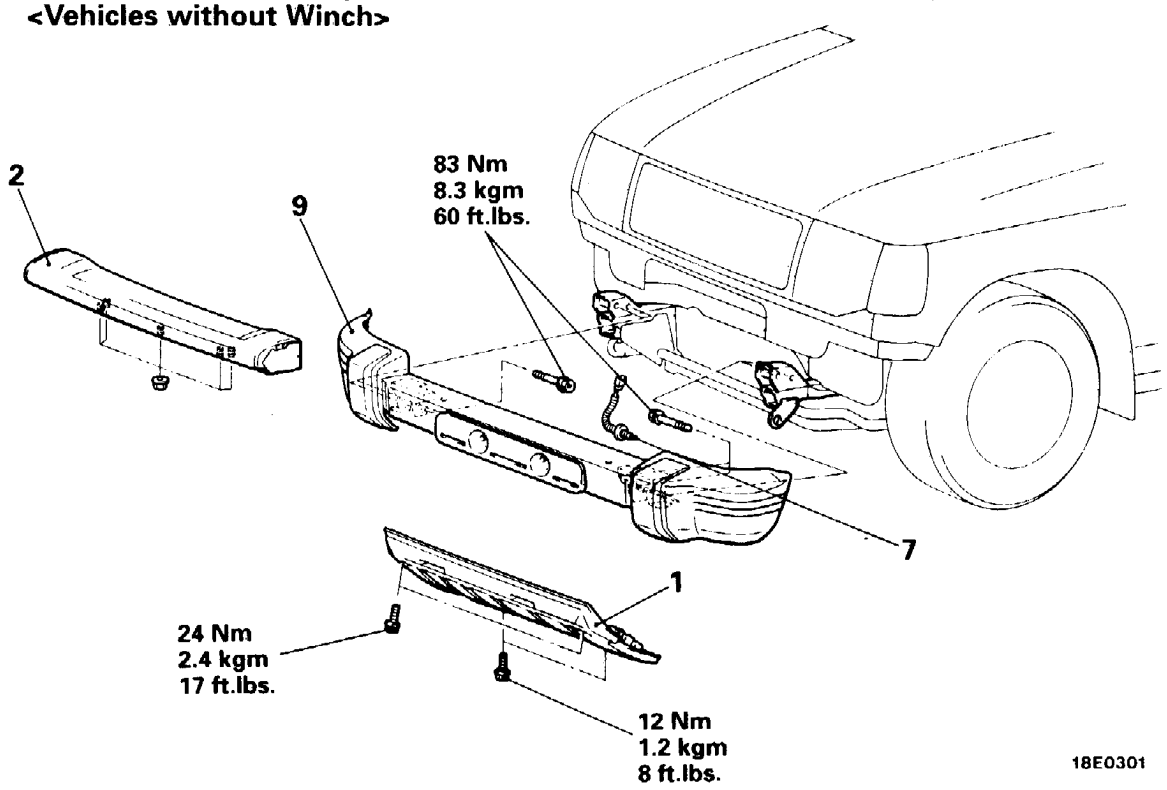
E51GABI

REMOVAL AND INSTALLATION

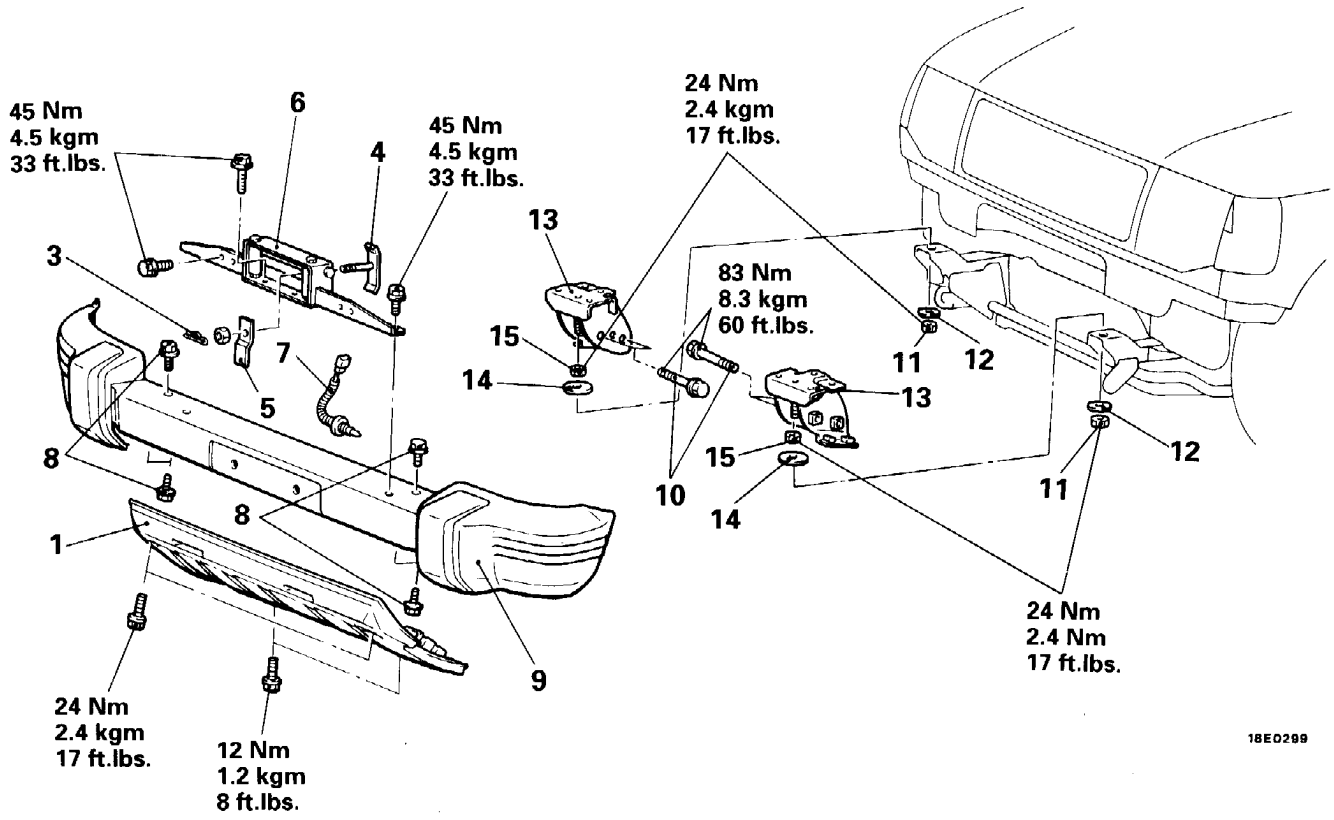
Vehicles built up to April 1991



Vehicles built from May 1991 <Vehicles without Winch>



<Vehicles with Winch>



Removal steps

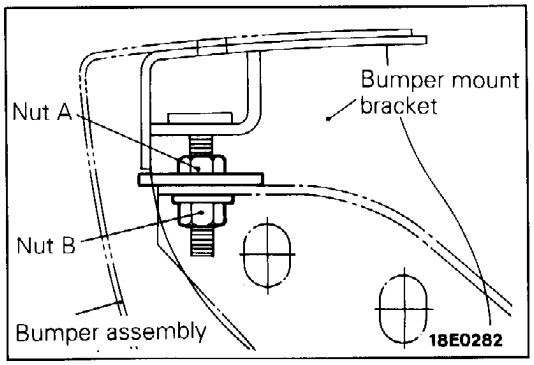
1. Skid plate
2. Bumper garnish <Vehicles without Winch>
3. Inner pin
4. Guide roller stopper
5. Rope hook stopper
6. Roller guide assembly

<Vehicles with Winch>

◆◆ 7. Outside temperature sensor <Vehicles with Multi-meter>

8. Bolts <Vehicles with Winch>
9. Bumper assembly
10. Bumper mount bracket bolts
◆◆ 11. Nut B
◆◆ 12. Washers
◆◆ 13. Bumper mount bracket
◆◆ 14. Washers
◆◆ 15. Nut A

<Vehicles with Winch>



SERVICE POINTS OF INSTALLATION

15. INSTALLATION OF NUT A/14. WASHERS/13. BUMPER MOUNT BRACKET/12. WASHERS/11. NUT B

Provisionally install the bumper mount bracket, and then adjust the fitting of the bumper assembly and the body with a nut A.

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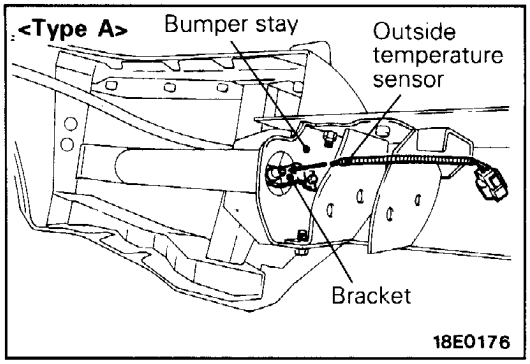
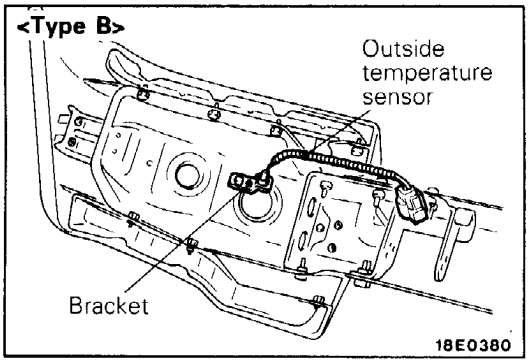
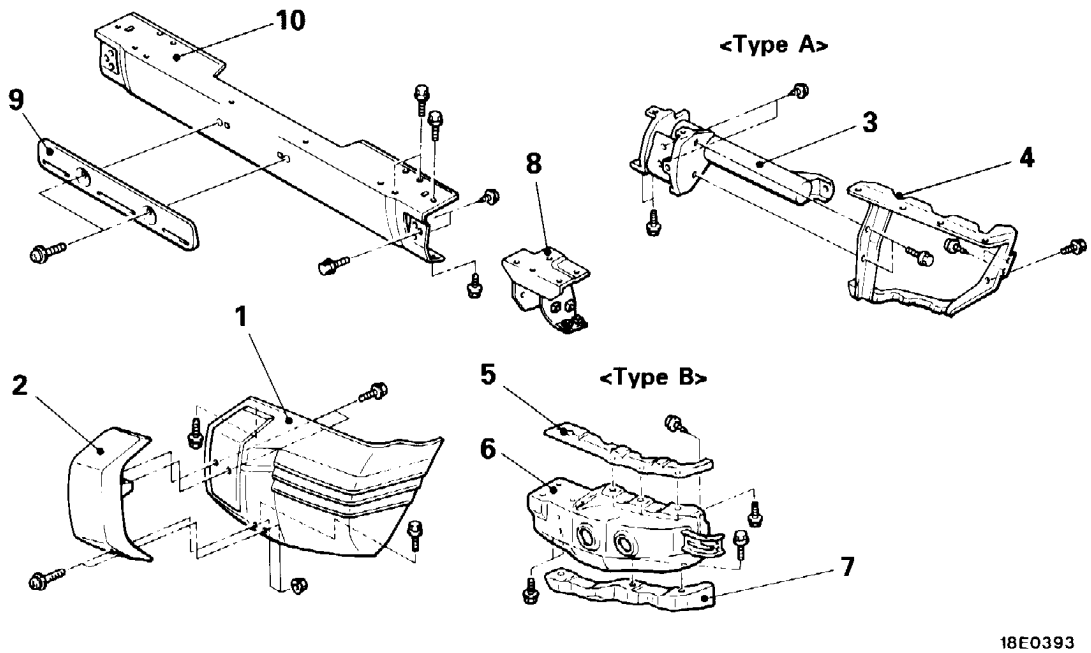




7. INSTALLATION OF OUTSIDE TEMPERATURE SENSOR <Vehicles with Multi-meter>

When installing the bumper assembly, insert the sensor section of the outside temperature sensor into the bracket hole installed.

DISASSEMBLY AND REASSEMBLY



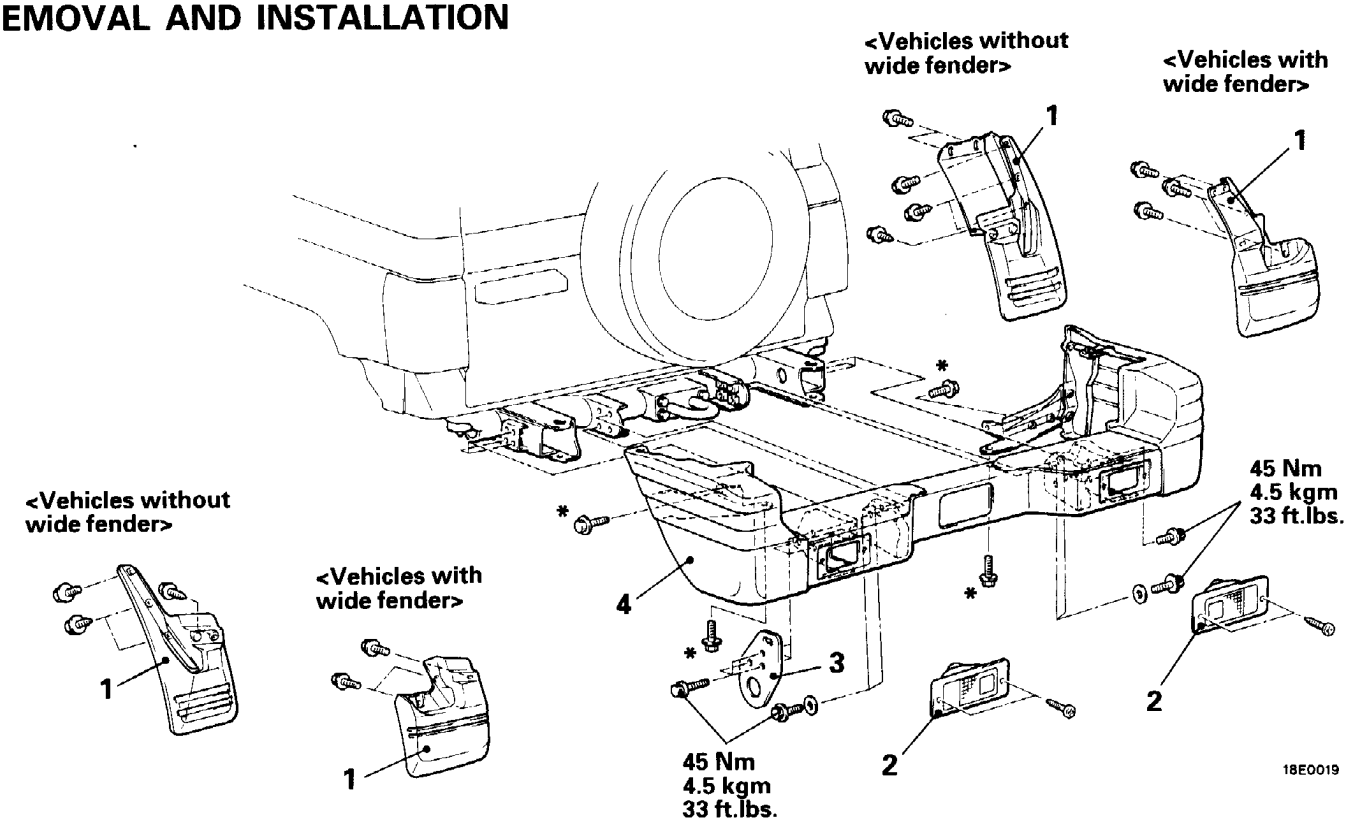
Disassembly steps

1. Bumper side face
2. Bumper guard
3. Bumper stay
4. Bumper side reinforcement
5. Bumper side upper reinforcement
6. Bumper side lower reinforcement
7. Bumper side reinforcement
8. Bumper mount bracket <Vehicles without winch>
9. Licence plate bracket
10. Bumper center face

REAR BUMPER

E51GABJ

REMOVAL AND INSTALLATION



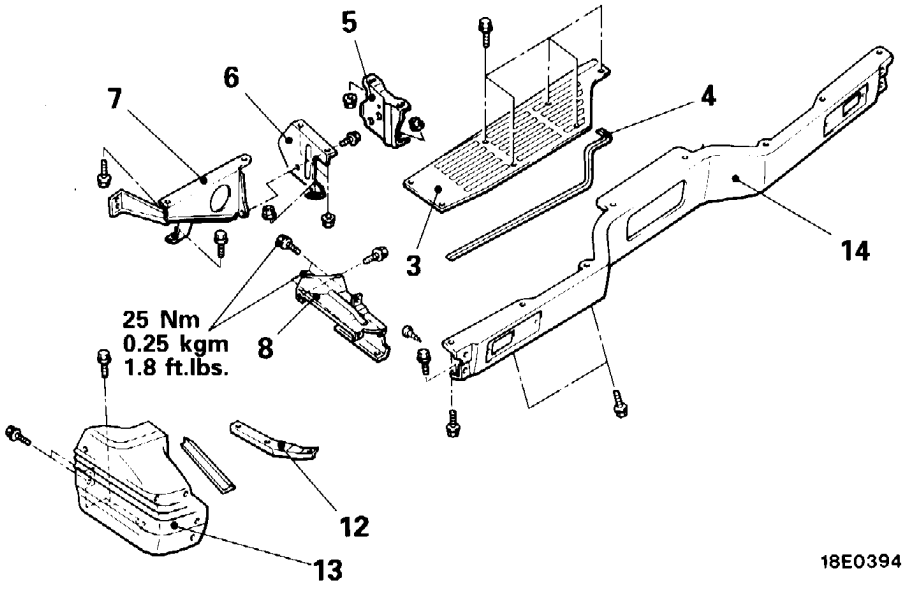
Removal steps

1. Rear mud guard
2. Rear combination lamp
3. Hook bracket
4. Bumper assembly

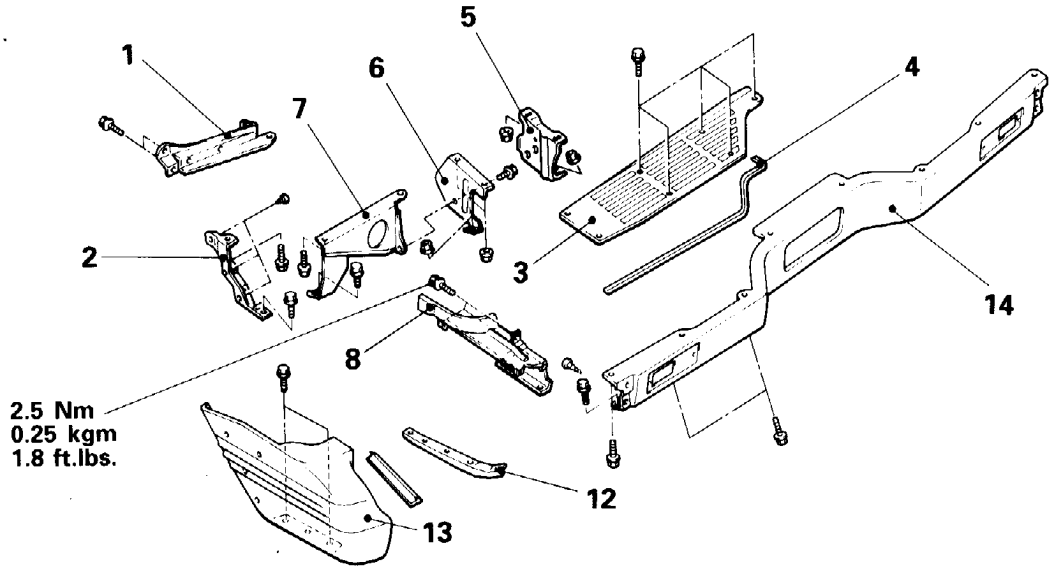
NOTE
Mounting bolts marked with * are for use on the standard body vehicles only.

DISASSEMBLY AND REASSEMBLY

<Long wheelbase>

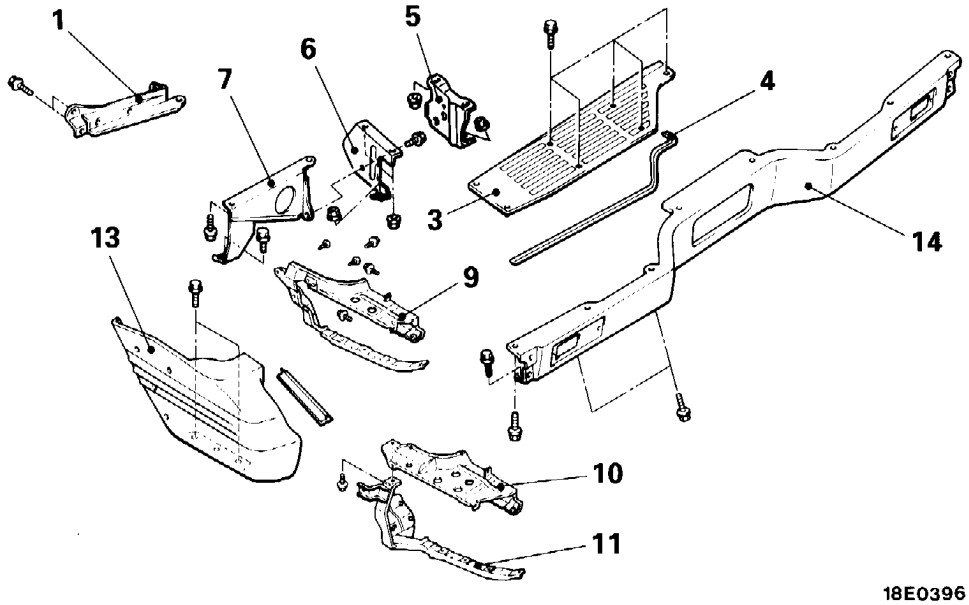


<Standard wheelbase – Type A>



18E0395

<Standard wheelbase – Type B>



18E0396

Removal steps

1. Bumper side front stay
2. Bumper side front reinforcement
3. Bumper step plate
4. Weatherstrip
5. Bumper stay A
6. Bumper stay B
7. Bumper reinforcement
8. Bumper side upper reinforcement
9. Bumper side reinforcement <Vehicles without wide fender>
10. Bumper side upper reinforcement <Vehicles with wide fender>
11. Bumper side lower reinforcement <Vehicles with wide fender>
12. Bumper side lower reinforcement
13. Bumper side face
14. Bumper center face

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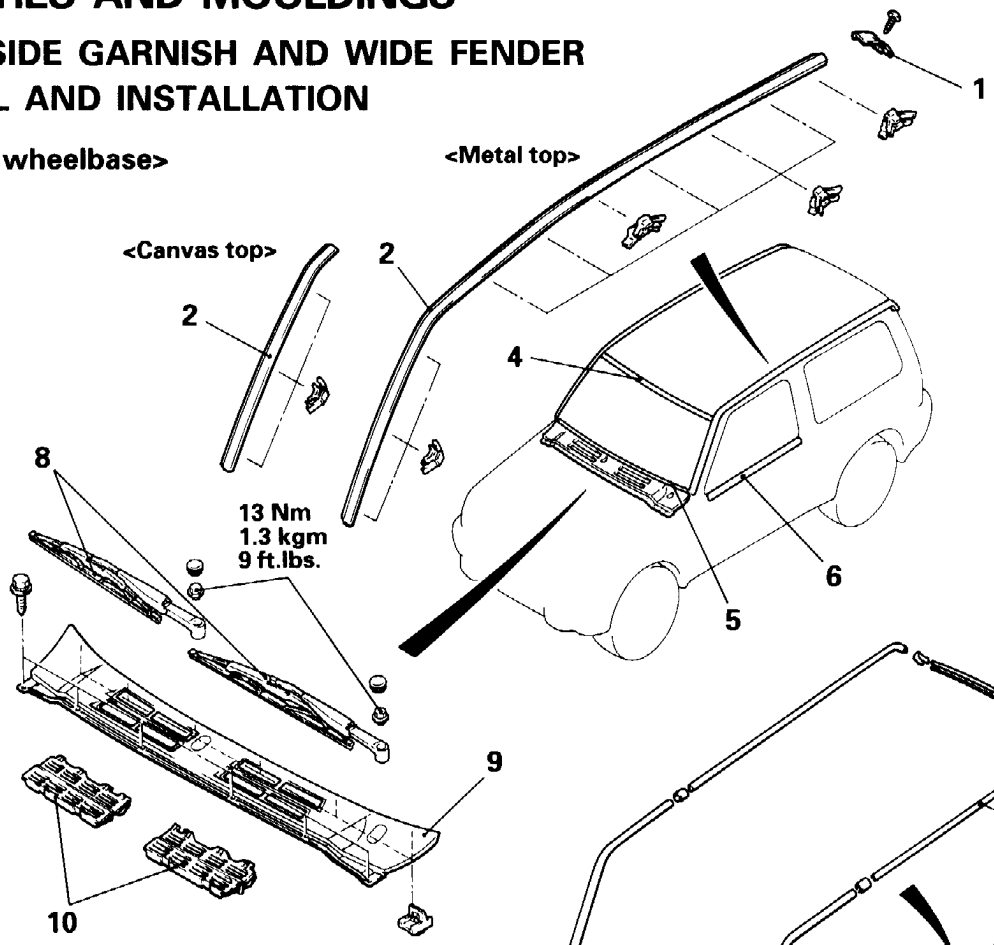
GARNISHES AND MOULDINGS

E51ICAN

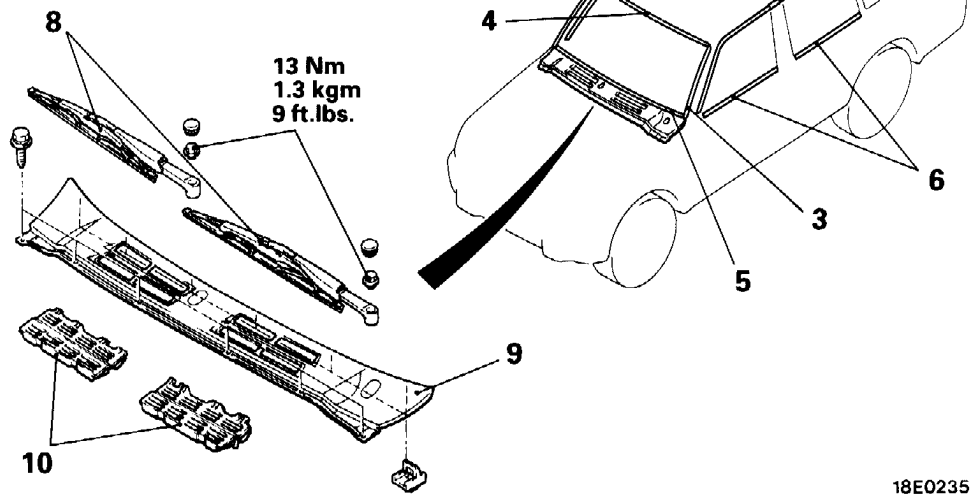
EXCEPT SIDE GARNISH AND WIDE FENDER REMOVAL AND INSTALLATION

<Standard wheelbase>



18E0236

<Long wheelbase>



18E0235

Removal steps of roof drip moulding

1. Roof drip cover
2. Roof drip moulding
3. Windshield side moulding
4. Windshield upper moulding
5. Windshield lower moulding

[Refer to GROUP 42–Windshield Glass.]

6. Belt line moulding [Refer to GROUP 42–Window Glass Runchannel and Door Opening Weatherstrip.]
7. Drip moulding

Removal steps of front deck garnish

- Hood [Refer to GROUP 42–Hood.]

8. Wiper arm assembly
9. Front deck garnish
10. Air intake garnish

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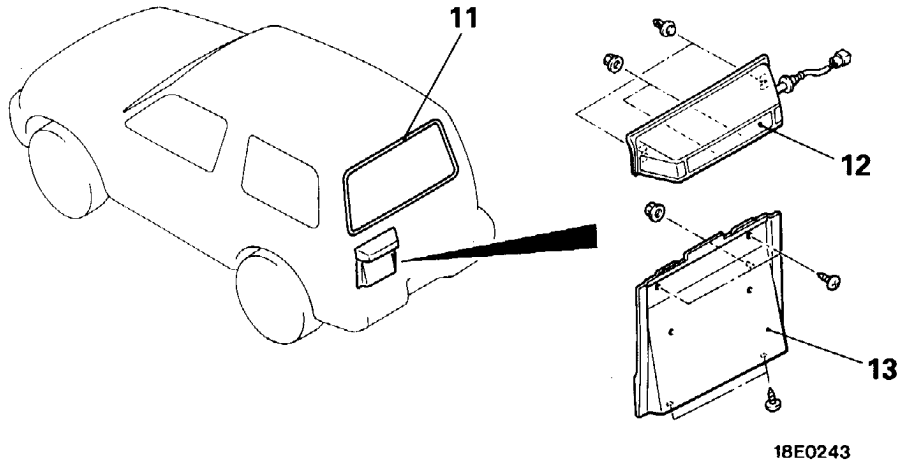


11. Back door window glass moulding
[Refer to GROUP 42–Back Door Window Glass.]

Removal steps of licence lamp garnish

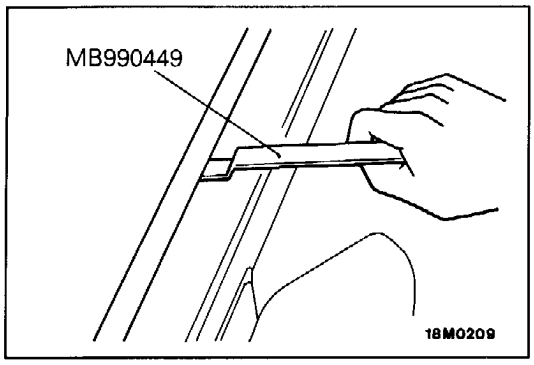
- Back door trim
[Refer to GROUP 42–Back Door Trim and Waterproof Film.]

12. Licence lamp garnish

Removal steps of licence plate garnish

13. Licence plate garnish

NOTE
For roof drip moulding on vehicles with roof rail, refer to P.51–17.



SERVICE POINT OF REMOVAL

2. REMOVAL OF ROOF DRIP MOULDING

Use the special tool to lever out each moulding.

Caution
Mouldings that become warped should not be re-used.

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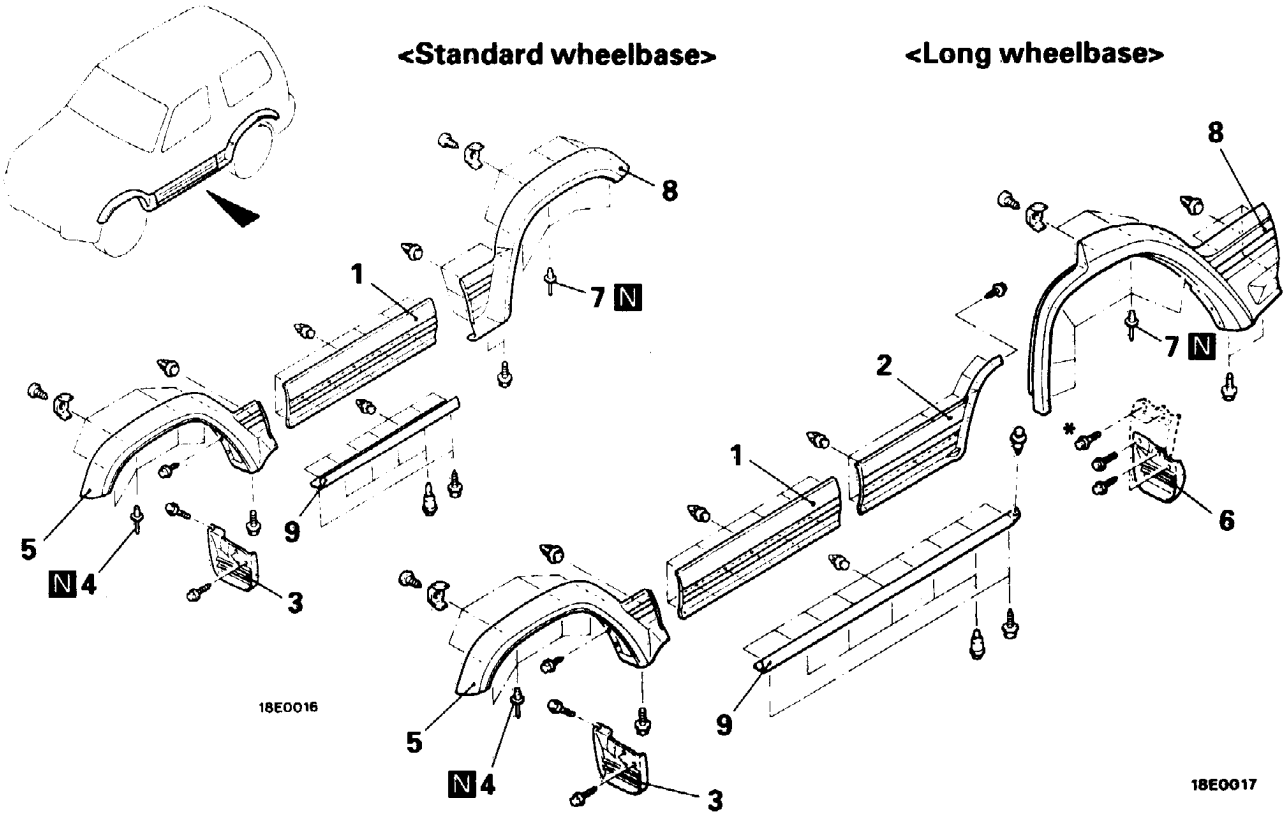
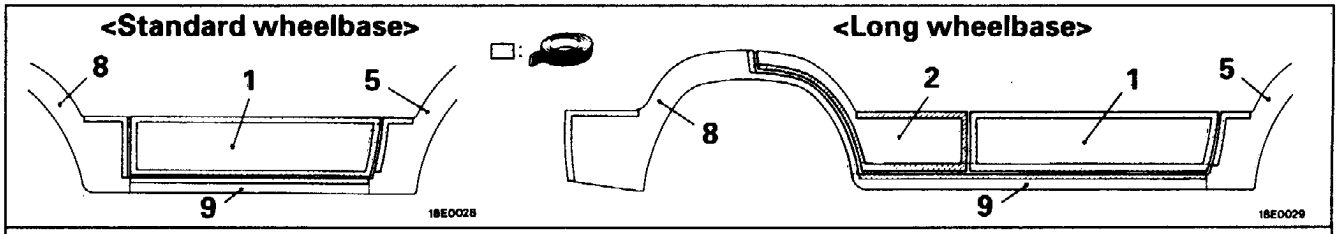
SIDE GARNISH AND WIDE FENDER REMOVAL AND INSTALLATION

E51ICAO





Adhesive tape: Both-side tape 7 mm (0.28 in.) wide and 1.2 mm (0.05 in.) thick

Removal steps of front door side garnish
1. Front door side garnish

Removal steps of rear door side garnish
2. Rear door side garnish

Removal steps of front flare
- Splash shield (Refer to GROUP 42–Fender.)

3. Front mud guard
4. Blind rivet
5. Front flare

Removal steps of rear flare
6. Rear mud guard <Long wheelbase>
7. Blind rivet
8. Rear flare

Removal steps of side sill garnish
5. Front flare
8. Rear flare <Standard wheelbase>
9. Side sill garnish

NOTE
Mounting bolts with * marks indicate R.H. side only.

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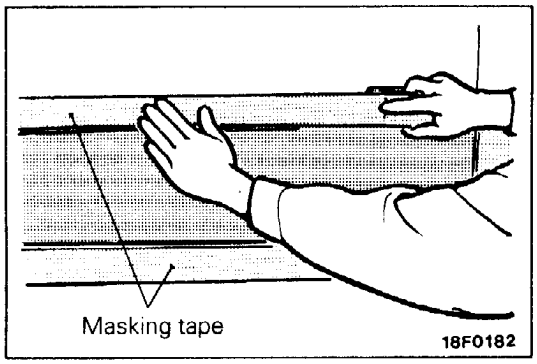
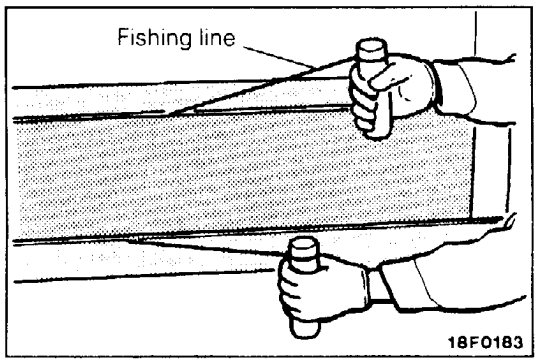


SERVICE POINTS OF REMOVAL

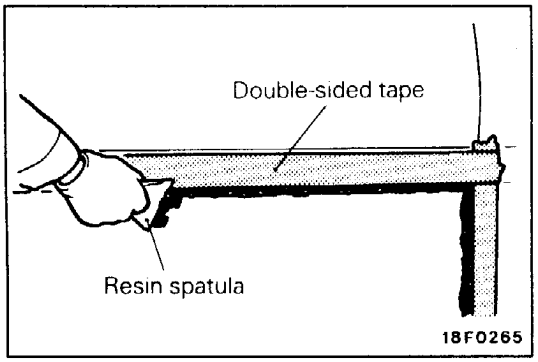
1. REMOVAL OF FRONT DOOR SIDE GARNISH/2. REAR DOOR SIDE GARNISH/5. FRONT FLARE/8. REAR FLARE/9. SIDE SILL GARNISH

(1) Apply masking tape to the outside circumference of each side garnish.

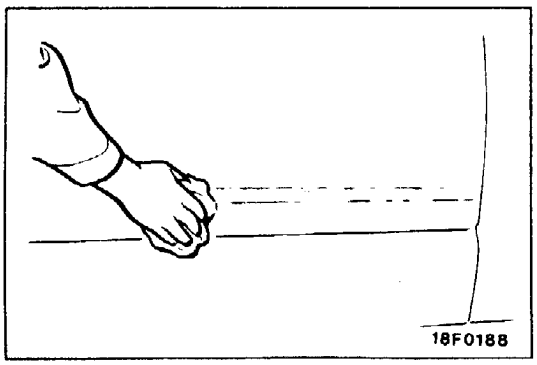


(2) Insert a fishing line [ϕ0.8 mm (0.03 in.)] in between the body and the side garnish, and pull both ends alternately to cut the adhesive section and remove the side garnish.
(3) Pull the section of the side garnish with the clips towards you to remove the clips.

Caution
1. **When reusing the side garnish, remove by pulling the fishing line along the edge of the body so as not to damage the edge of the side garnish.**
2. **If the adhesive is difficult to remove, heat it to 40°C (104°F).**



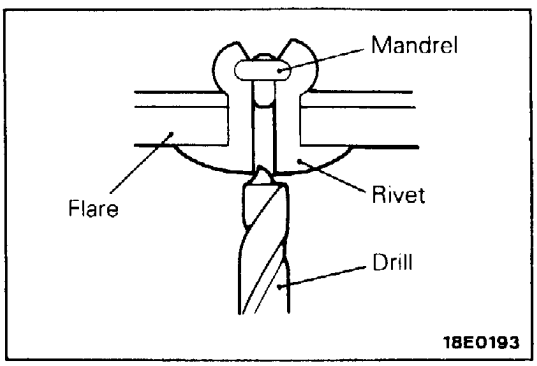
(4) Scrape off the double-sided adhesive tape with a resin spatula.
(5) Tear off the masking tape.



(6) Wipe the body surface clean with a rag moistened with isopropyl alcohol.

4./7. REMOVAL OF BLIND RIVETS

Use a drill [ϕ4.0–5.5mm (0.16–0.22 in.)] to break the rivet by drilling a hole, and remove the blind rivet.



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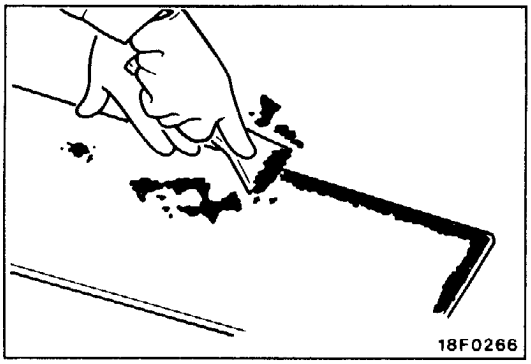
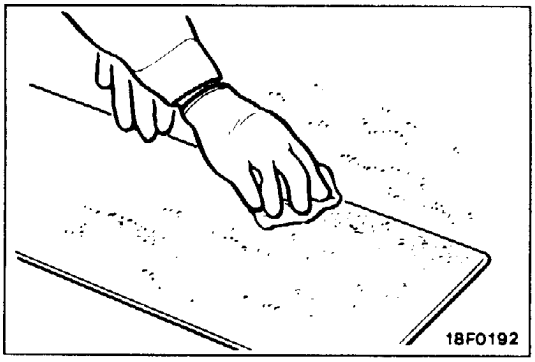


SERVICE POINTS OF INSTALLATION

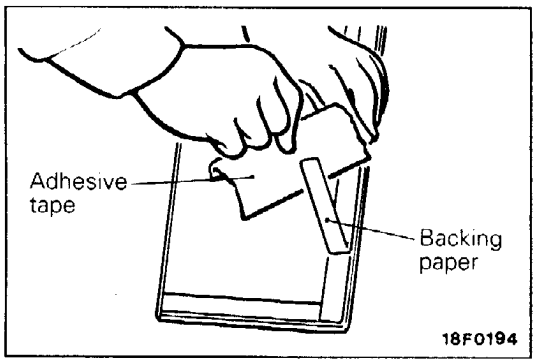
9. INSTALLATION OF SIDE SILL GARNISH/8. REAR FLARE/5. FRONT FLARE/2. REAR DOOR SIDE GARNISH/1. FRONT DOOR SIDE GARNISH

- **Attachment of double-sided tape to each side garnish (when reusing)**

(1) Scrape off the double-sided adhesive tape with a resin spatula or gasket scraper.



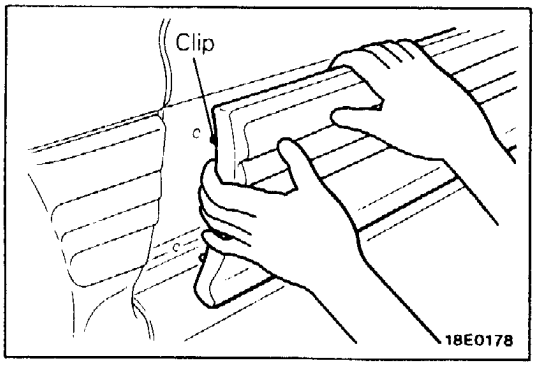
(2) Wipe the body surface clean with a rag moistened with isopropyl alcohol.
(3) Heat the adhesive surface of the double-sided tape on the side protector moulding to about 40–60°C (104–140°F).
(4) Attach specified double-sided adhesive tape to each side garnish.
Adhesive tape: Double-sided tape 7 mm (0.28 in.) wide and 1.2 mm (0.05 in.) thick



- **Installation of each side garnish**

(1) Tear off the double-sided tape backing paper.

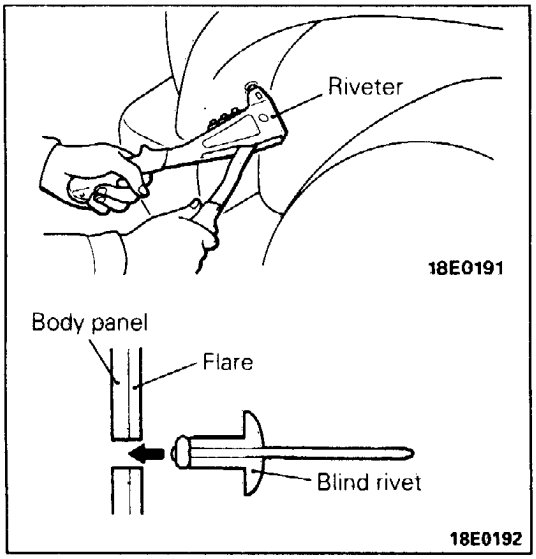
NOTE
If you attach part of the adhesive tape to the edge of the backing paper, it will be easy to tear off.



(2) Install the side garnish so that the clips match the body holes.

NOTE
If the double-sided adhesive tape is difficult to affix during winter, etc., warm the bonding surfaces of the body and the side garnishes to about 40–60°C (104–140°F) before affixing the tape.

(3) Firmly press in the side garnish.



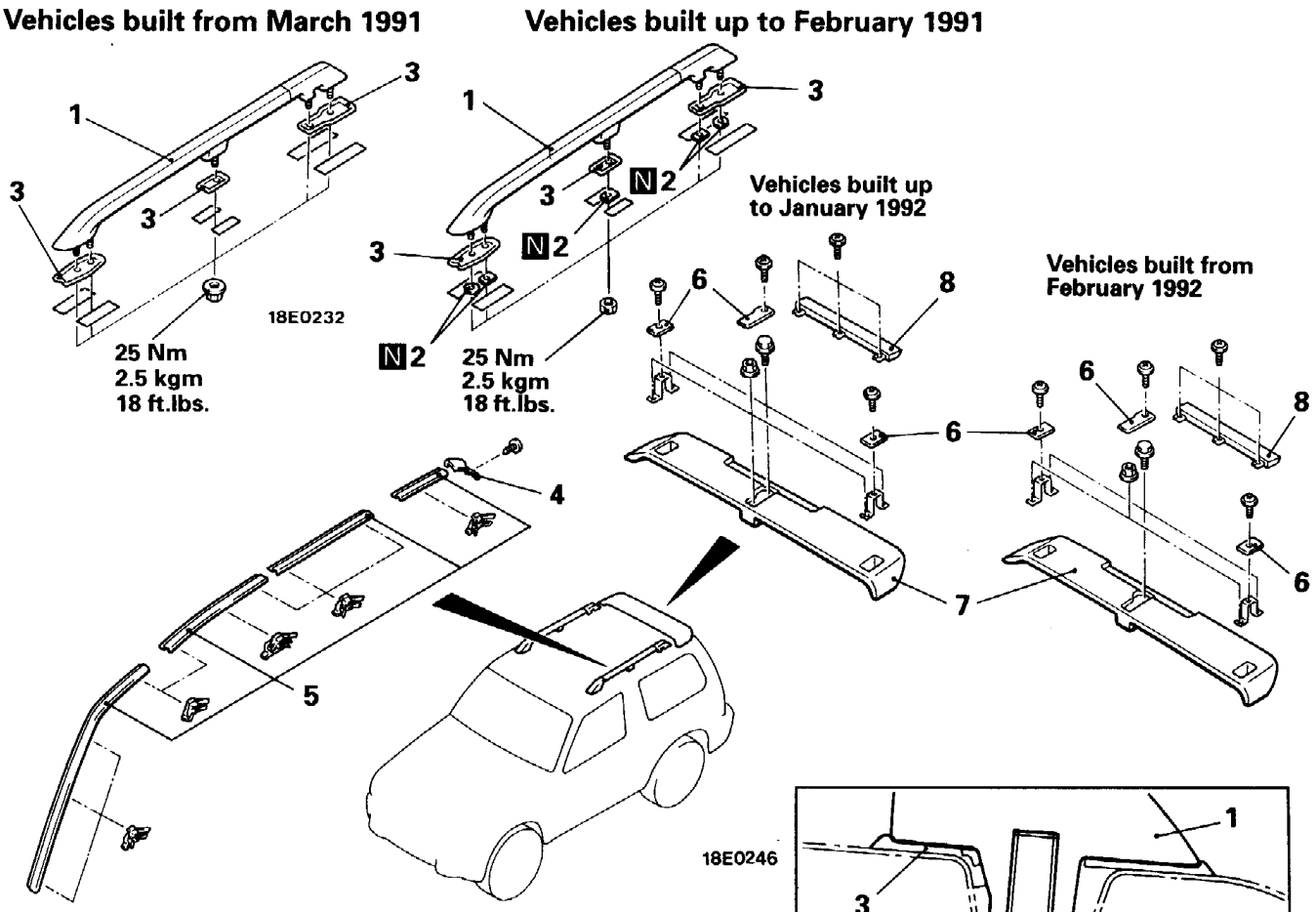
7./4. INSTALLATION OF BLIND RIVETS

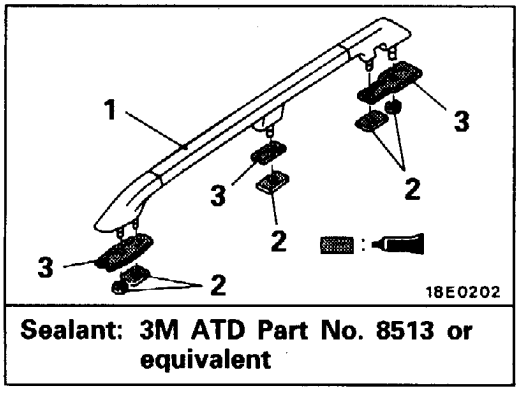
Use a riveter to connect the blind rivet.

EXTERIOR PARTS

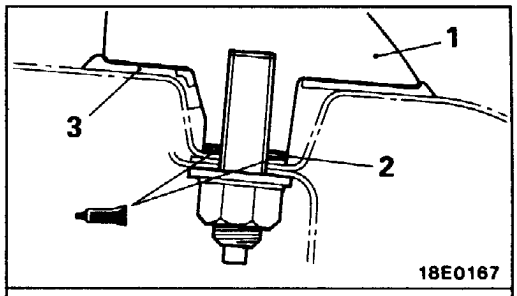
E51TAAA

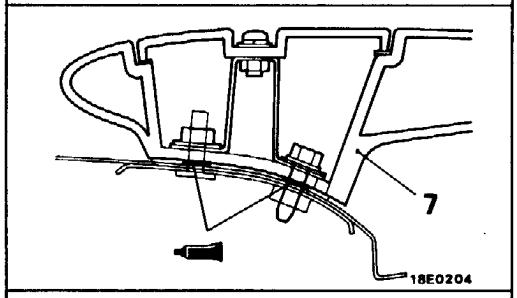
ROOF RAIL AND ROOF SPOILER
REMOVAL AND INSTALLATION





Sealant: 3M ATD Part No. 8513 or equivalent





Sealant: 3M ATD Part No. 8531, 8646 or equivalent

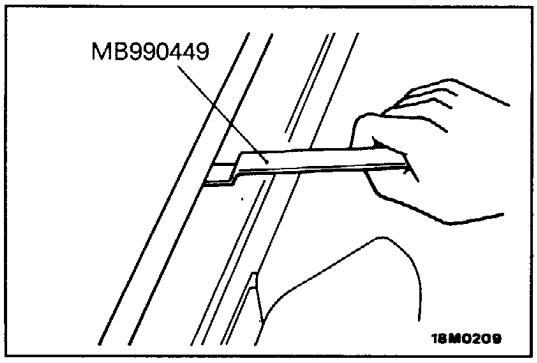
Removal steps of roof rail and roof drip moulding

- Headlining (Refer to GROUP 52–Headlining.)

1. Roof rail
2. Packing
3. Packing
4. Roof drip cover
5. Roof drip moulding

Removal steps of roof spoiler

6. Cap
7. Roof spoiler
8. Cover



SERVICE POINT OF REMOVAL

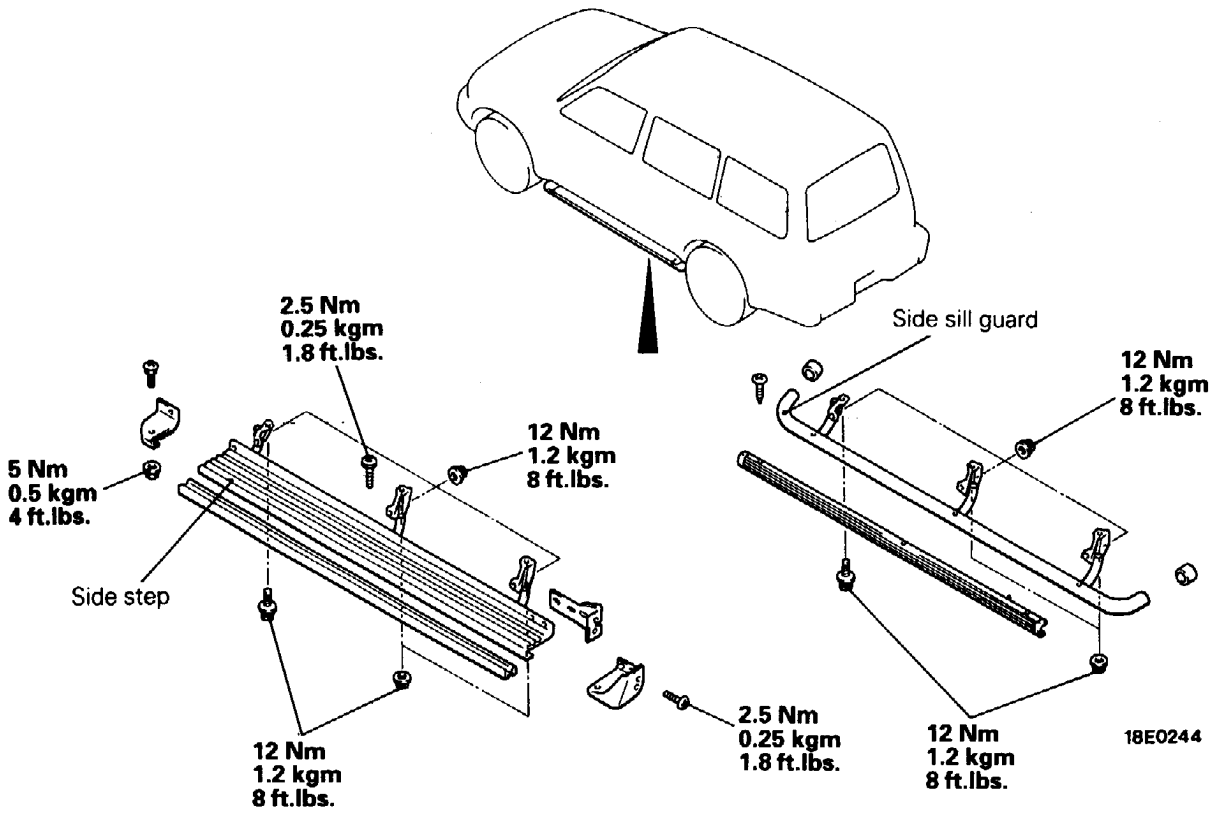
5. REMOVAL OF ROOF DRIP MOULDING

Use the special tool to lever out the moulding.

Caution
If the moulding has become warped, it should not be re-used.

SIDE STEP AND SIDE SILL GUARD REMOVAL AND INSTALLATION

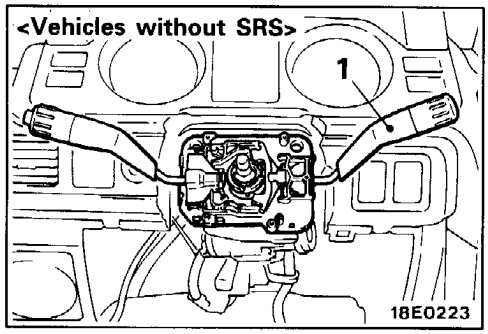
E51TAAB

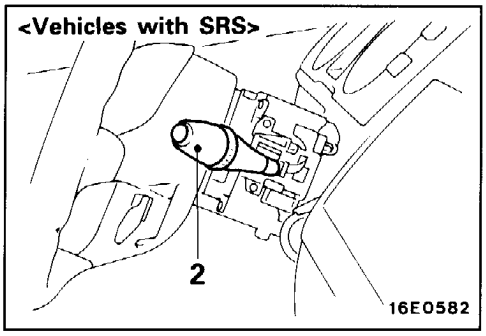


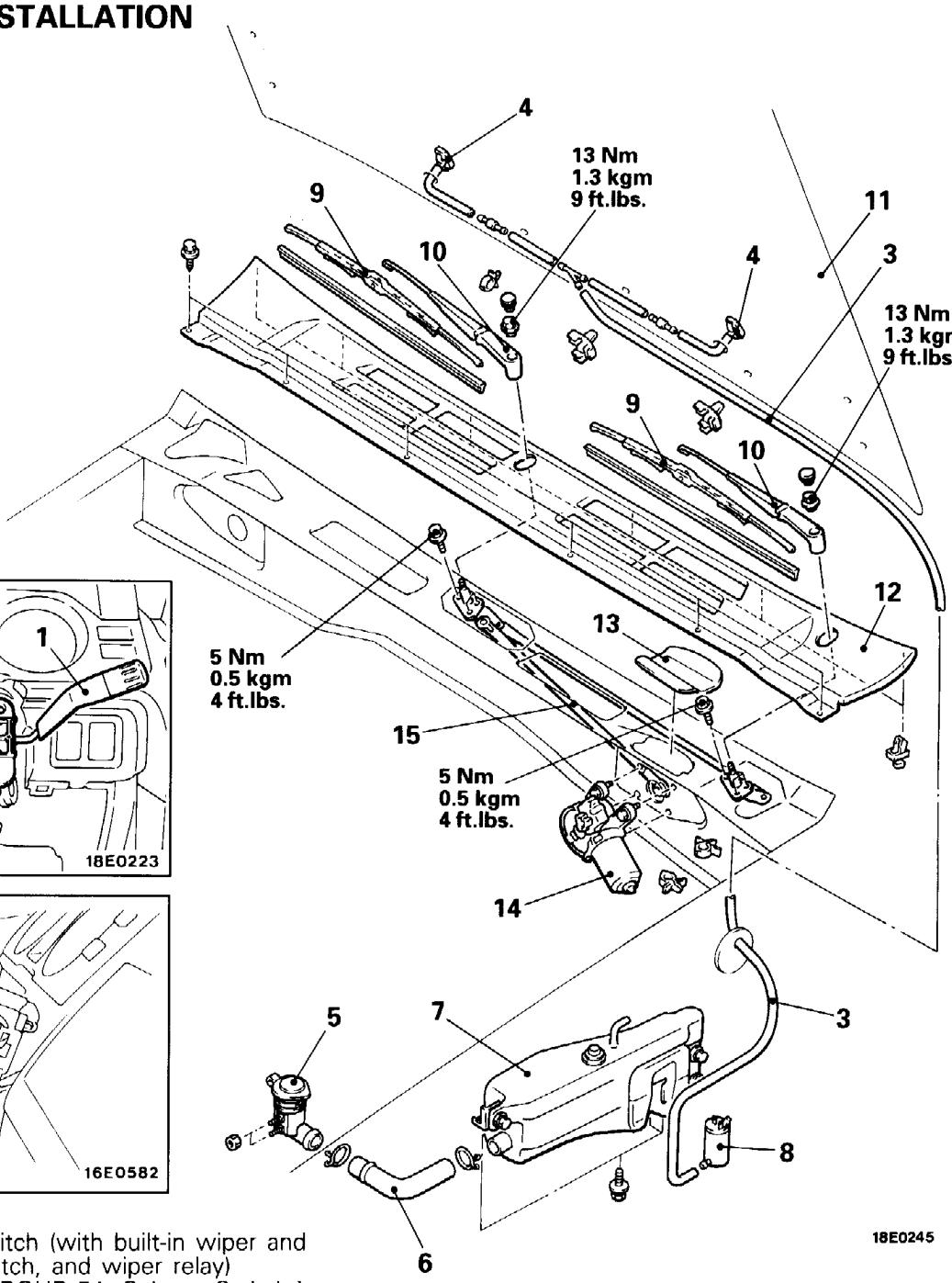
WINDSHIELD WIPER AND WASHER

E51KCAE

REMOVAL AND INSTALLATION







1. Column switch (with built-in wiper and washer switch, and wiper relay) [Refer to GROUP 54–Column Switch.]
2. Wiper and washer switch [Refer to P.51-21]
3. Washer tube
4. Washer nozzle

◆◆ 9. Wiper blade

◆◆ 10. Wiper arm

◆◆ 14. Wiper motor

Removal of washer tank

- Splash shield (Refer to GROUP 42–Fender.)
- Draining of washer fluid

3. Washer tube
5. Cap
6. Hose
7. Washer tank assembly
8. Washer motor

Removal steps of linkage

◆◆ 10. Wiper arm
11. Hood
12. Front deck garnish
13. Hole cover

◆◆ 14. Wiper motor

15. Linkage

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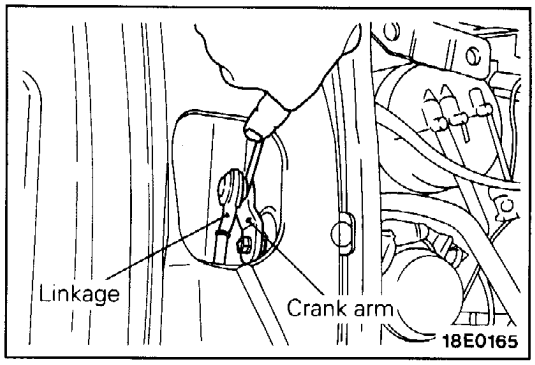
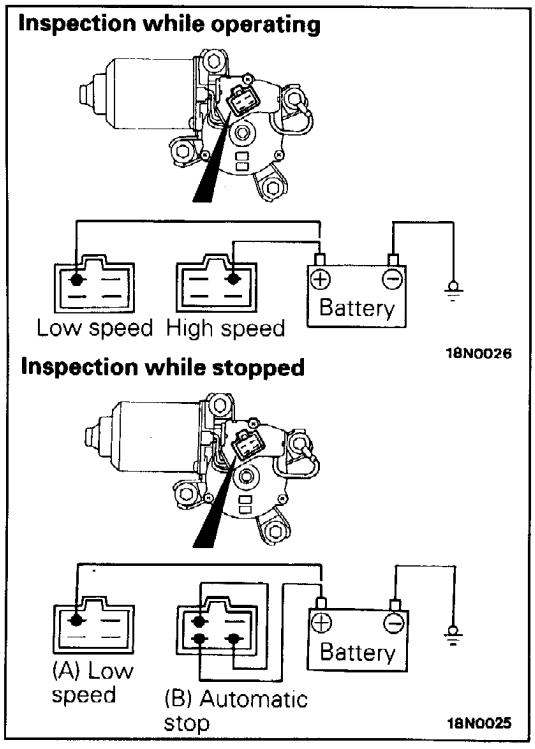


SERVICE POINTS OF REMOVAL

14. REMOVAL OF WIPER MOTOR

Loosen the wiper motor assembly mounting bolts, and then remove the wiper motor assembly. Disconnect the linkage and the motor assembly, and then remove the linkage.

Caution
Because the installation angle of the crank arm and the motor has been set, do not remove them unless it is necessary to do so. If they must be removed, remove them only after marking their mounting positions.



INSPECTION

WIPER MOTOR

Check the wiper motor after disconnecting the wiring harness connector, and with the wiper motor remaining installed to the body.

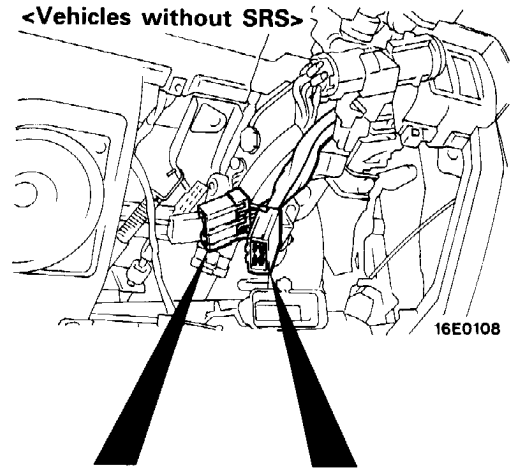
Operation of Wiper Motor at Low Speed and High Speed

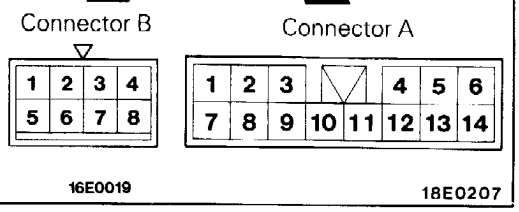
Connect a battery to the wiper motor as shown in the illustration and inspect motor operation at low speed and high speed.

Operation of Wiper Motor at Stop Position

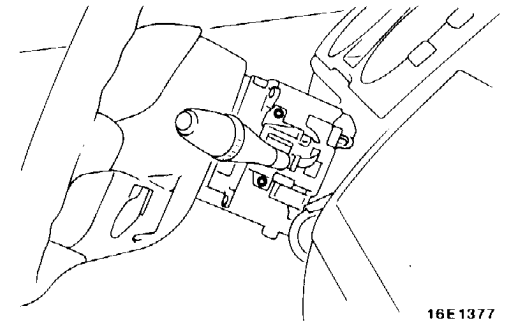
(1) Run the wiper motor at low speed, disconnect the battery, and stop the motor.
(2) Reconnect the battery as shown in the illustration, and confirm that after the motor starts turning at low speed, it stops at the automatic stop position.

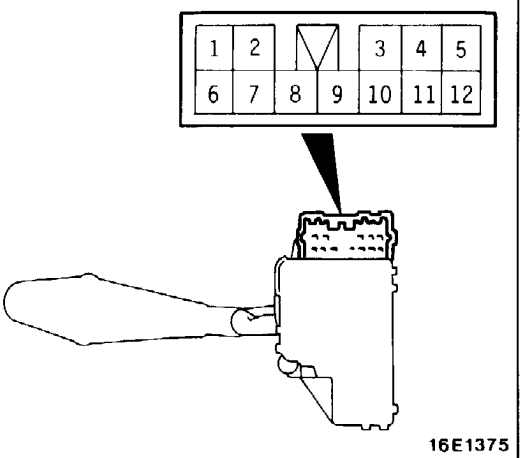
<Vehicles without SRS>





<Vehicles with SRS>





COLUMN SWITCH

Wiper and Washer Switch

<Vehicles without SRS>

Disconnect the column switch connector and check the continuity between the terminals for each switch.

Switch position	Terminal	A	B			
	Connector					
		5	3	4	7	8
Wiper switch	OFF		○		○	
	1 (LO)		○			○
	2 (HI)			○		○
Washer switch	ON	○				○

NOTE
○—○ indicates that there is continuity between the terminals.

<Vehicles with SRS>

(1) Remove the column cover lower.
(2) Remove the column cover upper.
(3) Loosen the screws indicated by arrows in the illustration, and then remove the wiper and washer switches.
(4) Operate the switches to check the continuity between the terminals.

(L.H. drive vehicles)

Switch position	Terminal	6	7	8	9	10
Wiper switch	OFF		○	○		
	1 (LO)			○		○
	2 (HI)				○	○
Washer switch	ON	○				○

(R.H. drive vehicles)

Switch position	Terminal	8	9	10	11	12
Wiper switch	OFF			○	○	
	1 (LO)	○		○		
	2 (HI)	○	○			
Washer switch	ON	○				○

NOTE
○—○ indicates that there is continuity between the terminals.

Intermittent Wiper Relay (Intermittent Operation Inspection)

(1) Connect the column switch connector.
(2) Turn the ignition switch to ACC.
(3) Inspect the intermittent operation time when the wiper switch is turned to INT.

Vehicles without variable intermittent control
Approx. 3–6 seconds
Vehicles with variable intermittent control
FAST Approx. 3 seconds
SLOW Approx. 12 seconds

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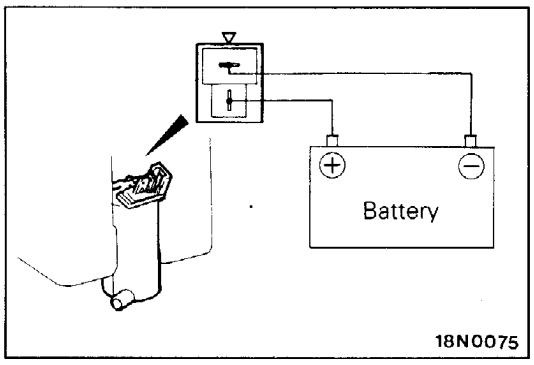
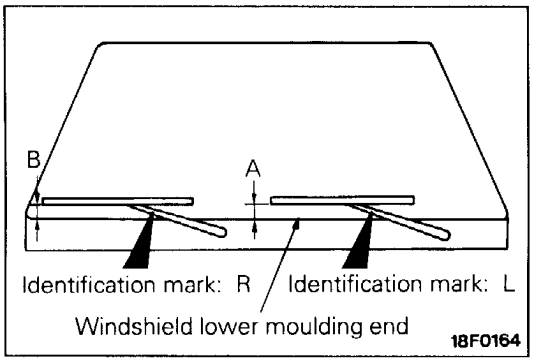


WASHER MOTOR

(1) With the washer motor installed to the washer tank, fill the washer tank with water.
(2) When the battery is connected as shown in the figure, check that the water squirts out strongly.



SERVICE POINTS OF INSTALLATION

10. INSTALLATION OF WIPER ARM/9. WIPER BLADE

(1) The movements of the left and right wiper arms are different, so check the identification marks.
(2) Install the wiper blade in the specified position (standard value) as shown in the illustration.

Standard value (A): 25–35 mm (0.98–1.38 in.)
(B): 35–45 mm (1.38–1.77 in.)

NOTES

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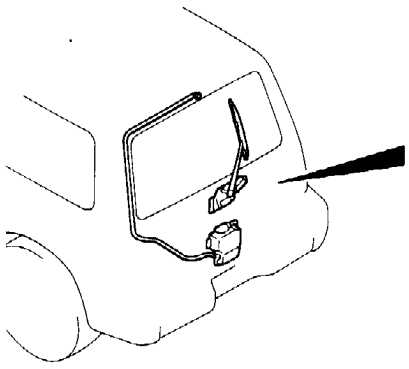
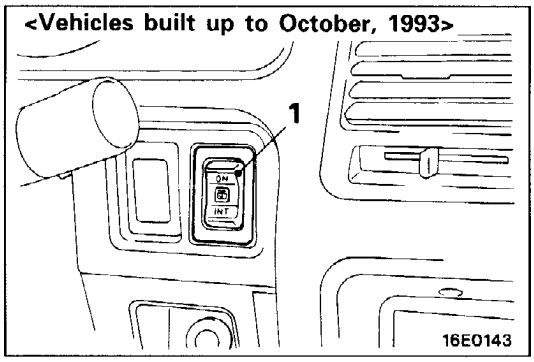
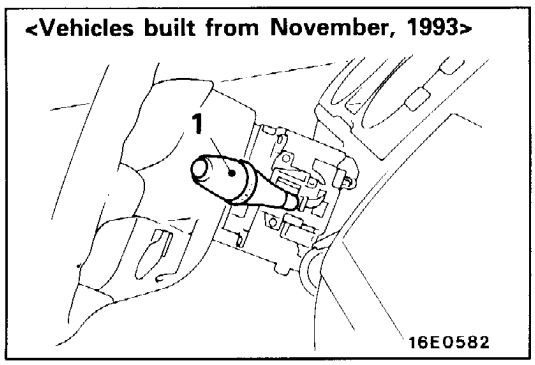
REAR WIPER AND WASHER

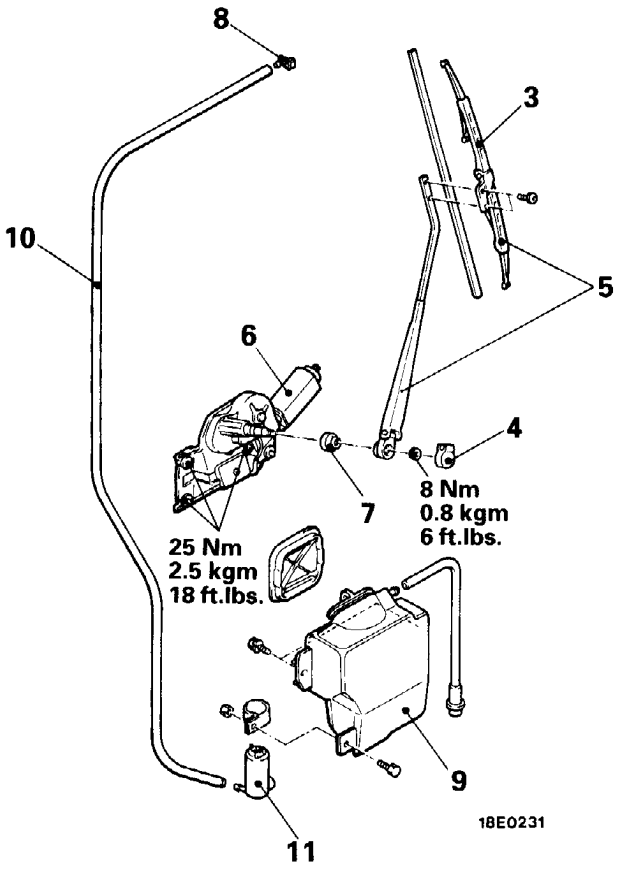
E51LAAK

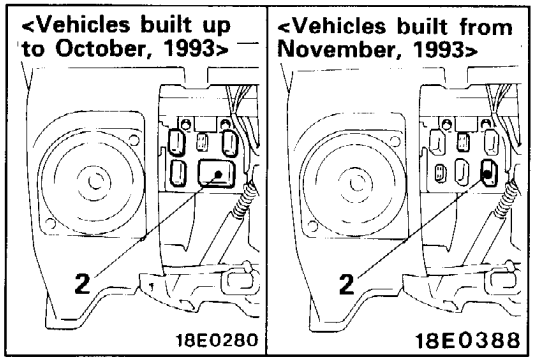
REMOVAL AND INSTALLATION











1. Rear wiper and washer switch (Refer to GROUP 54 – Column Switch) <Vehicles built from November, 1993>
3. Wiper blade
8. Washer nozzle

Removal steps of rear intermittent wiper relay

- Instrument under cover (Refer to GROUP 52–Instrument Panel.)

2. Rear intermittent wiper relay

Removal steps of wiper motor

4. Cover
5. Wiper arm and blade assembly
   - Back door trim (Refer to GROUP 42–Back Door Trim and Waterproof Film.)
6. Wiper motor and bracket assembly
7. Grommet

Removal steps of washer tank and motor

- Back door trim (Refer to GROUP 42–Back Door Trim and Waterproof Film.)

9. Washer tank assembly
   - Draining of washer fluid
10. Washer tube
11. Washer motor

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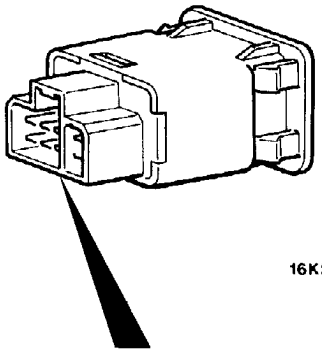
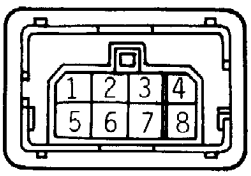
<Vehicles built up to October, 1993>



16K2646



16K2536

INSPECTION

REAR WIPER AND WASHER SWITCH

<Vehicles built up to October, 1993>

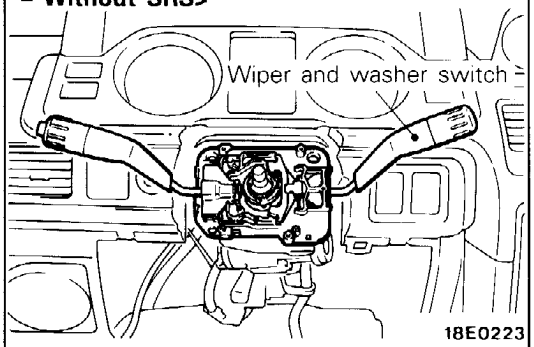
Operate the switch, and check the continuity between the terminals.

Switch position		Terminal 1	2	3	4	5	6	7	8
Wiper switch	ON		○					○	
	OFF				○			○	
	INT	○			○		○		
Washer switch	ON		○	○					
	OFF								
Illumination lamp						○	⊗	○	

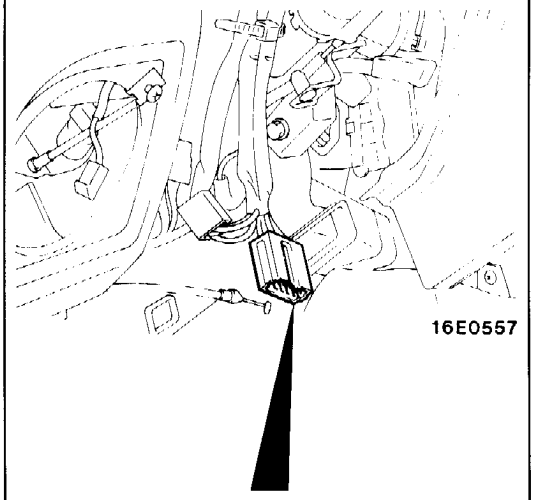
16A0252

NOTE
○—○ indicates that there is continuity between the terminals.

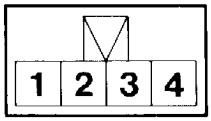
<Vehicles built from November, 1993 – Without SRS>



18E0223



16E0557



16E0555

<Vehicles built from November, 1993 – Without SRS>

(1) Remove the instrument under cover.
(2) Remove the column cover lower.
(3) Disconnect the wiring connector.

(4) Operate the switch, and check the continuity between the terminals.

Switch position		Terminal 1	2	3	4
Wiper switch	OFF				
	INT	○		○	
	ON	○	○		
Washer switch	ON	○			○

NOTE
○—○ indicates that there is continuity between the terminals.

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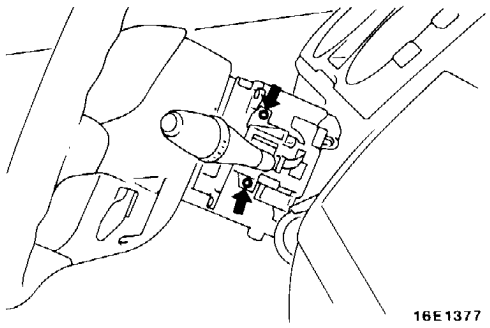
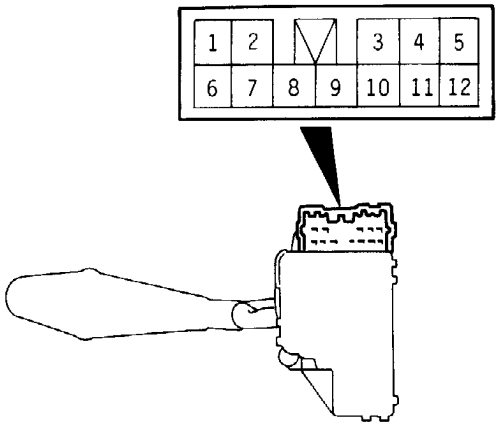
<Vehicles built from November, 1993 – With SRS>



16E1377



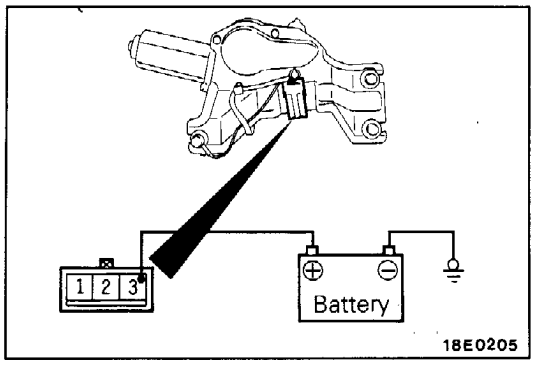
16E1375

<Vehicles built from November, 1993 – With SRS>

(1) Remove the column cover lower.
(2) Remove the column cover upper.
(3) Loosen the screws indicated by arrows in the illustration, and then remove the rear wiper and washer switches.
(4) Operate the switch, and check the continuity between the terminals.

Switch position \ Terminal		2	3	4	10
Wiper switch	OFF				
	INT		○		○
	ON			○	○
Washer switch	ON	○			○

NOTE
○—○ indicates that there is continuity between the terminals.



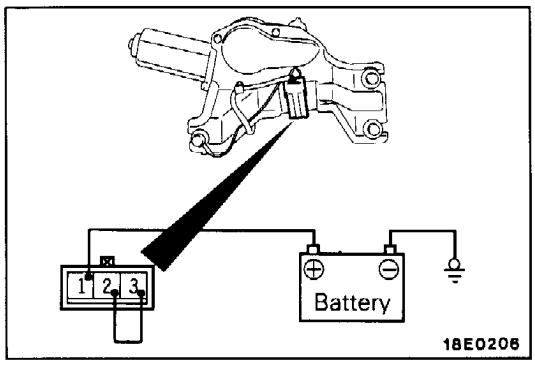
18E0205

WIPER MOTOR

Check the wiper motor after first disconnecting the wiring harness connector, and with the wiper motor remaining installed to the body.

Operation of Wiper Motor

Connect a battery to the wiper motor as shown in the illustration and inspect the motor operation.



18E0206

Operation of Wiper Motor at Stop Position

(1) Run the wiper motor, disconnect the battery, and stop the motor.
(2) Reconnect the battery as shown in the illustration, and confirm that after the motor starts turning, it stops as the automatic stop position.

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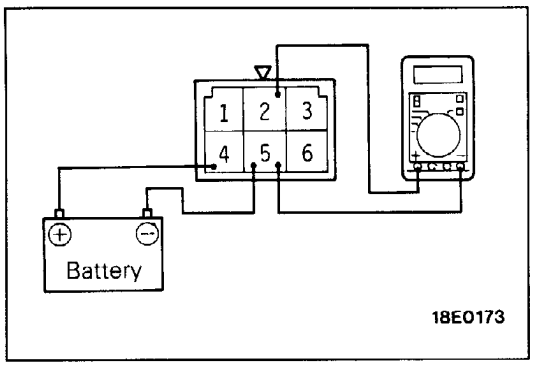
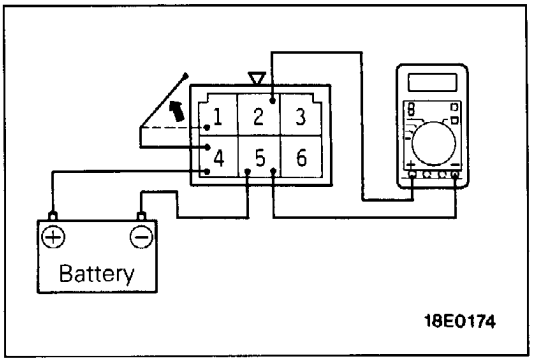
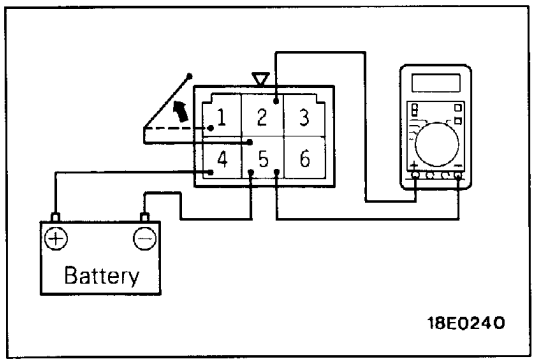


REAR INTERMITTENT WIPER RELAY
<Vehicles built up to October, 1993>

(1) Connect the ⊕ terminal of the voltmeter to terminal ②, and the ⊖ terminal to terminal ⑤.
(2) Check that battery voltage shows when the battery ⊕ terminal is connected to terminal ④ and the battery ⊖ terminal is connected to terminal ⑤.



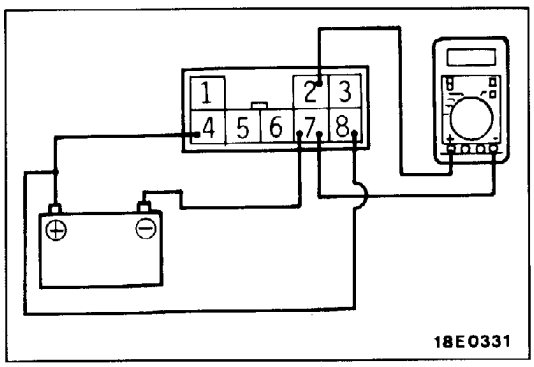
(3) Under the conditions in (2) above, after shorting terminals ① and ④ for approximately 2 seconds, remove the short connection between these terminals.



(4) Next, short terminal ① and terminal ⑤. Check that the voltage shown on the voltmeter at this time is 0 V.
(5) After terminal ① and terminal ⑤ have been shorted for approximately 8 seconds, check if there is battery voltage at terminal ②.

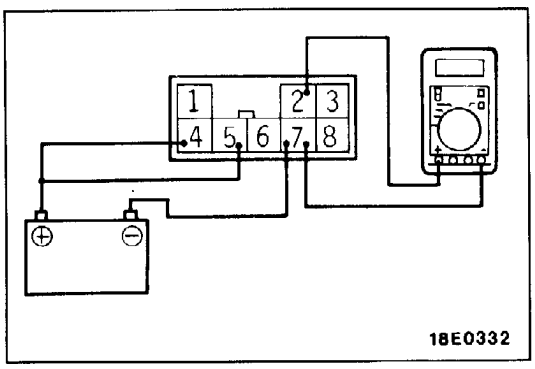
<Vehicles built from November, 1993>
Operation of Rear Wiper Washer

(1) Connect the ⊕ terminal of the voltmeter to terminal ②, and the ⊖ terminal to terminal ⑦.
(2) Check that battery voltage appears when the battery ⊕ terminal is connected to terminal ④, ⑧ and the battery ⊖ terminal is connected to terminal ⑦.



Operation of Rear Intermittent Wiper

(1) Connect the ⊕ terminal of the voltmeter to terminal ②, and the ⊖ terminal to terminal ⑦.
(2) Check that battery voltage shows at intervals of approximately 8 seconds when the battery ⊕ terminal is connected to terminals ④ and ⑤ as well as when the battery ⊖ terminal is connected to terminal ⑦.



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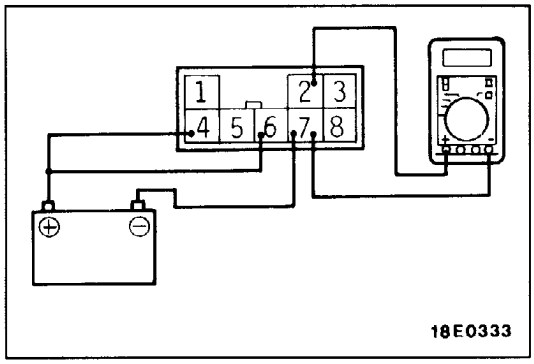
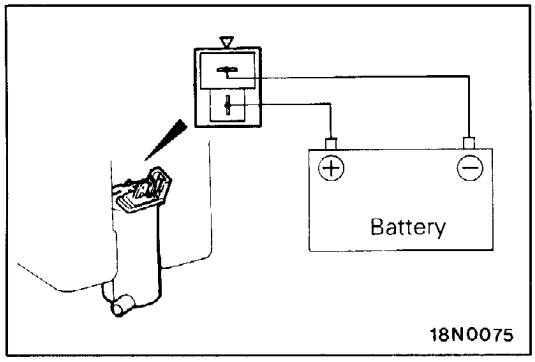


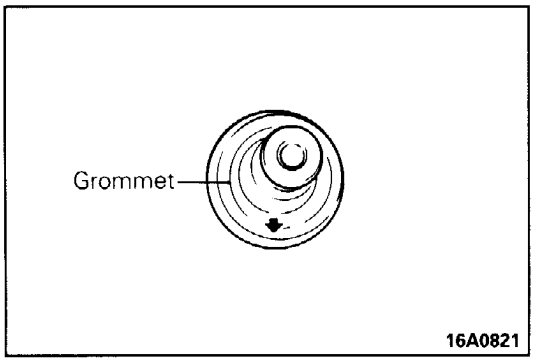
Operation of Rear Wiper at ON Position

(1) Connect the ⊕ terminal of the voltmeter to terminal ②, and the ⊖ terminal to terminal ⑦.
(2) Check that battery voltage shows when the battery ⊕ terminal is connected to terminal ④, ⑥ and the battery ⊖ terminal is connected to terminal ⑦.



WASHER MOTOR

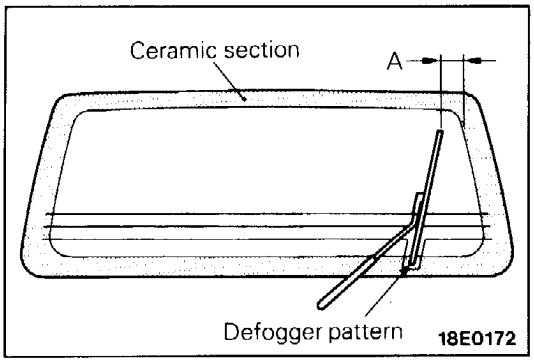
(1) With the washer motor installed to the washer tank, fill the washer tank with water.
(2) When the battery is connected as shown in the figure, check that the water squirts out strongly.



SERVICE POINT OF INSTALLATION

7. INSTALLATION OF GROMMET

Install the grommet so that the arrow points downwards.



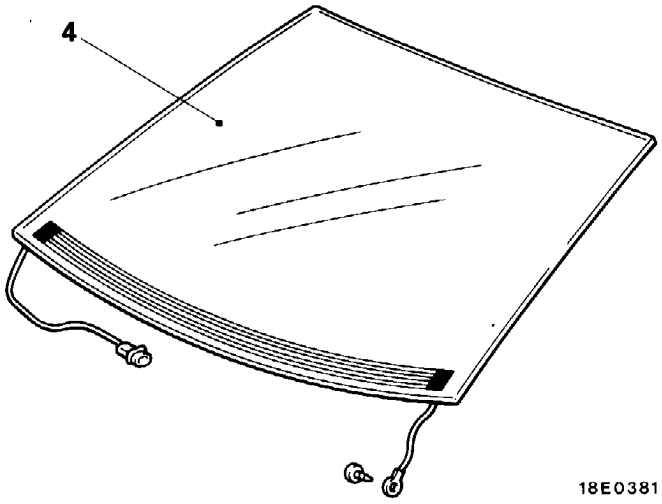
5. INSTALLATION OF WIPER ARM AND BLADE ASSEMBLY

Install the wiper blade so that the tip stops at the standard position (standard value), and also so that the lower section of the wiper blade enters the middle of the defogger pattern.

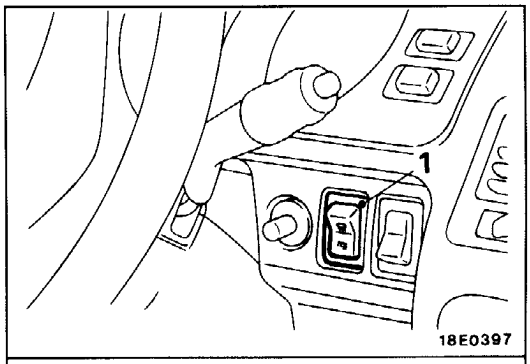
Standard value (A): 65–75 mm (2.56–2.95 in.)

WIPER DEICER

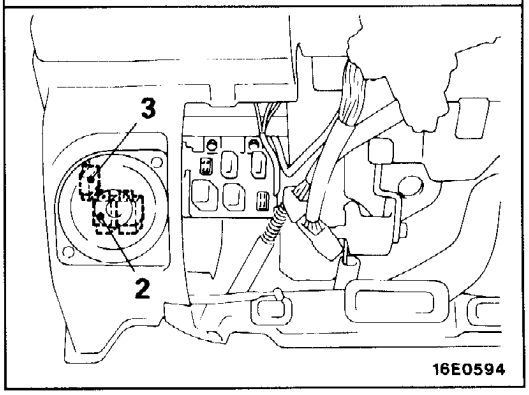
REMOVAL AND INSTALLATION



18E0381



18E0397



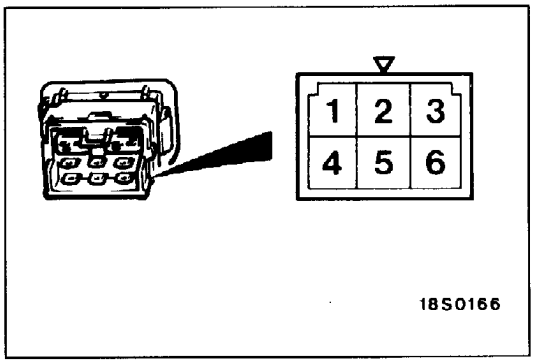
16E0594

Wiper deicer removal step
1. Wiper deicer switch

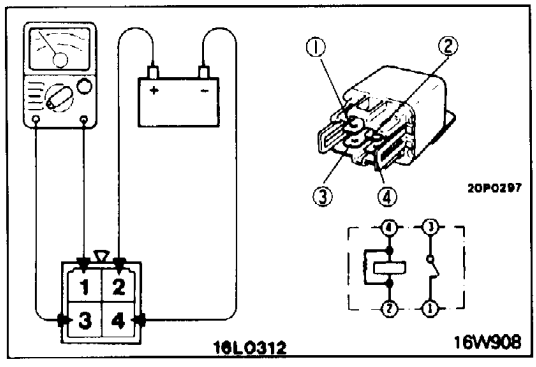
Wiper deicer relay removal step
2. Wiper deicer relay

Wiper deicer timer removal step
3. Wiper deicer timer

Removal of Windshield
4. Windshield
(Refer to GROUP 42 – Windshield Glass)



18S0166



INSPECTION

WIPER DEICER SWITCH CONTINUITY

Terminal / Switch position	2	5	1	4	3	6
OFF				ILL		IND
ON	○—○					

NOTE
○—○ indicates that there is continuity between the terminals.

WIPER DEICER RELAY

Apply battery voltage to terminal 2, and check the continuity between the terminals when terminal 4 is earthed.

Power is supplied	1–3 terminals	Continuity
Power is not supplied	1–3 terminals	No continuity
	2–4 terminals	Continuity

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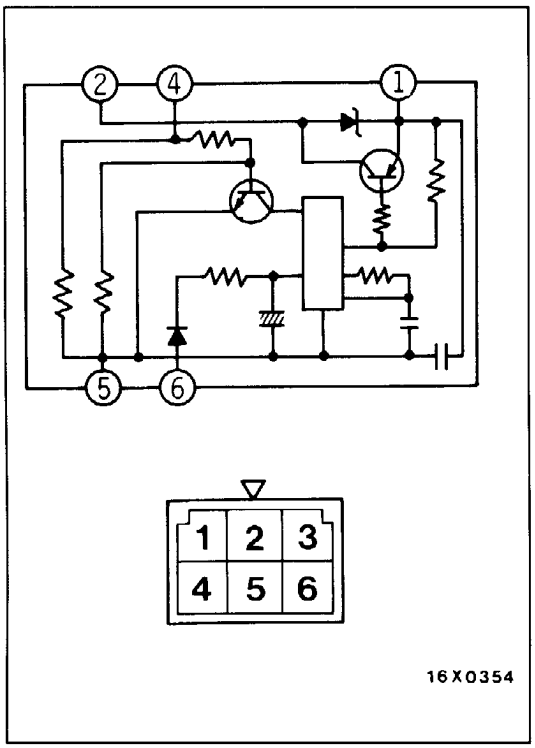


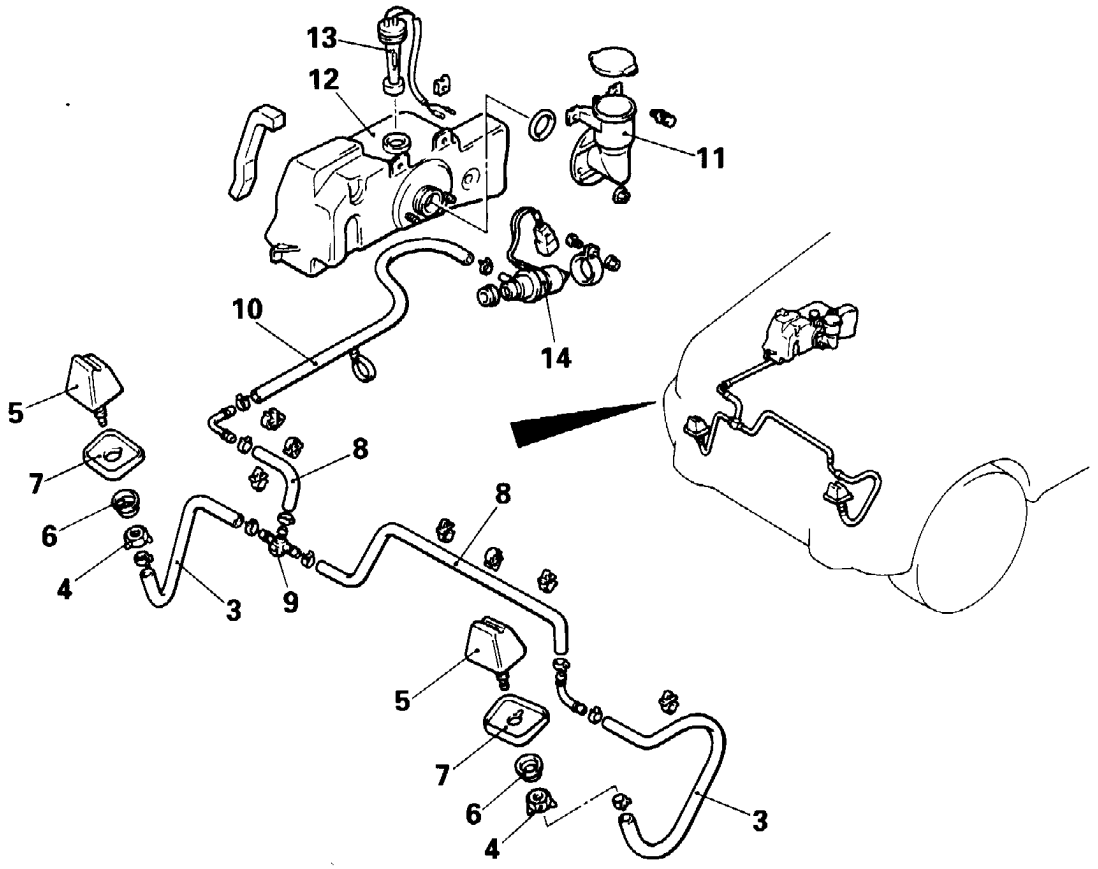
WIPER DEICER TIMER

(1) Connect the battery ⊕ terminal to terminals ① and ⑥ as well as the battery ⊖ terminal to terminal ⑤.
(2) Check that battery voltage is output to terminal ② for 18-22 minutes when battery voltage is momentarily applied to terminal ④ and then removed.

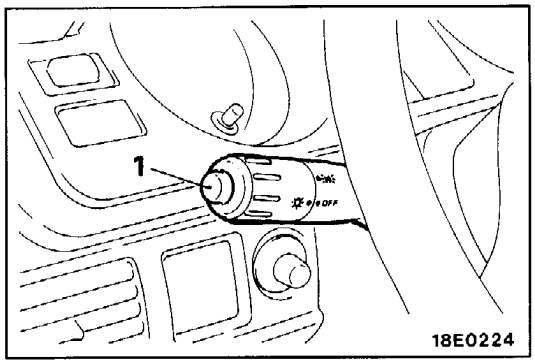
HEADLAMP WASHER

E51MAAM

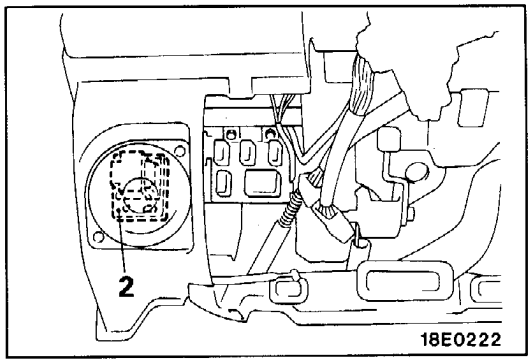
REMOVAL AND INSTALLATION



18E0229



18E0224



18E0222

Removal steps of headlamp washer switch

1. Headlamp washer switch
   (Refer to GROUP 54–Column Switch.)

Removal steps of nozzle and check valve

- Front bumper (Refer to P.51–8.)
- Draining of washer fluid

3. Washer hose
4. Nut
5. Nozzle
6. Collar
7. Nozzle base
   [Vehicles without bumper guard]
8. Washer hose
9. Check valve

Removal steps of headlamp washer relay

- Instrument under cover
  (Refer to GROUP 52–Instrument Panel.)

2. Headlamp washer relay

Removal steps of washer tank

- Splash shield [RH]
  (Refer to GROUP 42–Fender.)
- Front combination lamp
  (Refer to GROUP 54–Lighting System.)
- Draining of washer fluid

10. Washer hose
11. Cap
12. Washer tank assembly
13. Washer fluid level sensor
14. Washer motor

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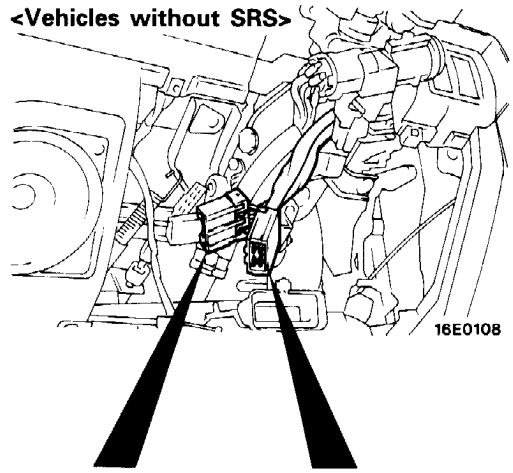
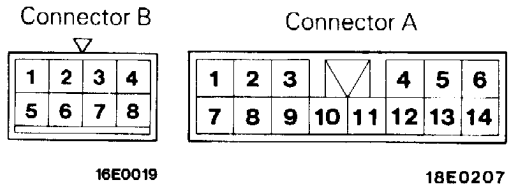
<Vehicles without SRS>





INSPECTION

HEADLAMP WASHER SWITCH

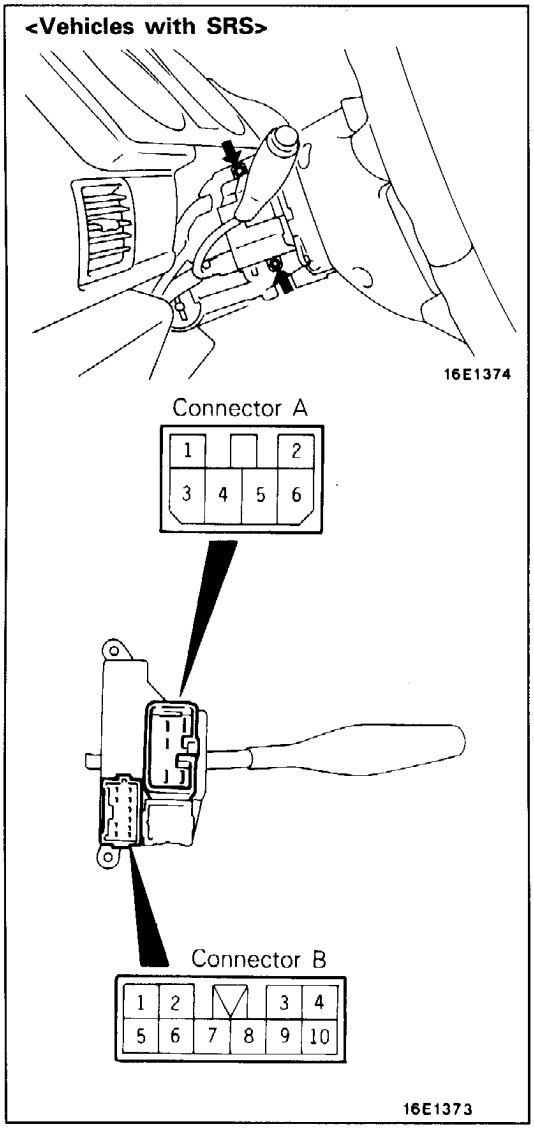
<Vehicles without SRS>

Disconnect the column switch connector and check the continuity between the terminals for each switch.

Switch position \ Terminal / Connector	A	B
	4	6
OFF		
ON	○———	———○

NOTE
○—○ indicates that there is continuity between the terminals.

<Vehicles with SRS>



<Vehicles with SRS>

(1) Remove the column cover lower.
(2) Remove the column cover upper.
(3) Loosen the screws indicated by arrows in the illustration, and then remove the head lamp washer switches.
(4) Disconnect the column switch connector and check the continuity between the terminals for each switch.

Switch position \ Terminal / Connector	A	B
	1	2
OFF		
ON	○———	———○

NOTE
○—○ indicates that there is continuity between the terminals.

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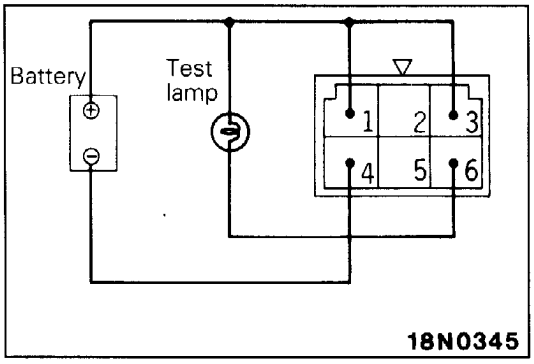
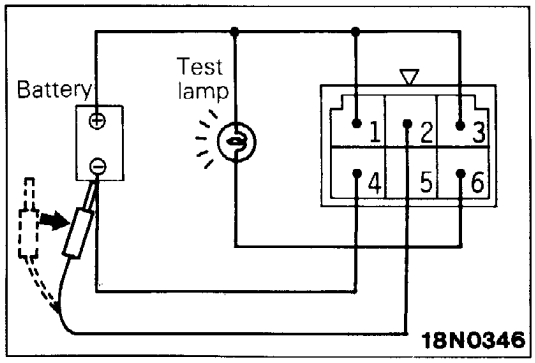
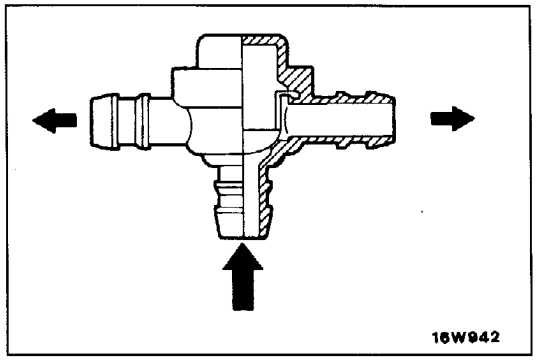


HEADLAMP WASHER RELAY

(1) Connect battery and test lamp to the relay as illustrated.



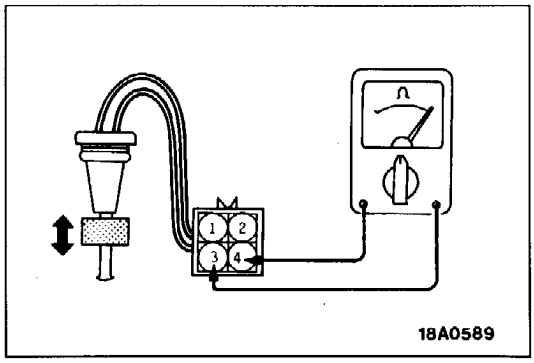
(2) The relay is normal if the lamp lights for approximately 0.3 second upon connection of terminal ② to battery (–).



CHECK VALVE

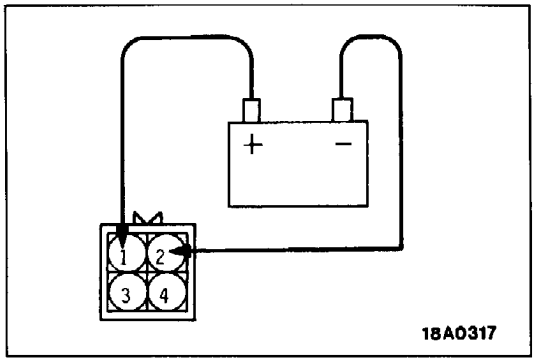
Apply pressure to the inlet of the check valve to check its opening pressure.

Opening pressure: 50–110 kPa
(0.5–1.1 kg/cm², 7.1–15.6 psi)



WASHER FLUID LEVEL SENSOR

(1) Remove the washer fluid level sensor from the washer tank.
(2) Connect a ohmmeter to the connector of washer fluid level sensor.
(3) Move the float up and down.
(4) Make sure that when the float is raised, there is no continuity and when it is lowered, there is continuity.



HEADLAMP WASHER MOTOR

(1) With the washer motor installed to the washer tank, fill the washer tank with water.
(2) Connect battery (+) and (–) cables to terminals ② and ① respectively to see that the washer motor runs and water is injected.

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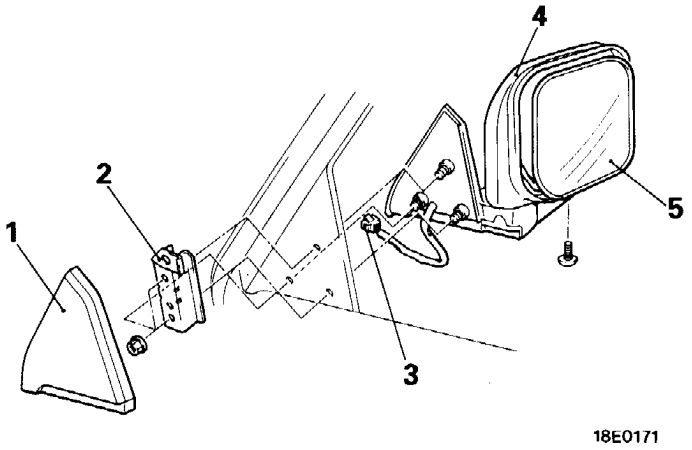
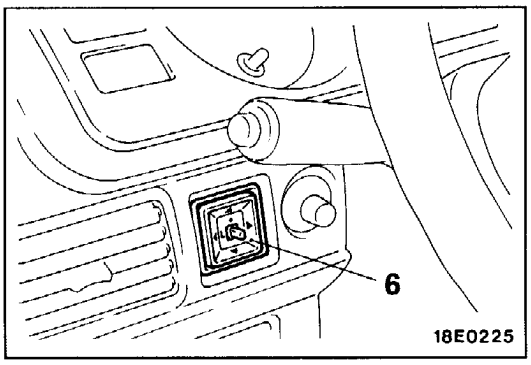
NOTES

DOOR MIRROR

E51JAAP

REMOVAL AND INSTALLATION





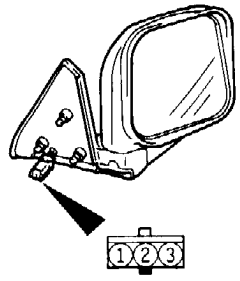
Door mirror removal steps

1. Delta cover inner
2. Inner cover bracket
3. Harness connector
4. Door mirror
5. Mirror

Door mirror control switch removal

6. Door mirror control switch

<Vehicles without heated mirror>



INSPECTION

REMOTE CONTROL MIRROR ASSEMBLY

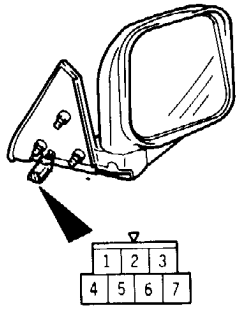
<Vehicles without heated mirror>

Check to be sure that the mirror moves as described in the table when each terminal is connected to the battery.

Connection / Direction of operation	Battery ⊕	Battery ⊖	Terminal 1	Terminal 2	Terminal 3
Up	○	○	○		○
Down	○	○	○		○
Left	○	○	○	○	
Right	○	○	○	○	

NOTE
○—○ indicates each terminal is connected to the battery.

<Vehicles with heated mirror>



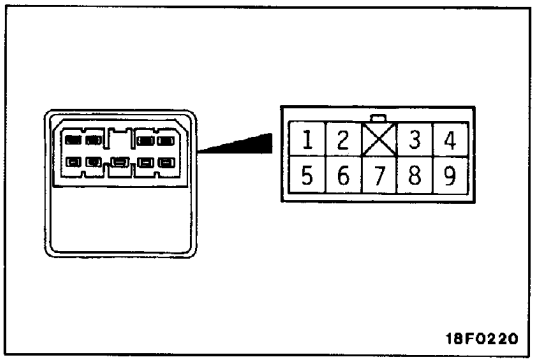
18E0211

<Vehicles with heated mirror>

1. Check to be sure that the mirror moves as described in the table when each terminal is connected to the battery.
2. Check if there is continuity between terminals ① and ④.

Connection / Direction of operation	Battery ⊕	Battery ⊖	Terminal 5	Terminal 6	Terminal 7	Terminal 1	Terminal 4
Up	○	○	○		○		
Down	○	○	○		○		
Left	○	○	○	○			
Right	○	○	○	○			

NOTE
○—○ indicates each terminal is connected to the battery.



18F0220

DOOR MIRROR CONTROL SWITCH

Operate switch and check for continuity between terminals.

Terminal / Direction	Left side 3	Left side 4	Left side 6	Left side 7	Left side 8	Right side 2	Right side 4	Right side 6	Right side 7	Right side 9
UP		○			○	○	○			
			○	○				○	○	
DOWN		○		○			○		○	
			○		○	○		○		
LEFT		○		○			○		○	
	○		○					○		○
RIGHT	○	○					○			○
			○	○				○	○	

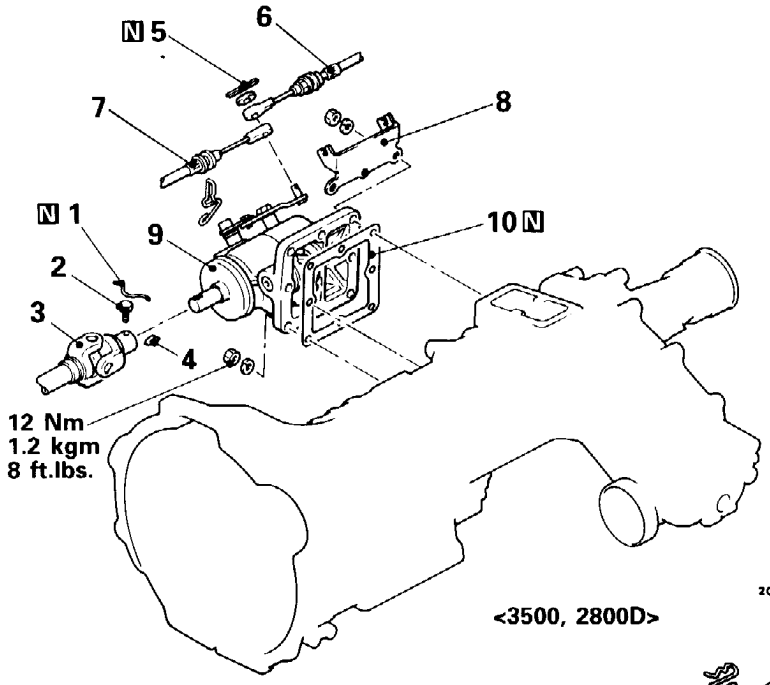
NOTE
○—○ indicates that there is continuity between the terminals.

P.T.O. (POWER TAKE OFF)

E51NBAB

REMOVAL AND INSTALLATION

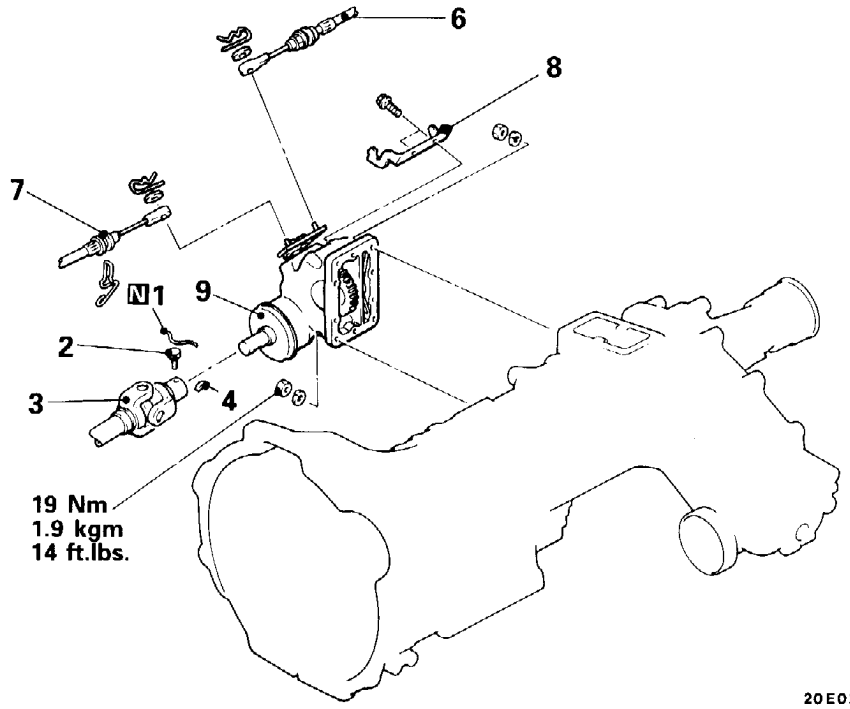
<2400, 3000, 2500D>



20E0031

Pre-removal and Post-installation Operation
- Draining and Refilling Transfer oil (Refer to P.51-7)
- Removal and Installation of Pre muffler (Refer to GROUP 15 – Exhaust pipe and Muffler <3500, 2800D>

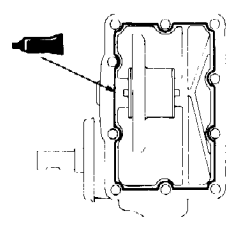
<3500, 2800D>



20E0261

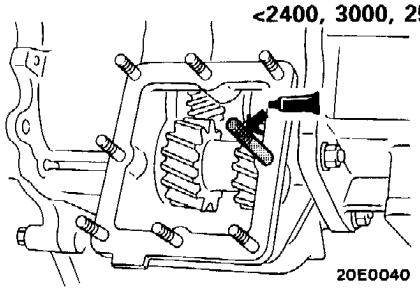
Removal steps
1. Wire
2. Winch bolt
3. Drive shaft
4. Woodruff key
5. Split pin
6. Rear P.T.O. cable
7. Front P.T.O. cable
8. P.T.O. bracket
9. P.T.O. assembly
10. Gasket

<3500, 2800D>

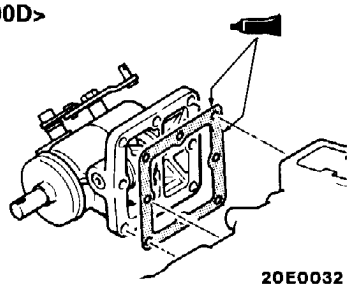


20E0259

<2400, 3000, 2500D>

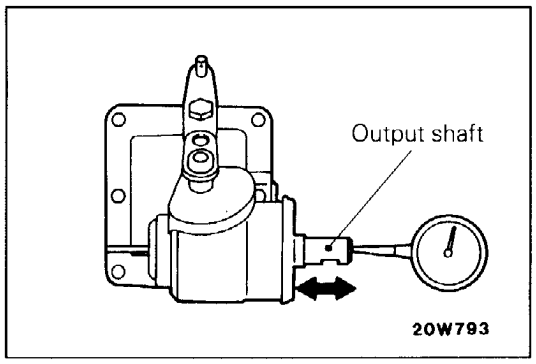


20E0040



20E0032

Sealant: 3M ATD Part No. 8661, 8663 or equivalent



INSPECTION

OUTPUT SHAFT END PLAY

Check the output shaft end play by following the steps below.

(1) Place a dial gauge as shown in the figure; then move the output shaft in the axial direction and measure the end play.

Standard value: 0–0.2 mm (0–0.008 in.)

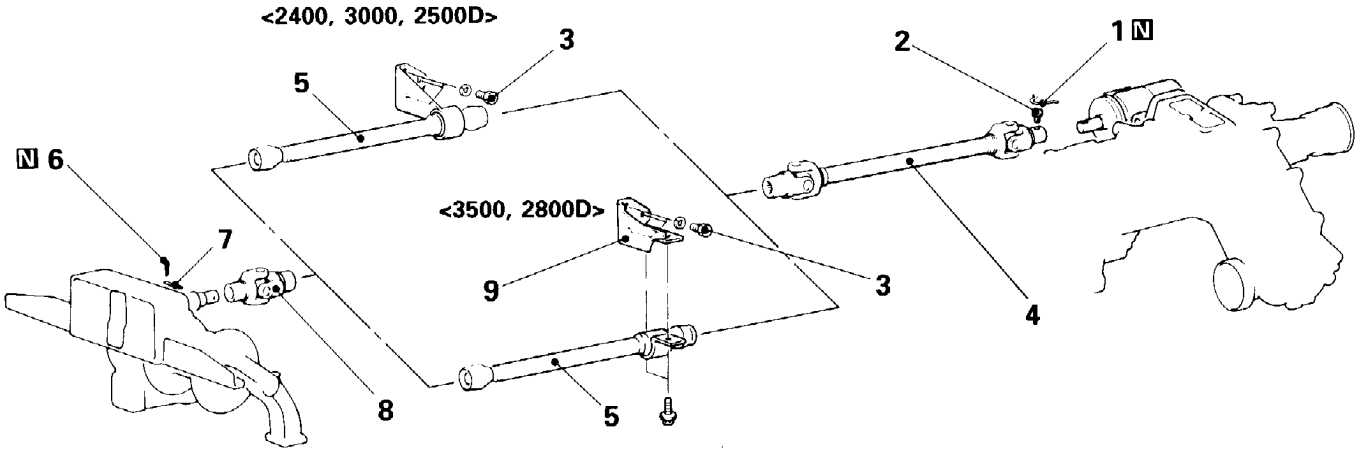
(2) If the end play exceeds the standard value, replace the P.T.O. assembly.

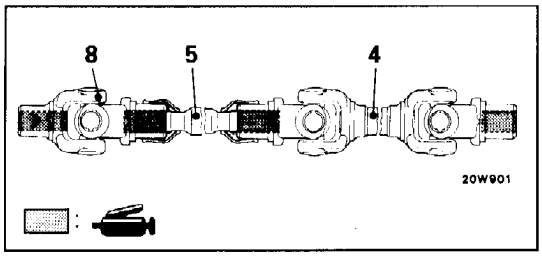
DRIVE SHAFT

E51NDAB

REMOVAL AND INSTALLATION

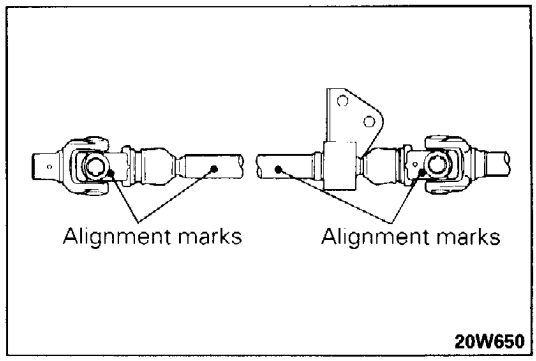
Pre-removal and Post-installation Operation
- Removal and Installation of the Skid Plate
- Removal and Installation of the Under Cover





Removal steps

1. Wire
2. Winch bolt
3. Bolt
4. Rear shaft assembly
5. Front shaft assembly
6. Split pin
7. Shear pin
8. Sleeve yoke assembly
9. Bearing bracket



SERVICE POINTS OF REMOVAL

3. REMOVAL OF BOLT

Before removing the bearing bracket attaching bolt, make alignment marks on the rear shaft assembly, front shaft assembly and sleeve yoke assembly.

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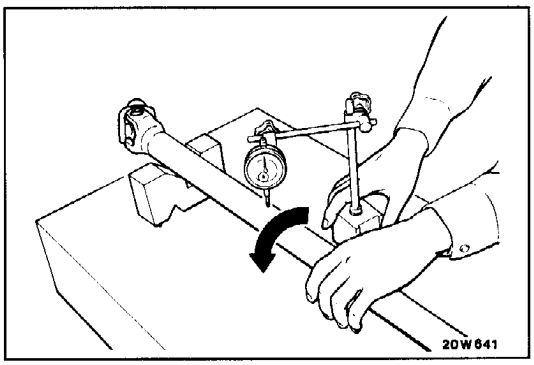
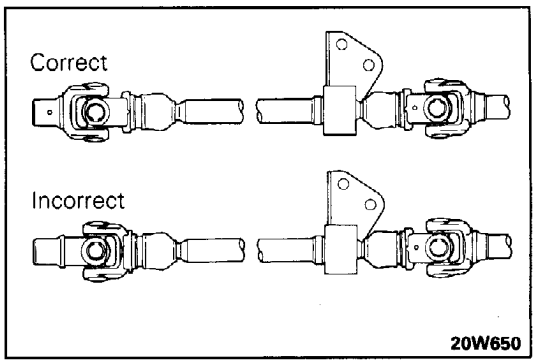


INSPECTION

DRIVE SHAFT RUNOUT

Limit:

Front shaft assembly	**1.0 mm (0.04 in.)**
Rear shaft assembly	**0.5 mm (0.02 in.)**



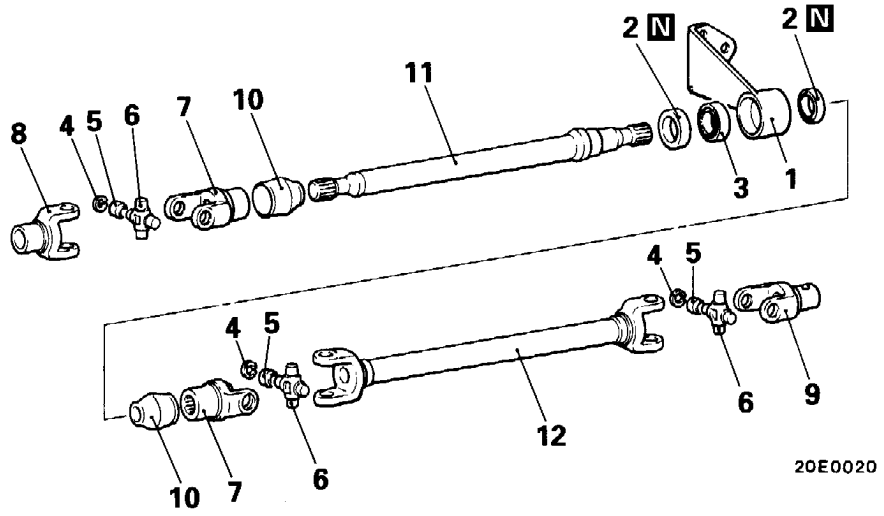
SERVICE POINTS OF INSTALLATION

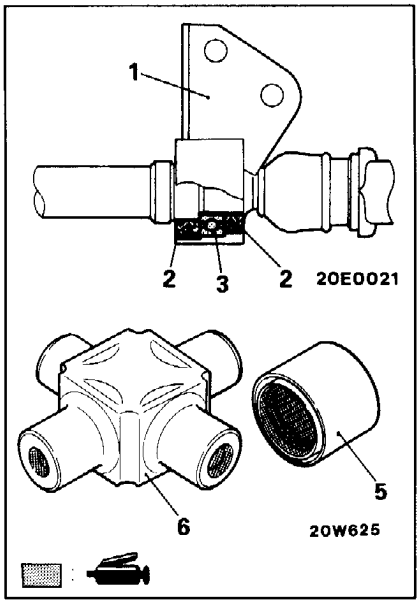
8. INSTALLATION OF FRONT SLEEVE YOKE ASSEMBLY

Install with the sleeve yoke assemblies in the same direction.

NOTE
When the rear shaft assembly, front shaft assembly and sleeve yoke assembly are to be reused, align the alignment marks made at removal.

DISASSEMBLY AND REASSEMBLY





Disassembly steps

1. Bearing bracket
2. Oil seal
3. Ball bearing
4. Snap ring
5. Needle bearing
6. Spider
7. Sleeve yoke assembly
8. Front yoke
9. Rear yoke
10. Boot
11. Front shaft
12. Rear shaft

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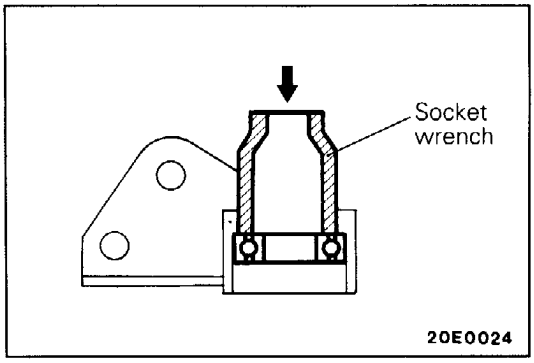
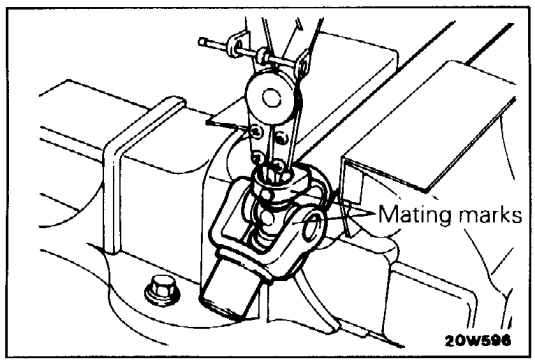


SERVICE POINTS OF DISASSEMBLY

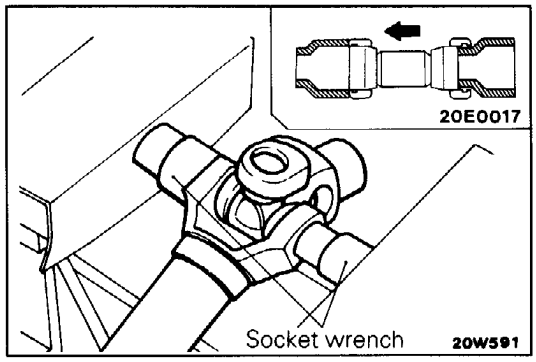
3. REMOVAL OF BALL BEARING



4. REMOVAL OF SNAP RING

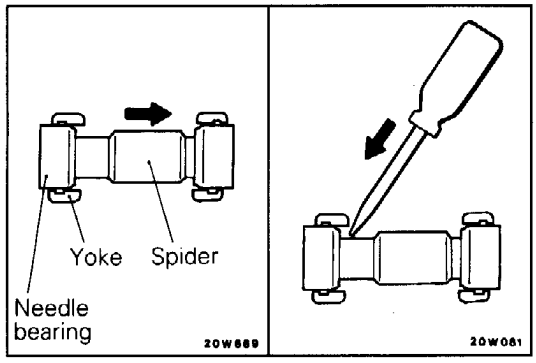
Make mating marks on the yokes of the universal joint that is to be disassembled.

NOTE
To replace the spider and needle bearing, use a universal joint kit.



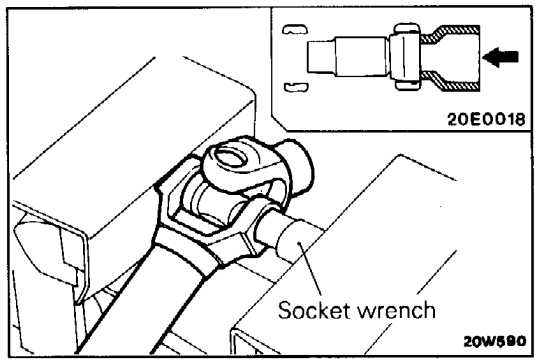
5. REMOVAL OF NEEDLE BEARING

(1) Use a socket wrench to push out the needle bearing.



(2) If the needle bearing cannot be removed, push the spider back to the opposite side, and insert a thin screwdriver block in the clearance between the spider and yoke to remove the needle bearing.

Caution
Use care to prevent damaging the needle bearing press-fitting portion of yoke.



SERVICE POINTS OF REASSEMBLY

5. INSTALLATION OF NEEDLE BEARING/4. SNAP RING

(1) Use a socket wrench to press-fit one needle bearing.
(2) Attach the snap ring to the side of the needle bearing that has been press-fitted.

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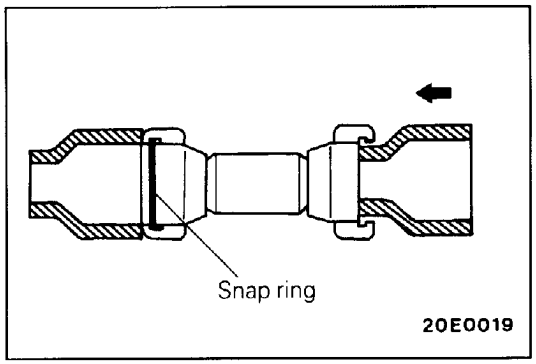
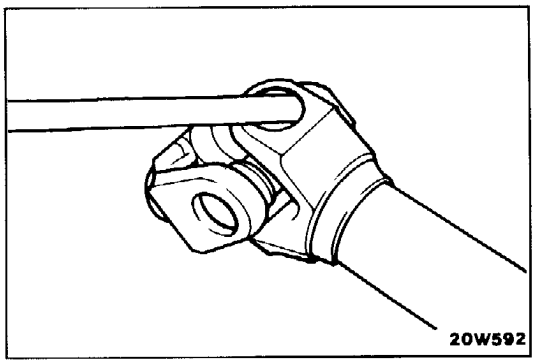


(3) Use the socket wrench to press-fit the opposite needle bearing.
(4) Attach a snap ring that is of the same thickness as the snap ring attached previously.

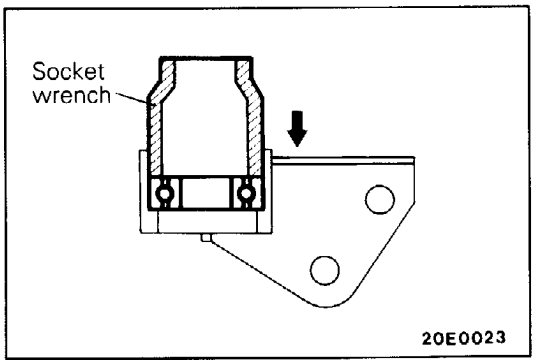


(5) Using a thickness gauge, check to ensure that the clearance between the snap ring groove and snap ring is within the specified value.

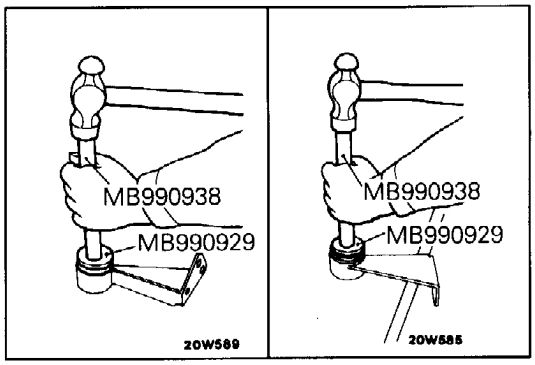
Standard value: 0—0.06 mm (0—0.0024 in.)

NOTE
If the clearance is out of specification, select snap rings of identical thickness for both sides to adjust the clearance to specification, and replace the existing snap rings with the selected ones.

3. PRESSING-IN OF BALL BEARING



2. PRESSING-IN OF OIL SEAL



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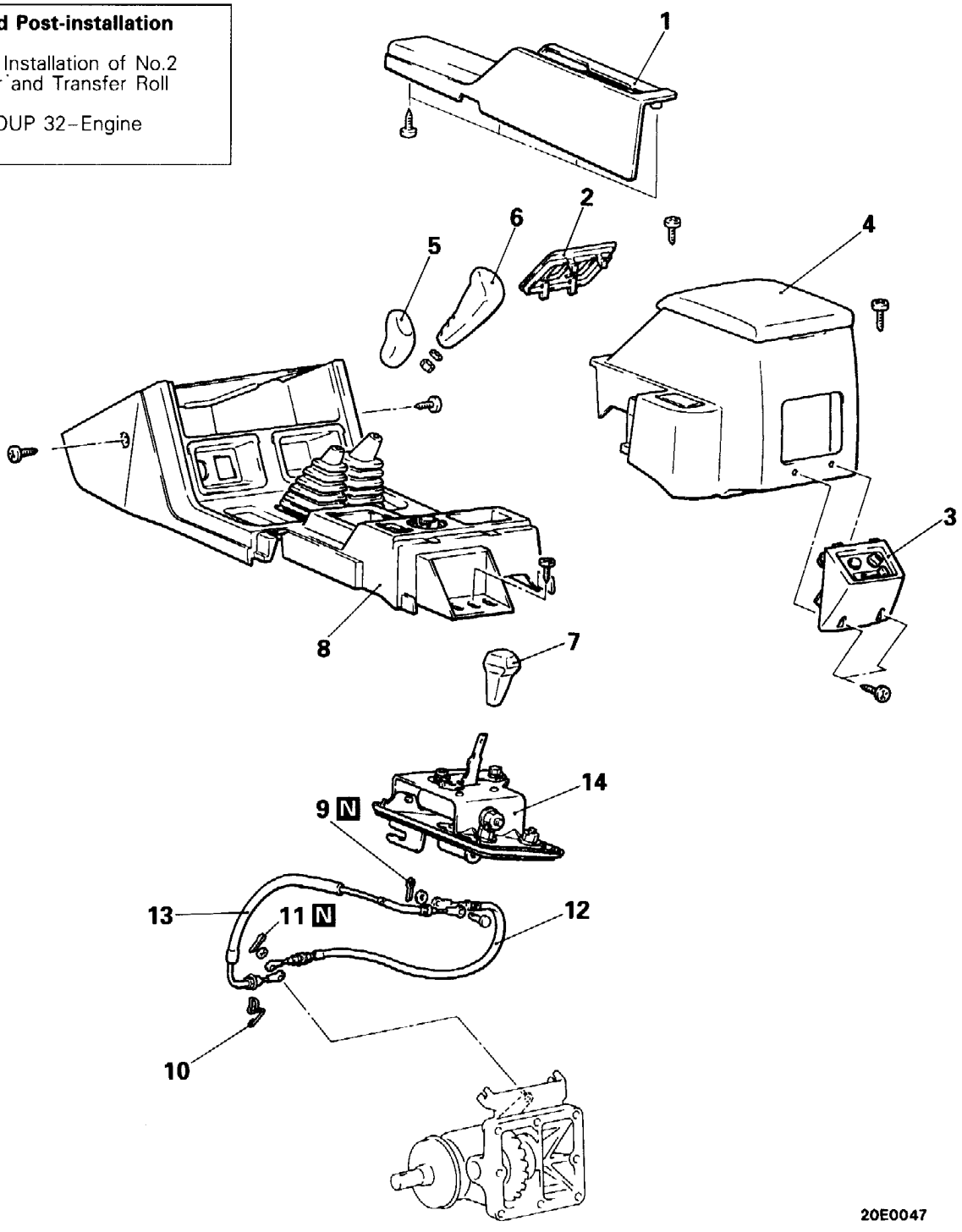
P.T.O. CONTROL

E51NCAB

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Removal and Installation of No.2 Crossmember and Transfer Roll Stopper (Refer to GROUP 32–Engine Mounting.)



20E0047

Removal steps

1. Side panel
2. Switch panel
3. Rear control assembly
4. Rear floor console
5. T/M shift knob
6. T/F shift knob
7. P.T.O. control knob
8. Front floor console

◆◆ • Adjustment of P.T.O. control cable
9. Split pin
10. Cable pin
11. Split pin
◆◆ 12. P.T.O. rear cable
◆◆ 13. P.T.O. front cable
14. P.T.O. control lever assembly

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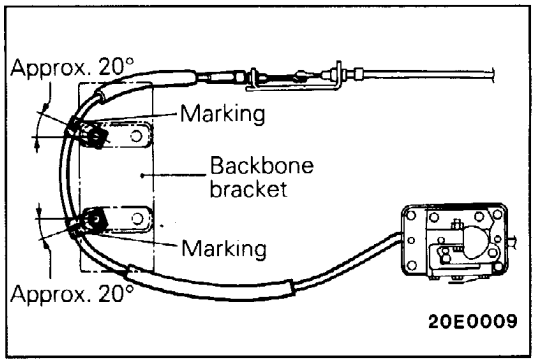
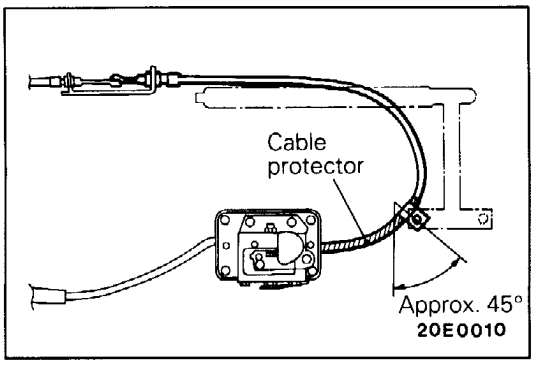


SERVICE POINTS OF INSTALLATION

12. ADJUSTMENT OF P.T.O. FRONT CABLE MOUNTING POSITION

<R.H. Drive Vehicles>

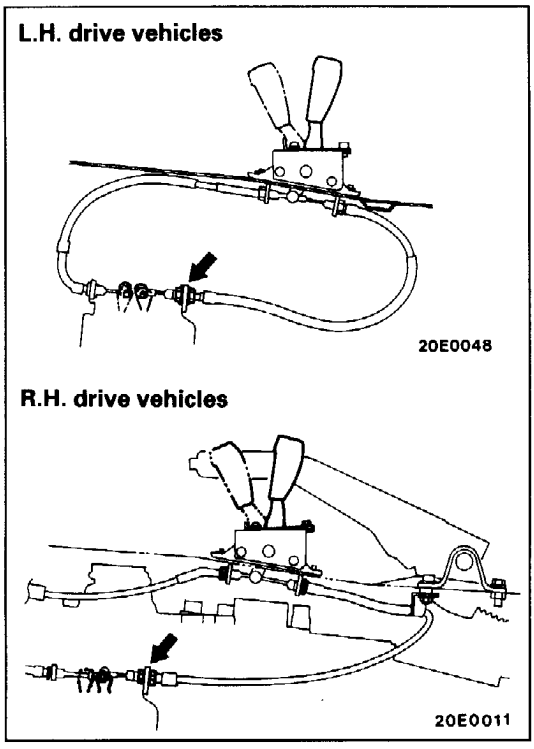
Install the clips to match the positions of the cable markings so that the clips conceal the markings.



13. ADJUSTMENT OF P.T.O. REAR CABLE MOUNTING POSITION

<R.H. Drive Vehicles>

Install the clips onto the cable protector as shown in the illustration.



P.T.O. CONTROL CABLE ADJUSTMENT

Adjust with the jam nut so that ON-OFF selection is possible within the movement range of the P.T.O. lever.

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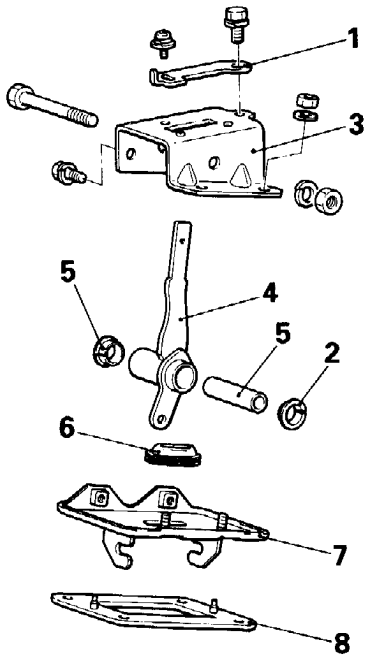
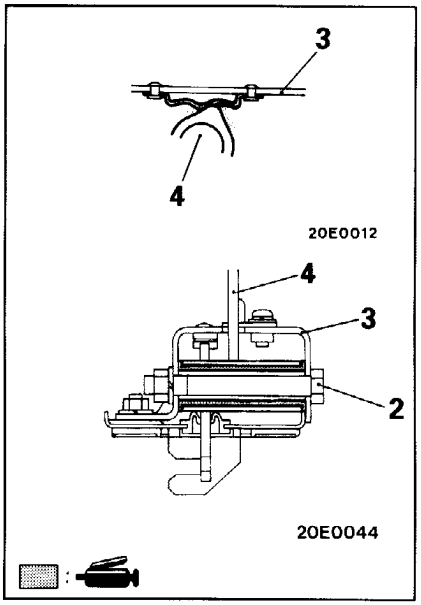
DISASSEMBLY AND REASSEMBLY (P.T.O. CONTROL LEVER ASSEMBLY)



20E0046



Disassembly steps

1. Stopper
2. Bolt
3. Bracket
4. Lever
5. Bushing
6. Grommet
7. Plate
8. Packing

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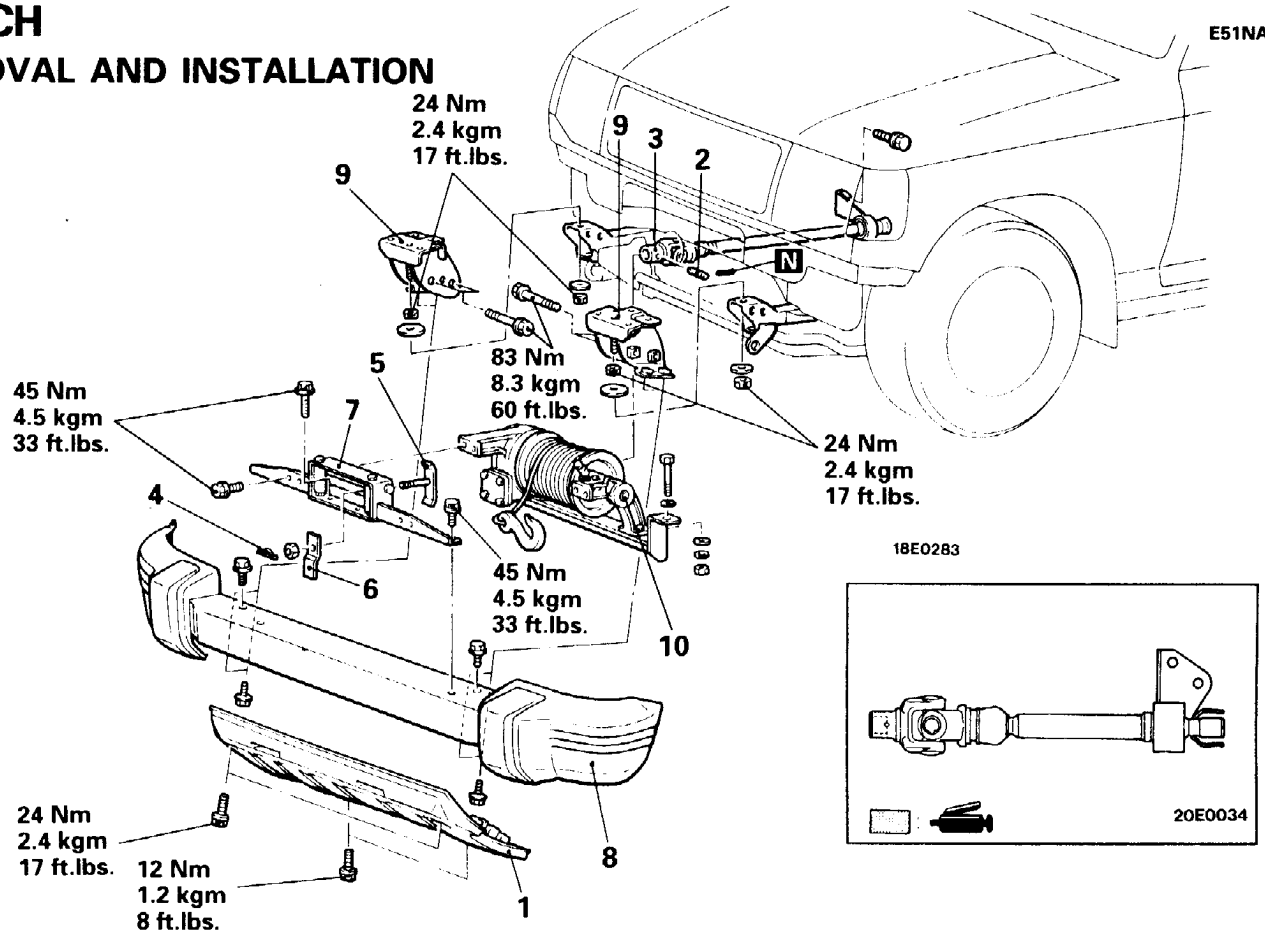
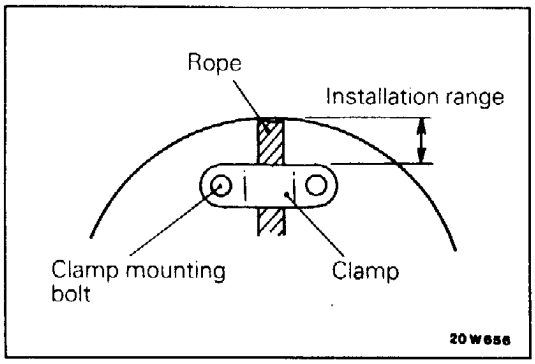
WINCH

REMOVAL AND INSTALLATION



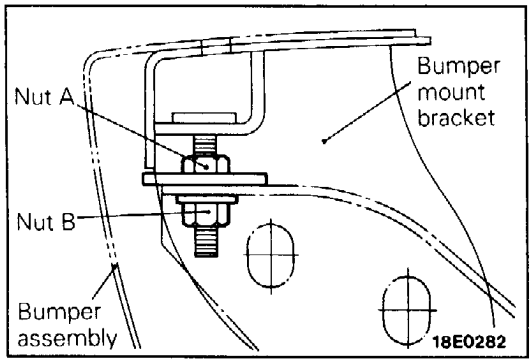
Removal steps

1. Skid plate
2. Shear pin
3. Front shaft assembly
4. Inner pin
5. Guide roller stopper
6. Rope hook stopper
7. Roller guide assembly
8. Front bumper
9. Bumper mount bracket
10. Winch assembly



REPLACEMENT OF WIRE ROPE

1. After pulling out all of the rope, remove the crank mounting bolt, and remove the wire rope.
2. Set the wire rope so that the end is within the range from the drum as shown in the illustration, and secure it with the clamp.



SERVICE POINT OF INSTALLATION

9. INSTALLATION OF BUMPER MOUNT BRACKET

Provisionally install the bumper mount bracket, and then adjust the fitting of the bumper assembly and the body with nut A.

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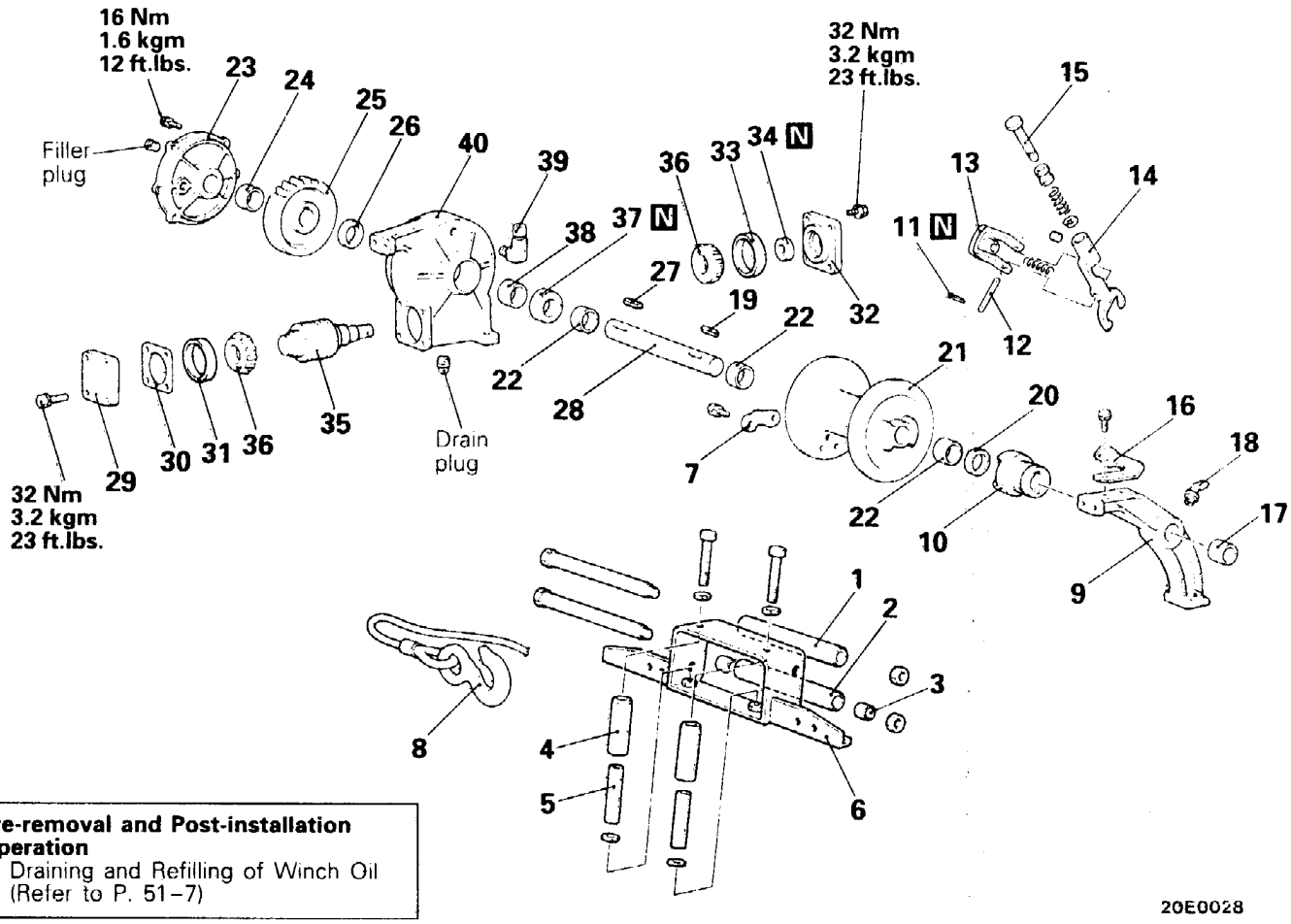
DISASSEMBLY AND REASSEMBLY



Pre-removal and Post-installation Operation
- Draining and Refilling of Winch Oil (Refer to P. 51–7)

Disassembly steps

- ◆◆ 1. Rope guide upper roller
- ◆◆ 2. Rope guide lower roller
- 3. Rope guide lower roller bushing
- 4. Rope guide side roller
- 5. Inner spacer
- 6. Guide roller bracket
- 7. Clamp
- 8. Rope hook
- 9. Drum bracket
- 10. Brake shoe clutch
- 11. Split pin
- 12. Brake shoe shaft
- 13. Brake shoe
- 14. Shift lever
- 15. Shift lever stopper
- 16. Shift lock bracket
- ◆◆ ◆◆ 17. Shift lock bracket bushing
- 18. Inner nipple
- ◆◆ 19. Drum shaft key
- 20. Gear case washer
- 21. Drum
- ◆◆ ◆◆ 22. Drum bushing
- 23. Side cover
- ◆◆ ◆◆ 24. Side cover bushing
- ◆◆ 25. Worm wheel
- 26. Inner washer
- 27. Drum shaft key
- ◆◆ 28. Drum shaft
- ◆◆ 29. Front cover
- 30. Adjustment shim
- 31. Bearing outer race
- 32. Rear cover
- 33. Bearing outer race
- ◆◆ 34. Gear case oil seal
- 35. Worm gear
- ◆◆ ◆◆ 36. Bearing inner race
- ◆◆ 37. Gear case oil seal
- ◆◆ ◆◆ 38. Gear case bushing
- 39. Gear case breather
- 40. Gear case

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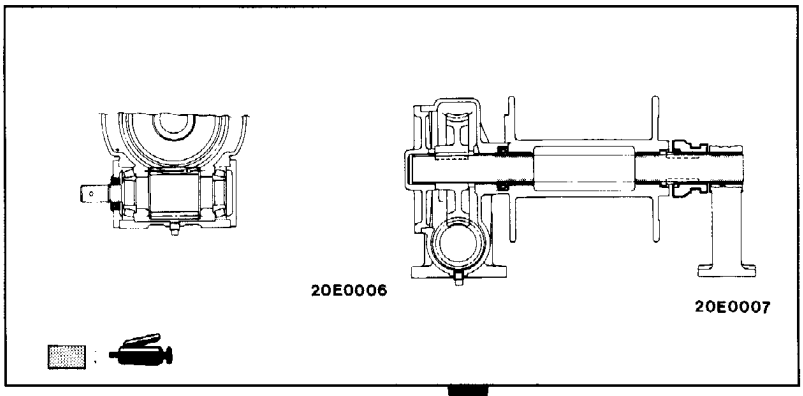
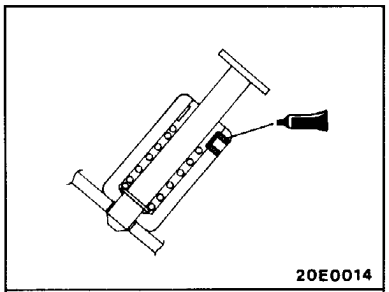
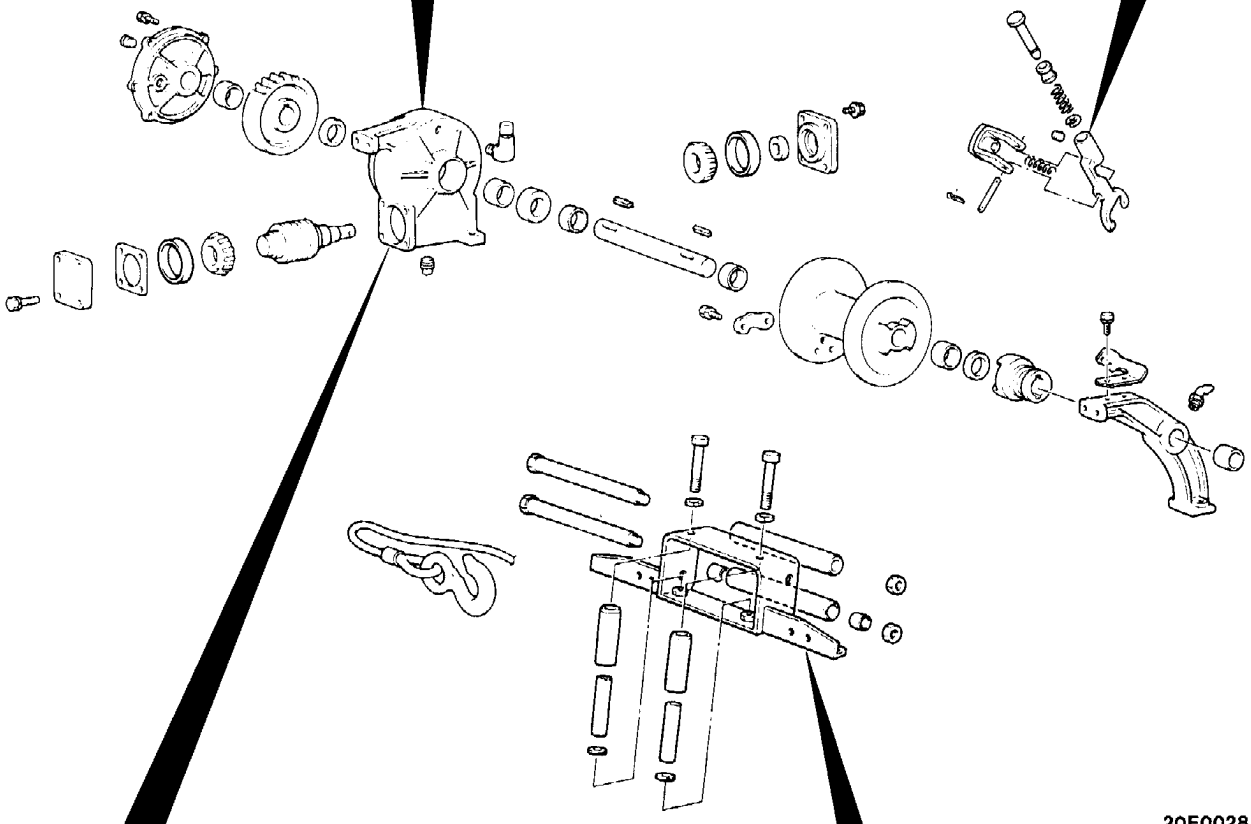
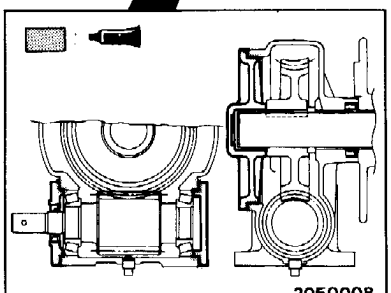
LUBRICATION, ADHESION AND SEALING POINTS



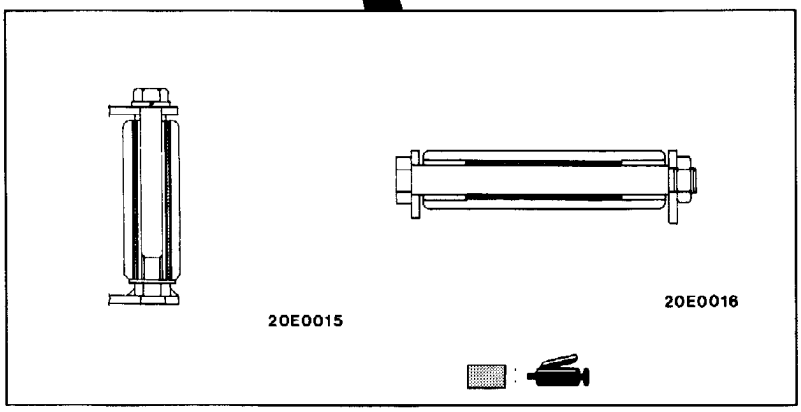


Adhesive: 3M ATD Part No. 8121, 8155 or equivalent





Adhesive: 3M ATD Part No. 8661, 8663 or equivalent



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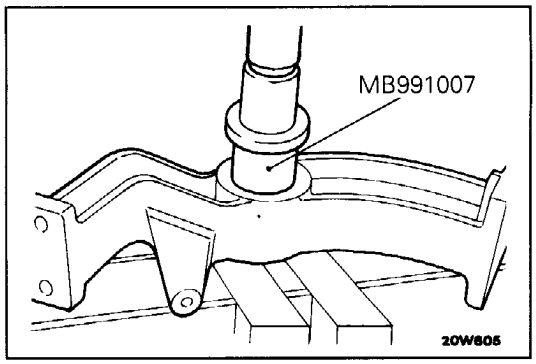
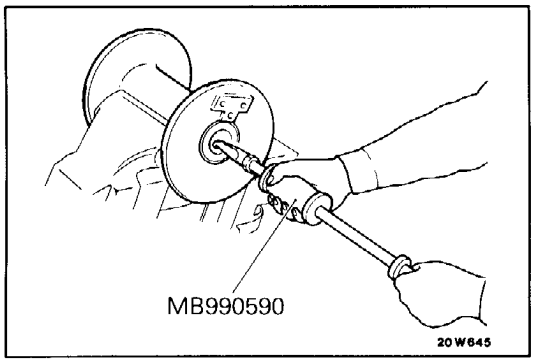
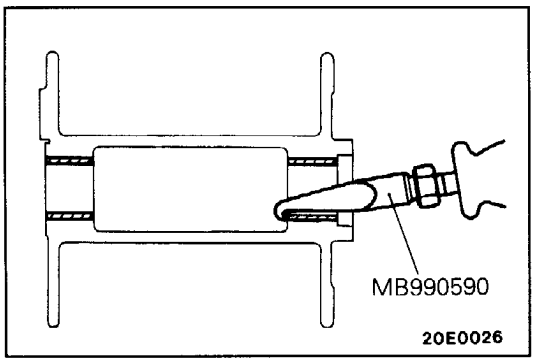
SERVICE POINTS OF DISASSEMBLY

17. REMOVAL OF SHIFT LOCK BRACKET BUSHING



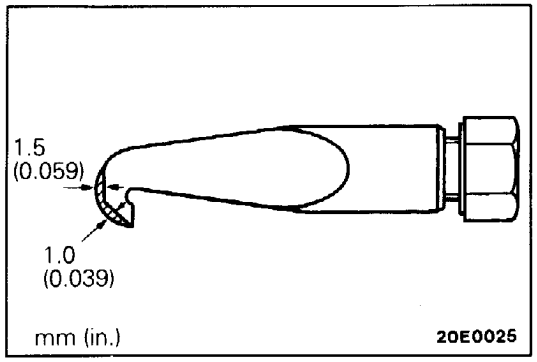
22. REMOVAL OF DRUM BUSHING



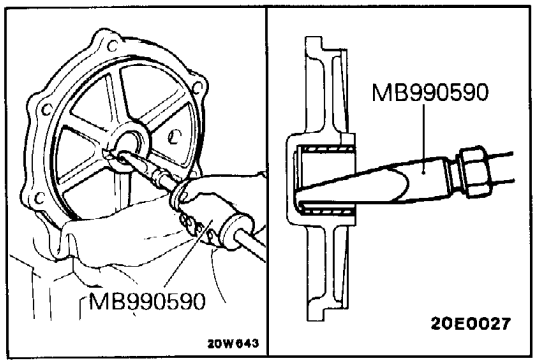


24. REMOVAL OF SIDE COVER BUSHING

(1) Sharpen the adaptor tab of the special tool as shown in the illustration.



(2) Use the processed special tool to pull out the bushing from the side cover.



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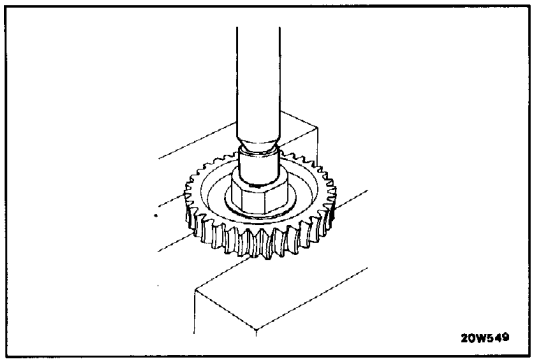
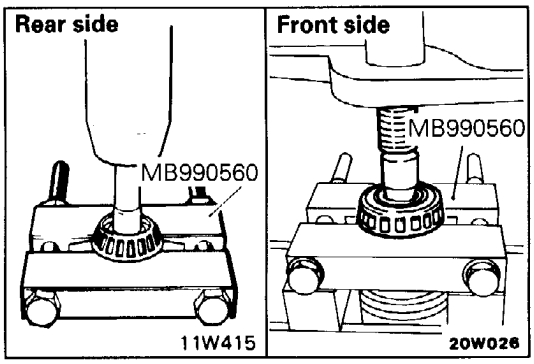
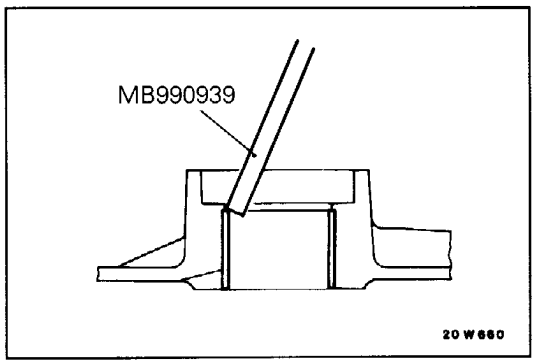


28. REMOVAL OF DRUM SHAFT

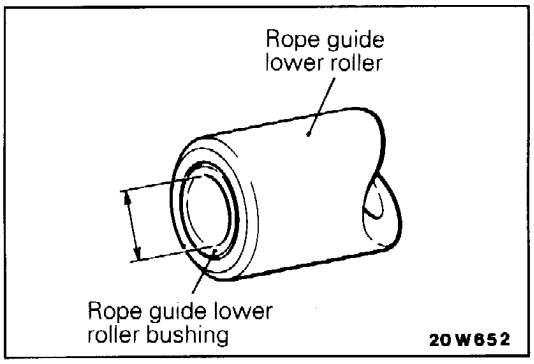
Remove the drum shaft from the worm wheel with a press.



36. REMOVAL OF BEARING INNER RACE



38. REMOVAL OF GEAR CASE BUSHING

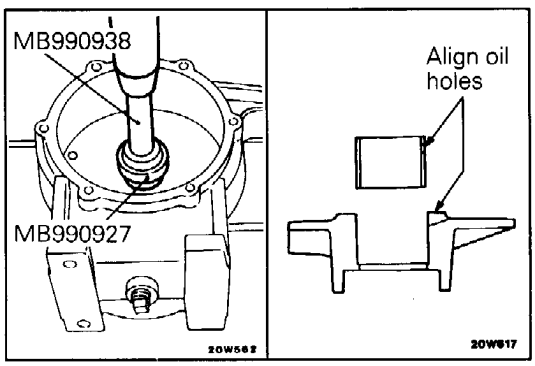


INSPECTION

MEASUREMENT OF INSIDE DIAMETER OF ROPE GUIDE LOWER ROLLER BUSHING

Measure the inside diameter of the bushing in two places or more, and check that the largest value is within the limit value.

Limit value: 19.5 mm (0.768 in.)



SERVICE POINTS OF REASSEMBLY

38. INSTALLATION OF GEAR CASE BUSHING

Using the special tools, install the bushing in the gear case, while making sure that the oil holes are in alignment.

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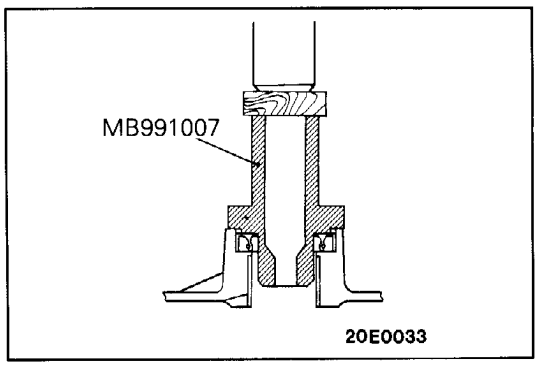
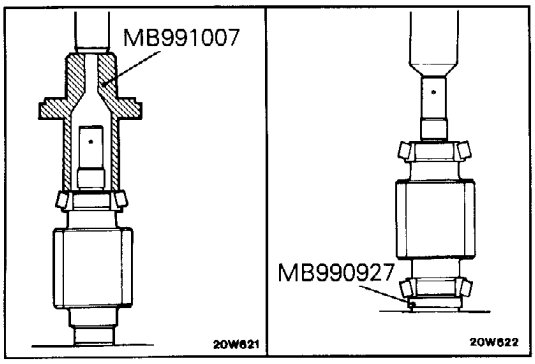
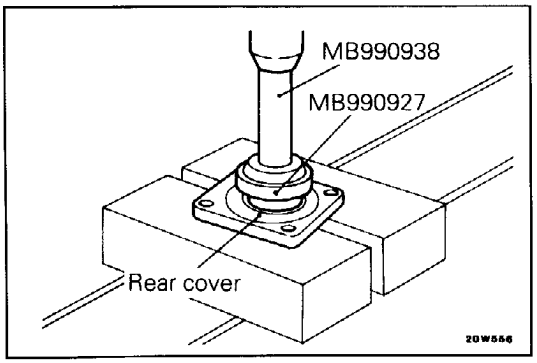


37. PRESSING-IN OF GEAR CASE OIL SEAL

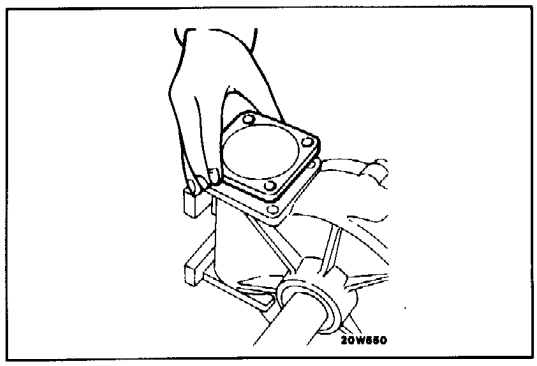


36. PRESSING-IN OF BEARING INNER RACE

Caution
When the worm gear is replaced, the worm wheel should also be replaced.

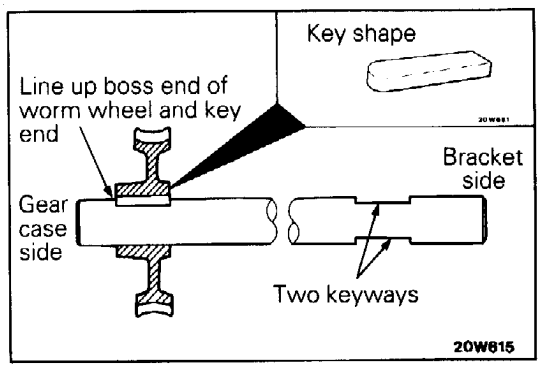


34. PRESSING-IN OF GEAR CASE OIL SEAL



29. INSTALLATION OF FRONT COVER

(1) Install the front cover and check that the worm gear turns smoothly and that there is no backlash in the shaft direction.
(2) If the worm gear does not turn smoothly, or if there is backlash, adjust with the shim.



25. INSTALLATION OF WORM WHEEL

(1) Attach the key to the drumshaft side with one keyway, and press-fit the drum shaft to the worm wheel.
(2) Attach so that the round end of the key and the long end of the worm wheel boss are facing towards the gear end.

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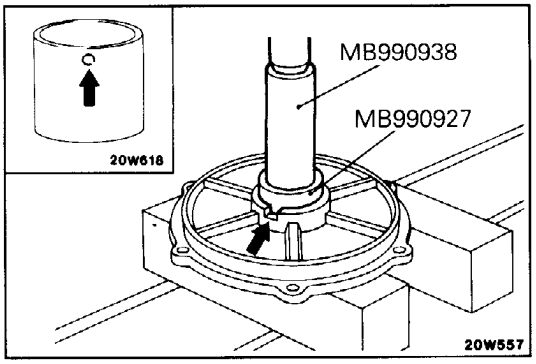
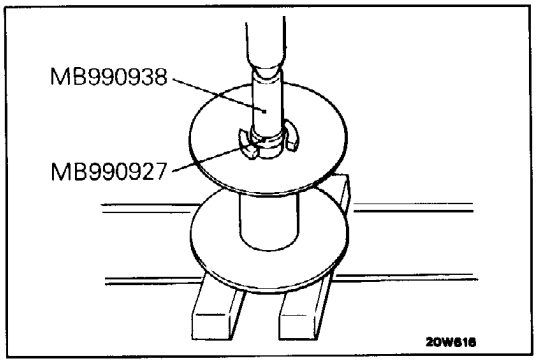
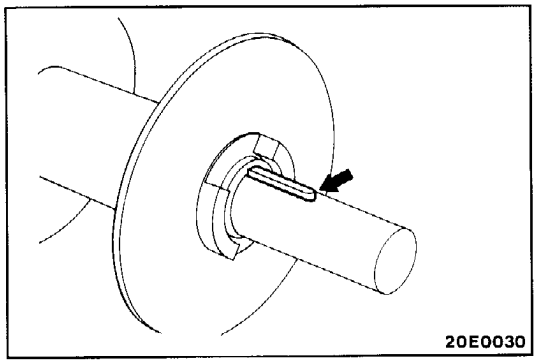


24. PRESSING-IN OF SIDE COVER BUSHING

Using the special tools, press-fit the bushing into the side cover, while making sure that the oil holes are in alignment.

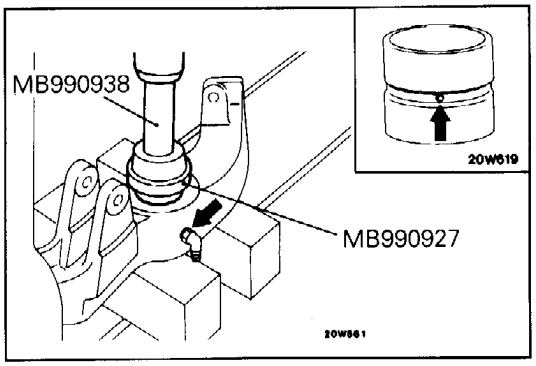


22. PRESSING-IN OF DRUM BUSHING



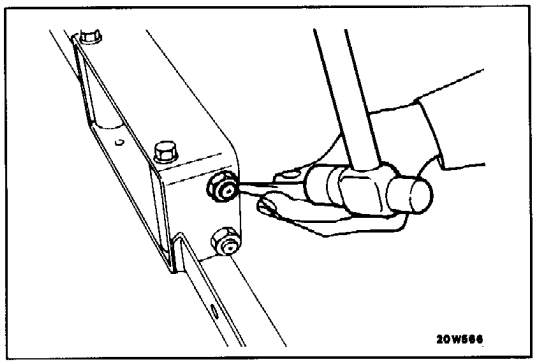
19. INSTALLATION OF DRUM SHAFT KEY

Install the key to the drum shaft channel so that the round end of the key is facing outside.



17. PRESSING-IN OF SHIFT LOCK BRACKET BUSHING

Using the special tools, press-fit the bushing into the drum bracket, while making sure that the grease holes are in alignment.



2. INSTALLATION OF ROPE GUIDE LOWER ROLLER/1. ROPE GUIDE UPPER ROLLER

Caulk the mounting nut of the rope guide upper and lower rollers with a punch.

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INTERIOR

CONTENTS

E52ZA00AA

INTERIOR 52A

SUPPLEMENTAL RESTRAINT SYSTEM (SRS) 52B

NOTES

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INTERIOR

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REAR SEAT 21
FRONT SEAT BELT 24
REAR SEAT BELT 26

SUPPLEMENTAL RESTRAINT SYSTEM (SRS) – AIR BAG

(1) An SRS air bag for the driver's side seat is optional equipment in this vehicle.
(2) The SRS includes the following components: impact sensors, SRS diagnosis unit: SRS warning lamp, air bag module, clock spring, interconnecting wiring. Other SRS-related components (that may have to be removed/installed in connection with SRS service or maintenance) are indicated in the table of contents by an asterisk (*).

WARNING!

(1) Improper service or maintenance of any component of the SRS, or any SRS-related component, can lead to personal injury or death to service personnel (from inadvertent firing of the air bag) or to the driver (from rendering the SRS inoperative).
(2) Service or maintenance of any SRS component or SRS-related component must be performed only at an authorized MITSUBISHI dealer.
(3) MITSUBISHI dealer personnel must thoroughly review this manual, and especially its GROUP 52B – Supplemental Restraint System (SRS), before beginning any service or maintenance of any component of the SRS or any SRS-related component.

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SPECIFICATIONS

GENERAL SPECIFICATIONS

E52CA--

Items		Specifications
Suspension seat		
Suspension mechanism		Coil spring type with shock absorber
Up-and-down movement stroke	mm (in.)	50 (2.0)
Body weight adjustment	kg (lbs.)	60–100 (132–220)
Seat height adjustment		3 steps
Heated seats		
Power consumption	W/[passenger compartment temperature at 20°C (68°F)]	
HIGH		48.4
LOW		12.1
Termostat working temperature	°C (°F)	
ON →OFF		35–45 (95–113)
OFF →ON		25–35 (77–95)

SERVICE SPECIFICATIONS

E52CB--

Items		Specifications
Standard value		
Heated seats		
Seatback heater resistance (between terminals)	Ω/[passenger compartment temperature at 20°C (68°F)]	Approx. 5.8
Seat cushion heater resistance (between terminals)	Ω/[passenger compartment temperature at 20°C (68°F)]	
Between terminals 1 and 3		Approx. 7.1
Between terminals 2 and 3		Approx. 7.4
Between terminals 1 and 2		Approx. 0.4

SPECIAL TOOLS

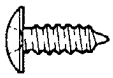
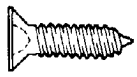
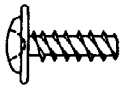
E52DA--

Tool	Number	Name	Use
	MB990784	Ornament remover	Removal of switch trim, etc.
	MB990826	Torque wrench	Removal and installation of special screw

INSTRUMENT PANEL

E52GAAL

For installation of the instrument panel, the bolts and screws described below are used. They are indicated by symblos in the illustration.

Name	Symbol	Size mm (in.) (D × L)	Colour	Shape
Tapping screw	A	5 × 12 (0.20 × 0.47)	–	
	B	5 × 16 (0.20 × 0.62)	–	
	C	5 × 16 (0.20 × 0.62)	Black	
	D	5 × 20 (0.20 × 0.79)	Black	
	E	5 × 20 (0.20 × 0.79)	Black	
	F	4 × 10 (0.16 × 0.39)	Black	
	G	5 × 12 (0.20 × 0.47)	–	
	H	5 × 16 (0.20 × 0.62)	–	
	I	5 × 20 (0.20 × 0.79)	–	
	J	5 × 25 (0.20 × 0.98)	–	
Washer assembled screw	K	5 × 12 (0.20 × 0.47)	–	
	L	5 × 20 (0.20 × 0.79)	Black	
Washer assembled bolt	M	8 × 20 (0.31 × 0.79)	–	
Machine screw	N	4 × 8 (0.16 × 0.31)	–	
	O	4 × 12 (0.16 × 0.47)	Black	
Cap installed screw	P	5 × 16 (0.20 × 0.62)	–	
Nut	Q	6 (0.24)	–	19N0001

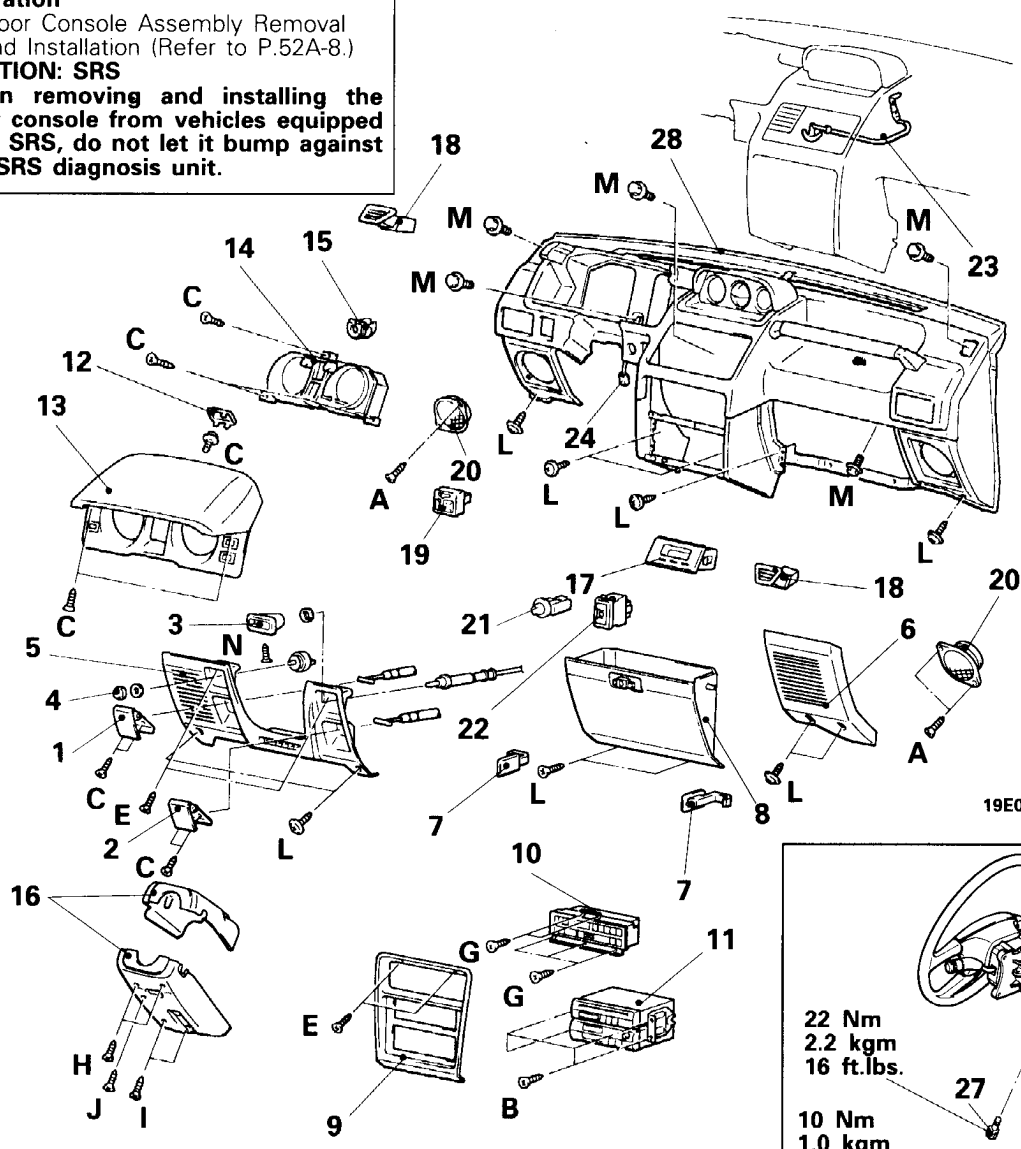
D = Thread diameter
L = Effective thread length

REMOVAL AND INSTALLATION

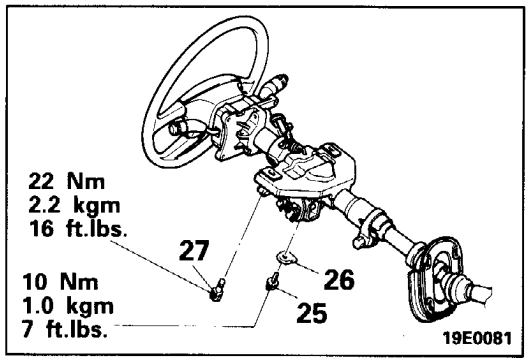
E52GB--

Pre-removal and Post-installation Operation
- Floor Console Assembly Removal and Installation (Refer to P.52A-8.)

CAUTION: SRS
When removing and installing the floor console from vehicles equipped with SRS, do not let it bump against the SRS diagnosis unit.



19E0058



19E0081

Removal steps

1. Hood lock release handle
2. Fuel filler door lock release handle
3. Idle control knob
4. Headlamp leveling switch
5. Instrument under cover
6. Instrument corner cover
7. Glove box stopper
8. Glove box assembly
9. Centre panel A
10. Heater control assembly
11. Radio or audio
12. Meter hood plug
13. Meter bezel assembly
14. Combination meter
15. Speedometer cable adapter <Vehicles built up to October, 1993>
16. Column cover
17. Clock
18. Side defroster garnish
19. Door mirror control switch
20. Front speaker
21. Rheostat
22. Rear wiper and washer switch
23. Ventilation control wire
24. Harness connector
25. Special screw
26. Special washer
27. Steering column installation bolts
28. Instrument panel assembly

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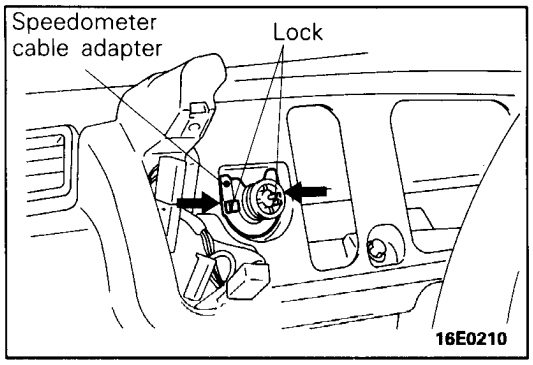

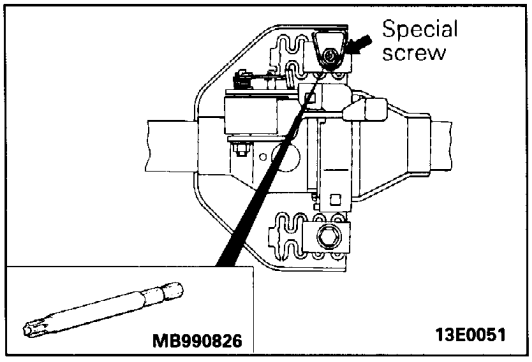

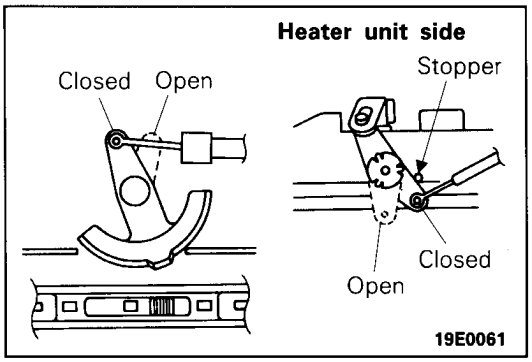

SERVICE POINTS OF REMOVAL E52GCAY

15. REMOVAL OF SPEEDOMETER CABLE ADAPTER <Vehicles built up to October, 1993>

(1) Disconnect the speedometer cable at the transmission end of the cable.
(2) Remove the lock of the sppedometer cable adapter from the instrument panel.
(3) Pull the speedometer cable slightly toward the vehicle interior, and then remove the sppedometer cable adapter.

25. REMOVAL OF SPECIAL SCREW

Steering column assembly is installed with a special screw. Remove it by using the special tool.

SERVICE POINTS OF INSTALLATION E52GEAI

23. INSTALLATION OF VENTILATION CONTROL WIRE

(1) Set the cool air bypass dial to the closed position.
(2) Close the cool air bypass lever at the heater unit side (lever is lightly hit against the stopper).
(3) Install the ventilation control wire and fix it securely with the clip.

25. INSTALLATION OF SPECIAL SCREW

Tighten the special screw using the special tool.

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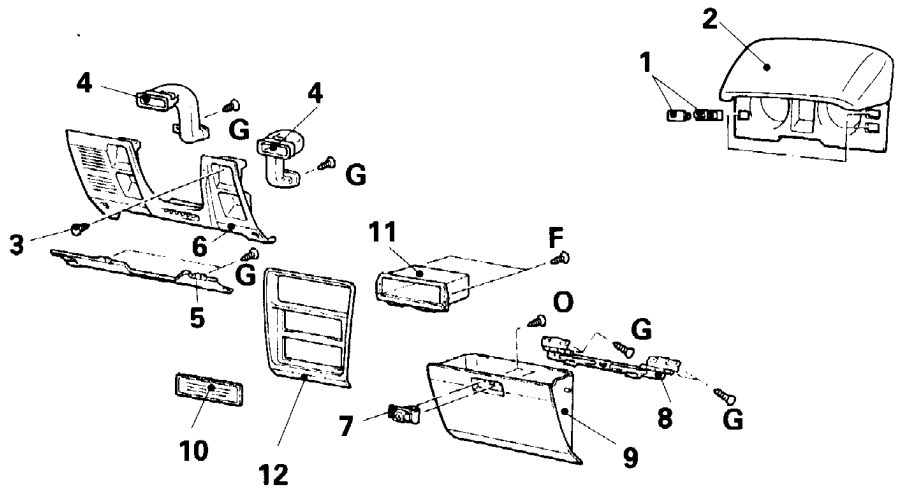
DISASSEMBLY AND REASSEMBLY

E52GF--



19E0059

Meter bezel assembly disassembly steps

1. Switch or plug
2. Meter bezel

Instrument under cover disassembly steps

3. Plug
4. Lap heater duct
5. Instrument under cover frame
6. Instrument under cover

Glove box assembly disassembly steps

7. Glove box lock
8. Glove box hinge
9. Glove box

Centre panel A disassembly steps

10. Radio plug
11. Box
12. Centre panel A

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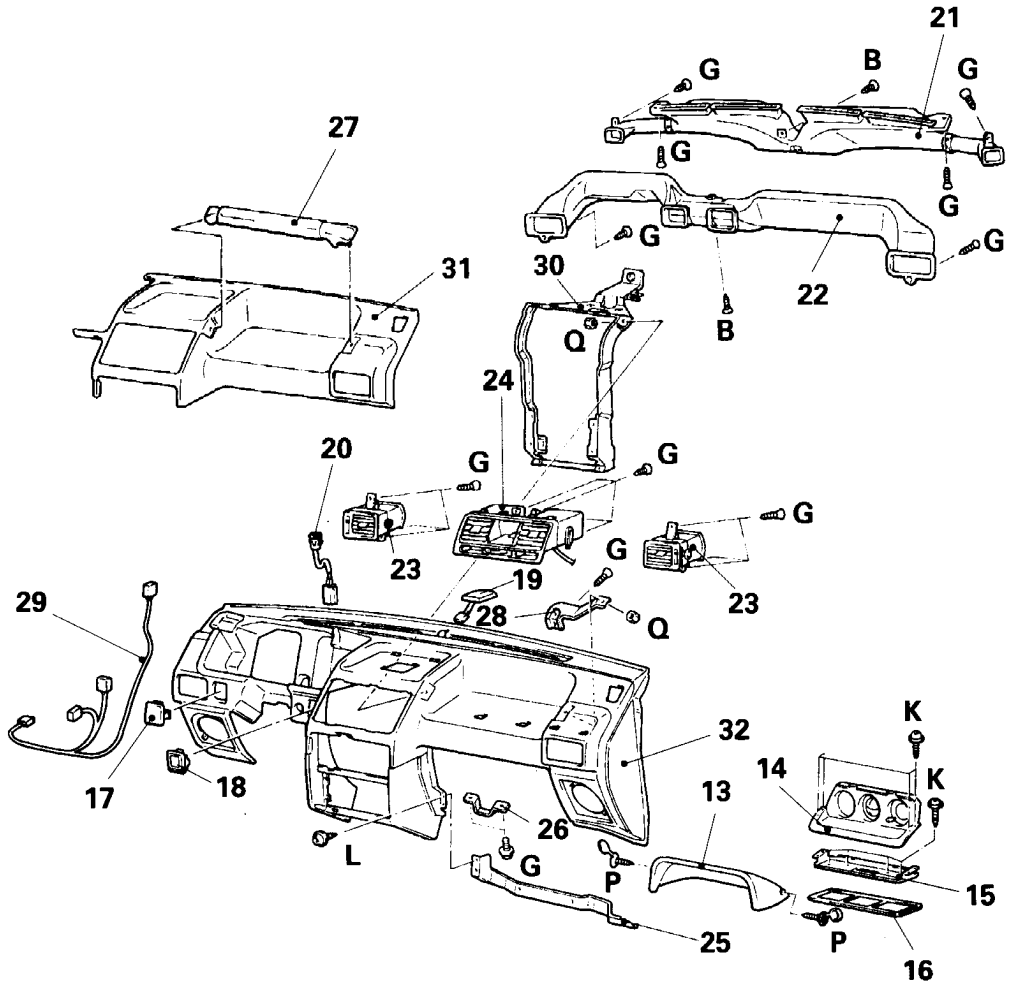


19E0059

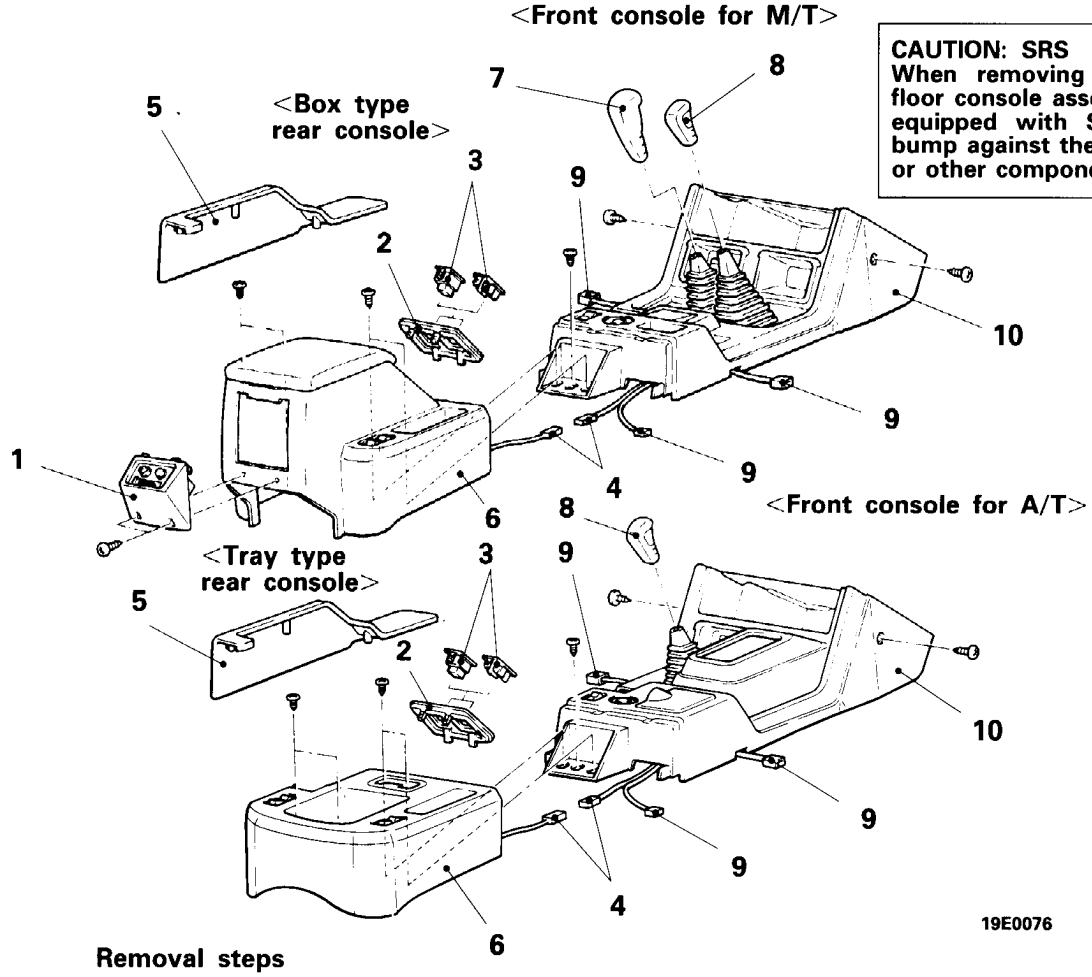
Instrument panel assembly disassembly steps

13. Meter hood
14. Multi meter
15. Meter bracket
16. Instrument panel mat <Vehicles without multi meter>
17. Plug
18. Hole cover
19. Geomagnetic sensor
20. Photo sensor
21. Side defroster duct and defroster nozzle assembly
22. Distribution duct
23. Side air outlet
24. Centre air outlet
25. Glove box frame
26. Glove box striker
27. Assist grip
28. Assist grip bracket
29. Instrument panel wiring harness
30. Instrument panel reinforcement
31. Instrument panel pad
32. Instrument panel

FLOOR CONSOLE

REMOVAL AND INSTALLATION

E52HA--



CAUTION: SRS
When removing and installing the floor console assembly from vehicles equipped with SRS, do not let it bump against the SRS diagnosis unit or other components.

Removal steps

1. Rear heater control assembly
2. Switch panel
3. Suspension control switch or hole cover
4. Rear console harness connector
5. Side panel A
6. Rear console assembly
7. M/T shift lever knob
8. Transfer shift lever knob
9. Floor console harness connector

◆◆ 10. Front console assembly

SERVICE POINT OF REMOVAL

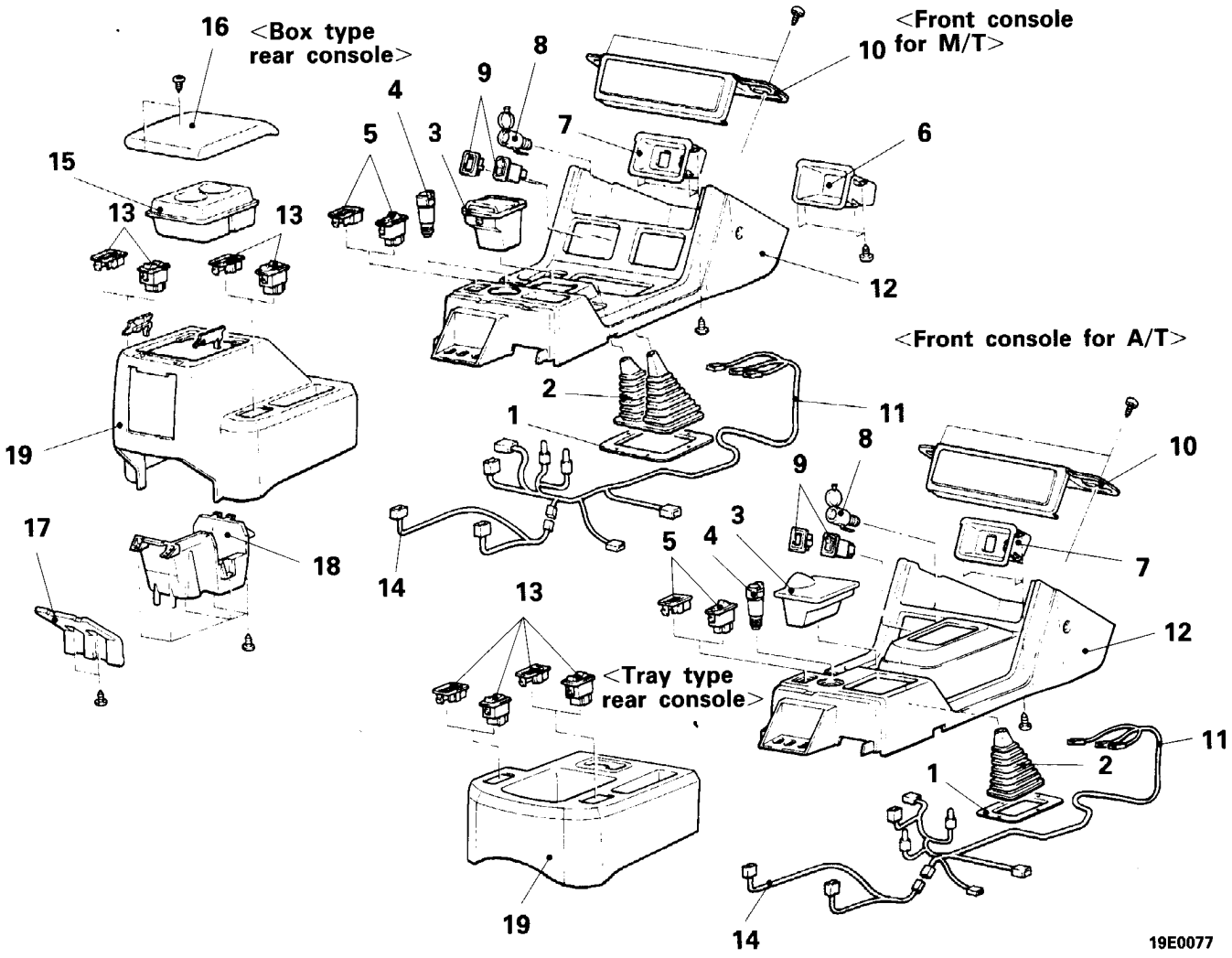
E52HBAI

10. REMOVAL OF FRONT CONSOLE ASSEMBLY

When removing the A/T front console assembly, set the A/T selector lever to "L".

DISASSEMBLY AND REASSEMBLY

E52HE--



Front console assembly disassembly steps

1. Boot reinforcement
2. Boot
3. Ashtray
4. Cigarette lighter
5. Rear heater fan switch or hole cover
6. Box
7. Plate
8. Accessory socket
9. Rear differential lock switch or hole cover
10. Accessory box cover
11. Floor console wiring harness
12. Front console

Rear console assembly disassembly steps

13. Heated seat switch or hole cover
14. Rear console wiring harness
15. Cup holder
16. Lid assembly
17. Rear console cover
18. Box
19. Rear console

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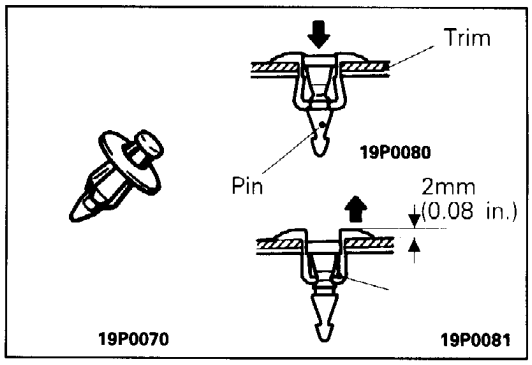
TRIMS

TRIM CLIP REMOVAL/INSTALLATION PROCEDURES

E52GIAA

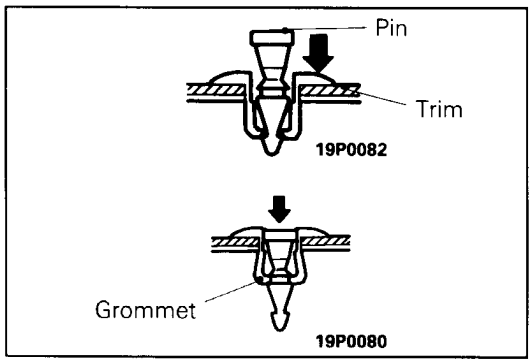
The type of clip shown in the illustration, which is used for the installation of trim, should be removed and installed by the following procedures described below.



REMOVAL

(1) Use a cross-tip (+) screwdriver to push inward the pin (at the centre of the trim clip) to a depth of about 2 mm (0.08 in.).
(2) Pull the trim clip outward to remove it.

Caution
Do not push the pin inward more than necessary because it may damage the grommet, or the pin may fall in, if pushed too far.



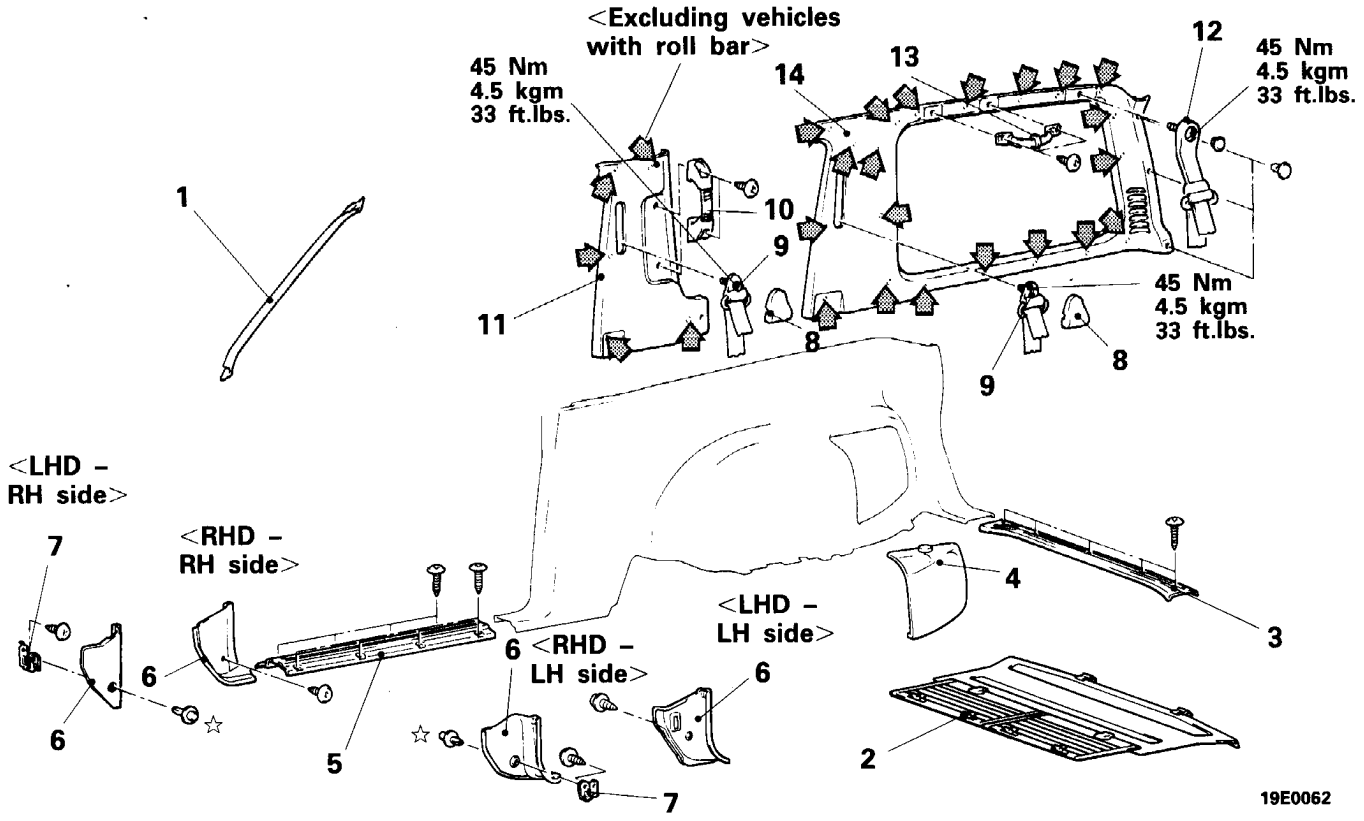
INSTALLATION

(1) With the pin pulled out, insert the trim clip into the hole in the trim.
(2) Push the pin inward until the pin's head is flush with the grommet.
(3) Check whether the trim is secure.

<Canvas Top and Metal Top>

REMOVAL AND INSTALLATION

E52JA-A



1. Front pillar edge trim <vehicles with partial trim>
2. Centre shelf assembly
3. Rear trimming plate
4. Jack lid

Cowl side trim removal steps

5. Front scuff plate
6. Cowl side trim
7. Cowl side bracket <RH side only for LHD, LH side only for RHD>

Centre pillar trim removal steps <Canvas Top>

8. Sash guide cover
9. Front seat belt sash guide
- Roll bar
  (Refer to GROUP 42 – Roll Bar.)

10. Assist grip
11. Centre pillar trim

Quarter trim upper removal steps <Vehicles with full trim (excluding Canvas Top)>

8. Sash guide cover <Front only>
9. Front seat belt sash guide
12. Rear seat belt sash guide
13. Assist grip
14. Quarter trim upper

NOTE
(1) ◀: Clip position
(2) ☆: Refer to trim clip removal/installation procedures (P.52A-10).

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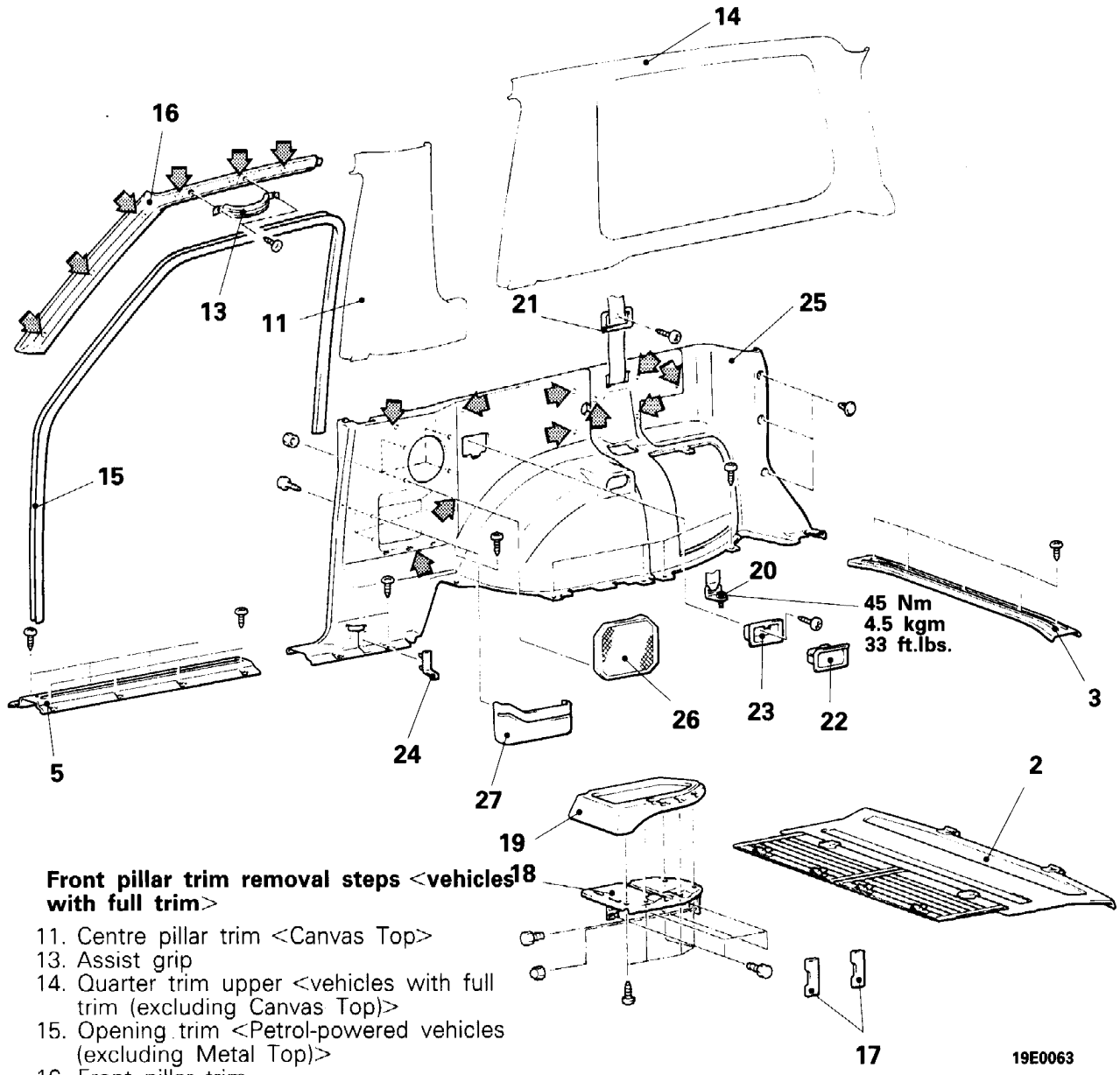


Front pillar trim removal steps <vehicles with full trim>

11. Centre pillar trim <Canvas Top>
13. Assist grip
14. Quarter trim upper <vehicles with full trim (excluding Canvas Top)>
15. Opening trim <Petrol-powered vehicles (excluding Metal Top)>
16. Front pillar trim

Side shelf removal steps

2. Centre shelf assembly
17. Shelf bracket cap
18. Side shelf bracket
19. Side shelf

Quarter trim lower removal steps

3. Rear trimming plate
5. Front scuff plate
14. Quarter trim upper <vehicles with full trim (excluding Canvas Top)>
19. Side shelf
- Roll bar (Refer to GROUP 42–Roll Bar)
- Link dumper
- Roof cover frame assembly } (Refer to GROUP 42–Canvas Top)

20. Rear seat belt anchor plate
21. Rear seat belt garnish
- Rear seat side back assembly <excluding Canvas Top> (Refer to P.52A-21.)

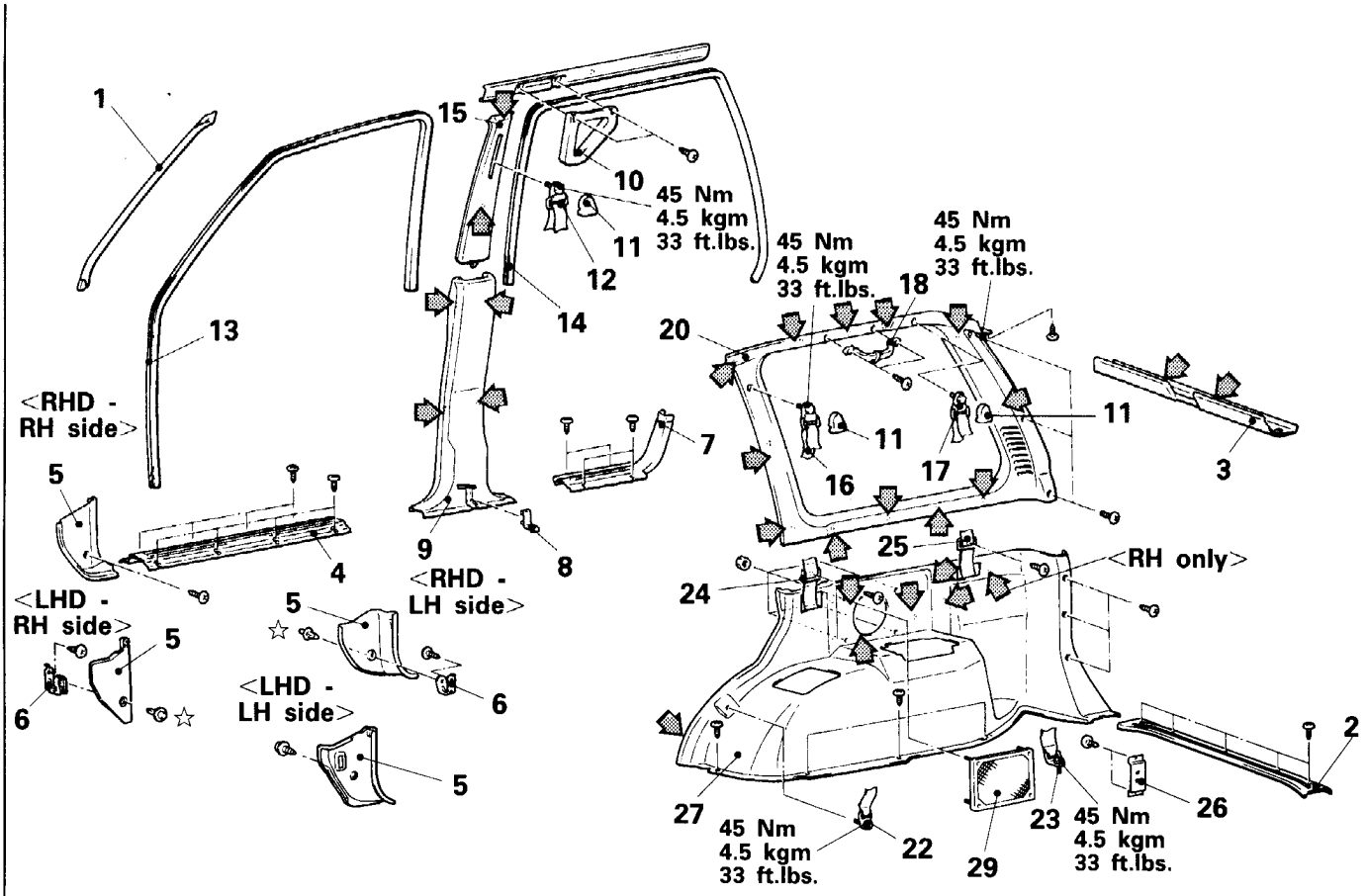
22. Rear ashtray case
23. Rear ashtray cover
24. Belt anchor cover
25. Quarter trim lower
26. Speaker garnish
27. Quarter pocket

NOTE
◀: Clip position

<Long Body>

REMOVAL AND INSTALLATION

E52JA-B



19E0064

1. Front pillar edge trim <vehicles with partial trim>
2. Rear trimming plate
3. Rear roof rail trim

Cowl side trim removal steps

4. Front scuff plate
5. Cowl side trim
6. Cowl side bracket <RH side only for LHD, LH side only for RHD>

Centre pillar trim removal steps

4. Front scuff plate
7. Rear scuff plate
8. Belt anchor cover
9. Centre pillar trim, lower
10. Grip
11. Sash guide cover
12. Front seat belt sash guide
13. Front opening trim } <Excluding petrol-powered vehicles with wide body>
14. Rear opening trim }
15. Centre pillar trim, upper <vehicles with full trim>

Quarter trim removal steps <vehicles without dual A/C and LH side of vehicles with dual A/C>

3. Rear roof rail trim
11. Sash guide cover
16. Second seat belt sash guide
17. Third seat belt sash guide
18. Assist grip
20. Quarter trim, upper
    - Third seat assembly (Refer to P.52A-21.)
2. Rear trimming plate
22. Second seat belt anchor plate
23. Third seat belt anchor plate
24. Second seat belt garnish
25. Third seat belt garnish
26. Cargo lamp bracket <LH side>
27. Quarter trim, lower
29. Speaker garnish

NOTE
(1) ◁: Clip position
(2) ☆: Refer to trim clip removal/installation procedures (P.52A-10).

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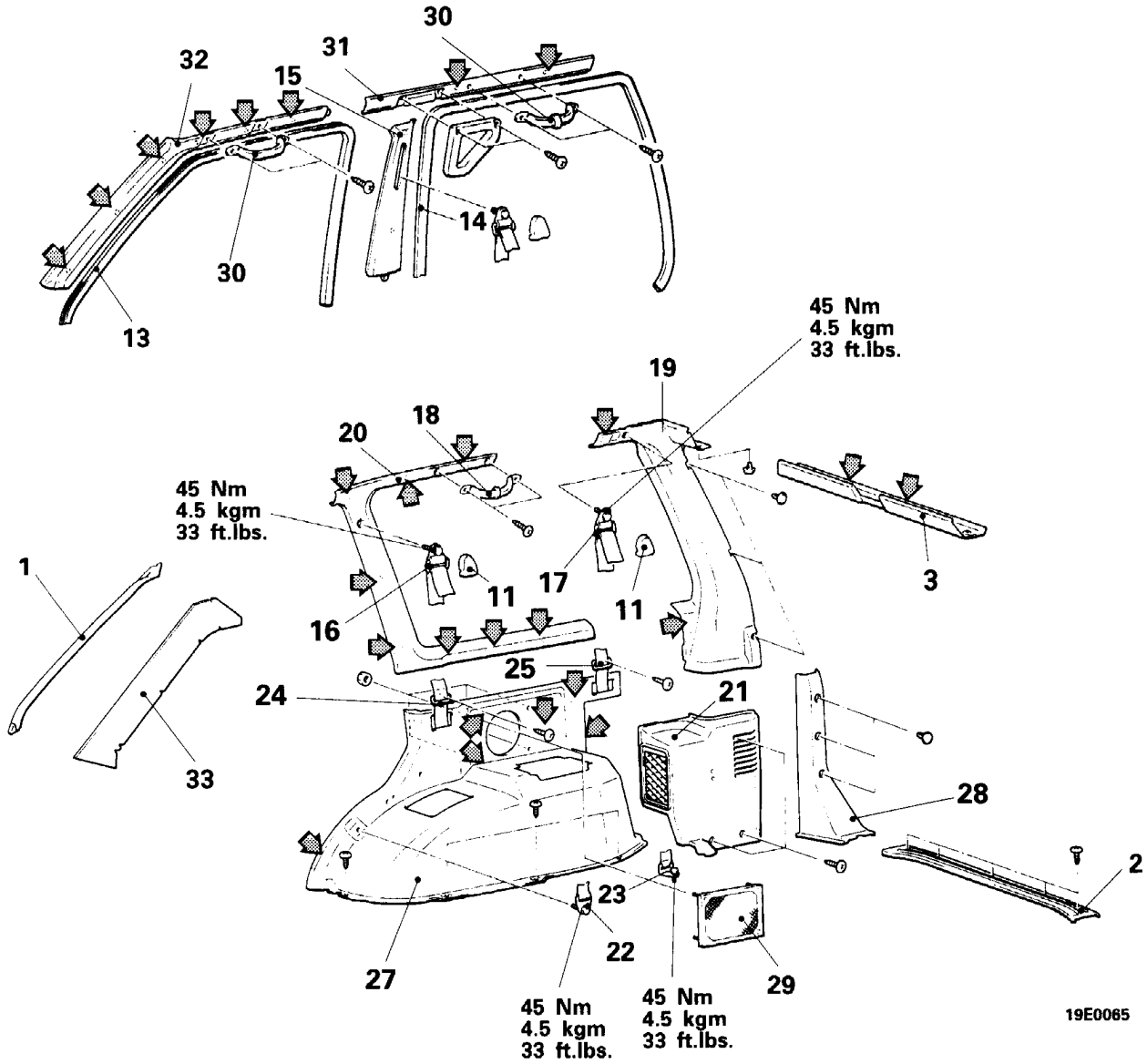

Quarter trim removal steps
<RH side of vehicles with dual A/C>

3. Rear roof rail trim
11. Sash guide cover
16. Second seat belt sash guide
17. Third seat belt sash guide
18. Assist grip
19. Quarter trim, upper (A/C)
20. Quarter trim, upper
- Third seat assembly (Refer to P.52A-21.)

2. Rear trimming plate
21. Rear air conditioner unit cover
22. Second seat belt anchor plate
23. Third seat belt anchor plate
24. Second seat belt garnish
25. Third seat belt garnish
27. Quarter tim, lower
28. Quarter trim, lower, rear
29. Speaker garnish

Front pillar trim and side roof rail trim removal steps
<vehicles with full trim>

13. Front opening trim } <Petrol-powered vehicles excluding wide>
14. Rear opening trim }
15. Centre pillar trim, upper
20. Quarter trim, upper
30. Assist grip
31. Side roof rail trim
32. Front pillar trim

Front pillar trim removal steps
<Vehicles with partial trim>

1. Front pillar edge trim
13. Front opening trim
◆◆ 33. Front pillar trim

NOTE
◁: Clip position

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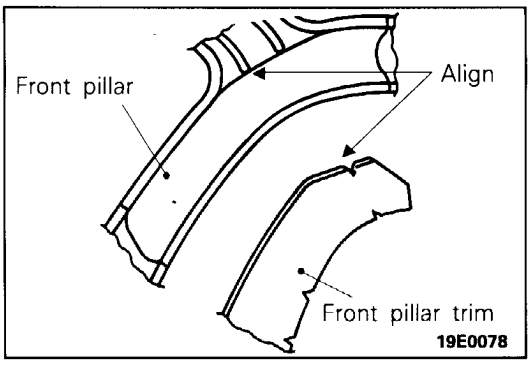
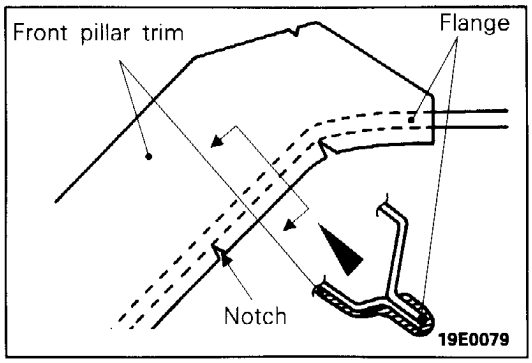


SERVICE POINTS OF INSTALLATION

33. INSTALLATION OF FRONT PILLAR TRIM

(1) Peel off the backing paper.
(2) Position the front pillar and the top of the trim as shown in the illustration so that the notches are matched.



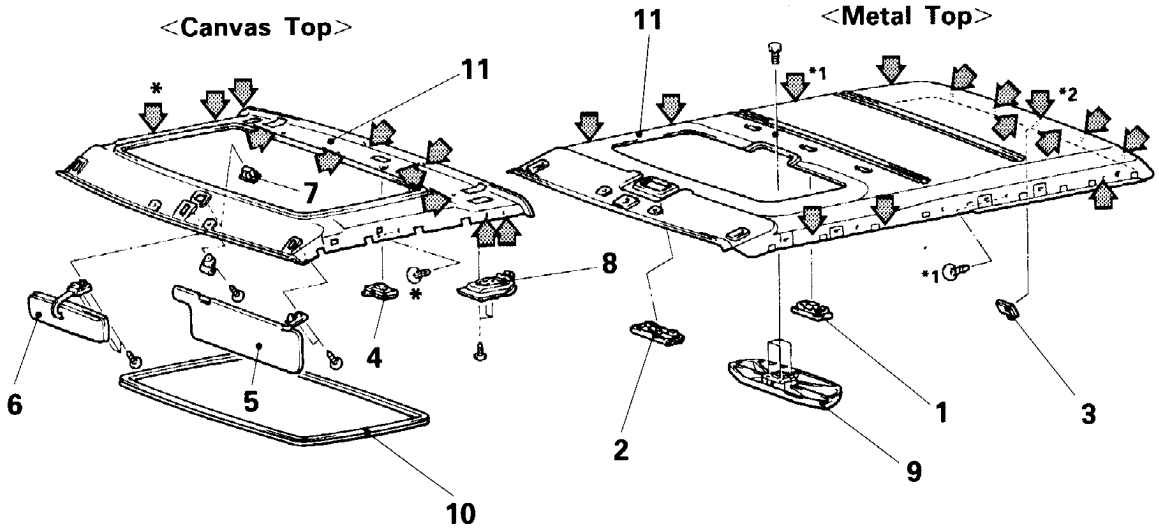
(3) Match the ends of the notches on the lower side of the trim with the front pillar flange ends.
(4) Apply the trim securely so that there are no wrinkles.
(5) Roll the trim onto the flange.

HEADLINING

E52IA-A

<Canvas Top and Metal Top>

REMOVAL AND INSTALLATION



19E0013

Removal steps <Canvas Top>

4. Room lamp
5. Sunvisors
6. Inside rear view mirror
7. Canvas roof switch <vehicles with Power Canvas>
8. Folding top lock assembly <vehicles with full trim>
- Centre pillar trim
- Front pillar trim

(Refer to P.52A-11.)

10. Headlining trim <vehicles with Power Canvas>
11. Headlining

NOTE <Canvas Top>
(1) ◀: Clip position
(2) * : Install these clips first to determine the position.

Removal steps <Metal Top>

1. Room lamp <vehicles without sunroof>
2. Room lamp, spot lamp <vehicles with sunroof> or map lamp <vehicles without sunroof>
3. Luggage compartment lamp <vehicles with sunroof>
5. Sunvisors
6. Inside rear view mirror
- Sunroof glass assembly (Refer to GROUP 42 – Sunroof)

9. Sunroof regulator assembly
- Quarter trim, upper
- Front pillar trim

(Refer to P.52A-11.)

10. Headlining trim <Vehicles with full trim> <vehicles with sunroof>
11. Headlining

NOTE <Metal Top>
(1) ◀: Clip position
(2)*1: Vehicles with full trim only
(3)*2: Vehicles without sunroof only

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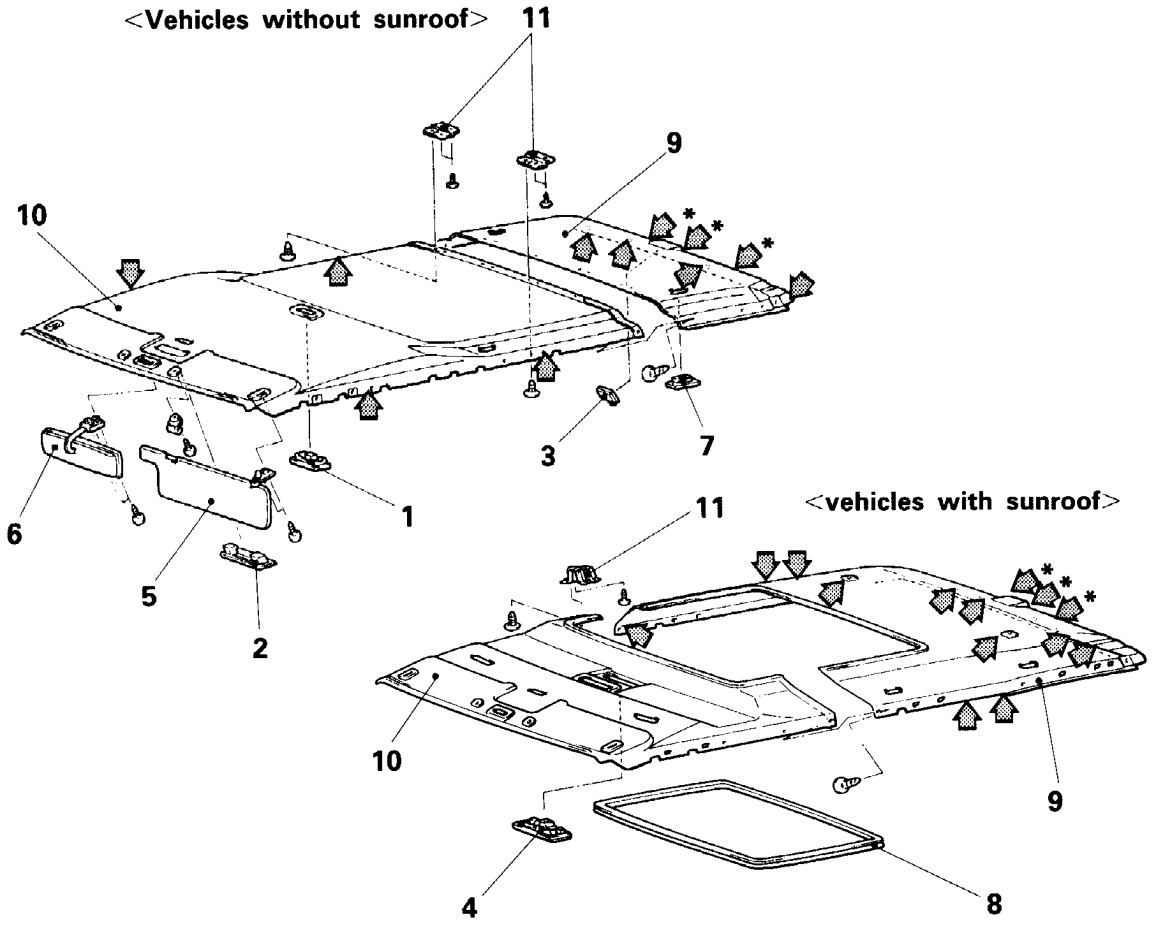
<Mid Roof>

E52IA-B

REMOVAL AND INSTALLATION



19E0014

Removal steps <Vehicles without sunroof>

1. Room lamp
2. Map lamp
3. Luggage compartment lamp
5. Sunvisors
6. Inside rear view mirror
7. Air outlet assembly
   <vehicles with dual A/C>
   - Rear roof rail trim
   - Quarter trim, upper
   - Centre pillar trim, upper
   - Side roof rail trim
   - Front pillar trim

   <Vehicles with full trim> (Refer to P.52A-13.)
9. Rear headlining
10. Front headlining
11. Joint bracket

Removal steps <vehicles with sunroof>

1. Room lamp
2. Map lamp
3. Luggage compartment lamp
4. Sunroof switch
5. Sunvisors
6. Inside rear view mirror
7. Air outlet assembly
   <vehicles with dual A/C>
   - Rear roof rail trim
   - Quarter trim, upper
   - Centre pillar trim, upper
   - Side roof rail trim
   - Front pillar trim

   <Vehicles with full trim> (Refer to P. 52A-13.
8. Headlining trim
9. Rear headlining
10. Front headlining
11. Joint bracket

NOTE

(1) ◁: Clip position

(2) * : Vehicles with partial trim

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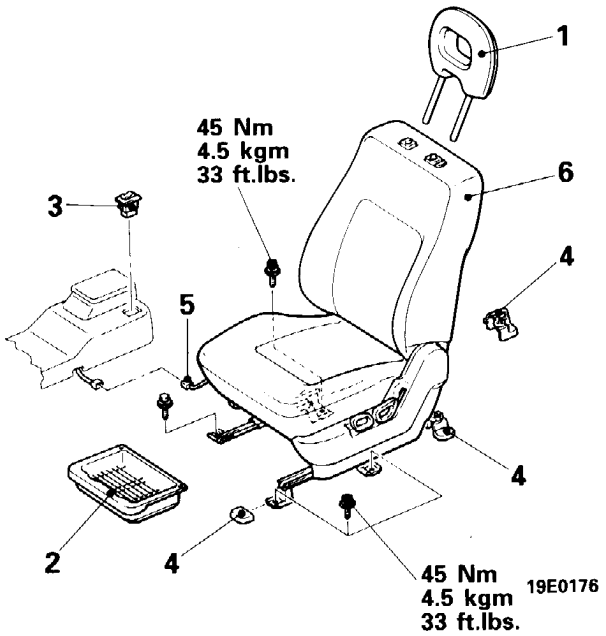
FRONT SEAT

REMOVAL AND INSTALLATION

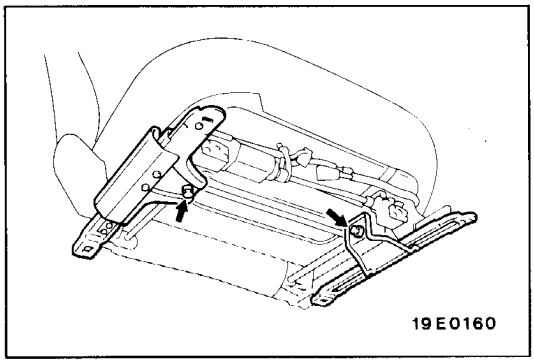
E52KA-A

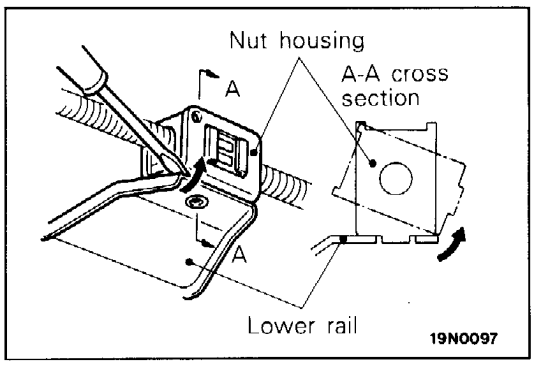


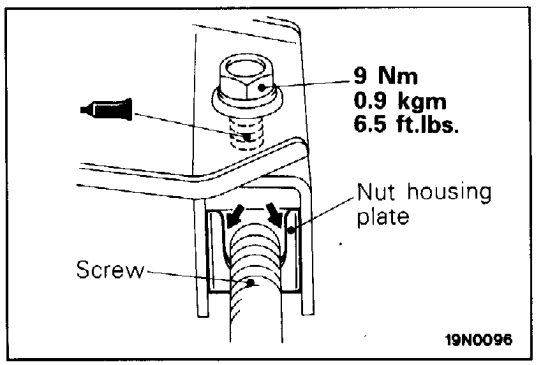
1. Headrestraint
2. Seat under tray
   <passenger's side only>
3. Heated seat switch

Front seat assmbly removal steps

◆◆ 4. Seat anchor covers
5. Heated seat harness connector
◆◆ 6. Front seat assembly







REMOVAL AND INSTALLATION POINTS OF FRONT SEAT ASSEMBLY WHEN THERE IS A MALFUNCTION IN THE POWER SEAT SLIDE MECHANISM E52AK01AA

If removal of the seat mounting bolt is impossible when there is a malfunction in the slide motor or the slide switch and the seat cannot slide, remove and install the front seat assembly by the following procedure.

(1) Remove the seat cushion assembly.
(Refer to P.52A-20-1.)
(2) Remove the power seat relay box.
(Refer to P.52A-20-1.)
(3) Remove the bolts below the seat cushion as shown in the illustration.

(4) Insert a flat-tipped screwdriver in between the lower rail and the nut housing, and detach the nut hosing from the lower rail hole and turn it.
(5) Slide the seat, and remove the seat mounting bolts.

(6) When reusing the power height adjuster assembly, apply specified adhesive to the mounting bolt, and tighten to the specified torque.

Specified adhesive: 3M Stud Locking Part No.4170 or equivalent

Caution
1. Match to the left and right nut housing positions.
2. Install so that the screw and nut housing plate do not cause interference.

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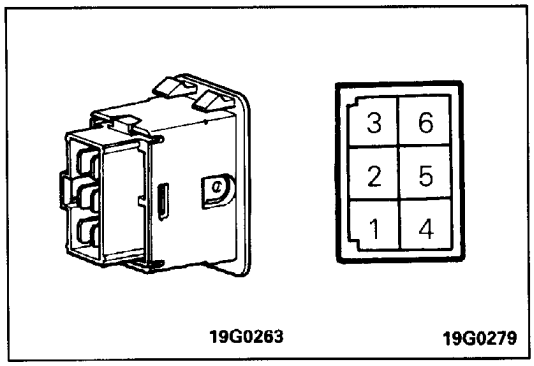
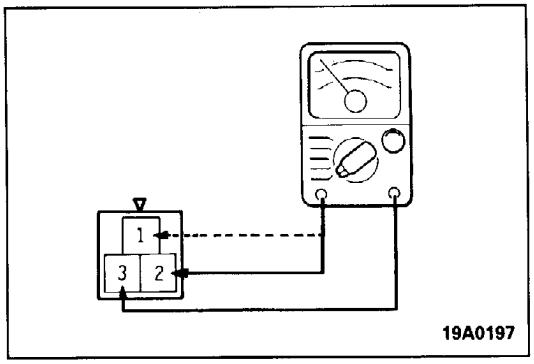
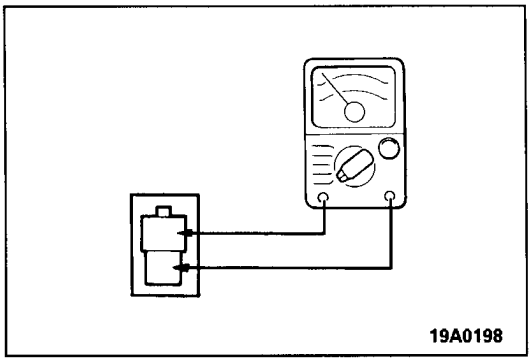
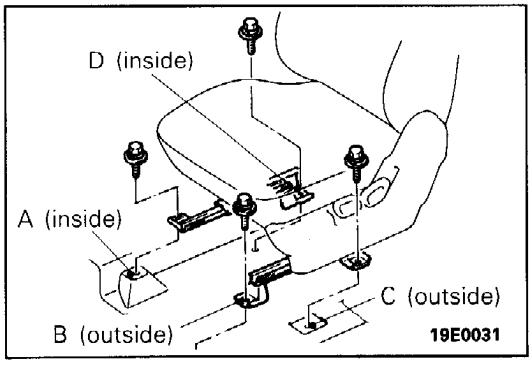








INSPECTION E52KCAC

HEATED SEAT SWITCH

Operate the switch to check continuity between terminals.

Terminal No. / Switch position	5	2	1	6	3	4
HI	○	○	○	○	○	ILL
LO	○	○	○	○		
OFF						

NOTE
○—○ indecates there is continuity between the terminals.

SEAT CUSHION HEATER

Measure the resistance between terminals.

Standard value [When passenger compartment temperature is 20°C (68°F)]:

Between terminals 1 and 3	**Approx. 7.1 Ω**
Between terminals 2 and 3	**Approx. 7.4 Ω**
Between terminals 1 and 2	**Approx. 0.4 Ω**

SEATBACK HEATER

Measure the resistance between terminals.

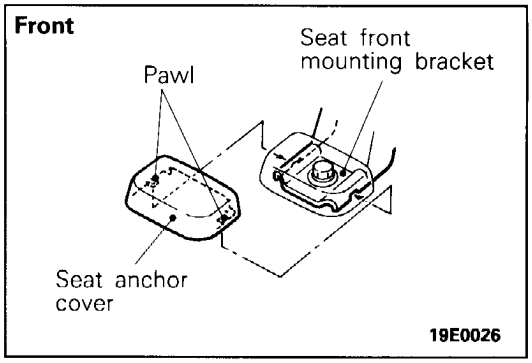
Standard value [When passenger compartment temperature is 20°C (68°F)]: Between terminals Approx. 5.8 Ω

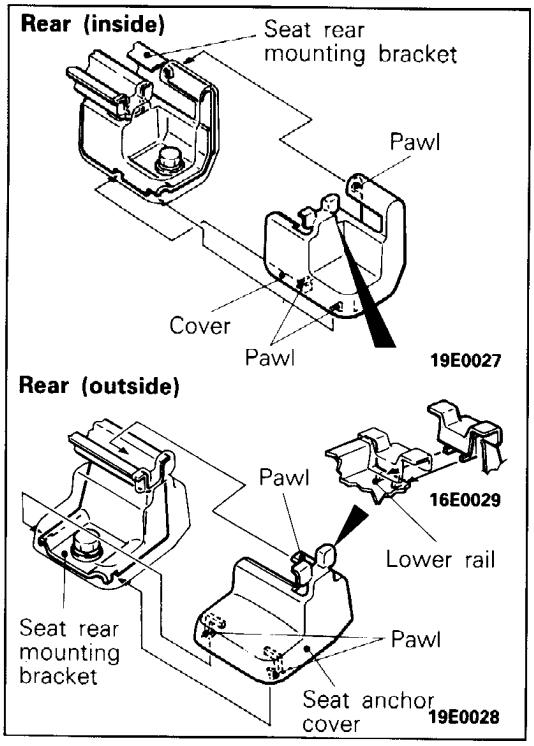
SERVICE POINTS OF INSTALLATION E52KDAN

6. INSTALLATION OF FRONT SEAT ASSEMBLY

(1) Install the lower rail so that it matches the left and right front seat mounting hole positions, and lock both sides of the seat adjustor.
(2) Provisionally tighten the seat mounting bolts in the order A, B, C, and D, and then tighten them to the specified torque.
(3) After installing the front seat assembly, check that the seat moves backward and forwards smoothly, and that the seat adjuster locks on both sides in all lock positions.

NOTE
The illustration shows the LH side seat.





4. INSTALLATION OF SEAT ANCHOR COVER

(1) Press down the front seat anchor cover from the top of the seat front mounting bracket, and hang the anchor cover tab on the bracket.

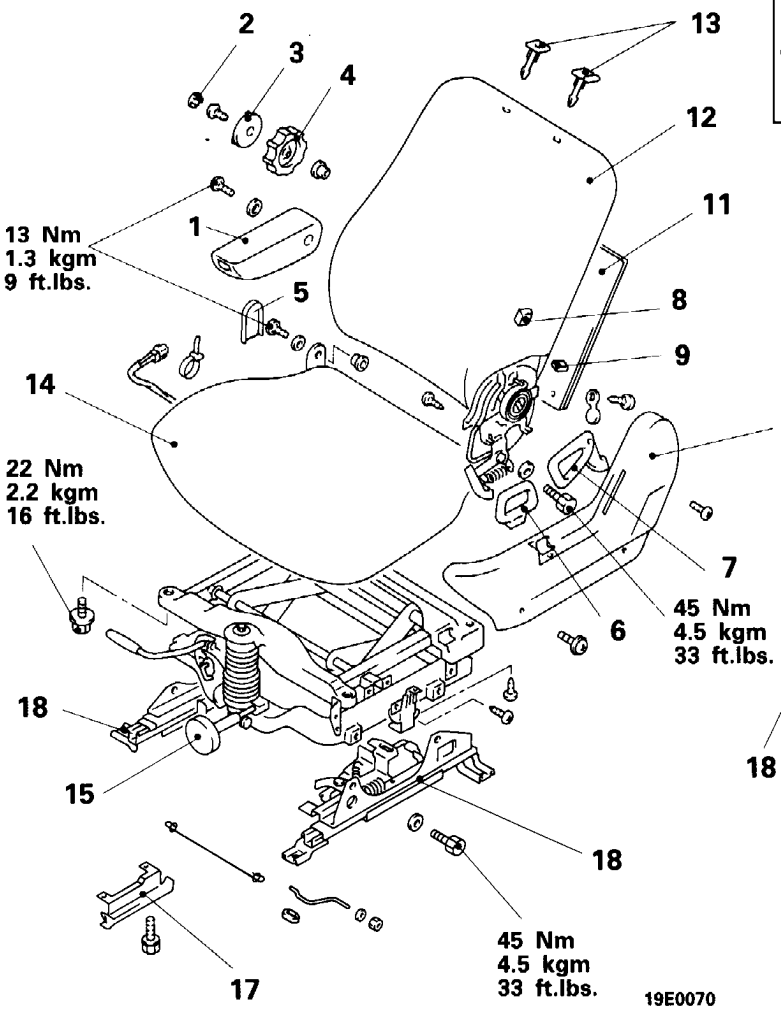
(2) Insert the rear seat anchor cover from the rear of the seat rear mounting bracket, and hang the anchor cover tab on the bracket while inserting into the lower rail.

NOTES

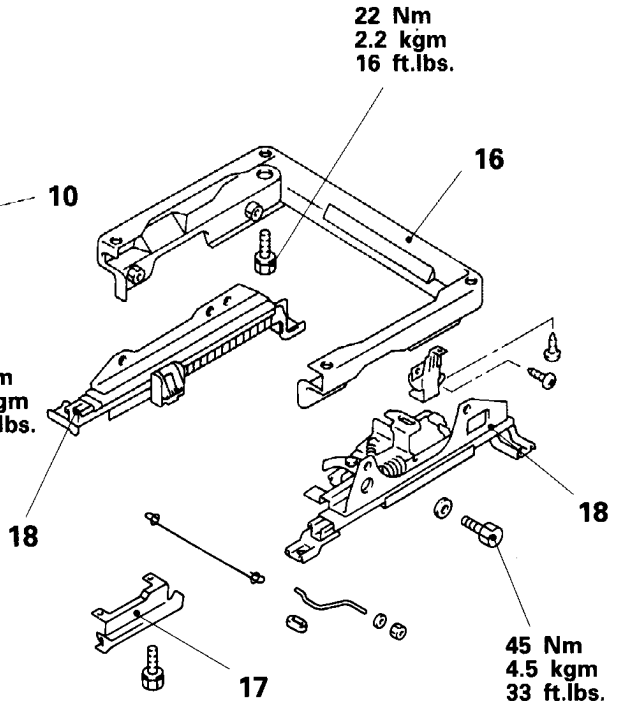
DISASSEMBLY AND REASSEMBLY <MANUAL SEAT>

E52KE-A

Pre-removal and Post-installation Operation
- Removal and Installation of Front inner seat belt assembly (Refer to P.52A-24.)

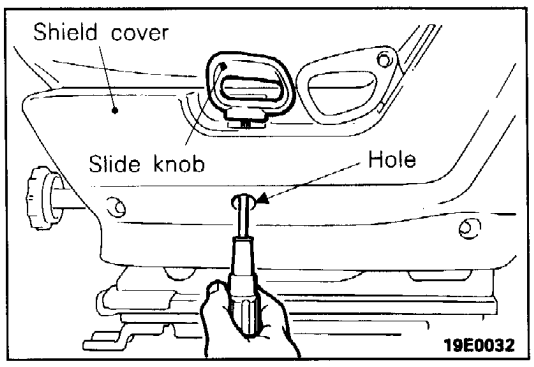


<Fixed seat type>



Disassembly steps

1. Armrest assmbly
2. Side support lever cap
3. Side support lever
4. Lumbar support lever
5. Free hinge protector
6. ◆Slide knob◆
7. Reclining knob
8. Reclining memory knob
9. Walk-in knob
10. Shield cover
11. Back pocket assembly
12. Seatback assembly
13. Headrestraint guide
14. Seat cushion assmbly
15. Suspension assembly
16. Leg assembly
17. Under tray bracket
18. Seat adjuster



SERVICE POINT OF DISASSEMBLY

E52KFDB

6. REMOVAL OF SLIDE KNOB

Pass a screwdriver through the shield cover hole and remove the slide knob mounting screw.

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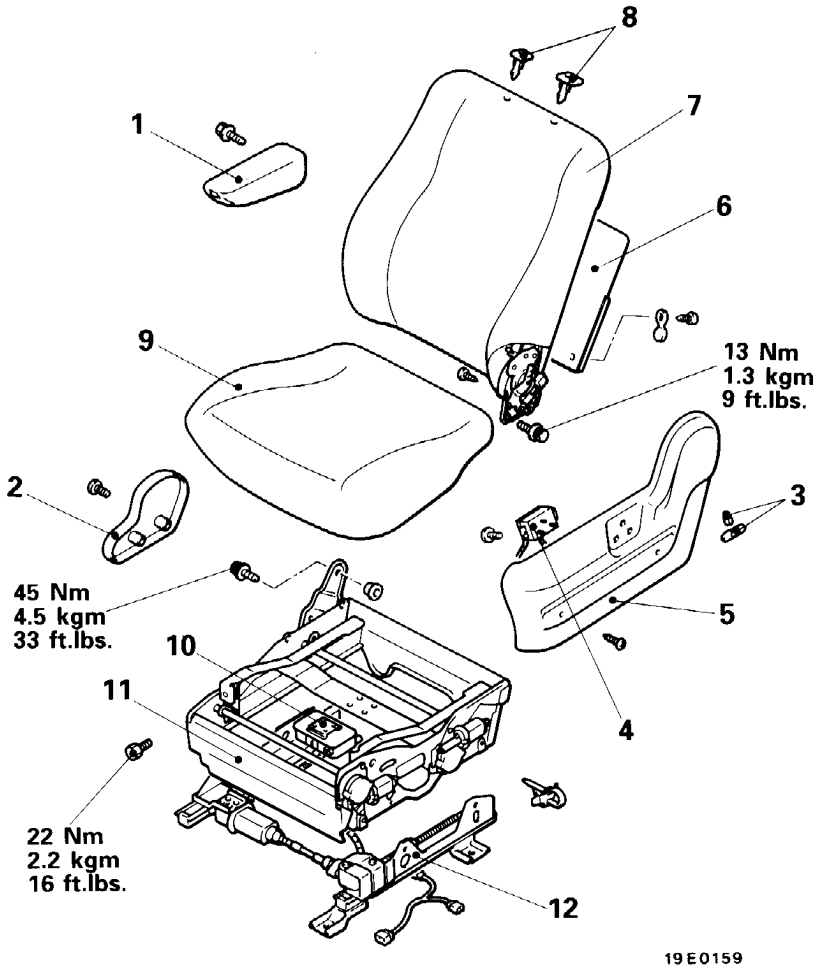
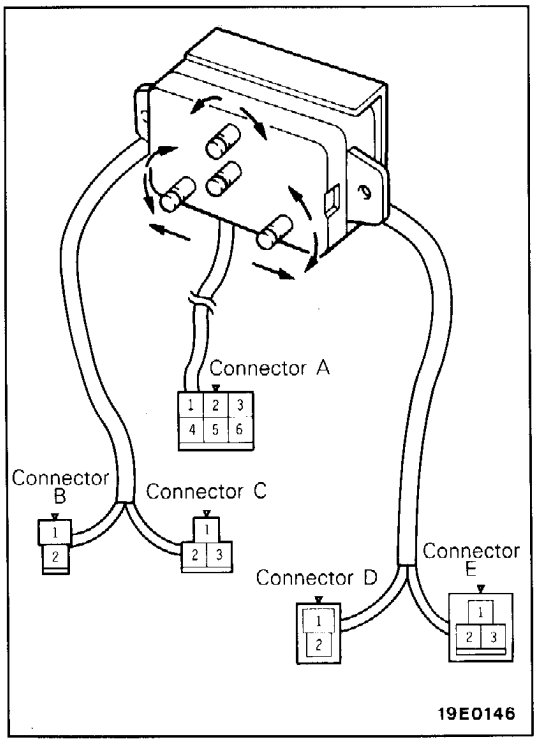
DISASSEMBLY AND REASSEMBLY <POWER SEAT>

Pre-removal and Post-installation Operation
- Removal and Installation of Front inner seat belt assembly (Refer to P.52A-24.)



Disassembly steps

1. Armrest assembly
2. Free hinge protector
3. Power seat lever
4. Power seat switch
5. Shield cover
6. Back pocket assembly
7. Seatback assembly
8. Headrestraint guide
9. Seat cushion assembly
10. Power seat relay box
11. Leg assembly
12. Power seat adjuster



INSPECTION

POWER SEAT SWITCH

Operate the power seat switch and check for continuity.

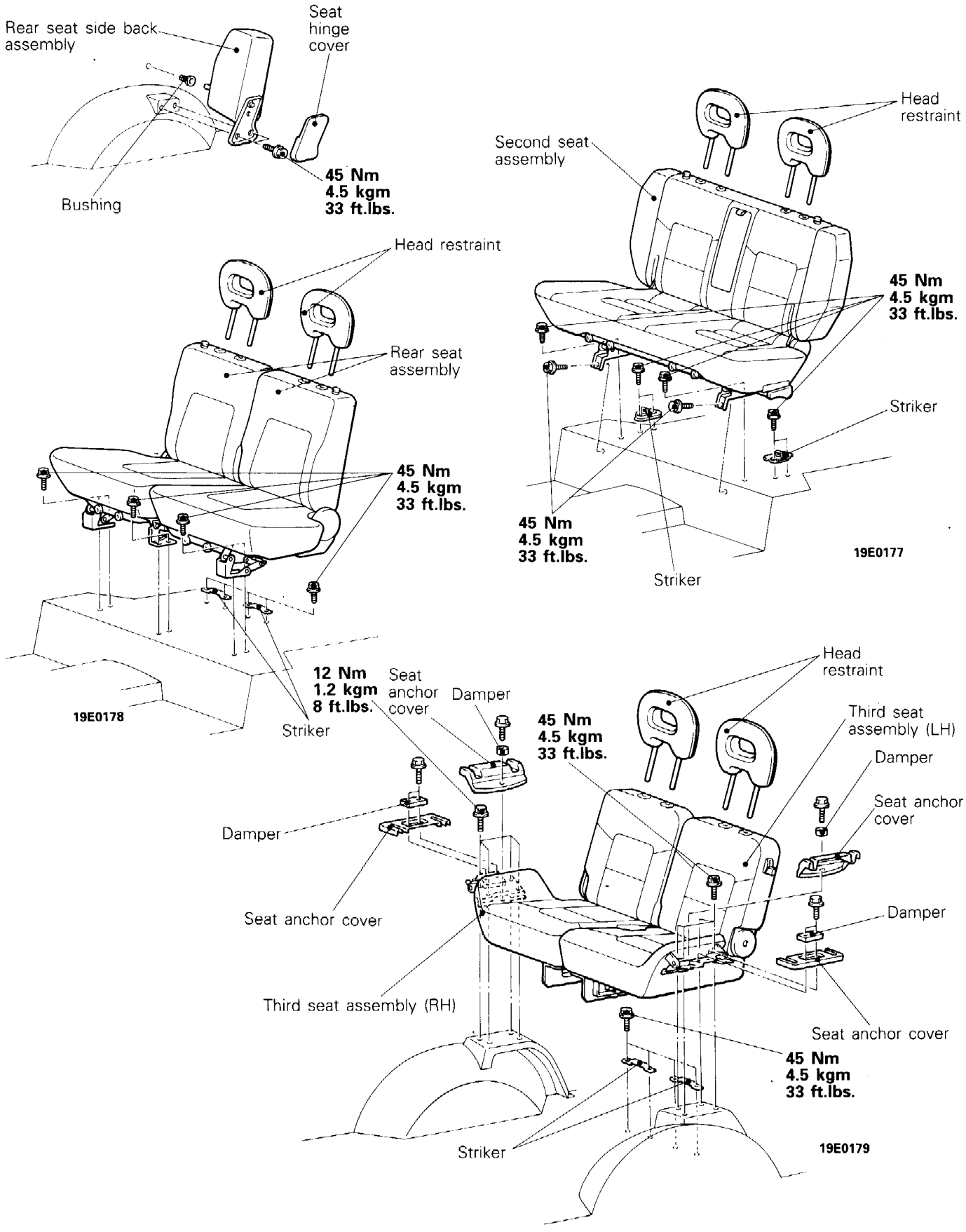
Switch position		Connector	A						B		C			D		E		
		Terminal No.	1	2	3	4	5	6	1	2	1	2	3	1	2	1	2	3
Reclining switch	Forward		○		○													
	Backward		○					○										
Slide switch	Forward		○	○														
	Backward		○				○											
Height switch (Front)	Up		○						○	○			○					
	Down		○						○			○						
Height switch (Rear)	Up		○											○	○			
	Down		○												○			○
All switches	OFF			○	○	○	○	○			○					○		

NOTE
○—○ indicates that there is continuity between the terminals.

REAR SEATS

REMOVAL AND INSTALLATION

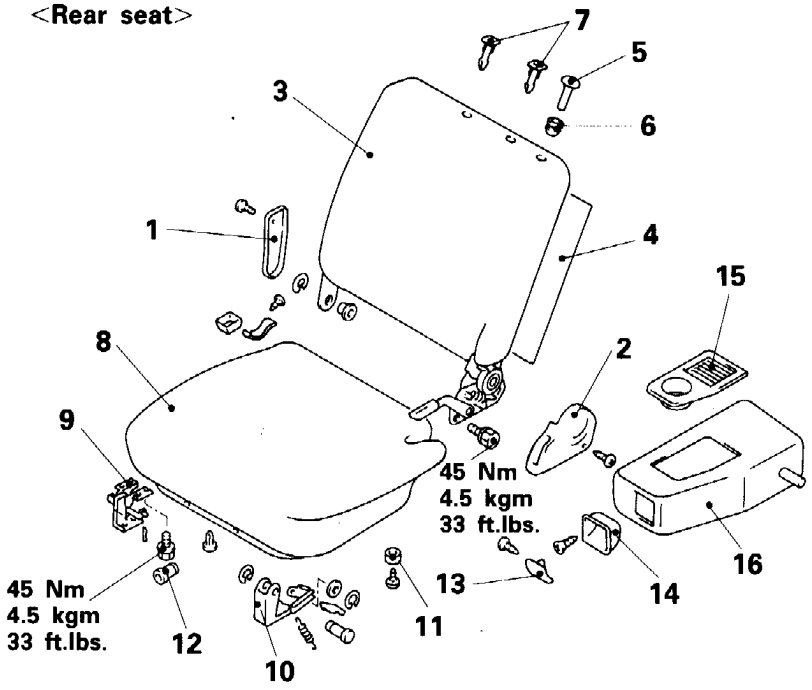
E52KA-B



DISASSEMBLY AND REASSEMBLY

E52KE-B

<Rear seat>



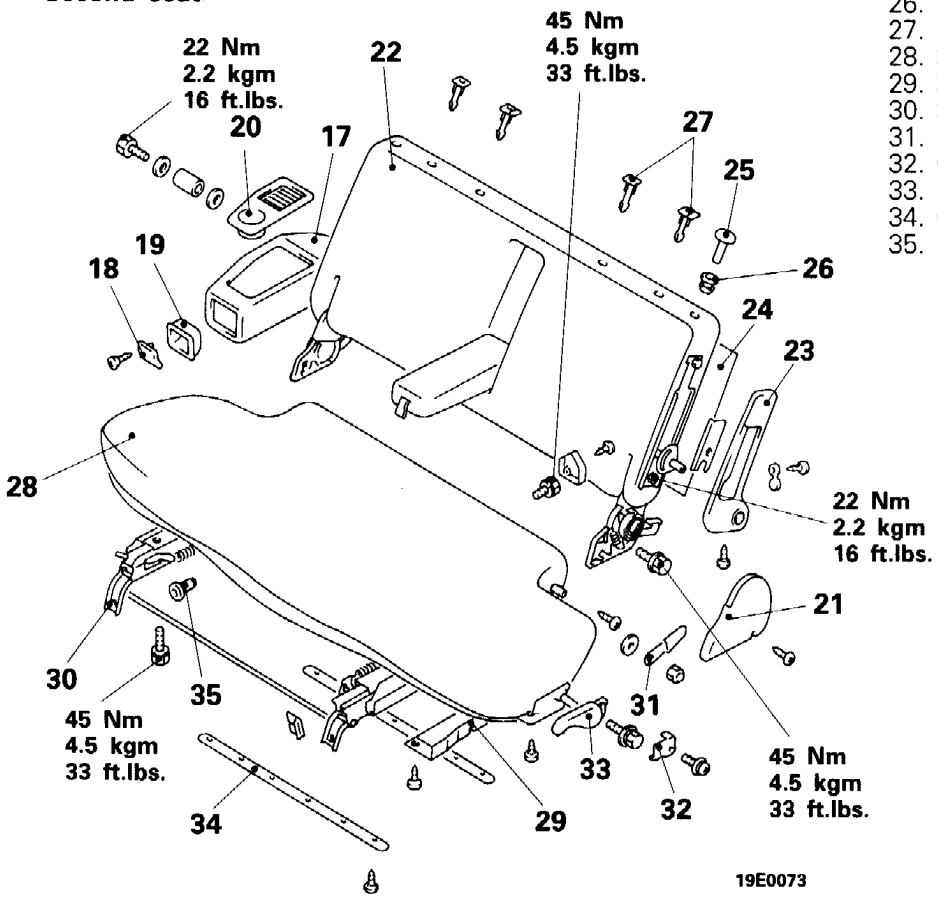
19E0072

Rear seat disassembly steps
1. Free hinge cover
2. Reclining cover
3. Seat back assembly
4. Seat back trim
5. Knob
6. Knob guide
7. Head restraint guide
8. Seat cushion assembly
9. Centre leg assembly
10. Leg and link assembly
11. Bumper
12. Head restraint guide

Rear seat back disassembly steps
13. Seat back knob
14. Seat back garnish
15. Seat back tray
16. Rear seat side back

Disassembly steps
17. Side back assembly
18. Seat back knob
19. Seat back garnish
20. Seat back tray
21. Reclining cover
22. Seat back assembly
23. Rail cover
24. Seat back trim
25. Knob
26. Knob guide
27. Head restraint guide
28. Seat cushion assembly
29. Slide leg cover
30. Seat adjuster
31. Full flat knob
32. Cover
33. Knob
34. Cushion trim moulding
35. Head restraint guide

<Second seat>



19E0073

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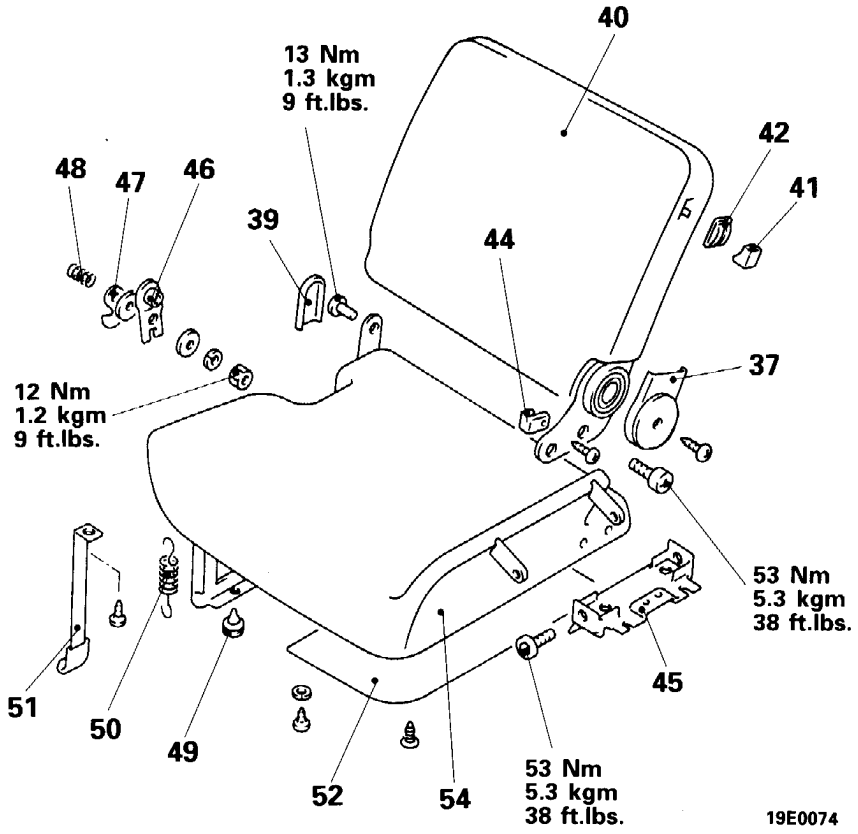
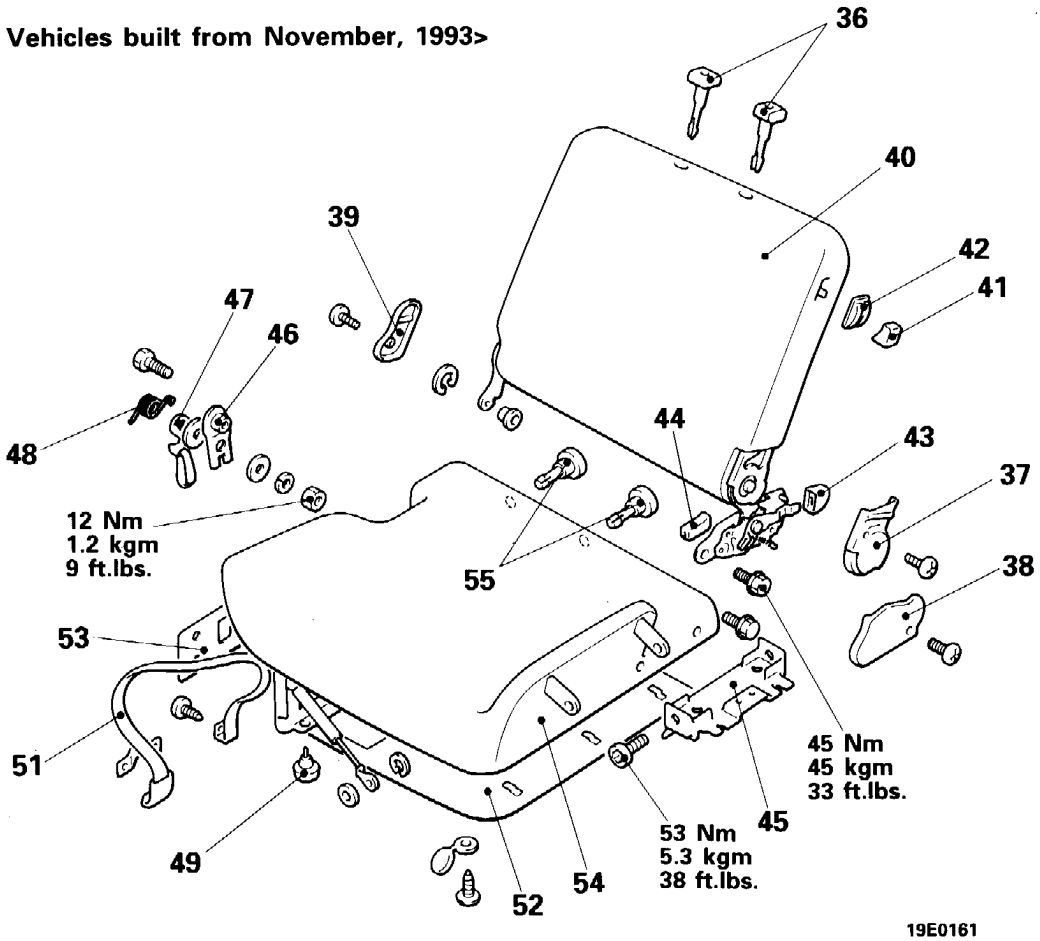
<Third seat – Vehicles built up to October, 1993>



Disassembly steps

36. Head restraint guide
37. Reclining cover
38. Reclining cushion cover
39. Free hinge protector
40. Seat back assembly
41. Knob
42. Garnish
43. Full flat knob
44. Seat belt protector
45. Attaching bracket
46. Lock plate
47. Catch assembly
48. Torsion spring
49. Bumper
50. Torsion spring
51. Strap assembly
52. Back trim
53. Cushion side trim
54. Seat cushion assembly
55. Head restraint guide

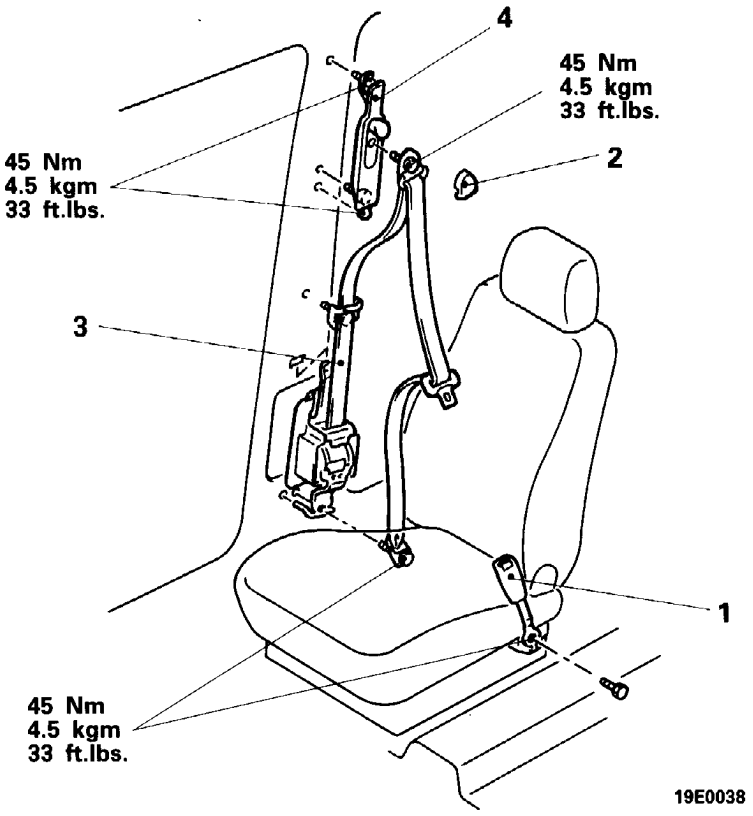
<Third seat – Vehicles built from November, 1993>



FRONT SEAT BELT

REMOVAL AND INSTALLATION

E52MA-A



◆◆ 1. Inner seat belt assmbly

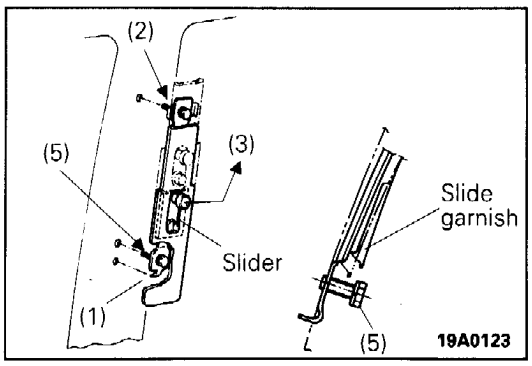
Removal steps

2. Sash guide cover <Canvas Top>
- Centre pillar trim
- Quarter trim, lower <Metal Top>
- Quarter trim, lower
- Quarter trim, upper <Long Body>
- Centre pillar trim, lower
- Centre pillar trim, upper

(Refer to P.52A-11, 13)

◆◆ 3. Outer seat belt assembly

◆◆ 4. Adjustable seat belt anchor <vehicles with full trim>



SERVICE POINTS OF INSTALLATION

E52MDAP

4. INSTALLATION OF ADJUSTABLE SEAT BELT ANCHOR

(1) Securely fit the tab of the adjustable seat belt anchor into the hole in the centre pillar.
(2) Provisionally tighten the installation bolt at the upper side.
(3) Lock the slider at the uppermost position.
(4) Raise the slide garnish to the upper side.
(5) Tighten the lower side mounting bolt to the specified torque.
(6) Lower the slide garnish and slider, and tighten the upper side mounting bolt to the specified torque.

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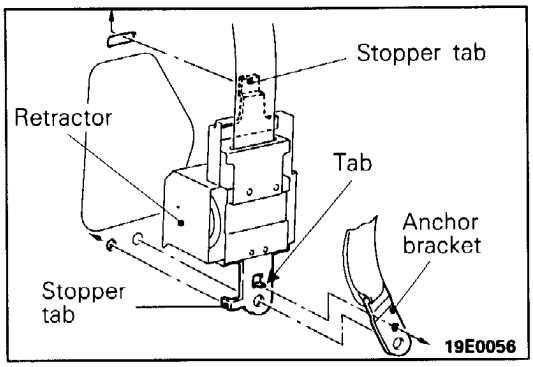
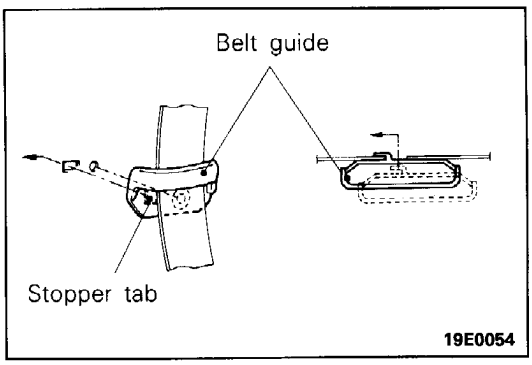
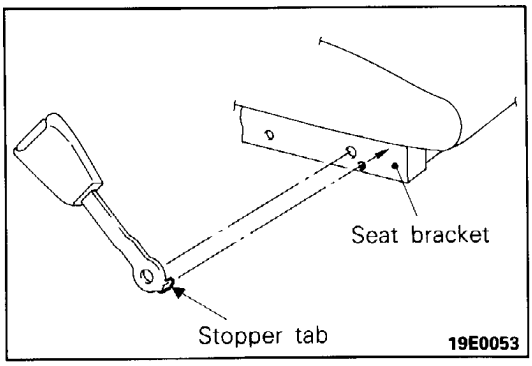


3. INSTALLATION OF OUTER SEAT BELT ASSEMBLY

(1) Securely insert the retractor stopper tab into the body hole.
(2) Securely insert the retractor bracket tab into the anchor bracket hole.



(3) Securely insert the belt guide tab into the body hole.



1. INSTALLATION OF INNER SEAT BELT ASSEMBLY

Securely insert the stopper tab into the seat bracket hole.

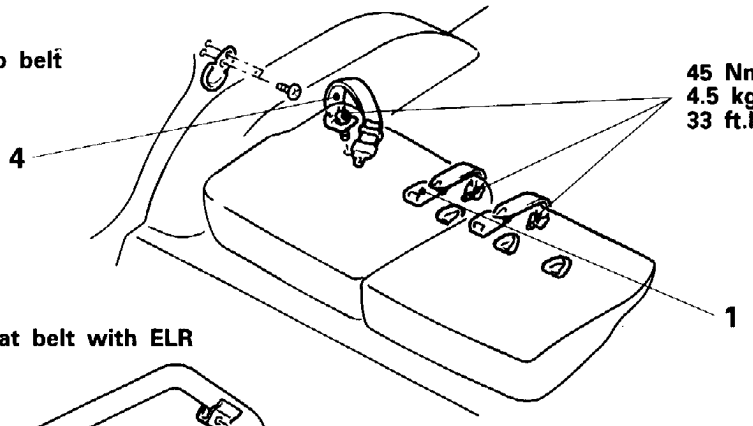
REAR SEAT BELT

E52MA-B

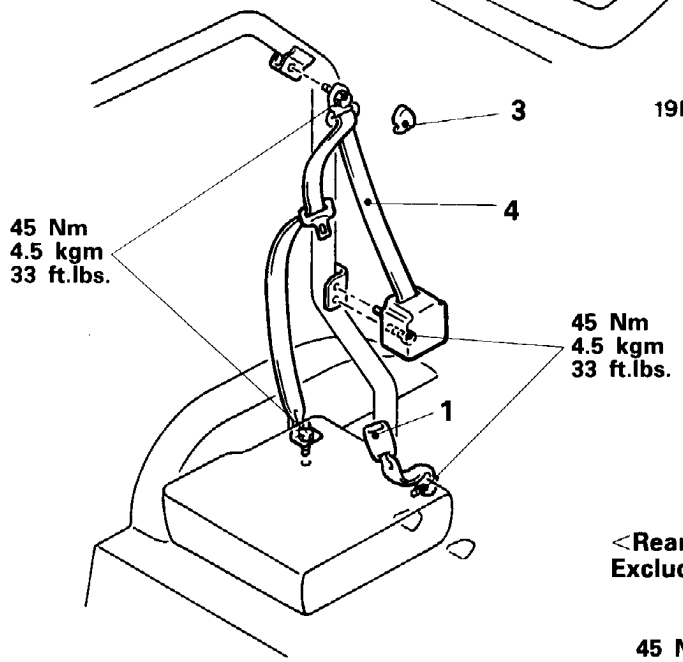
REMOVAL AND INSTALLATION

<Rear seat belt – Canvas Top>

2-point lap belt



3-point seat belt with ELR



19E0060

1. Inner seat belt assembly
4. Outer seat belt assembly

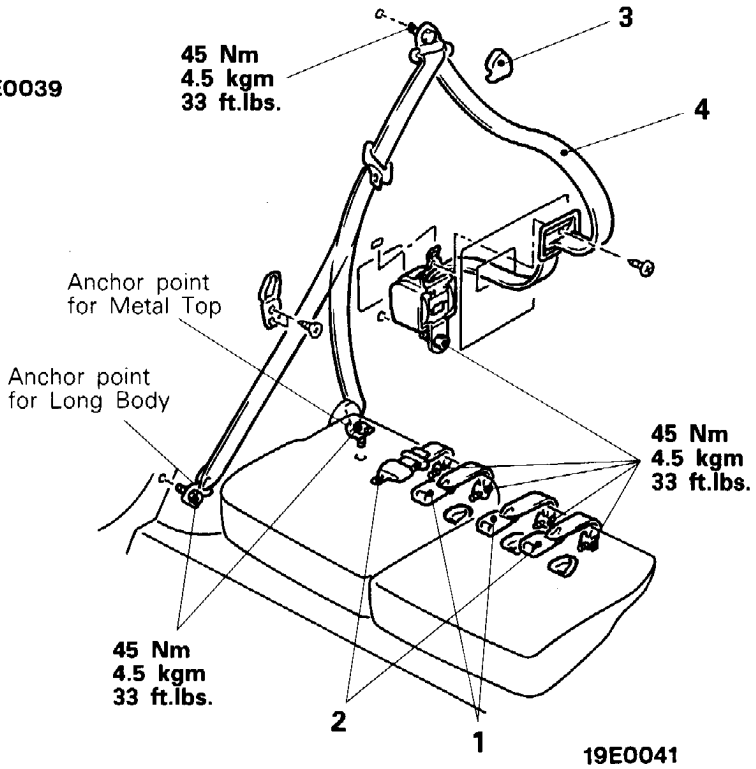
19E0039

1. Inner seat belt assembly

Outer seat belt assembly removal steps

3. Sash guide cover
◆◆ 4. Outer seat belt assembly

<Rear or second seat belt – Excluding Canvas Top>



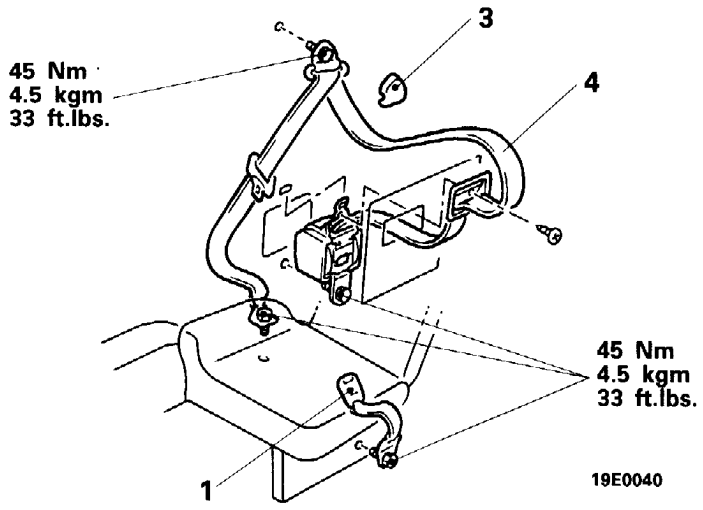
19E0041

1. Inner seat belt assembly
2. Centre seat belt assembly

Outer seat belt assembly removal steps

3. Sash guide cover <Excluding Metal Top>
● Quarter trim, lower (Refer to P.52A-11, 13.)
◆◆ 4. Outer seat belt assembly

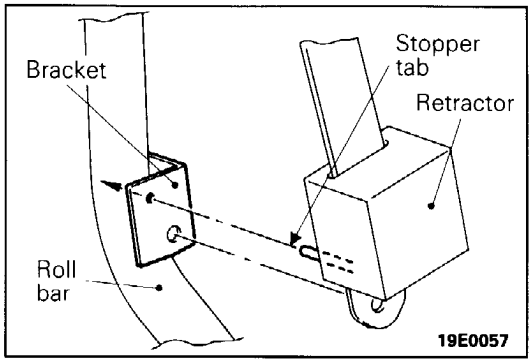
<Third seat belt>



1. Inner seat belt assembly

Outer seat belt assembly removal steps

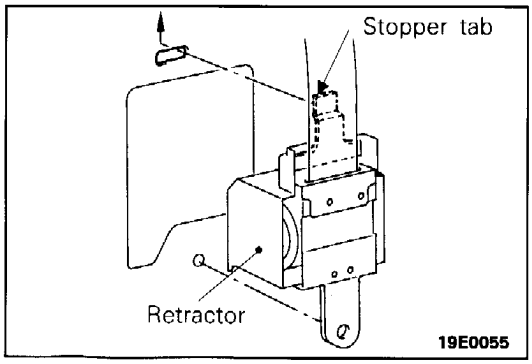
3. Sash guide cover
● Quarter trim, lower (Refer to P.52A-13.)
◆◆ 4. Outer seat belt assembly



SERVICE POINTS OF INSTALLATION E52MDBQ

4. INSTALLATION OF OUTER SEAT BELT ASSEMBLY

<3-POINT TYPE BELT WITH ELR – CANVAS TOP>
Securely insert the retractor stopper pin into the bracket hole in the roll bar.



<3-POINT TYPE BELT WITH ELR – METAL TOP AND LONG BODY>
Securely insert the retractor stopper tab into the body hole.

SUPPLEMENTAL RESTRAINT SYSTEM (SRS)

CONTENTS

E52BA00AA

GENERAL INFORMATION 2
SRS SERVICE PRECAUTIONS 3
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INDIVIDUAL COMPONENT SERVICE 32
WARNING/CAUTION LABELS 32
FRONT IMPACT SENSORS 33
SRS DIAGNOSIS UNIT (SDU) 35
AIR BAG MODULE AND CLOCK SPRING 38
AIR BAG MODULE DISPOSAL PROCEDURES 44
Undeployed Air Bag Module Disposal 44
Deployed Air Bag Module Disposal Procedures 47

CAUTION

- **Carefully read and observe the information in the SRS SERVICE PRECAUTIONS (P.52B-3.) Prior to any service.**
- **For information concerning troubleshooting or maintenance, always observe the procedures in the Troubleshooting (P.52B-7) or the SRS Maintenance (P.52B-25) sections respectively.**
- **If any SRS components are removed or replaced in connection with any service procedures, be sure to follow the procedures in the INDIVIDUAL COMPONENT SERVICE section (P.52B-32) for the components involved.**
- **If you have any questions about the SRS, please contact your local distributor.**

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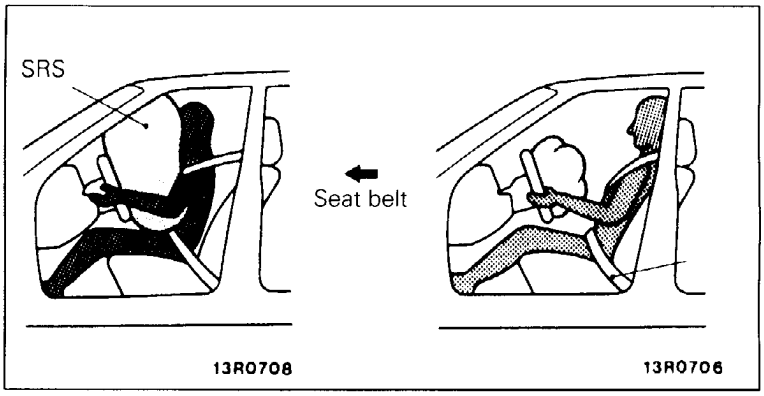
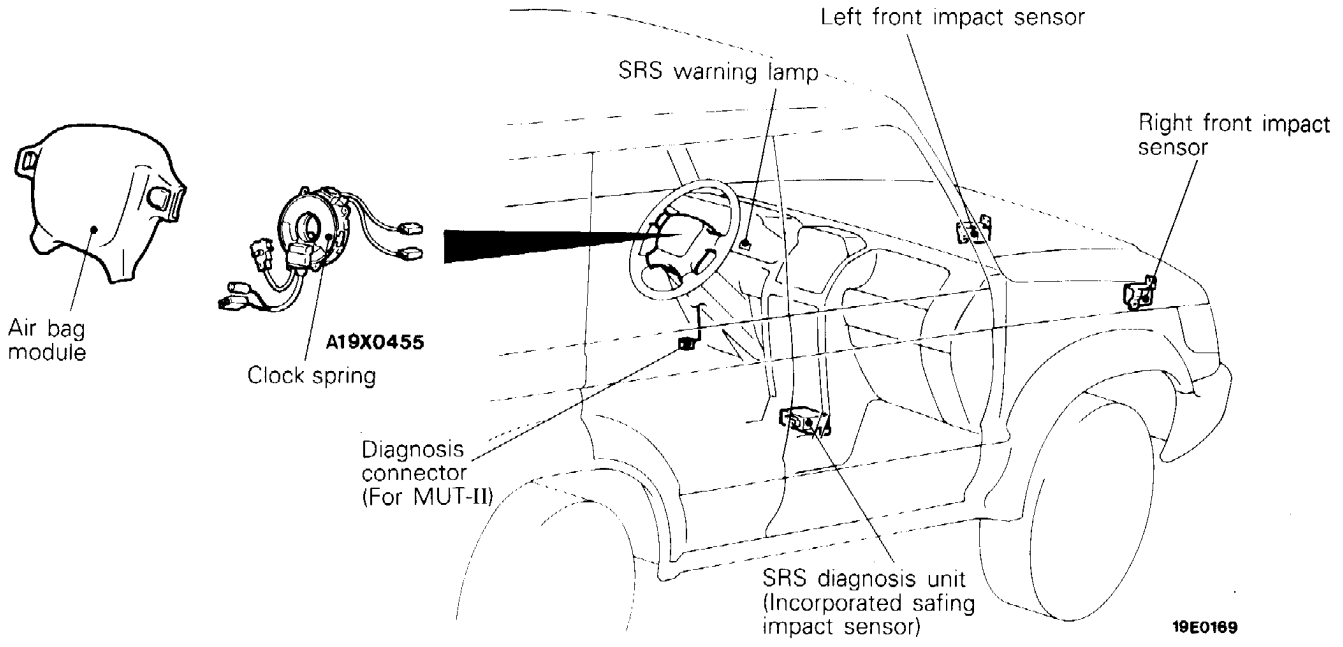
GENERAL INFORMATION

E00AF10AA

The Supplemental Restraint System (SRS) is designed to supplement the driver's seat belt to help reduce the risk or severity of injury to the driver by activating and deploying an air bag in certain frontal colisions.
The SRS consists of: left front and right front impact sensors one located, on the right and left radiator support panel; an air bag module located in the centre of the steering wheel, which contains the folded air bag and an inflator unit; the SRS diagnosis unit located in front of the shift lever, which monitors the system, and which contains a safing impact sensor; an SRS warning lamp located on the instrument panel, which indicates the operational status of the SRS, and clock spring interconnection located within the steering column; wiring.
The SRS is designed so that the air bag will deploy when the safing sensor, plus either or both of the left front and right front impact sensors simultaneously activate while the ignition switch is "ON". That is designed to occur in frontal or near-frontal impacts of moderate to severe force.
Only authorized service personnel should do work on or around the SRS components. Those service personnel should read this manual carefully before starting any such work. Extreme care must be used when servicing the SRS. to avoid injury to the service personnel (by inadvertent deployment of the air bag) or the driver (by rendering the SRS inoperative).





SRS SERVICE PRECAUTIONS

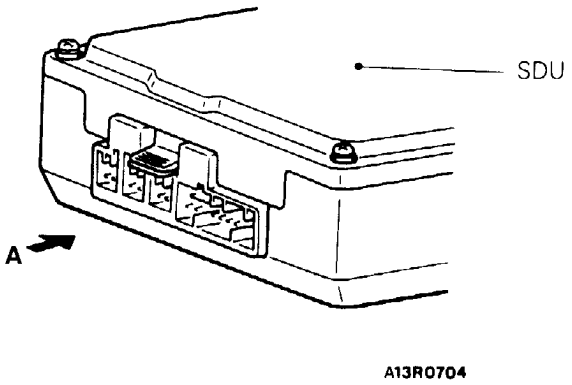
E52BB10AA

1. In order to avoid injury to yourself or others from accidental deployment of the air bag during servicing, read and carefully follow all the precautions and procedures described in this manual.
2. Do not use any electrical test equipment on or near SRS components, except those specified on P.52B-5.
   Never use an analogue ohmmeter.
3. **Never Attempt to Repair the Following Components:**
   - Front Impact Sensors
   - SRS Diagnosis Unit (SDU)
   - Clock Spring
   - Air Bag Module

   If any of these components are diagnosed as faulty, they should only be replaced, in accordance with the INDIVIDUAL COMPONENTS SERVICE procedures in this manual, starting at page 52B-32.
4. Do not attempt to repair the wiring harness connectors of the SRS. If any of the connectors are diagnosed as faulty, replace the wiring harness. If the wires are diagnosed as faulty, replace or repair the wiring harness according to the following table.

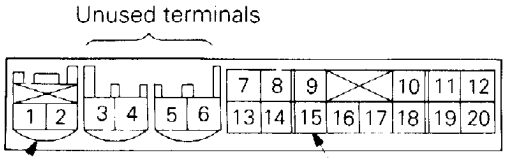
SDU Terminal No.	Harness Connector (No. of Terminals, Colour)	Destination of Harness	Corrective Action
1 2	2 pins, red	Dash wiring harness ► Clock spring	Correct or replace each wiring harness Replace clock spring
7 and 8	14 pins, red	–	–
9		Dash wiring harness ► Diagnosis connector	Correct or replace each wiring harness
10		Dash wiring harness ► Control wiring harness ► Dash wiring harness ► Ignition switch (ST)	
11		Dash wiring harness ► Junction block (fuse No. 18)	
12		Dash wiring harness ► Junction block (fuse No. 12)	
13 14		Dash wiring harness ► Instrument panel wiring harness ► SRS warning lamp	
16 17		Dash wiring harness ► Front wiring harness ► Front impact sensor (LH)	Replace with sensor cable*
15 18		Dash wiring harness ► Front wiring harness ► Front impact sensor (RH)	
19 20		Dash wiring harness ► Earth	Correct or replace dash wiring harness

NOTE
(1) The sensor cable marked with* is available as service part.
(2) The sensor cable used as a replacement part is routed along the dash wiring harness and front wiring harness.

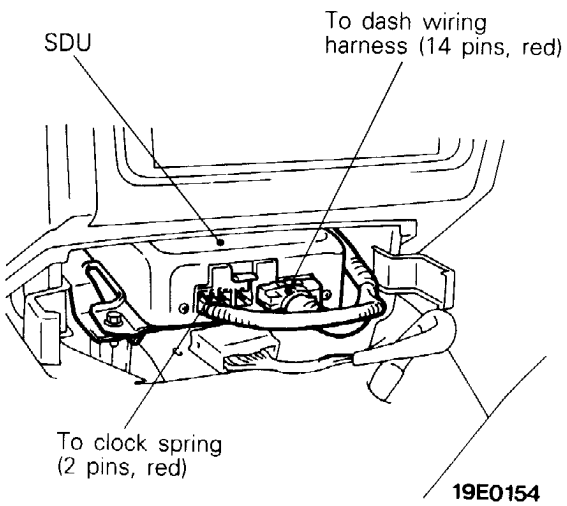


A13R0704

View A



19X0357



19E0154

5. **After disconnecting the battery cable, wait 60 seconds or more before proceeding with the following work. The SRS system is designed to retain enough voltage to deploy the air bag for a short time even after the battery has been disconnected, so serious injury may result from unintended air bag deployment if work is done on the SRS system immediately after the battery cables are disconnected.**
6. SRS components should not be subjected to heat over 93°C, so remove the front impact sensors, SRS diagnosis unit, air bag module and clock spring before drying or baking the vehicle after painting. Recheck SRS system operability after re-installing the components.
7. Whenever you finish servicing the SRS, check the SRS warning lamp operation to make sure that the system functions properly. (Refer to P.52B-7.)
8. Make certain that the ignition switch is OFF when the MUT-II is connected or disconnected.
9. If you have any questions about the SRS, please contact your local distributor.

NOTE
SERIOUS INJURY CAN RESULT FROM UNINTENDED AIR BAG DEPLOYMENT, SO USE ONLY THE RROCEDURES AND EQUIPMENT SPECIFIED IN THIS MANUAL.

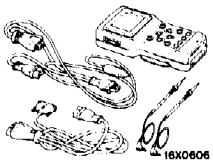
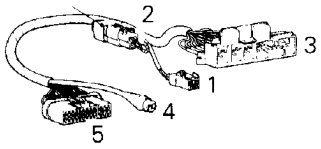
SERVICE SPECIFICATIONS

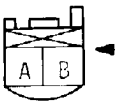
E52BC00AA

Items		Specifications
Standard value		
Front impact sensor resistance	Ω	2,000 ± 20
Clock spring resistance	Ω	less than 0.4

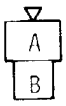
SPECIAL TOOLS AND TEST EQUIPMENT

E52BD00AA

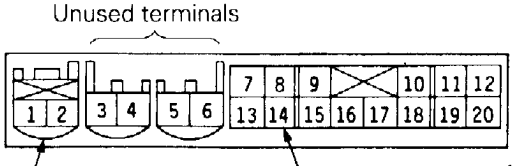
Tool	Number	Name	Use
 16X0606	MB991502	MUT-II sub assembly	• Reading diagnosis codes • Erasing diagnosis code • Reading trouble period • Reading erase times [Refer to MUT-II INSTRUCTION MANUAL]
16X0607	For the number, refer to GROUP 00 – Precautions Before Service.	ROM pack	
Resistor (3 Ω) 	MB991349	SRS Check Harness	• Checking the SRS electrical circuitry with a digital multi-meter NOTE SRS check harness is used on various Diagnostic Tests. For details, refer to DIAGNOSTIC SEQUENCE (P.52B-9 – P.52B-24.)

1  19X0463

To SDU connector for clock spring

2  19X0464

(connected 3 Ω resistor)

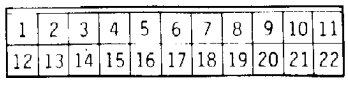
3  A19X0524

Connect to harness-side clock spring connector (2-pin, red)

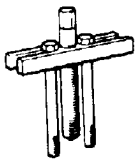
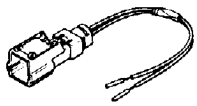
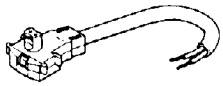
Connect to harness-side dash wiring harness connector (14-pin, red)

4 19X0462

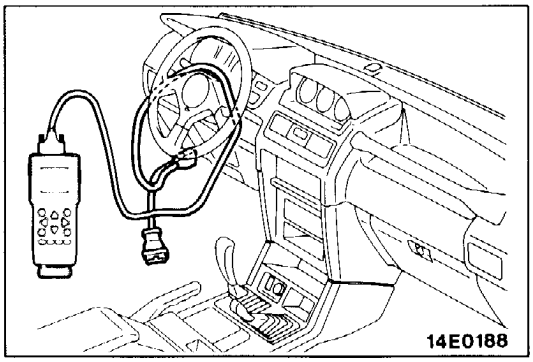
To clock spring connector for air bag module

5 

(check connector) 19X0546

Tool	Number	Name	Use
13R0746		Digital multi-meter Use a multi-meter for which the maximum test current is 2 mA or less at the minimum range of resistance measurement	Checking the SRS electrical circuitry with SRS Check Harness
	MB990803	Steering wheel puller	Removal of steering wheel
 13R0732	MB686560	SRS AIR BAG ADAPTER HARNESS A	Deployment of air bag module inside the vehicle
 13R0751	MB628919	SRS AIR BAG ADAPTER HARNESS B	Deployment of air bag module outside the vehicle

TROUBLESHOOTING



DIAGNOSTIC FUNCTION

E52BE01AA

DIAGNOSTIC CODES CHECK

Connect the MUT-II to the diagnosis connector (16-pin) under the instrument under cover, then check diagnostic codes.

ERASING DIAGNOSTIC CODES

Connect the MUT-II to the diagnosis connector (16-pin) then erase the diagnostic codes.

INSPECTION CHART FOR DIAGNOSTIC TROUBLE CODES

E52BE02AA

Inspect according to the inspection chart that is appropriate for the malfunction code.

Code No.	Diagnostic item		Reference page
11	Front impact sensor system		P.52B-8
12			
13			
21	Air bag module (squib) system		P.52B-10
22			
31	SDU capacitor system		P.52B-12
32			
33*2	Cranking signal system		P.52B-13
34*2	Connector lock system		P.52B-14
41*1, *2	IG1 (A) power circuit system		P.52B-15
42*1, *2	IG1 (B) power circuit system		P.52B-16
43	SRS warning lamp drive circuit system	Lamp does not illuminate*2	P.52B-18
		Lamp does not switch off	P.52B-19
44	SDU warning lamp drive circuit system		P.52B-20
45	SDU non-volatile memory (EEPROM) and A/D converter system		P.52B-21

NOTE

1. *1: For diagnosis codes marked with *, if the vehicle condition returns to normal for a continuous period of 5 ± 0.2 seconds, the diagnosis code will be automatically erased, and the SRS warning lamp will return to normal.
2. *2: If the vehicle has a discharged battery it will store the fault codes 41 or 42. When these diagnosis codes are displayed, check the battery.

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INSPECTION PROCEDURE CLASSIFIED BY DIAGNOSTIC TROUBLE

E52BE03AA

Code No. 11, 12 or 13 — Front impact sensor system

Probable cause

- Malfunction of front impact sensor
- Malfunction of harnesses or connectors
- Malfunction of SDU

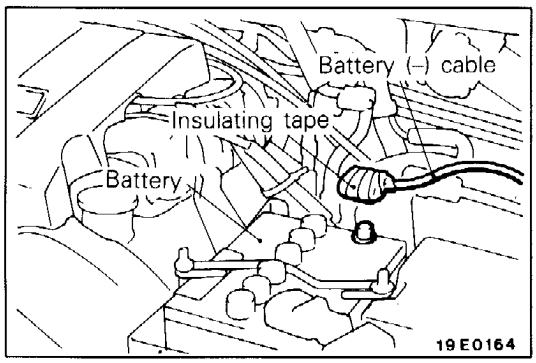
[Comment]

(1) These diagnosis codes are output if there is abnormal resistance between the input terminals of the SDU front impact sensor.
The trouble causes for each code No. are as follows.

Code No.	Trouble Symptom
11	• Short in front impact sensor or harness short • Short in front impact sensor or air bag module (squib) harnesses leading to the vehicle body earth • Short in front impact sensor or air bag module (squib) harnesses leading to the power supply
12	• Open circuit in either left or right front impact sensor or open harness • Short in front impact sensor or air bag module (squib) harnesses leading to the power supply
13	• Open circuit in both left and right front impact sensors or open harness • Short in front impact sensor or air bag module (squib) harnesses leading to the power supply

(2) Diagnosis codes 11, 12 and 13 are sometimes generated in combination with malfunction codes relating to the air bag module (squib) (code Nos. 21 and 22), but sometimes only one may be output instead of both being memorised. Because of this, the air bag module should also be inspected at the same time.
The relationships between the codes are as follows.

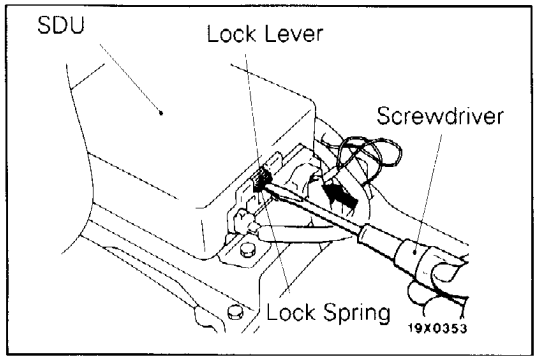
Air bag module (squib) \ Front impact sensor	Short	Open circuit (1 sensor)	Open circuit (2 sensors)
Short	11 or 21	12 or 21	13 or 21
Open circuit	11 or 22	12 or 22	13 or 22



1. Turn the ignition key to the "LOCK" position, disconnect the negative battery cable and tape the terminal.

   Caution
   Wait at least 60 seconds after disconnecting the battery cable before doing any further work. (Refer to P. 52B-4)

2. Remove the floor console assembly. (Refer to GROUP 52A – Floor Console.)



3. Place a flat-tipped (–) screwdriver against the lock spring (metal portion) of the SDU connector lock lever, and push the spring horizontally toward the inside of the unit.

   Caution
   1. **Do not use excessive force to raise the lock lever (green).**
   2. **Do not insert the screwdriver into the gap between the lock lever (green) and the lock spring (metal portion).**

4. Disconnect the red 14-pin connector from the SDU.

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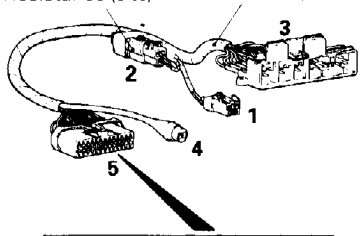
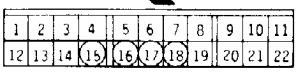
Inspection of front impact sensor (Refer to P.52B-39.) NG → **Replace**

OK ↓

Resistance (3 Ω) SRS check harness (MB991349)





19X0468

Measure at SRS check harness connector (5).

- Disconnect SDU connector C-47.
- Connect SRS check harness connector (3)
- Resistance between terminals (15) – (18)
  OK :2,000±20 Ω
- Resistance between terminals (16) – (17)
  OK :2,000±20 Ω
- Continuity between terminals (15), (16), (17), (18) and body earth
  OK: No continuity

NG → **Check the following connectors**
C-47, C-29, A-28 and A-54 NG → **Repair**

OK ↓

Check trouble symptom

NG ↓

Inspect harness between SDU and front impact sensor.

NG ↓

Replace the sensor harness.

OK ↓

Inspect the air bag module (squib) system (Refer to P.52B-38.)

OK ↓

Replace the SDU.

Code No. 21 or 22 — Air bag module (squib) system

Probable cause

- Malfunction of clock spring
- Malfunction of harnesses or connectors
- Malfunction of air bag module (squib)
- Malfunction of SDU

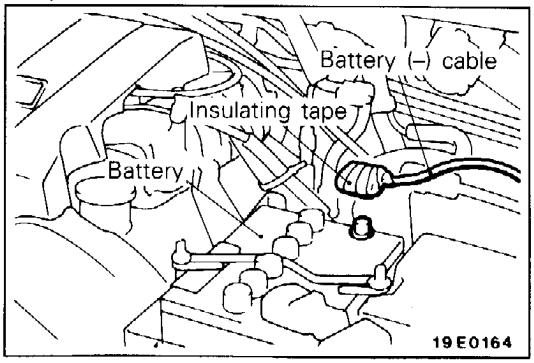
[Comment]

(1) These diagnosis codes are output if there is abnormal resistance between the input terminals of the SDU air bag module (squib).
The trouble causes for each code No. are as follows.

Code No.	Trouble Symptom
21	• Short in air bag module (squib) or harness short • Short in clock spring • Short in air bag module (squib) or front impact sensor harnesses leading to the power supply
22	• Open circuit in air bag module (squib) or open harness • Open circuit in clock spring • Malfunction of connector contact • Short in air bag module (squib) or front impact sensor harnesses leading to the power supply

(2) Diagnosis codes 21 and 22 are sometimes generated in combination with malfunction codes relating to the front impact sensor (code Nos. 11, 12 and 13), but sometimes only one may be output instead of both being memorised. Because of this, the front impact sensor should also be inspected at the same time.
The relationships between the codes are as follows.

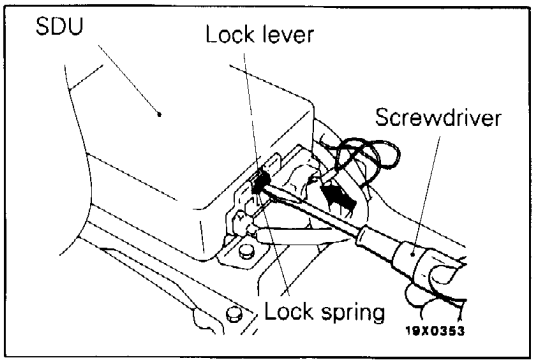
		Front impact sensor		
		Short	Open circuit (1 sensor)	Open circuit (2 sensors)
Air bag module (squib)	Short	11 or 21	12 or 21	13 or 21
	Open circuit	11 or 22	12 or 22	13 or 22



1. Turn the ignition key to the "LOCK" position, disconnect the negative battery cable and tape the terminal.

   Caution
   Wait at least 60 seconds after disconnecting the battery cable before doing any further work. (Refer to P. 52B-4)

2. Remove the floor console assembly. (Refer to GROUP 52A – Floor Console.)



3. Place a flat-tipped (–) screwdriver against the lock spring (metal portion) of the SDU connector lock lever, and push the spring horizontally toward the inside of the unit.

   Caution
   1. **Do not use excessive force to raise the lock lever (green).**
   2. **Do not insert the screwdriver into the gap between the lock lever (green) and the lock spring (metal portion).**

4. Disconnect the red 14-pin connector from the SDU.

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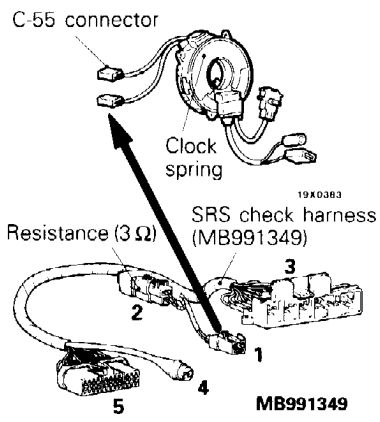
Clock spring inspection (Refer to P.52B-38, 40.) — NG → **Replace**

OK ↓



MUT-II SELF DIAG. CODE
- Connect clock spring connector C-55.
- Connect SRS check harness connector (1)
- Erase diagnosis code memory

Are code Nos. 21 and 22 output?

NG → **Check the following connectors.** C-48 and C-55 — NG → **Repaire**

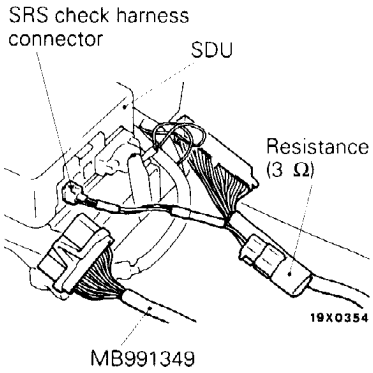
OK ↓

Check trouble symptom

NG ↓

Replace the air bag module (squib).

Yes ↓



MUT-II SELF DIAG. CODE
- Connect clock spring connector C-55.
- Disconnect SDU connector C-48.
- Connect SRS check harness connector (1)
- Erase diagnosis code memory

Are code Nos. 21 and 22 output?

No → Check the harness between the SDU and clock spring, and repair if necessary.

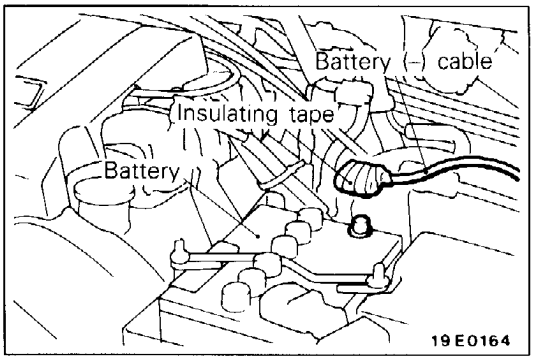
Yes ↓

Inspect the front impact sensor system (Refer to P.52B-33.)

OK ↓

Replace the SDU.

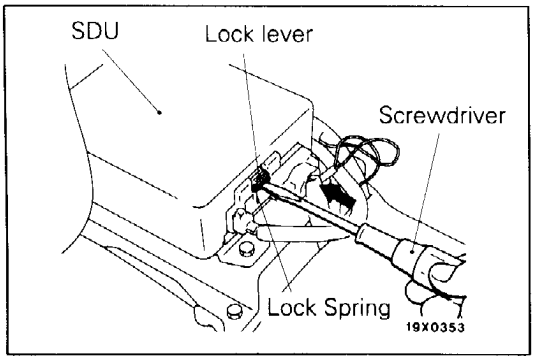
Code No. 31 or 32	SDU capacitor system	Probable cause
[Comment] These diagnosis codes are output if the voltage at the SDU capacitor terminals is higher (No. 31) or lower (No. 32) than the specified value for 5 seconds or more. However, if diagnosis code Nos. 41 and 42 are being output due to a drop in battery voltage, code No. 32 will not be detected.		• Malfunction of front impact sensor • Malfunction of SDU



1. Turn the ignition key to the "LOCK" position, disconnect the negative battery cable and tape the terminal.

   Caution
   Wait at least 60 seconds after disconnecting the battery cable before doing any further work. (Refer to P. 52B-4)

2. Remove the floor console assembly. (Refer to GROUP 52A – Floor Console.)

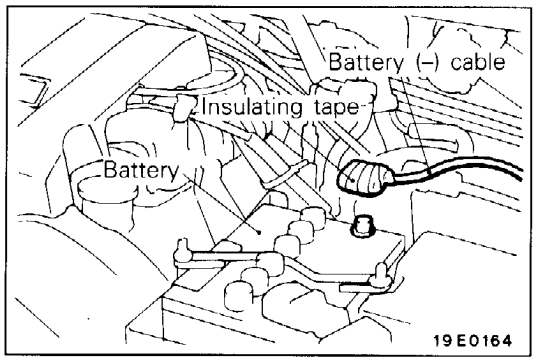


3. Place a flat-tipped (–) screwdriver against the lock spring (metal portion) of the SDU connector lock lever, and push the spring horizontally toward the inside of the unit.

   Caution
   1. **Do not use excessive force to raise the lock lever (green).**
   2. **Do not insert the screwdriver into the gap between the lock lever (green) and the lock spring (metal portion).**

4. Disconnect the red 14-pin connector from the SDU.
   The capacitor inside the SDU is probably defective, so replace the SDU.
   However, code No. 32 could also be a result of a short in the front impact sensor, so inspection of the front impact sensor system should also be carried out. (Refer to P.52B-8.)

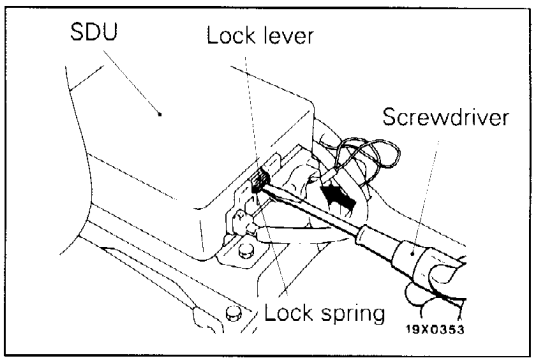
Code No. 33	Cranking signal system	Probable cause
[Comment] The cranking signal is provided in order to prevent mistaken detection of power supply voltage drops at the IG1 terminal during cranking. This diagnosis code is output if the cranking signal is output for a continuous period of 45 seconds or more (cranking signal harness is shorted to the power supply). However, if the vehicle condition returns to normal for a continuous period of 5 ± 0.2 seconds (except when cranking), diagnosis code No. 33 will be automatically erased, and the SRS warning lamp will switch off.		• Malfunction of harnesses or connectors • Malfunction of SDU



1. Turn the ignition key to the "LOCK" position, disconnect the negative battery cable and tape the terminal.

   Caution
   Wait at least 60 seconds after disconnecting the battery cable before doing any further work. (Refer to P. 52B-4)

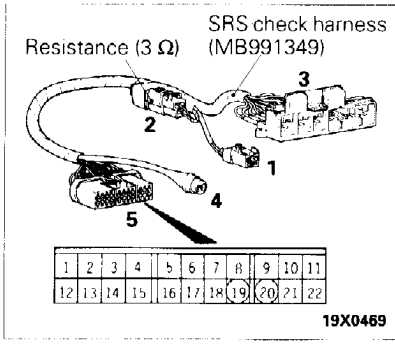
2. Remove the floor console assembly. (Refer to GROUP 52A – Floor Console.)



3. Place a flat-tipped (–) screwdriver against the lock spring (metal portion) of the SDU connector lock lever, and push the spring horizontally toward the inside of the unit.

   Caution
   1. **Do not use excessive force to raise the lock lever (green).**
   2. **Do not insert the screwdriver into the gap between the lock lever (green) and the lock spring (metal portion).**

4. Disconnect the red 14-pin connector from the SDU.



Measure at SRS check harness connector (5).
- Disconnect SDU connector C-47.
- Connect SRS check harness connector (3)
- Continuity between terminals (19) – (20)

OK: Continuity

NG → **Check the following connectors.**
- C-47

NG → **Repair**

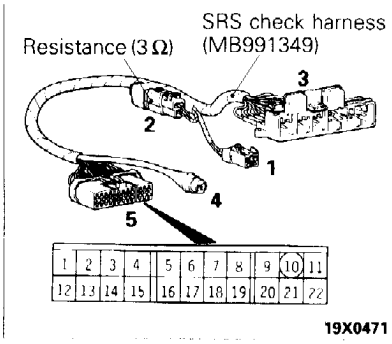
OK

Check trouble symptoms

NG

Check the harness wire between each, SDU and earth, and repair if necessary.

OK



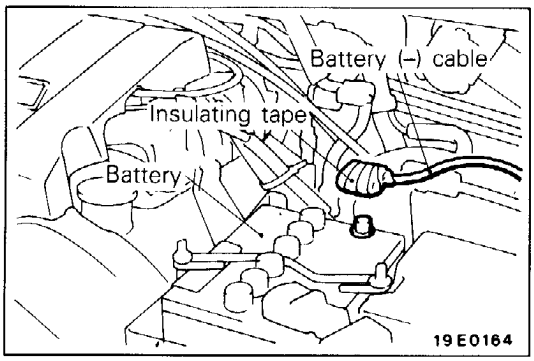
Measure at SRS check harness connector (5).
- Ignition switch ON
- Voltage between terminal (10) and body earth

OK: 0 V

NG → Check the harness between the SDU and ignition switch (ST), and reapir if necessary.

OK → Replace the SDU

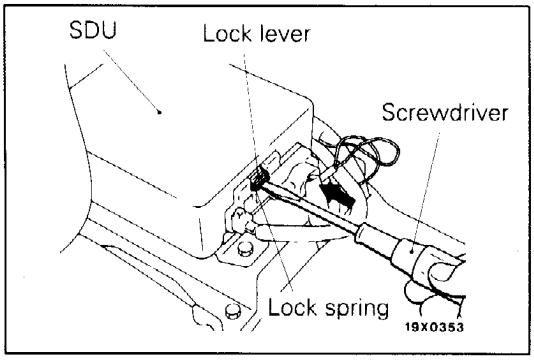
Code No. 34	Connector lock system	Probable cause
[Comment] This diagnosis code is output if the double lock shorting bar of the SDU connector is detected to be open. However, if the vehicle condition returns to normal for a continuous period of 5 ± 0.2 seconds, diagnosis code No. 34 will be automatically erased, and the SRS warning lamp will switch off.		• Malfunction of connectors • Malfunction of SDU



1. Turn the ignition key to the "LOCK" position, disconnect the negative battery cable and tape the terminal.

   Caution
   Wait at least 60 seconds after disconnecting the battery cable before doing any further work.
   (Refer to P.52B-4.)

2. Remove the floor console assembly. (Refer to GROUP 52A – Floor Console.)



3. Place a flat-tipped (–) screwdriver against the lock spring (metal portion) of the SDU connector lock lever, and push the spring horizontally toward the inside of the unit.

   Caution
   1. Do not use excessive force to raise the lock lever (green).
   2. Do not insert the screwdriver into the gap between the lock lever (green) and the lock spring (metal portion).

4. Disconnect the red 14-pin connector from the SDU.

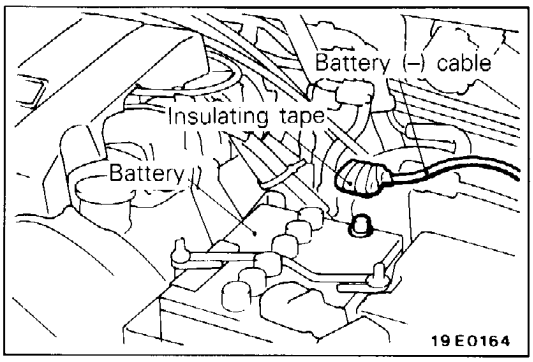
Is the SDU engagement detection mechanism operating correctly?

No. → Insert the connector securely and lower the lock lever to lock the connector.

Yes ↓

Replace the SDU

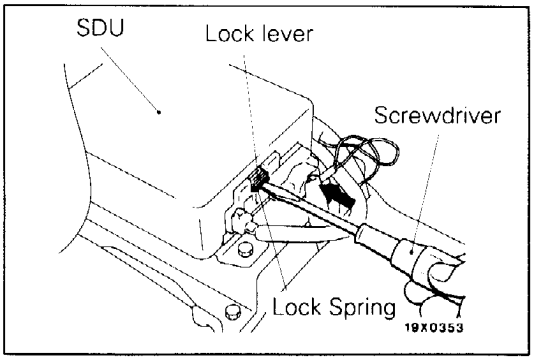
Code No. 41	IG_1 (A) power circuit system	Probable cause
[Comment] This diagnosis code is output if the voltage between the IG_1 (A) terminal and the earth is lower than the specified value for a continuous period of 5 seconds or more. However, if the vehicle condition returns to normal for a continuous period of 5 ± 0.2 seconds, diagnosis code No. 41 will be automatically erased, and the SRS warning lamp will switch off.		• Malfunction of harnesses or connectors • Malfunction of SDU



1. Turn the ignition key to the "LOCK" position, disconnect the negative battery cable and tape the terminal.

Caution
Wait at least 60 seconds after disconnecting the battery cable before doing any further work. (Refer to P. 52B-4)

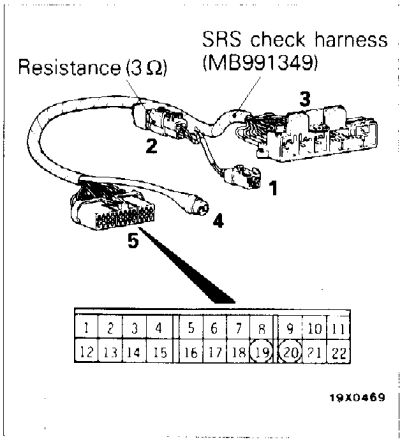
2. Remove the floor console assembly. (Refer to GROUP 52A – Floor Console.)



3. Place a flat-tipped (–) screwdriver against the lock spring (metal portion) of the SDU connector lock lever, and push the spring horizontally toward the inside of the unit.

Caution
1. **Do not use excessive force to raise the lock lever (green).**
2. **Do not insert the screwdriver into the gap between the lock lever (green) and the lock spring (metal portion).**

4. Disconnect the red 14-pin connector from the SDU.



Measure at SRS check harness connector (5).
- Disconnect SDU connector C-47.
- Connect SRS check harness connector (3)
- Continuity between terminals (19) – (20)

OK: Continuity

NG → **Check the following connector.** C-47 → NG → **Repair**

OK ↓

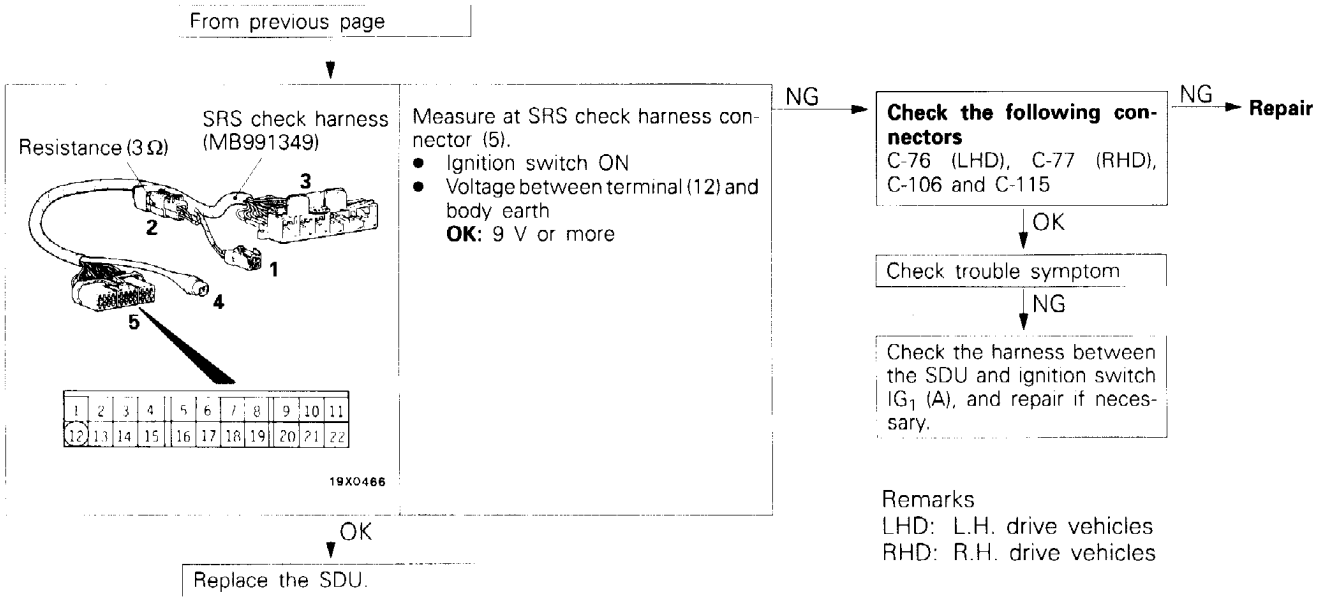
Check trouble symptom

NG ↓

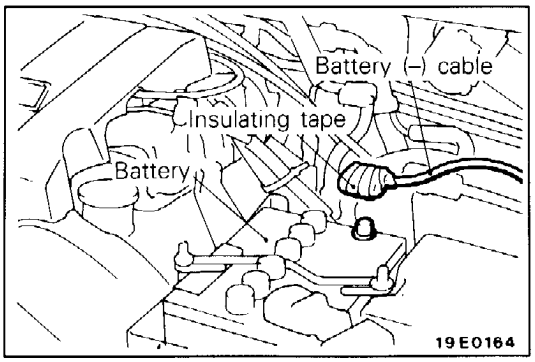
Check the harness between the SDU and earth, and repair if necessary.

OK ↓

To next page



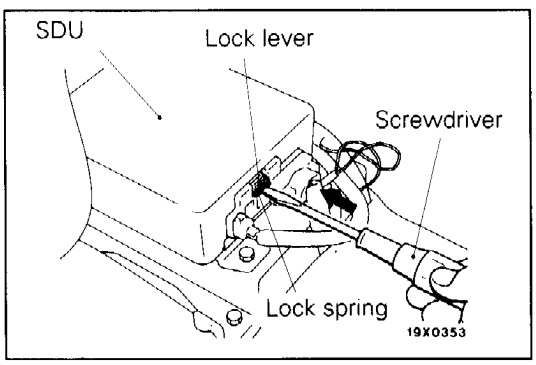
Code No. 42	IG_1 (B) power circuit system	Probable cause
[Comment] This diagnosis code is output if the voltage between the IG_1 (B) terminal and the earth is lower than the specified value for a continuous period of 5 seconds or more. However, if the vehicle condition returns to normal for a continuous period of 5 ± 0.2 seconds, diagnosis code No. 41 will be automatically erased, and the SRS warning lamp will switch off.		• Malfunction of harnesses or connectors



1. Turn the ignition key to the "LOCK" position, disconnect the negative battery cable and tape the terminal.

   Caution
   Wait at least 60 seconds after disconnecting the battery cable before doing any further work. (Refer to P. 52B-4)

2. Remove the floor console assembly. (Refer to GROUP 52A – Floor Console.)



3. Place a flat-tipped (–) screwdriver against the lock spring (metal portion) of the SDU connector lock lever, and push the spring horizontally toward the inside of the unit.

   Caution
   1. **Do not use excessive force to raise the lock lever (green).**
   2. **Do not insert the screwdriver into the gap between the lock lever (green) and the lock spring (metal portion).**

4. Disconnect the red 14-pin connector from the SDU.

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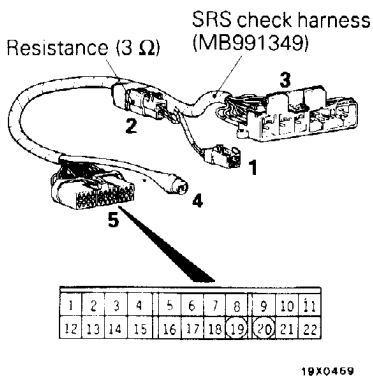


Measure at SRS check harness connector (5).
- Disconnect SDU connector C-47.
- Connect SRS check harness connector (3)
- Continuity between terminals (19) – (20)

OK: Continuity

NG → **Check the following connector.**
C-47

OK ↓

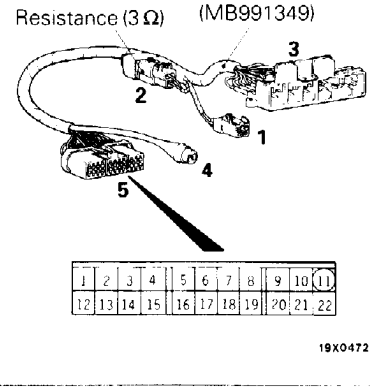
Check trouble symptom

NG ↓

Check the harness between the SDU and earth, and repair if necessary.

NG → **Repair**

OK ↓



Measure at SRS check harness connector (5).
- Ignition switch: ON
- Voltage between the terminal (11) and body earth.

OK: 9 V or more

NG → **Check the following connectors.**
C-106, C-101 and C-115

OK ↓

Check trouble symptom

NG ↓

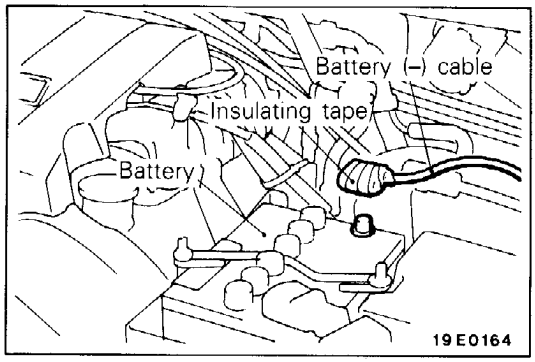
Check the harness between the SDU and ignition switch IG_1 (B), and repair if necessary.

NG → **Repair**

OK ↓

Replace the SDU.

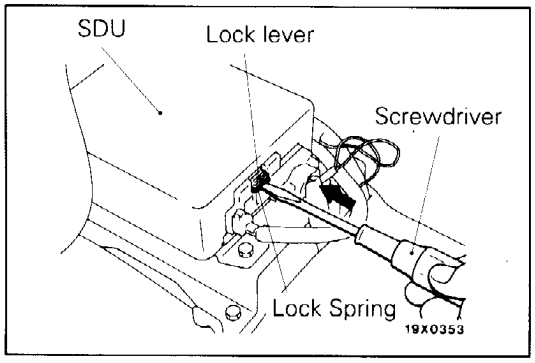
Code No. 43	SRS warning lamp drive circuit system (Lamp does not illuminate.)	Probable cause
[Comment] This diagnosis code is output when an open circuit occurs for a continuous period of 5 seconds while the SDU is monitoring the SRS warning lamp and the lamp is OFF (transistor OFF). However, if this code is output due to an open circuit, if the vehicle condition returns to normal for a continuous period of 5 ± 0.2 seconds, this diagnosis code will be automatically erased, and the SRS warning lamp will return to normal.		• Malfunction of harnesses or connectors • Blown bulb • Malfunction of SDU • Malfunction of combination meter



1. Turn the ignition key to the "LOCK" position, disconnect the negative battery cable and tape the terminal.

   Caution
   Wait at least 60 seconds after disconnecting the battery cable before doing any further work. (Refer to P. 52B-4)

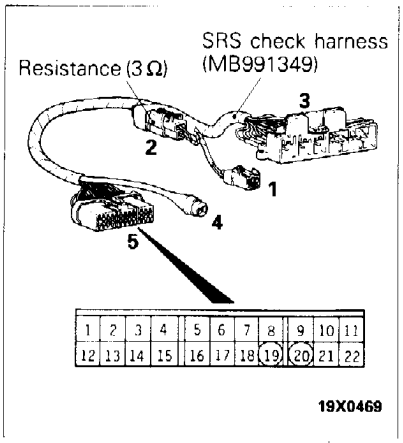
2. Remove the floor console assembly. (Refer to GROUP 52A – Floor Console.)



3. Place a flat-tipped (–) screwdriver against the lock spring (metal portion) of the SDU connector lock lever, and push the spring horizontally toward the inside of the unit.

   Caution
   1. **Do not use excessive force to raise the lock lever (green).**
   2. **Do not insert the screwdriver into the gap between the lock lever (green) and the lock spring (metal portion).**

4. Disconnect the red 14-pin connector from the SDU.



Measure at SRS check harness connector (5).
- Disconnect SDU connector C-47.
- Connect SRS check harness connector (3).
- Continuity between terminals (19) – (20)

OK: Continuity

NG → **Check the following connector.** C-47 → NG → **Repair**

OK ↓

Check trouble symptom

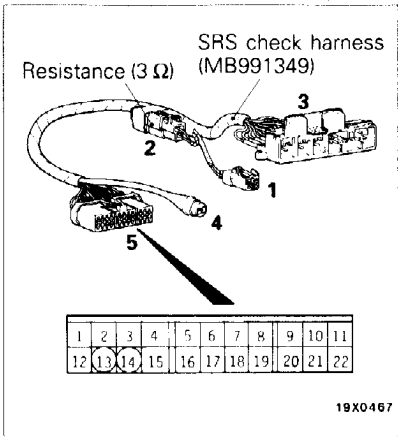
NG ↓

Check the harness between the SDU and earth, and repair if necessary.

OK ↓

To next page

From previous page



Measure at SRS check harness connector (5).
- Ignition switch ON
- Connect terminal (13) to the body earth
  OK: Lamp illuminates
- Connect terminal (14) to the body earth
  OK: Lamp illuminates

NG → Blown bulb inspection → NG → **Repair**

OK ↓

Check the following connectors
C-4, C-11, C-109 and C-115 → NG → **Repair**

OK ↓

Check trouble symptom

NG ↓

Check the harness between the SDU and ignition switch (IG_1), and repair if necessary. → NG → **Repair**

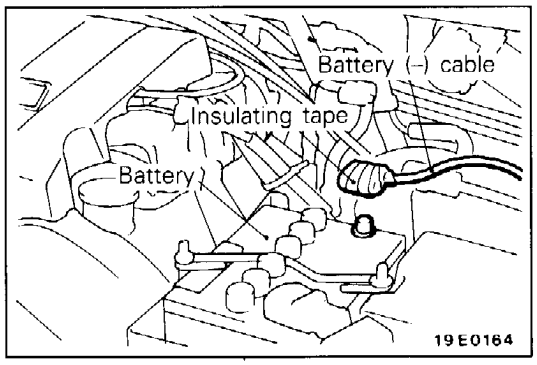
OK ↓

Replace the combination meter.

OK ↓

Replace the SDU.

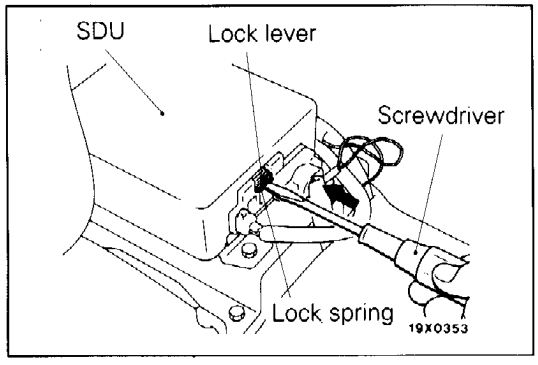
Code No. 43	SRS warning lamp drive circuit system (Lamp does not switch off.)	Probable cause
[Comment] This diagnosis code is output when a short to earth occurs in the harness between the lamp and the SDU while the SDU is monitoring the SRS warning lamp and the lamp is ON.		• Malfunction of harnesses or connectors • Malfunction of SDU



1. Turn the ignition key to the "LOCK" position, disconnect the negative battery cable and tape the terminal.

   Caution
   Wait at least 60 seconds after disconnecting the battery cable before doing any further work. (Refer to P. 52B-4)

2. Remove the floor console assembly. (Refer to GROUP 52A – Floor Console.)



3. Place a flat-tipped (–) screwdriver against the lock spring (metal portion) of the SDU connector lock lever, and push the spring horizontally toward the inside of the unit.

   Caution
   1. **Do not use excessive force to raise the lock lever (green).**
   2. **Do not insert the screwdriver into the gap between the lock lever (green) and the lock spring (metal portion).**

4. Disconnect the red 14-pin connector from the SDU.

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SRS warning lamp inspection
- Ignition switch ON
- Does lamp switch off when SDU connector C-47 is disconnected?

Yes → Replace the SDU

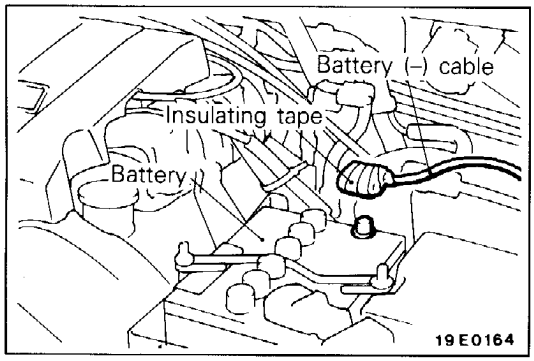
No → **Check the following connector.** C-47

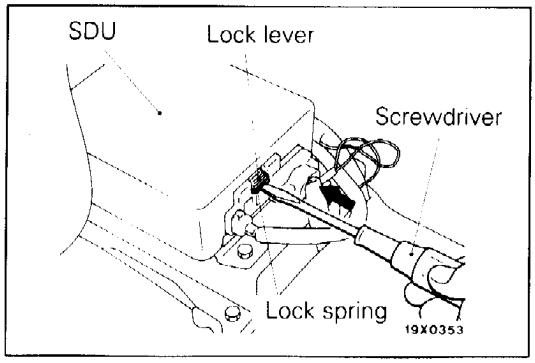
NG → **Repair**

OK → Check trouble symptom

NG → Check the harness between the SDU and combination meter, and repair if necessary.

Code No. 44	SRS warning lamp drive circuit system	Probable cause
[Comment] This diagnosis code is output when a short occurs in the lamp drive circuit or a malfunction of the output transistor inside the SDU is detected while the SDU is monitoring the SRS warning lamp drive circuit.		• Malfunction of harnesses or connectors • Malfunction of SDU





1. Turn the ignition key to the "LOCK" position, disconnect the negative battery cable and tape the terminal.

   Caution
   Wait at least 60 seconds after disconnecting the battery cable before doing any further work. (Refer to P. 52B-4)

2. Remove the floor console assembly. (Refer to GROUP 52A – Floor Console.)

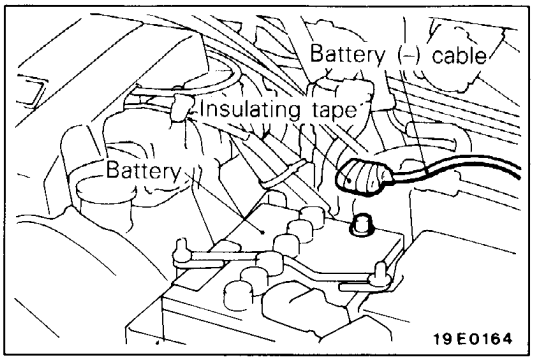
3. Place a flat-tipped (–) screwdriver against the lock spring (metal portion) of the SDU connector lock lever, and push the spring horizontally toward the inside of the unit.

   Caution
   1. **Do not use excessive force to raise the lock lever (green).**
   2. **Do not insert the screwdriver into the gap between the lock lever (green) and the lock spring (metal portion).**

4. Disconnect the red 14-pin connector from the SDU.

If the results of inspection of the SRS warning lamp drive circuit system (refer to P.52B-18) are normal, the transistor inside the SDU is probably defective, so replace the SDU.

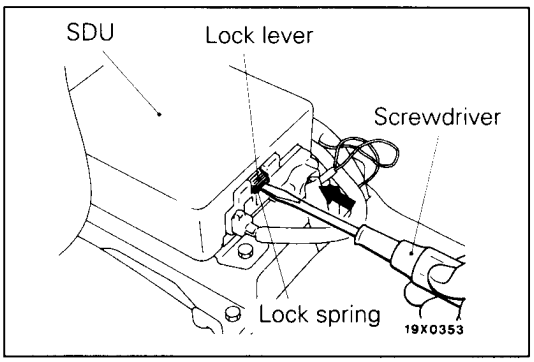
Code No. 45	SDU non-volatile memory (EEPROM) and A/D converter system	Probable cause
[Comment] This diagnosis code is output if there is a malfunction in the SDU non-volatile memory (EEPROM) or A/D converter.		• Malfunction of SDU



1. Turn the ignition key to the "LOCK" position, disconnect the negative battery cable and tape the terminal.

   Caution
   Wait at least 60 seconds after disconnecting the battery cable before doing any further work. (Refer to P. 52B-4)

2. Remove the floor console assembly. (Refer to GROUP 52A – Floor Console.)

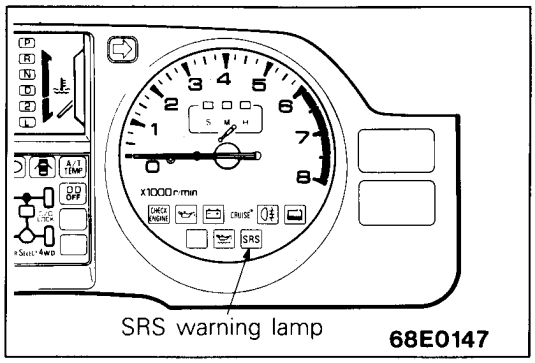


3. Place a flat-tipped (–) screwdriver against the lock spring (metal portion) of the SDU connector lock lever, and push the spring horizontally toward the inside of the unit.

   Caution
   1. **Do not use excessive force to raise the lock lever (green).**
   2. **Do not insert the screwdriver into the gap between the lock lever (green) and the lock spring (metal portion).**

4. Disconnect the red 14-pin connector from the SDU.

The SDU non-volatile memory (EEPROM) or A/D converter is probably defective, so replace the SDU.

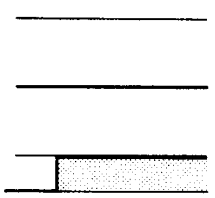
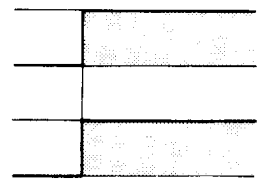


SRS WARNING LAMP INSPECTION E52BE04AA

1. Check to be sure that the SRS warning lamp illuminates when the ignition switch is in the ON position.
2. Check to be sure that it illuminates for approximately 7 seconds and then switches off.
3. If the above is not the case, inspect the diagnosis codes.

INSPECTION CHART FOR TROUBLE SYMPTOMS

Get an understanding of the trouble symptoms and check according to the inspection procedure chart.

Trouble symptom		Inspection Procedure No.	Reference page
Communication with MUT-II is not possible.	Communication with all systems is not possible.	1	P.52B-23
	Communication is not possible with SRS only	2	P.52B-23
When the ignition key is turned to "ON" (engine stopped), the SRS warning lamp does not illuminate. SRS warning lamp: Illuminated / Not illuminated Ignition key: ON / ACC, LOCK  14N0167		Refer to diagnosis code No. 43.	P.52B-18
After the ignition switch is turned to ON, the SRS warning lamp is still on after approximately 7 seconds have passed. SRS warning lamp: Illuminated / Not illuminated Ignition key: ON / ACC, LOCK  14N0166		Refer to diagnosis code No. 43.	P.52B-19

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

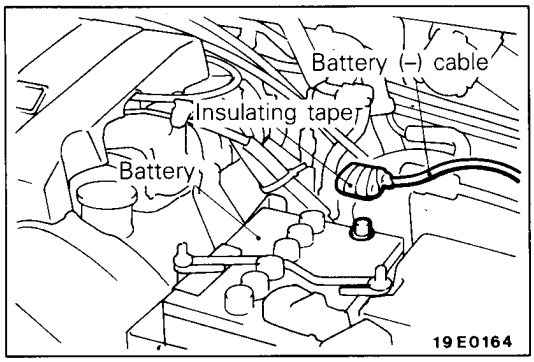
Inspection Procedure 1

Communication with MUT-II is not possible. (Communication with all system is not possible)	Probable cause
[Comment] The cause is probably a power supply system (including earth circuit) of the diagnosis line.	• Malfunction of connectors • Malfunction of harness

Refer to GROUP 13A – Troubleshooting

Inspection Procedure 2

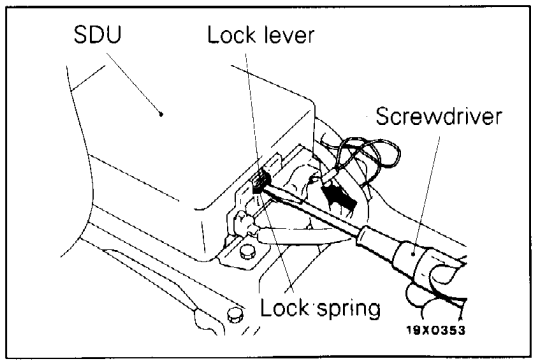
Communication with MUT-II is not possible. (Communication is not possible with SRS only)	Probable cause
[Comment] If communication is not possible with the SRS only, the cause is probably an open circuit in the diagnosis output circuit of the SRS or in the power circuit (including earth circuit).	• Malfunction of harnesses or connectors • Malfunction of SDU



1. Turn the ignition key to the "LOCK" position, disconnect the negative battery cable and tape the terminal.

   Caution
   Wait at least 60 seconds after disconnecting the battery cable before doing any further work. (Refer to P. 52B-4)

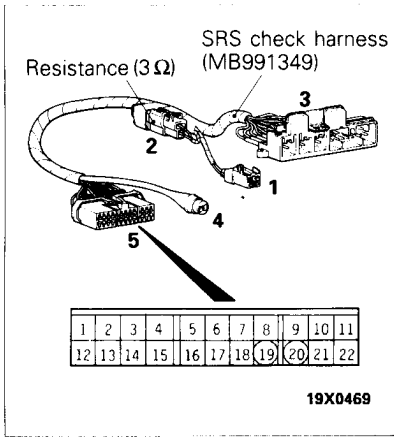
2. Remove the floor console assembly. (Refer to GROUP 52A – Floor Console.)



3. Place a flat-tipped (–) screwdriver against the lock spring (metal portion) of the SDU connector lock lever, and push the spring horizontally toward the inside of the unit.

   Caution
   1. **Do not use excessive force to raise the lock lever (green).**
   2. **Do not insert the screwdriver into the gap between the lock lever (green) and the lock spring (metal portion).**

4. Disconnect the red 14-pin connector from the SDU.

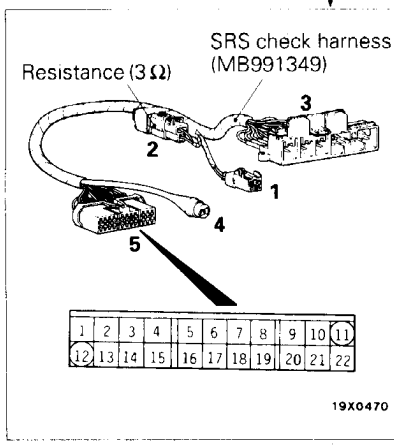


Measure at SRS check harness connector (5).
- Disconnect SDU connector C-47.
- Connect SRS check harness connector (3)
- Continuity between terminals (19) – (20)
  OK: Continuity

NG → **Check the following connector.**
C-47
NG → **Repair**

OK → Check Trouble symptom
NG → Check the harness between the SDU and earth, and repair if necessary.

OK ↓



Measure at SRS check harness connector (5).
- Disconnect SDU connector C-47.
- Connect SRS check harness connector (3)
- Voltage between the terminal (11) and body earth.
  OK: 9 V or more
- Voltage between the terminal (12) and body earth
  OK: 9 V or more

NG → **Check the following connectors.**
C-76 (LHD), C-77 (RHD), C-101 C-106 and C-115
NG → **Repair**

OK → Check Trouble symptom
NG → Check the harness between the SDU and ignition switch IG_1 (A) or ignition switch IG_1 (B), and repair if necessary.

OK ↓

Inspect the harness between the SDU and diagnosis connector.
NG → **Repair**

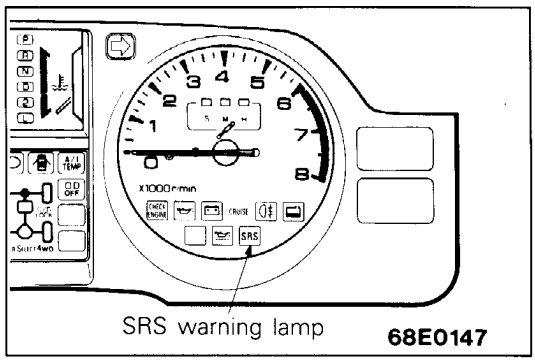
OK ↓

Replace the SDU

Remarks
LHD: L.H. drive vehicles
RHD: R.H. drive vehicles

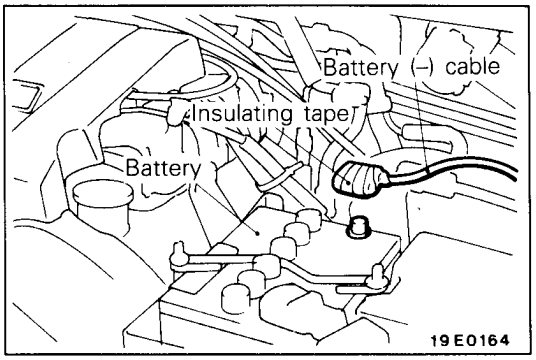
SRS MAINTENANCE E52BF00AA

The SRS must be inspected by an authorized dealer 10 years after the date of vehicle registration.



"SRS" WARNING LAMP CHECK E52BF01AA

Turn the ignition with the key "ON" position. Does the "SRS" warning lamp illuminate for about 7 seconds, turn OFF and then remain extinguished for at least 45 seconds? If yes, SRS system is functioning properly. If no, consult page 52B-7.

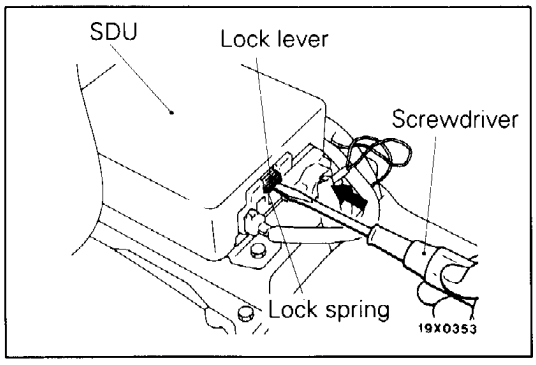


SRS COMPONENTS VISUAL CHECK. E52BF03AA

1. Turn the ignition key to "LOCK" position, disconnect the negative battery cable and tape the terminal.

   Caution
   Wait at least 60 seconds after disconnecting the battery cable before doing any further work. (Refer to P.52B-4.)

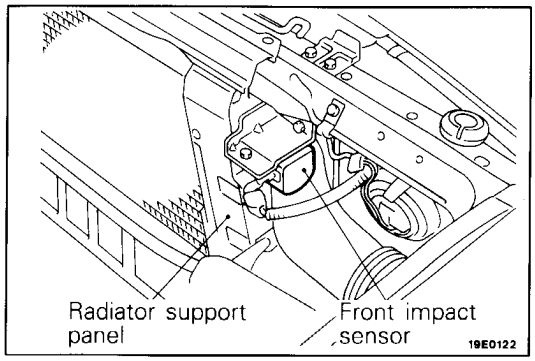
2. Remove the floor console assembly. (Refer to GROUP 52A – Floor Console.)



3. Place a flat-tipped (–) screwdriver against the lock spring (metal portion) of the SDU connector lock lever, and push the spring horizontally toward the inside of the unit.

   Caution
   1. **Do not use excessive force to raise the lock lever (green).**
   2. **Do not insert the screwdriver into the gap between the lock lever (green) and the lock spring (metal portion).**

4. Disconnect the red 14-pin connector from the SRS diagnosis unit while pressing down the lock of the connector.

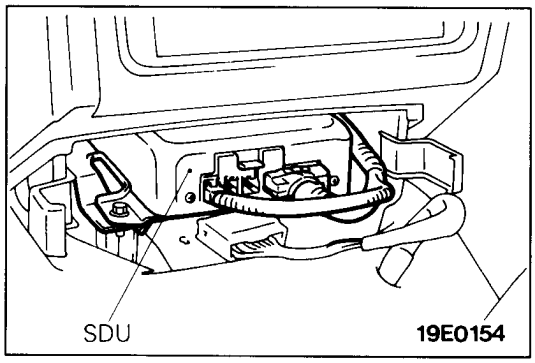


FRONT IMPACT SENSORS E52BF03BA

1. Check sensors to ensure the arrow marks face the front of the vehicle.
2. Check radiator support panel and front impact sensor for deformities or rust.

Caution
The SRS may not activate if a front impact sensor is not installed properly, which could result in serious injury or death to the vehicles driver.

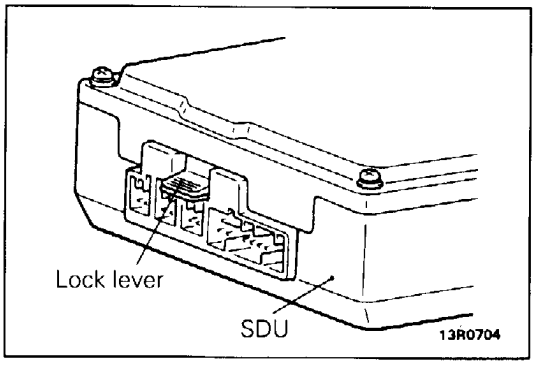
3. Check wiring harness (for front impact sensor) for binds, connector for damage, and terminals for deformities.
   Replace sensor and/or wiring harness if it fails visual check. (Refer to P.52B-3 and P.52B-33.)



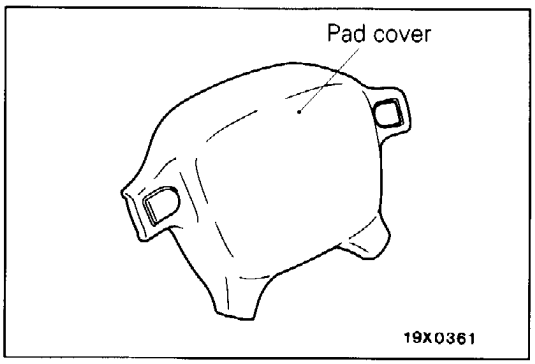
SRS DIAGNOSIS UNIT (SDU) E52BF03CA

1. Check SDU case and brackets for dents, cracks, deformities or rust.

Caution
The SRS may not activate if a front impact sensor is not installed properly, which could result in serious injury or death to the vehicles driver.



2. Check connectors and lock lever for damage, and terminals for deformities or rust.
   Replace SDU if it fails visual check. (Refer to P.52B-35.)



AIR BAG MODULE, STEERING WHEEL AND CLOCK SPRING E52BF03DA

1. Remove the air bag module, steering wheel and clock spring. (Refer to P.52B-38.)

Caution
The removed air bag module should be stored in a clean, dry place with the pad cover face up.

2. Check pad cover for dents, cracks of deformities.

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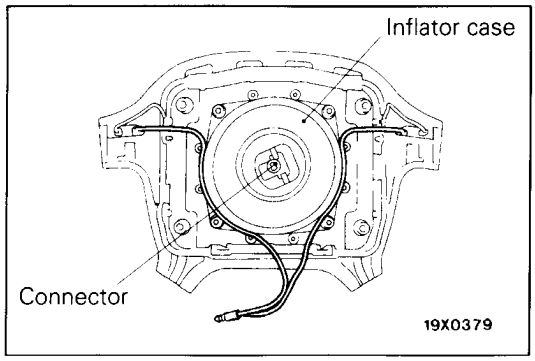
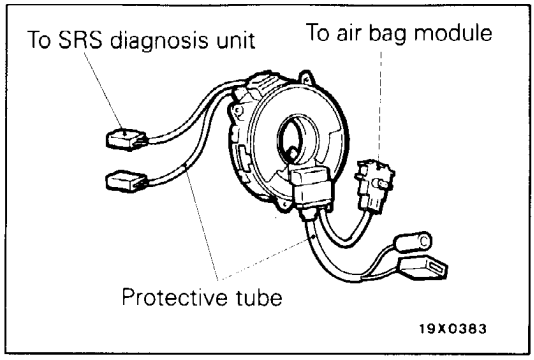
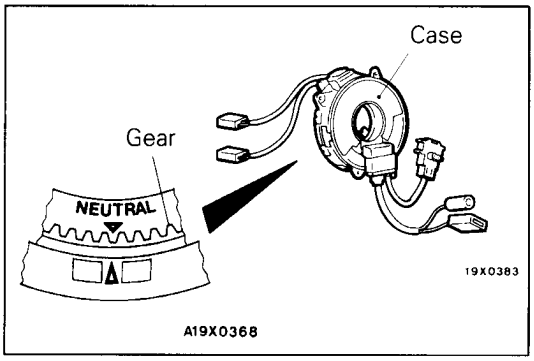


3. Check connector for damage, terminals deformities, and harness for binds.
4. Check air bag inflator case for dents, cracks or deformities.
5. Check harness (built into steering wheel) and connectors for damage, and terminals for deformities.

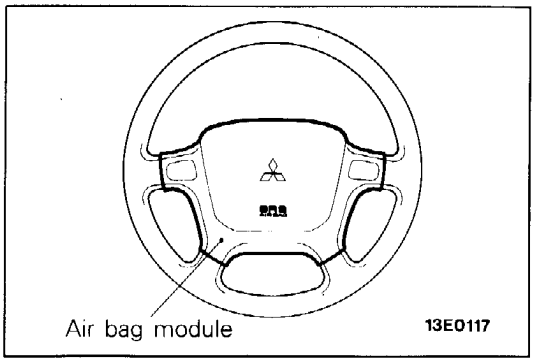


6. Check clock spring connectors and protective tube for damage, and terminals for deformities.



7. Visually check the clock spring case and the gears for damage.
8. Align the mating mark and "NEUTRAL" position indicator and, after turning the vehicle's front wheels to straighta-head position, install the clock spring to the column switch.

Caution
If the clock spring's mating mark is not properly aligned, the steering wheel may not be completely rotational during a turn, or the flat cable within the clock spring may be severed, obstructing normal operation of the SRS and possibly leading to serious injury to the vehicle's driver.



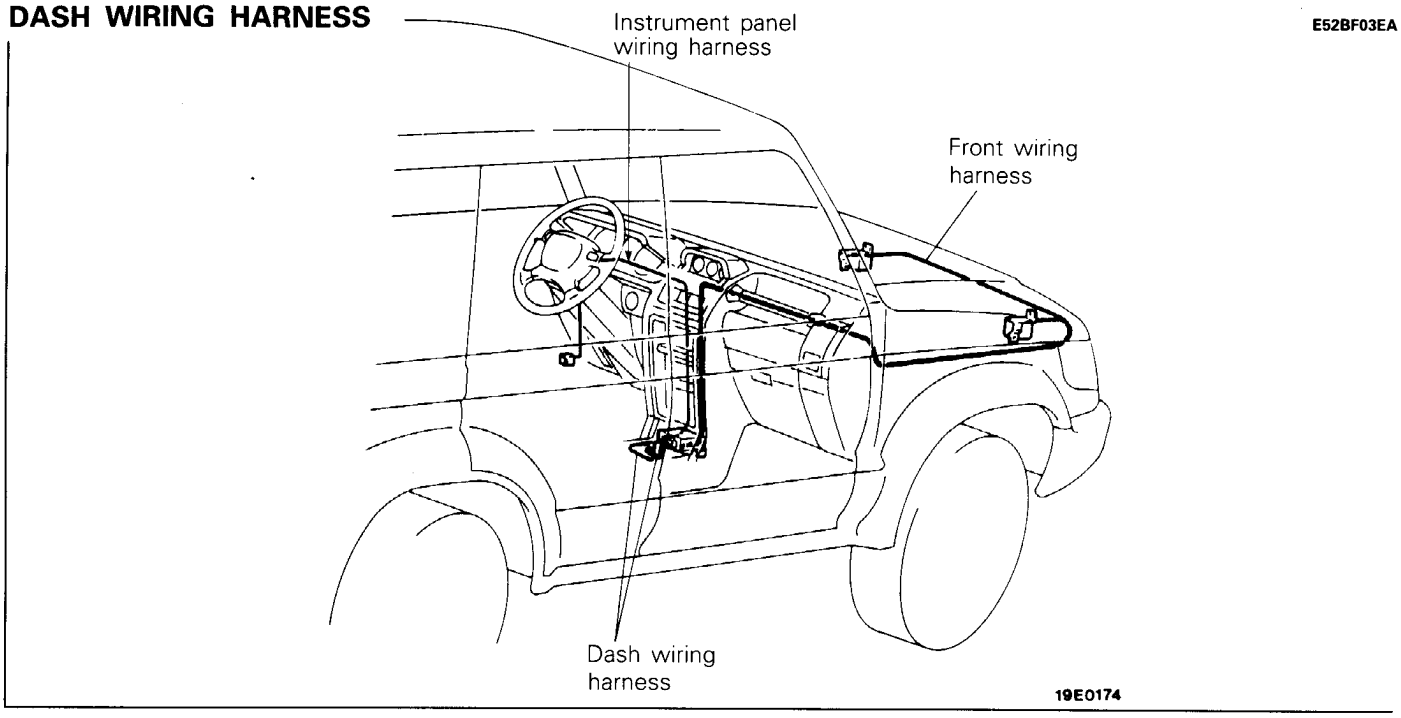
9. Install the steering column covers, steering wheel and the air bag module.
10. Check steering wheel for noise, binds of difficult operation.
11. Check steering wheel for excessive free play.

REPLACE ANY VISUALLY INSPECTED PART IF IT FAILS THAT INSPECTION.

(Refer to P.52B-38.)

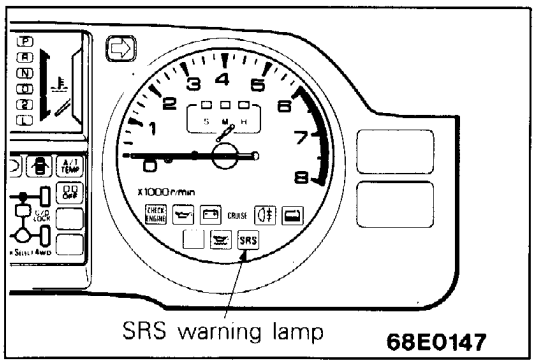
Caution
The SRS may not activate if any of the above components is not installed properly, which could result in serious injury or death to the vehicle's driver.

FRONT WIRING HARNESS, INSTRUMENT PANEL WIRING HARNESS AND DASH WIRING HARNESS E52BF03EA



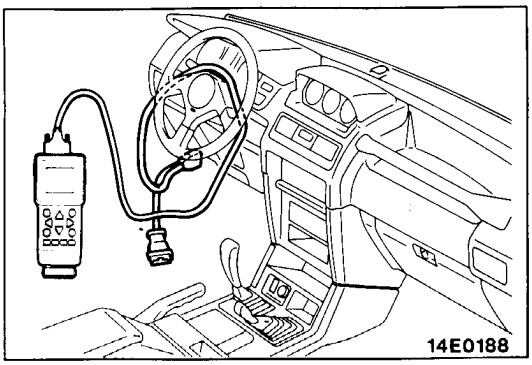
1. Check connector for poor connection.
2. Check harnesses for binds, connectors for damage, and terminals for deforimities.
   REPLACE ANY CONNECTORS OR HARNESS THAT FAIL THE VISUAL INSPECTION.
   (Refer to P.52B-3.)

Caution
The SRS may not activate if SRS harnesses or connectors are damaged or improperly connected, which could result in serious injury or death to the vehicle's driver.



POST-INSTALLATION INSPECTION E52BF04AA

Reconnect the negative battery terminal. Turn the ignition key to the "ON" position. Does the "SRS" warning lamp illuminate for about 7 seconds, turn OFF and then remain extinguished for at least 45 seconds? If yes. SRS system is functioning properly. If no. consult page 52B-7.)



POST-COLLISION DIAGNOSIS E13BF20AA

To inspect and service the SRS after a collision (whether or not the air bag has deployed), perform the following steps.

SRS DIAGNOSIS UNIT MEMORY CHECK E13BF21AA

1. Connect the MUT-II to the diagnosis connector (16-pin) located at the right or left side of the junction block.

   Caution
   Make certain that the ignition switch is OFF when the MUT-II is connected or disconnected.

2. Read (and write down) all displayed diagnosis codes. (Refer to P.52B-7.)

   NOTE
   If the battery power supply has been disconnected or disrupted by the collision, the MUT-II cannot communicate with the SRS diagnosis unit. Inspect and, if necessary, repair the body wiring harness before proceeding further.

3. Read the service data (fault duration and how many times memories are erased) using the MUT-II.

   NOTE
   - Maximum stored period: 9999 minutes (approximately 7 days)
   - Maximum number of times to be stored: 250

4. Erase the diagnosis codes and after waiting 45 seconds or more read (and write down) all displayed diagnosis codes. (Refer to P.52B-7.)

REPAIR PROCEDURE E13BF22AA

When air bag deploys collision.

1. Replace the following parts with new ones.
   - Front impact sensors (Refer to P.52B-33.)
   - SRS diagnosis unit (SDU)(Refer to P.52B-35.)
   - Air bag module (Refer to P.52B-38.)
2. Check the following parts and replace a part if there is a malfunction.
   - Clock spring (Refer to P.52B-38.)
   - Steering wheel, steering column and intermediate joint (Refer to P.52B-31 or GROUP 37 – Steering wheel and Shaft.)
3. Check harnesses for binding, connectors for damage, poor connections, and terminals for deformities. (Refer to P.52B-3.)

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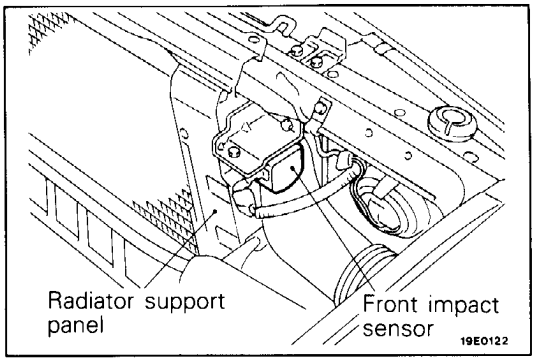
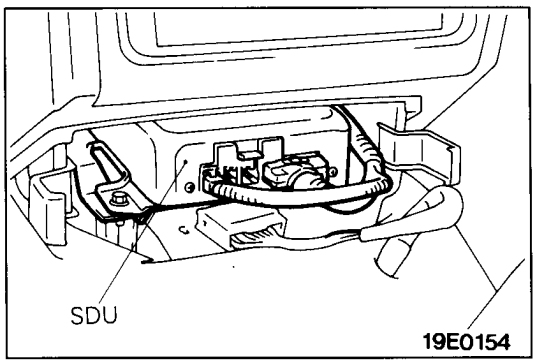
When air bag does not deploy in low-speed collision.

Check the SRS components.
If the SRS components are showing any visible damage such as dents, cracks, or deformation, replace them with new ones.
Concerning parts removed for inspection, replacement with new parts and cautionary points for working, refer to appropriate INDIVIDUAL COMPONENT SERVICE, P.52B-32.



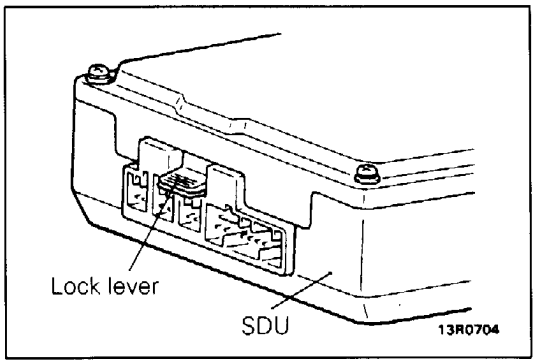
FRONT IMPACT SENSORS E52BF23AA

1. Check radiator support panel for deformities or rust.
2. Check front impact sensor for dents, cracks deformities or rust.
3. Check sensor harnesses for binds, connectors for damage, and terminals for deformities.

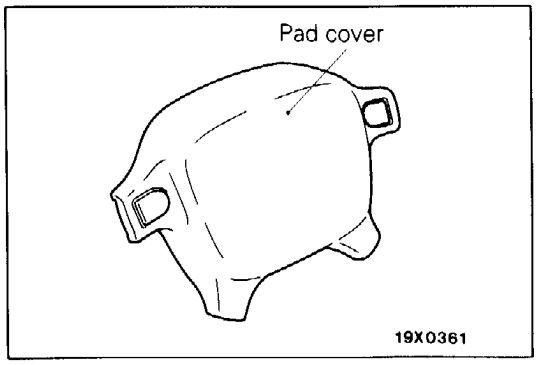


SRS DIAGNOSIS UNIT (SDU) E52BF24AA

1. Check SDU case and brackets for dents, cracks or deformities.



2. Check connectors and lock lever for damage, and terminals for deformities.



AIR BAG MODULE E52BF25AA

1. Check pad cover for dents, cracks or deformities.

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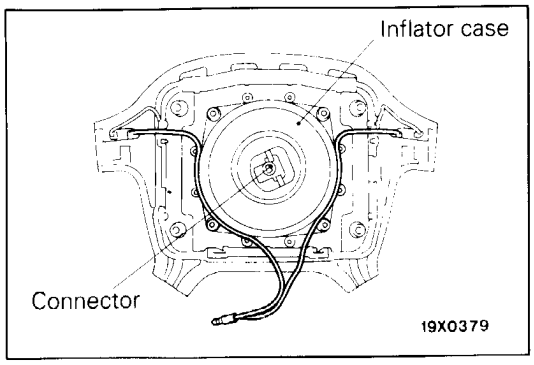
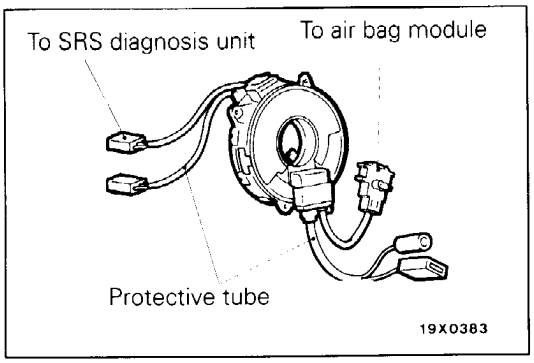
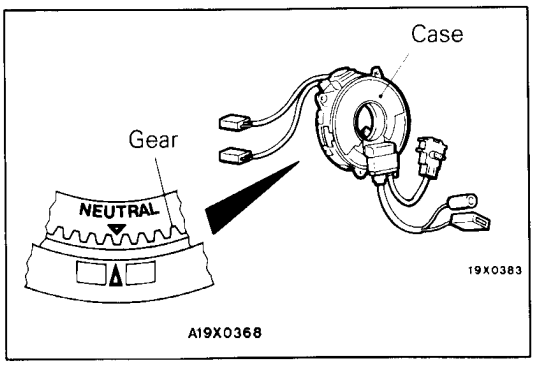


2. Check connector for damage, terminals deformities, and harness for binds.
3. Check air bag inflator case for dents, cracks or deformities.
4. Install air bag module to steering wheel to check fit or alignment with the wheel.



CLOCK SPRING E52BF26AA

1. Check clock spring connectors and protective tube for damage, and terminals for deformities.



2. Visually check the case and the gear for damage.

STEERING WHEEL, STEERING COLUMN AND INTERMEDIATE JOINT E52BF27AA

1. Check wiring harness (built into steering wheel) and connectors for damage, and terminals for deformities.
2. Install air bag module to check fit or alignment with steering wheel.
3. Check steering wheel for noise, binds or difficult operation and excessive free play.

HARNESS CONNECTOR (BODY AND FRONT WIRING HARNESS) E52BF28AA

Check harnesses for binding, connectors for damage, poor connections, and terminals for deformities. (Refer to P.52B-3.)

INDIVIDUAL COMPONENT SERVICE

E52BF40AA

If the SRS components are to be removed or replaced as a result of maintenance, troubleshooting, etc., follow each procedure (P.52B-33 – P.52B-43.)

Caution

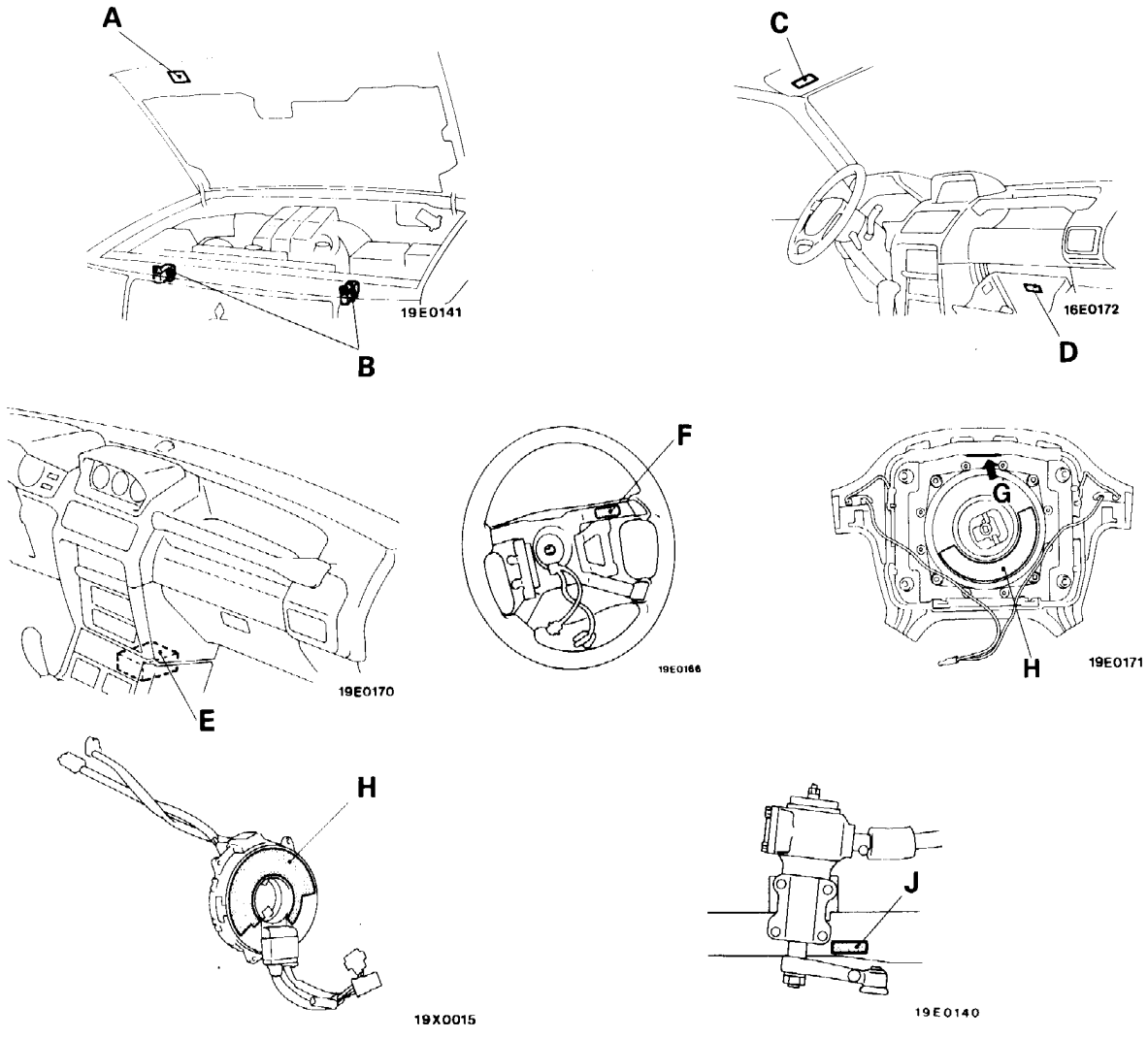
1. **SRS components should not be subjected to heat over 93°C, so remove the front impact sensors, SRS diagnosis unit and air bag module and clock spring before drying or baking the vehicle after painting. Recheck SRS system operability after re-installing them.**
2. **If the SRS components are removed for the purpose of check, sheet metal repair, painting, etc., they should be stored in a clean, dry place until they are reinstalled.**

WARNING/CAUTION LABELS

E52BF41AA

A number of caution labels relating to the SRS are found in the vehicle, as shown in the following illustration. Follow label instructions when servicing SRS.

If labels are dirty or damaged, replace them with new ones.



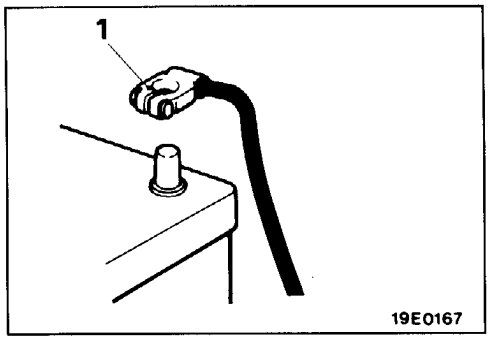
FRONT IMPACT SENSORS

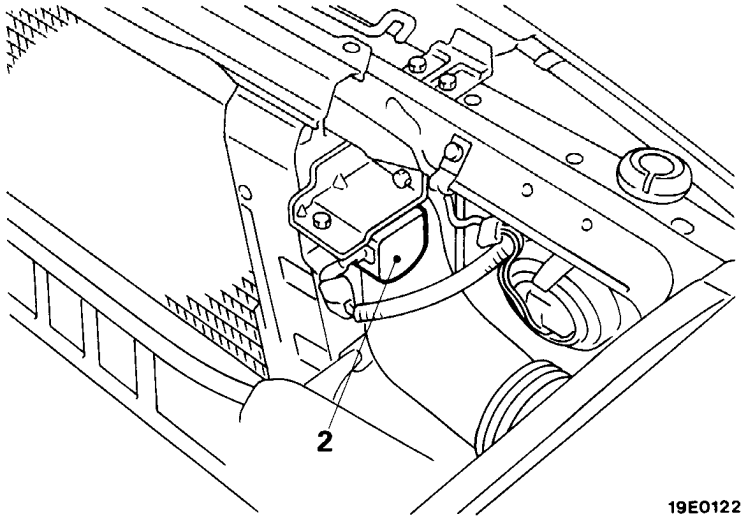
N52BG00AA

Caution

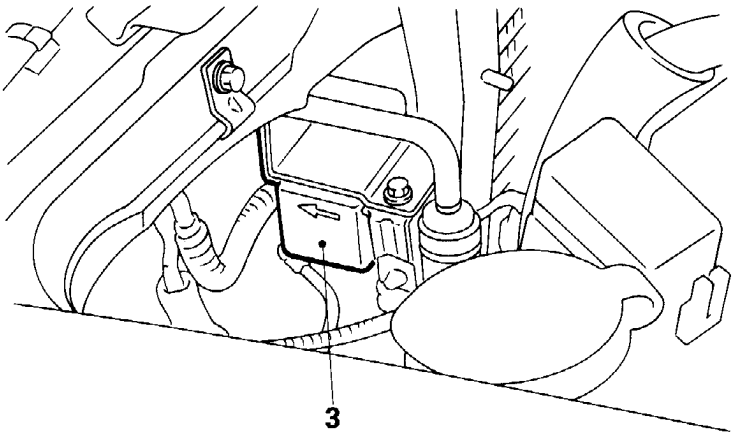
1. **Never repair or disassemble a front impact sensor. If faulty, replace it.**
2. **Handle the front impact sensors very carefully, taking care not to drop them or subject them to impact. If a sensor is seen to be dented, cracked, deformed or rusted, replace it with a new one.**
3. **Replace sensors with new ones after the air bags have deployed.**

REMOVAL AND INSTALLATION



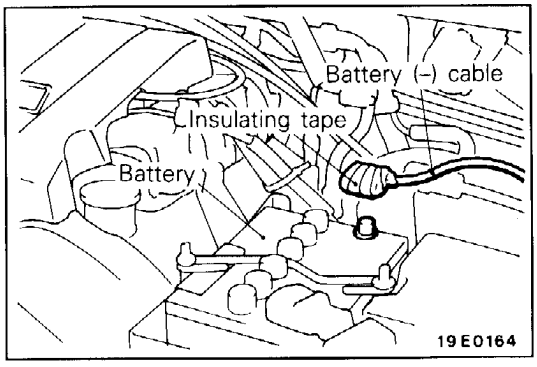


Pre-removal Operation
- Turn the ignition key to the "LOCK" position.



Removal steps

- ◆◆ • Post-installation inspection
- ◆◆ 1. Connection of the negative (–) battery cable to the battery
- ◆◆ ◆◆ 2. Front impact sensor (R.H.)
- ◆◆ • Reserve tank
- ◆◆ ◆◆ 3. Front impact sensor (L.H.)
- ◆◆ • Pre-installation inspection



SERVICE POINTS OF REMOVAL

1. DISCONNECTION OF THE NEGATIVE (–) BATTERY CABLE FROM THE BATTERY

Disconnect the negative battery cable from the battery and tape and terminal.

Caution

Wait at least 60 seconds after disconnecting the battery cable before doing any further work. (Refer to P.52B-4.)

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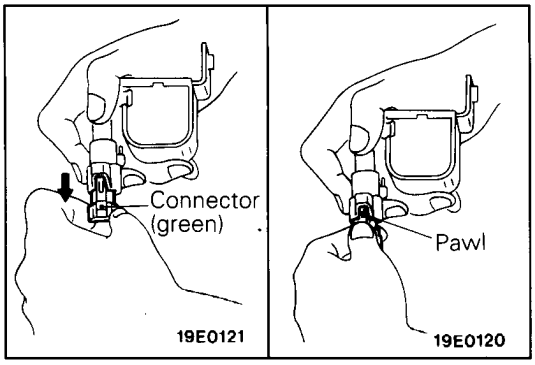

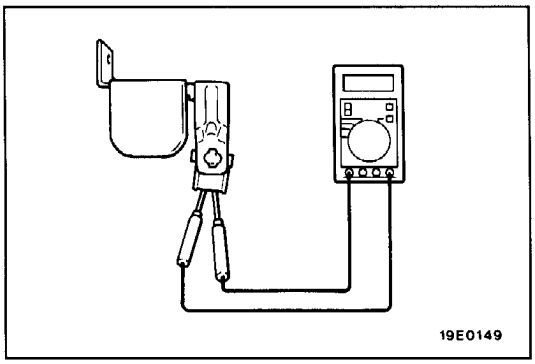

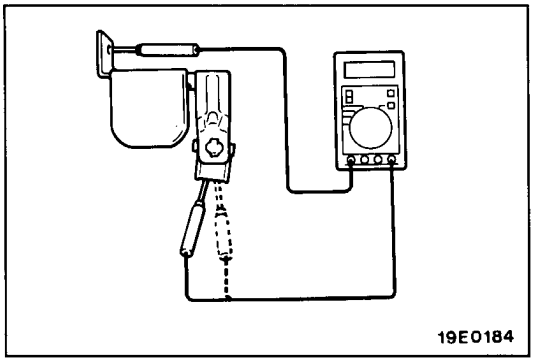

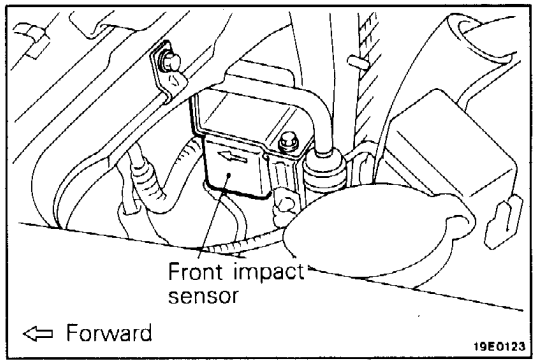

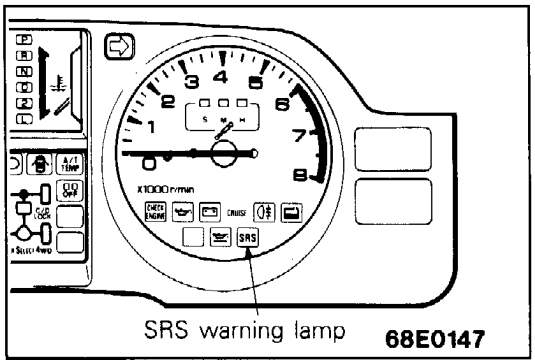

2. REMOVAL OF FRONT IMPACT SENSOR (R.H.)/ 3. FRONT IMPACT SENSOR (L.H.)

(1) Slide the connector (green section) to release the lock.
(2) Push down the pawl and disconnect the connector.

INSPECTION N52BG02AA

(1) Check upper frame and sensor brackets for deformities or rust.
(2) Check sensor harness for binds, connectors for damage, and terminals for deformities.
(3) Check for dents, cracks, deformation or rust of the front impact sensor.

Caution
If a dent, crack, deformation or rust is detected, replace with a new sensor.

(4) Measure the resistance between terminals and check whether it is within the standard value.

Standard value: 2,000 ± 20 Ω

Caution
Always replace the sensor with a new one if the resistance is not within the standard value.

(5) Check for continuity between the terminal and the bracket. If there is continuity, it indicates a poor insulation. In that case, replace the sensor.

SERVICE POINT OF INSTALLATION N52BG04AA

PRE-INSTALLATION INSPECTION

To mount the new front impact sensor, visually check it and measure the resistance between the terminals. (Refer to the previous item "INSPECTION")

3. INSTALLATION OF FRONT IMPACT SENSOR (L.H.)/ 2. FRONT IMPACT SENSOR (R.H.)

(1) Securely connect the connector.
(2) Set front impact sensor towards the front of the vehicle as shown by the arrow in the illustration, and install it securely.

Caution
The SRS may not activate properly if a front impact sensor is not installed properly, which could result in the SRS system not operating properly during a collision.

POST-INSTALLATION INSPECTION

Reconnect the negative battery terminal. Turn the ignition key to the "ON" position. Does the "SRS" warning lamp illuminate for about 7 seconds, turn OFF and then remain OFF for at least 45 seconds? If yes, SRS system is functioning properly. If no, consult page 52B-7.

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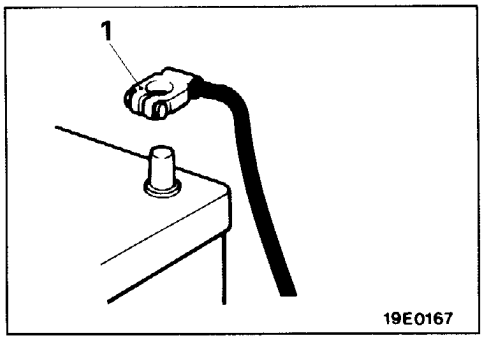
SRS DIAGNOSIS UNIT (SDU)

N52BH00AA

Caution

1. **Never attempt to disassemble or repair the SDU. If faulty, replace it.**
2. **Do not drop or subject the SDU to impact or vibration. If dents, cracking, deformation, or rust are discovered on the SDU, replace it with a new SDU. Discard the old one.**
3. **After deployment of the air bags, replace the SDU with a new one.**
4. **Never use an ohmmeter on or near the SDU, and use only the special test equipment described on P.52B-5.**

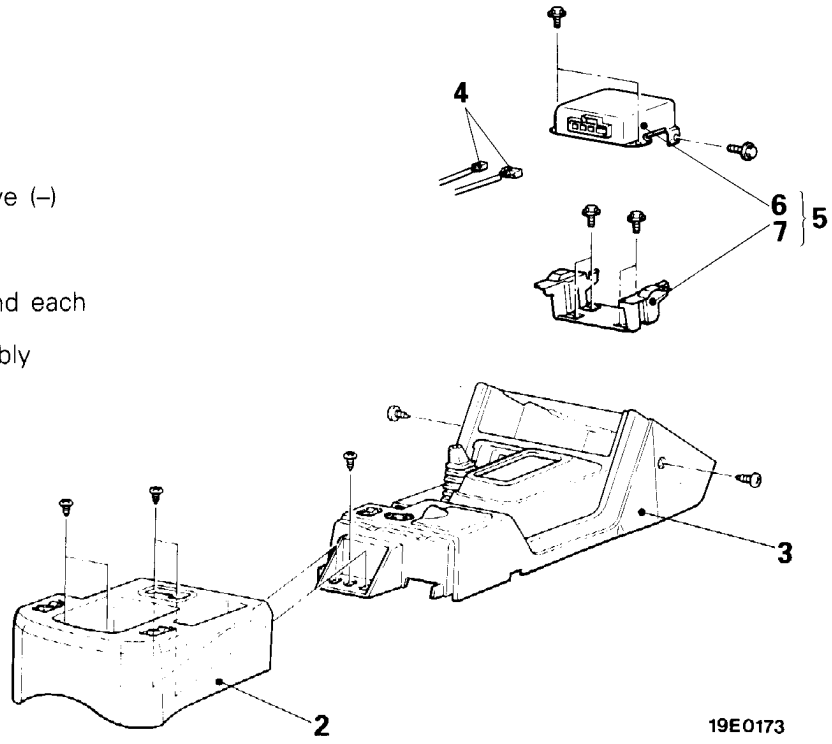
REMOVAL AND INSTALLATION

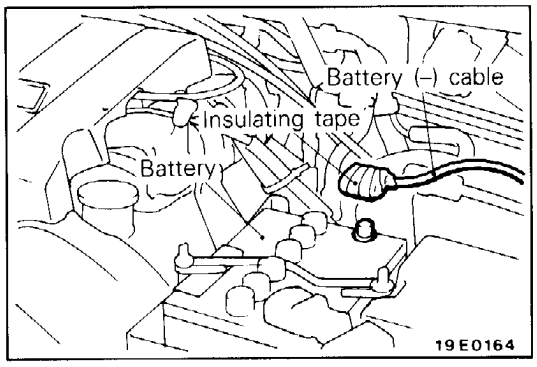


Pre-removal Operation
- Turn the ignition key to the "LOCK" position.

Removal steps

- Post-installation inspection
- 1. Connection for the negative (–) battery cable
- 2. Rear console assembly
- 3. Front console assembly
- 4. Connection of the SDU and each harness connector
- 5. SRS diagnosis unit assembly
- 6. SRS diagnosis unit (SDU)
- 7. Bracket





SERVICE POINTS OF REMOVAL

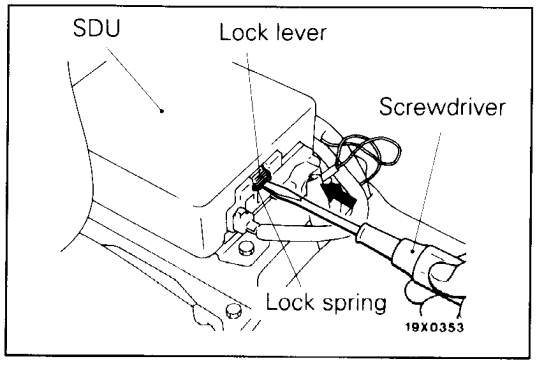
1. DISCONNECTION OF THE NEGATIVE (–) BATTERY CABLE FROM THE BATTERY

Disconnect the negative battery cable from the battery and tape and terminal.

Caution

Wait at least 60 seconds after disconnecting the battery cable before doing any further work. (Refer to P.52B-4.)

ADDED



4. DISCONNECTION OF THE SDU AND EACH HARNESS CONNECTOR

(1) Place a flat-tipped (–) screwdriver against the lock spring (metal portion) of the SDU connector lock lever, and push the spring horizontally toward the inside of the unit.

Caution
1. **Do not use excessive force to raise the lock lever (green).**
2. **Do not insert the screwdriver into the gap between the lock lever (green) and the lock spring (metal portion.)**

(2) While pushing the locks of each connector downwards, remove each connector from the SDU.

Caution
Because a double lock mechanism is employed for the SDU connectors, be careful not to exert undue force to remove the connectors, as this will damage them.

INSPECTION E52BH02AA

- Check the SDU case and brackets for dents, cracks or deformities.
- Check connectors and lock lever for damage, and terminals for deformities.

Caution
If a dent, cracks, deformation or rust discovered, replace the SDU with a new one.

NOTE
For checking of the SDU other than described above, refer to the section concerning troubleshooting. (Refer to P.52B-7.)

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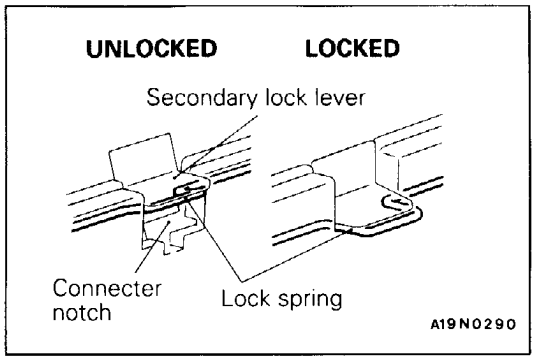
SERVICE POINTS OF INSTALLATION

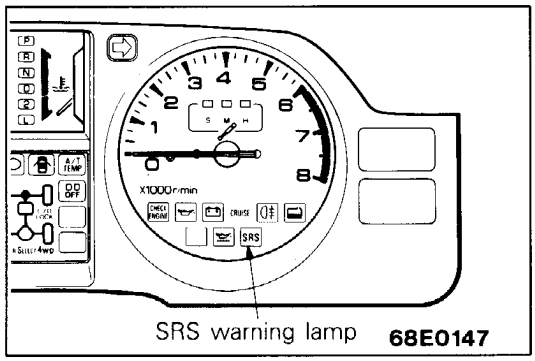
6. INSTALLATION OF SRS DIAGNOSIS UNIT (SDU)

Caution
The SRS may not activate if SDU is not installed properly, which could result in serious injury or death to the vehicle's driver.



4. CONNECTION OF THE SDU AND EACH HARNESS CONNECTOR

After connecting each harness connector securely and correctly to the SDU, be sure to press down the lock lever of the SDU.



POST INSTALLATION INSPECTION

Reconnect the negative battery terminal. Turn the ignition key to the "ON" position. Does the "SRS" warning lamp illuminated for about 7 seconds, turn OFF and then remain extinguished for at least 45 seconds? If yes, SRS system is functioning properly. If no, consult page 52B-7.)

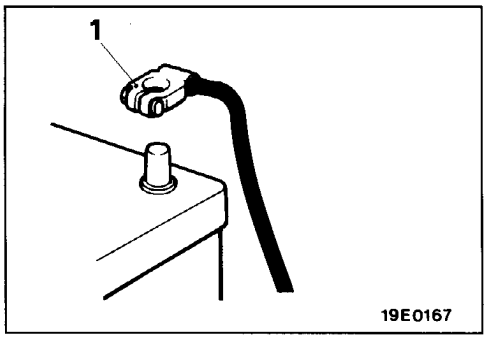
AIR BAG MODULES AND CLOCK SPRING

N52BI00AA

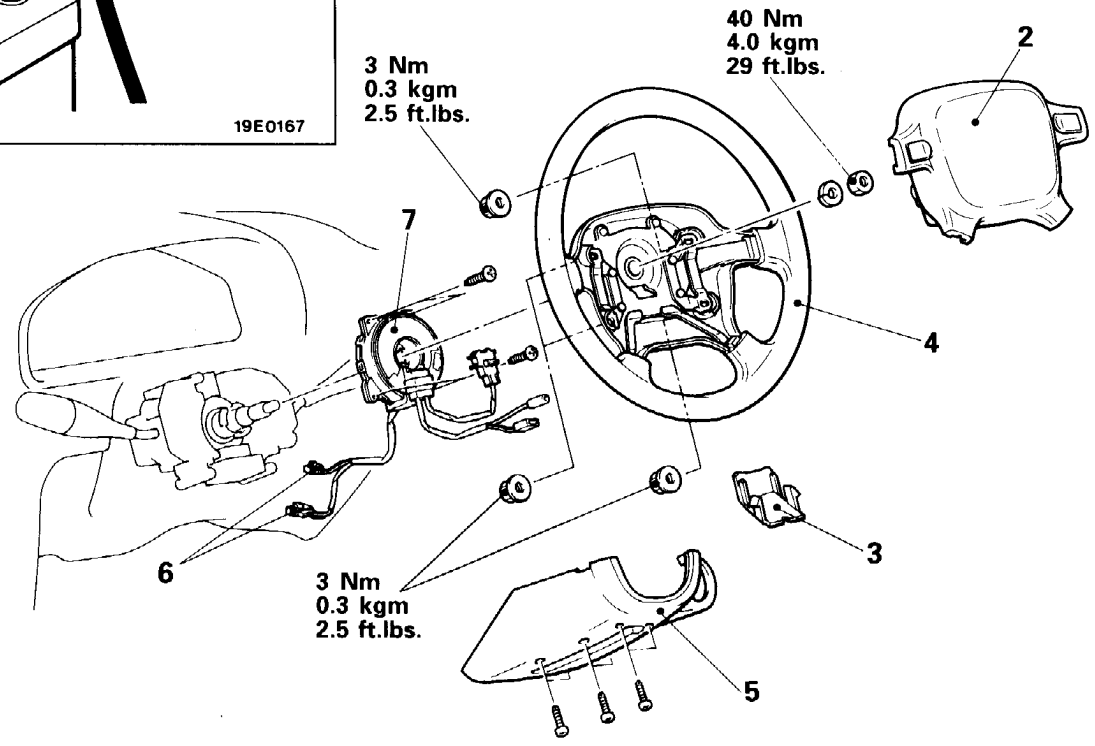
Caution

1. **Never attempt to disassemble or repair the air bag module or clock spring. If faulty, replace it.**
2. **Do not drop the air bag module or clock spring or allow contact with water, grease or oil. Replace it if a dent, crack, deformation or rust are detected.**
3. **The air bag modules should be stored on a flat surface and placed so that the pad surface is facing upward.**
   Do not place anything on top of the air bag modules.
4. **Do not expose the air bag module to temperature over 93°C (200°F).**
5. **After deployment of an air bag, replace the clock spring with a new one.**
6. **Wear gloves and safety glasses when handling an air bag that has deployed.**
7. **An undeployed air bag module should only be disposed of in accordance with the procedures P.52B-44 – P.52B-47.**

REMOVAL AND INSTALLATION



Pre-removal Operation
- After setting the steering wheel and the front wheels to the straight ahead position, remove the ignition key.



Clock spring removal steps

- ◆◆ • Post-installation inspection
- ◆◆ 1. Connection of the negative (–) battery cable to the battery
- ◆◆ ◆◆ 2. Air bag module
- 3. Cap
- ◆◆ ◆◆ 4. Steering wheel
- 5. Column cover lower
- 6. Clock spring and body wiring harness connection
- ◆◆ ◆◆ 7. Clock spring
- ◆◆ • Pre-installation inspection

Air bag module removal steps

- ◆◆ • Post-installation inspection
- ◆◆ 1. Connection of the negative (–) battery cable to the battery
- ◆◆ ◆◆ 2. Air bag module

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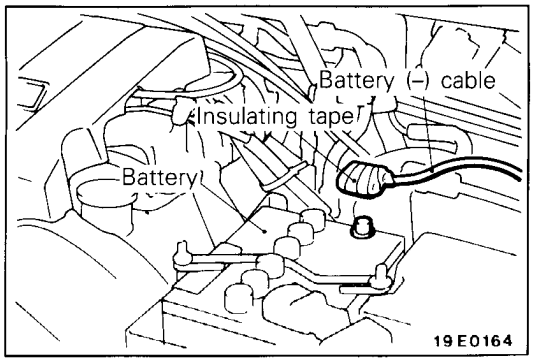
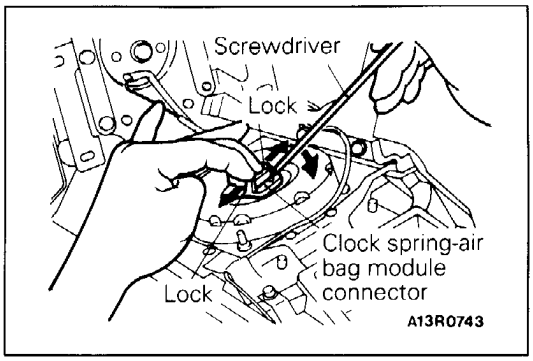


SERVICE POINTS OF REMOVAL

1. DISCONNECTION OF THE NEGATIVE (–) BATTERY CABLE FROM THE BATTERY

Disconnect the negative battery cable and tape the terminal.

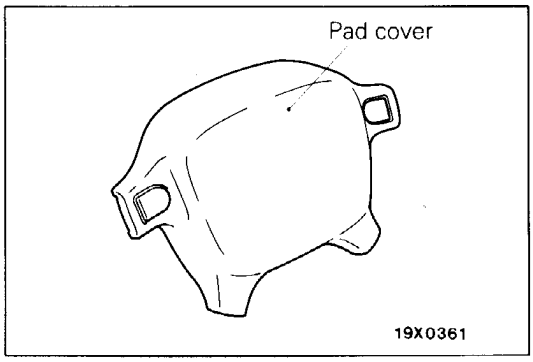
Caution
Wait at least 60 seconds after disconnecting the battery cable before doing any further work. (Refer to P.52B-4.)

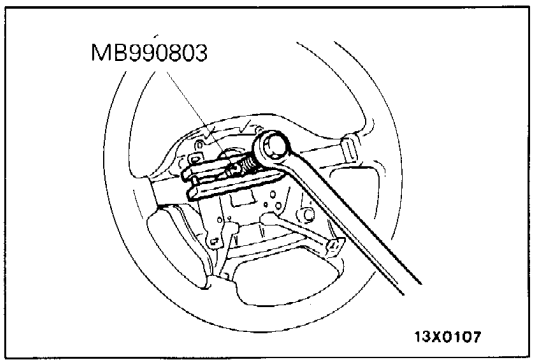


2. REMOVAL OF AIR BAG MODULE

(1) Remove the air bag module mounting nut using a socket wrench from the back side.
(2) When disconnecting the connector of the clock spring from the air bag module, press the air bag's lock toward the outer side to spread it open. Use a screwdriver, as shown in the figure at the left, to pry so as to remove the connector gently.

Caution
1. **When disconnection the air bag module-clock spring connector, take care not to apply excessive force to it.**
2. **The removed air bag module should be stored in a clean, dry place with the pad cover face up.**





4. REMOVAL OF STEERING WHEEL

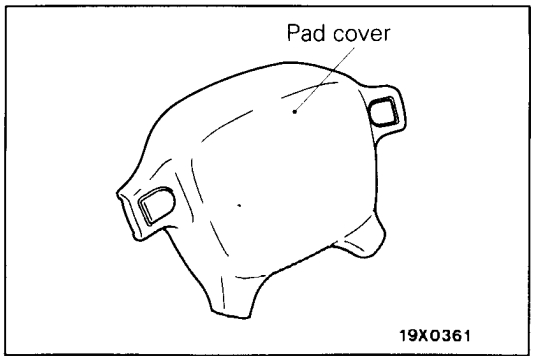
Caution
Do not hammer on the steering wheel. Doing so may damage the collapsible column mechanism.

INSPECTION E52BI02AA

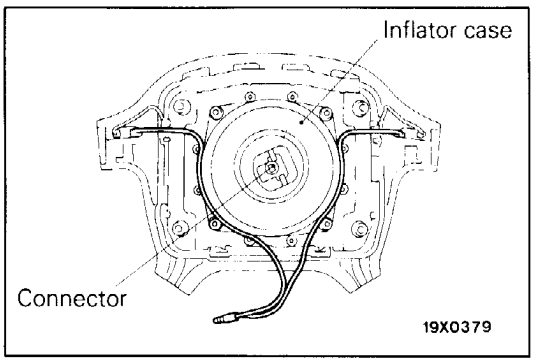
AIR BAG MODULE

If any improper part is found during the following inspection, replace the air bag module with a new one.
Dispose of the old one according to the specified procedure. (Refer to P.52B-44.)

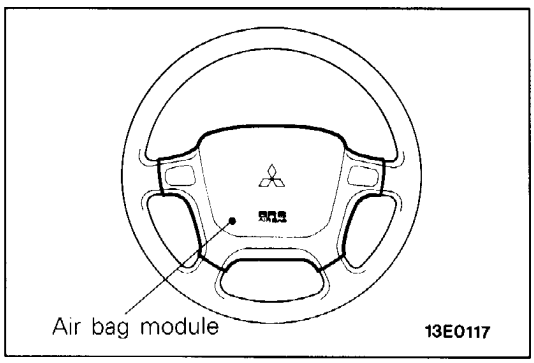
Caution
Never attempt to measure the circuit resistance of the air bag module (squib) even if you are using the specified tester. If the circuit resistance is measured with a tester, accidental air bag deployment will result in serious personal injury.



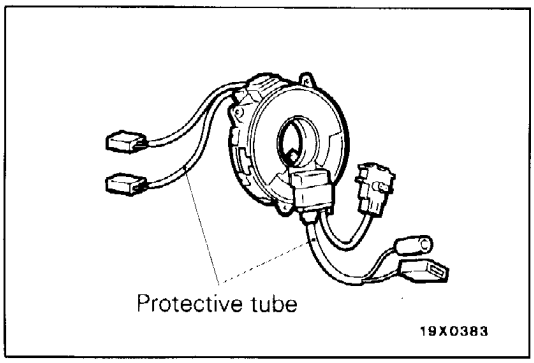
(1) Check pad cover for dents, cracks or deformities.



(2) Check the air bag module for denting, cracking or deformation.
(3) Check hooks and connectors for damage, terminals for deformities, and harness for binds.
(4) Check air bag inflator case for dents, cracks or deformities.

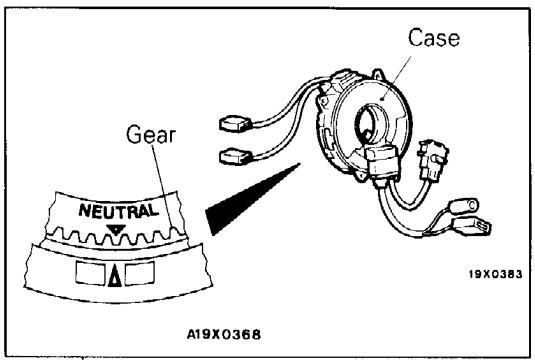


(5)Install the air bag module to steering wheel to check fit or alignment with the wheel.



CLOCK SPRING E52BI02BA

If, as result of following checks, even one abnormal point is discovered, replace the clock spring with a new one.
(1) Check connectors and protective tube for damage, and terminals for deformities.



(2) Visually check the case and the gears for damage.

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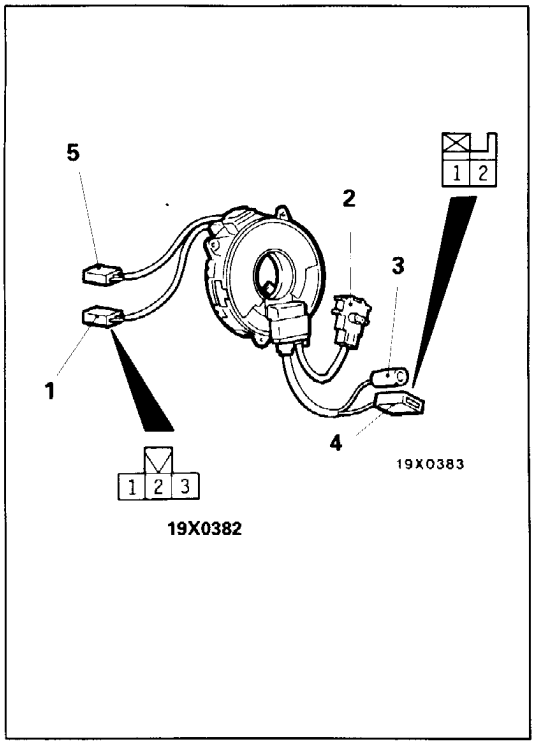
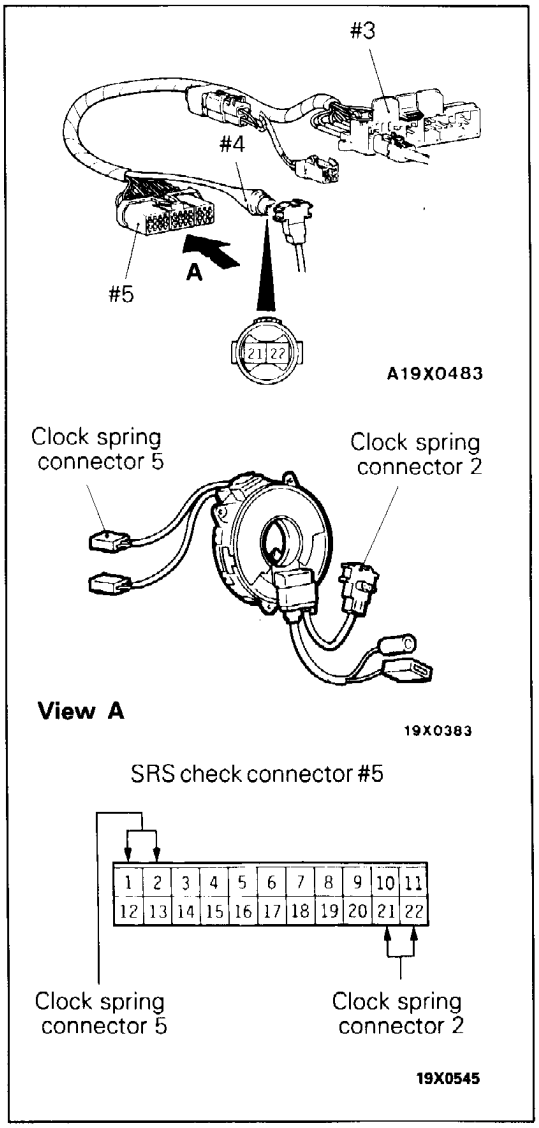


(3) Check for continuity between the No.1 connector of the clock spring and connectors No.3 and 4

No.1 connector			No.3 connector	No.4 connector	
Terminal 1	Terminal 2	Terminal 3		Terminal 1	Terminal 2
To auto-cruise control unit	To ACC power	To horn relay	To horn switch	To auto-cruise control switch	

NOTE
○—○ indicates that there is continuity between the terminal.



(4) Check of resistance between the terminals.
a. Joint the No. 2 connector and No. 5 connector of the clock spring to connector # 4 and connector # 3, respectively, of the SRS Check Harness.

NOTE
When joining SRS Check Harness connector # 4, align its white paint with the hollow portion of the No.2 connector of the clock spring.

b. Check for continuity between terminal 1 and terminal 22, and terminal 2 and terminal 21, of SRS Check Harness connector # 5, using a digital multi-meter.

Standard value: less than 0.4 Ω

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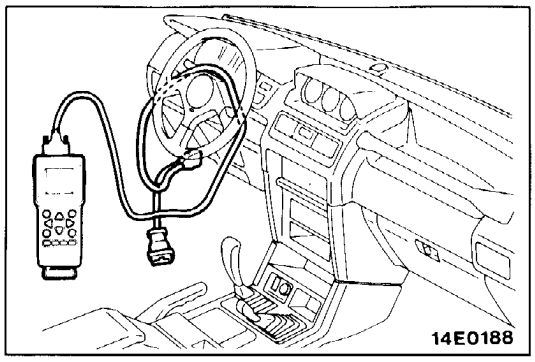
SERVICE POINTS OF INSTALLATION E52BI04AA

PRE-INSTALLATION INSPECTION

(1) When installing the new air bag module and clock spring, refer to "INSPECTION"

Caution
Dispose of an air bag module only according to the specified procedure. (Refer to P.52B-44.)

(2) Connect the battery (–) terminal.

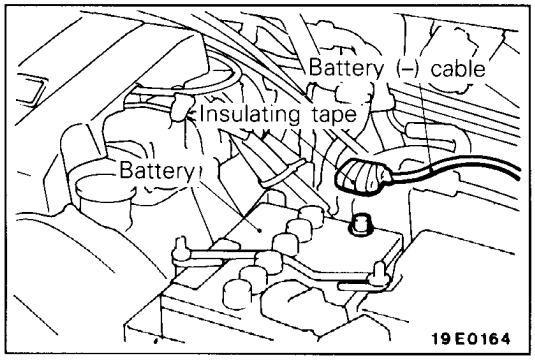


(3) Connect the MUT-II to the diagnosis connector (16-pin) located at the right or left side of the junction block.

Caution
Make certain that the ignition switch is OFF when the MUT-II is connected or disconnected.

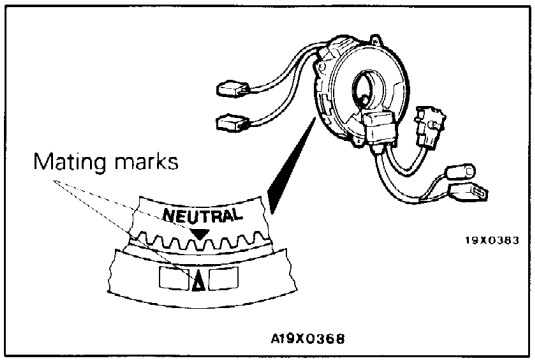
(4) Reconnect negative terminal of battery, and turn the ignition key to the "ON" position.

(5) Conduct self-diagnosis using the MUT-II to ensure entire SRS operates properly, except open circuit of air bag module (Diagnosis code No.22). (Refer to P.52B-7.)



(6) Turn the ignition key to the "LOCK" position, disconnect the negative battery cable and tape the terminal.

Caution
Wait at least 60 seconds after disconnecting the battery cable before doing any further work. (Refer to P.52B-4.)



7. INSTALLATION OF CLOCK SPRING

Align the mating mark and "NEUTRAL" position indicator of the clock spring, and, after turning the front wheels to the straight-ahead position, install the clock spring to the column switch.

Caution
If the clock spring's mating mark is not properly aligned, the steering wheel may not be completely rotational during a turn, or the flat cable within the clock spring may be severed, obstructing normal operation of the SRS and possibly leading to serious injury to the vehicle's driver.

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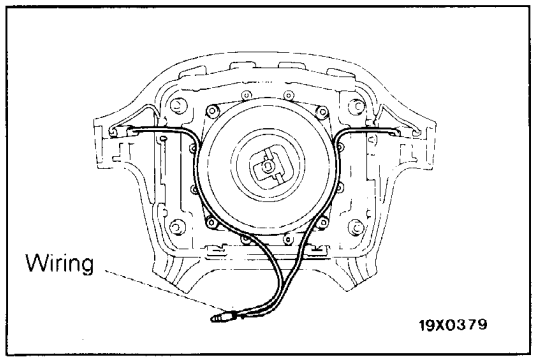
4. INSTALLATION OF STEERING WHEEL

(1) Before installing the steering wheel, be sure to first turn the vehicle's front wheels to the straight-ahead position and align the mating mark and "NEUTRAL" position indicator of the clock spring.

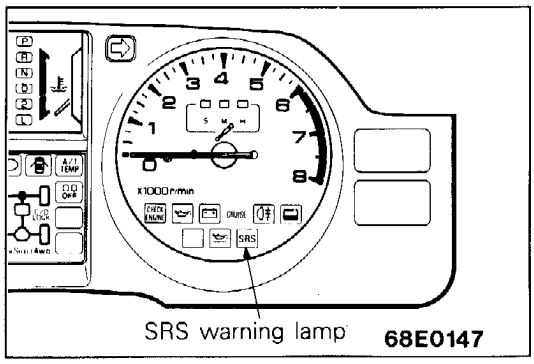
Caution
Be sure when installing the steering wheel, that the harness of the clock spring does not become caught or tangled.

(2) After clamping, turn the steering wheel all the way in both directions to confirm that steering is normal.



2. INSTALLATION OF AIR BAG MODULE

Install the air bag module, taking care that no wiring is caught by it.



POST-INSTALLATION INSPECTION

(1) After installing the clock spring, the steering wheel, the column covers and the air bag module, check steering wheel of noise, binds or difficult operation.

(2) Reconnect the negative battery terminal. Turn the ignition key to the "ON" position. Does the "SRS" warning lamp illuminate for about 7 seconds, turn OFF and then remain extinguished for at least 45 seconds? If yes, SRS system is functioning properly. If no. consult page 52B-7.)

AIR BAG MODULE DISPOSAL PROCEDURES

E52BF50AA

Before either disposing of a vehicle equipped with an air bag, or prior to disposing of the air bag module, be sure to first follow the procedures described below to and deploy the air bag.

UNDEPLOYED AIR BAG MODULE DISPOSAL

E52BF51AA

Caution

1. **If the vehicle is to be scrapped, or otherwise disposed of, deploy the air bag inside the vehicle.**
   If the vehicle will continue to be operated and only the air bag module is to be disposed of, deploy the air bag outside the vehicle.
2. **Since a large amount of smoke is produced when the air bag is deployed, select a well-ventilated site. Moreover, never attempt the test near a smoke sensor.**
3. **Since there is a loud noise when the air bag is deployed, avoid residental areas Whenever possible. If anyone is nearby, give warning of the impending noise.**

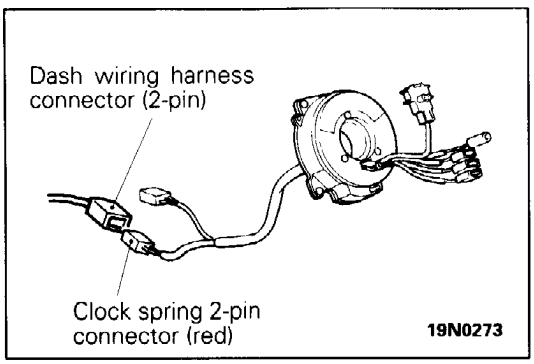
DEPLOYMENT INSIDE THE VEHICLE

E52BF51BA

(when disposing a vehicle)

(1) Open all windows and doors of the vehicle. Move the vehicle to an isolated spot.
(2) Disconnect the negative (–) and positive (+) battery cables from the battery terminals, and then remove the battery from the vehicle.

Caution
Wait at least 60 seconds after disconnecting the battery cables before doing any further work. (Refer to P.52B-4.)



(3) Remove the steering column cover lower.
(4) Remove the connection between the clock spring 2-pin connector (red) and the dash wiring harness connector.

NOTE
If the clock spring connector is disconnected from the dash wiring harness, both electrodes of the clock spring connector will be automatically shorted to prevent unintended deployment of the air bag due to static electricity, etc.

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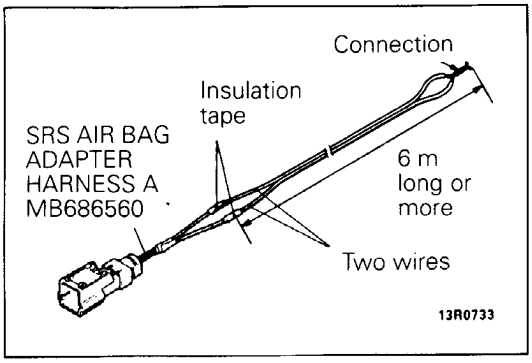
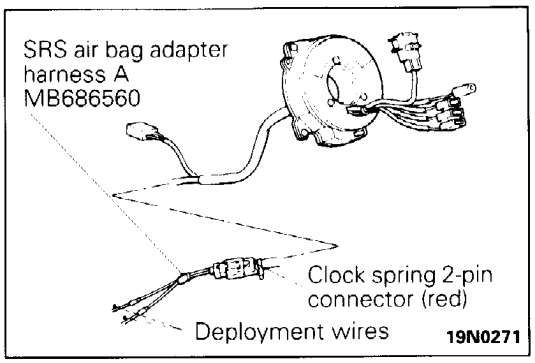
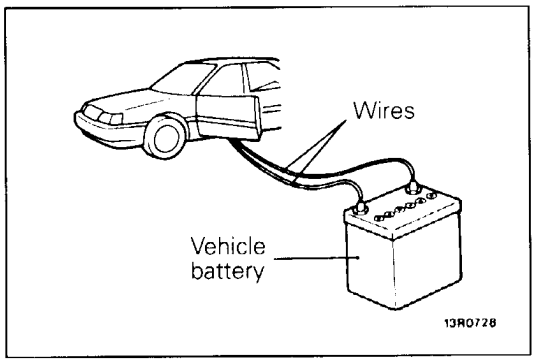


(5) Connect two wires, each six meters long or more, to the two leads of SRS AIR BAG ADAPTER HARNESS A and cover the connections with insulation tape. The other ends of the two wires should be connected to each other (short-circuited), to prevent sudden unexpected deployment of the air bag.



(6) Connect the clock spring 2-pin connector (red) to SRS air bag adapter harness A and pass the deployment wires out of the vehicle.



(7) At a location as far away from the vehicle as possible, disconnect the two connected wires from each other, and connect them to the two terminals of the battery (removed from the vehicle) to deploy the air bag.

Caution

1. **Before deploying the air bag in this manner, first check to be sure that there is no one in or near the vehicle. Wear safety glasses.**
2. **The inflator will be quite hot immediately following the deployment, so wait at least 30 minutes to allow it to cool before attempting to handle it.**
   Although not poisonous, do not inhale gas from air bag deployment.
   See Deployed Air Bag Module Disposal Procedures (P.52B-47.) for post-deployment handling instructions.
3. **If the air bag module fails to deploy when the procedures above are followed, do not go near the module.**
   Contact your local distributor.

(8) Dispose of the air bag module after deployment according to the Deployed Air Bag Module Disposal Procedures. (Refer to P.52B-47.)

DEPLOYMENT OUTSIDE THE VEHICLE E52BF51CA

Caution

1. **Should be carried out in a wide, flat area at least 6 m away from obstacles and other people.**
2. **Do not perform deployment outside, if a strong wind is blowing, and if there is even a slight breeze, the air bag module should be placed and deployed downwind from the battery.**

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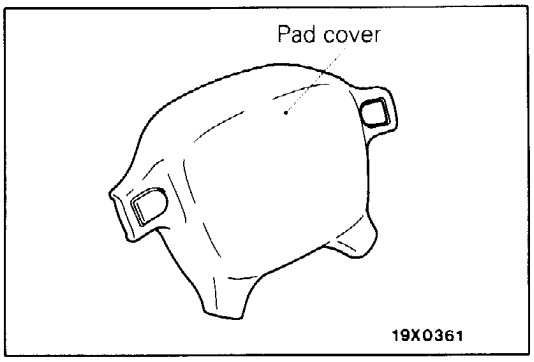
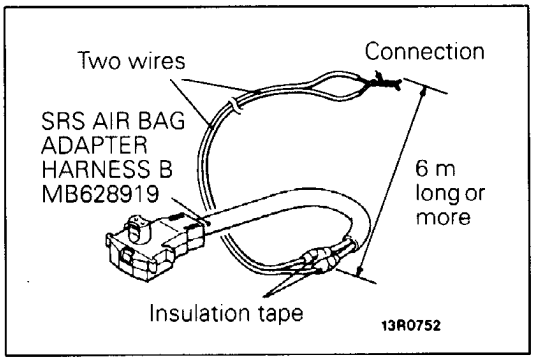
Disconnect the negative (–) and positive (+) battery cables from the battery terminals, and then remove the battery from the vehicle

Caution
Wait at least 60 seconds after disconnecting the battery cables before doing any further work. (Refer to P.52B-4.)

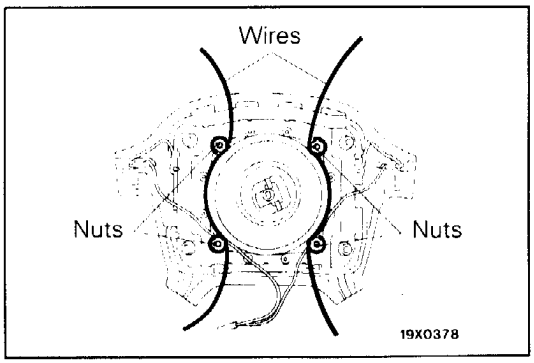


(2) Remove the air bag module from the vehicle. (Refer to P.52B-38.)

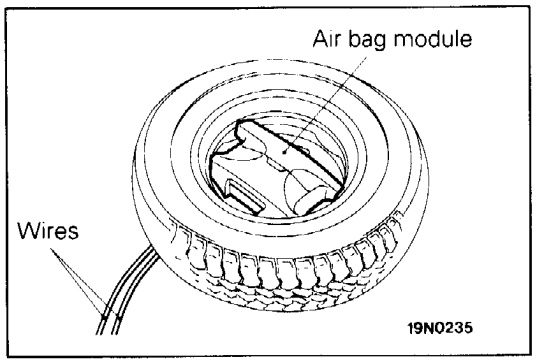
Caution
The air bag module should be stored on a flat surface and placed so that the pad cover face up. Do not place anything on top of it.



(3) Connect two wires, each six meters long or more, to the two leads of SRS AIR BAG ADAPTER HARNESS B, and cover the connections with insulation tape. The other ends of the two wires should be connected to each other (short-circuited), to prevent sudden unexpected deployment of the air bag.



(4) Install nuts that are no longer needed to the four bolts on the rear side of the air bag module, and tie on some thick wire to secure to the wheel.
(5) Take the SRS air bag adaptor harness B that is connected to the wires, pass it beneath the old tyre that is attached to the wheel, and connect it to the air bag module.



(6) Insert the air bag module into the wheel on which the old tyre has been installed, and secure it with the wires that are tied to the bolts, with the air bag facing upward.

Caution
Leave some space below the wheel for the adaptor harness. If there is no space, the reaction when the air bag deploys could damage the adaptor harness.

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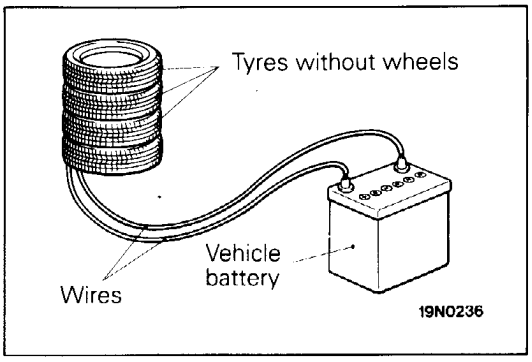


(7) Place three old tyres with no wheels on top of the tyre secured to the air bag module.
(8) At a location as far away from the air bag module as possible, and from a shielded position, if possible, disconnect the two connected wires from each other and connect them to the two terminals of the battery (removed from the vehicle) to deploy the air bag.

Caution

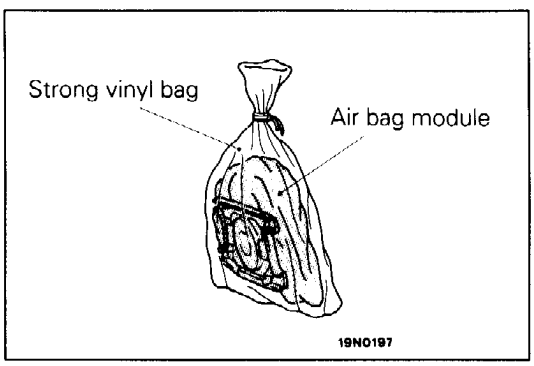
1. **Before deployment, check carefully to be sure that no one is nearby.**
2. **The inflator will be quite hot immediately following deployment, so wait at least 30 minutes to allow it to cool before attempting to handle it. Although not poisonous, do not inhale gas from air bag deployment. See Deployed Air Bag Module Disposal Procedures (as shown below) for post-deployment handling instructions.**
3. **If the air bag module fails to deploy when the procedures above are followed, do not go near the module. Contact your local distributor.**

(9) Dispose of the air bag module after deployment according to the Deployed Air Bag Module Disposal Procedures.

DEPLOYED AIR BAG MODULE DISPOSAL PROCEDURES

E52BF52AA

After deployment, the air bag module should be disposed of in the same manner as any other scrap parts, except that the following points should be carefully noted during disposal.
(1) The inflator will be quite hot immediately following deployment, so wait at least 30 minutes to allow it to cool before attempting to handle it.
(2) Do not put water or oil on the air bag after deployment.
(3) There may be, adhered to the deployed air bag module, material that could irritate the eyes and/or skin, so wear gloves and safety glasses when handling a deployed air bag module. IF DESPITE THESE PRECAUTIONS, THE MATERIAL DOES, GET INTO THE EYES OR ON THE SKIN, IMMEDIATELY RINSE THE AFFECTED AREA WITH A LARGE AMOUNT OF CLEAN WATER.
IF ANY IRRITATION DEVELOPS, SEEK MEDICAL ATTENTION.



(4) Tightly seal the air bag module in a strong vinyl bag for disposal.
(5) Be sure to always wash your hands after completing this operation.

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CHASSIS ELECTRICAL

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E54AA--

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SUPPLEMENTAL RESTRAINT SYSTEM (SRS) – AIR BAG

(1) An SRS air bag for the driver's side seat is optional equipment in this vehicle.
(2) The SRS includes the following components: impact sensors, SRS diagnosis unit: SRS warning lamp, air bag module, clock spring, interconnecting wiring. Other SRS-related components (that may have to be removed/installed in connection with SRS service or maintenance) are indicated in the table of contents by an asterisk (*).

WARNING!

(1) Improper service or maintenance of any component of the SRS, or any SRS-related component, can lead to personal injury or death to service personnel (from inadvertent firing of the air bag) or to the driver (from rendering the SRS inoperative).
(2) Service or maintenance of any SRS component or SRS-related component must be performed only at an authorized MITSUBISHI dealer.
(3) MITSUBISHI dealer personnel must thoroughly review this manual, and especially its GROUP 52B – Supplemental Restraint System (SRS), before beginning any service or maintenance of any component of the SRS or any SRS-related component.

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NOTES

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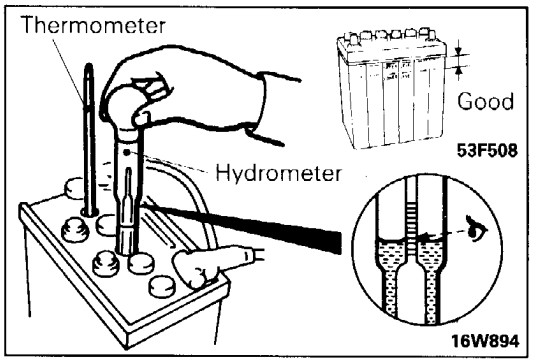
BATTERY

SPECIFICATION

SERVICE SPECIFICATION

E54CB--

Items	Specifications
Standard value Specific gravity of the battery fluid	1,220–1,290 [20°C (68°F)]



SERVICE ADJUSTMENT PROCEDURES

E54CBAD

INSPECTION OF FLUID LEVEL AND SPECIFIC GRAVITY

1. Inspect whether or not the battery fluid is between the UPPER LEVEL and LOWER LEVEL marks.
2. Use a hydrometer and thermometer to check the specific gravity of the battery fluid.

   Standard value: 1,220–1,290 [20°C (68°F)]

   The specific gravity of the battery fluid varies with the temperature, so use the following formula to calculate the specific gravity for 20°C (68°F). Use the calculated value to determine whether or not the specific gravity is satisfactory.

   D20 = Dt + 0.0007 (t–20)
   D20: specific gravity of the battery fluid calculated for 20°C (68°F).
   Dt: actually measured specific gravity
   t: actually measured temperature

VISUAL INSPECTION

Remove the battery from the vehicle.

Caution
If battery fluid has leaked from the battery, use rubber gloves to protect your hands when removing the battery.

(1) If there is corrosion of the battery stays or battery brackets from the battery fluid, clean by washing in warm or cold water.
(2) If there is a leak from a crack in the battery case, replace the battery.
(3) Clean the battery terminals with a wire brush, and replace any parts that are damaged.

CHARGING

1. When charging a battery while still installed in the vehicle, disconnect the battery cables to prevent damage to electrical parts.
2. The current normally used to charge a battery should be approximately 1/10th the battery capacity.
3. When quick charging due to lack of time, etc., the charging current should never exceed the battery capacity as indicated in ampered.
4. Determining if charging is completed.
   (1) If the specific gravity of the battery fluid reaches 1.250–1.290 and remains constant for at least one hour.
   (2) If the voltage of each cell reaches 2.5–2.8V and remains constant for at least one houe.

   Caution
   Take care since the battery fluid level may rise during charging.
   Keep all sources of fire away while charging because there is danger of explosion.
   Take care not to do anything that could generate sparks while charging.
   When charging is completed, replace the battery caps, pour clean water over the battery to remove any sulfuric acid and dry.

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BATTERY TEST

TEST STEP	RESULT	ACTION TO TAKE
A0 VISUAL INSPECTION • Remove negative cable, then positive cable. • Check for dirty or corroded connections.	NG ▶ OK ▶	CLEAN terminals and clamps. Go to A1. Go to A1.
A1 LOOSE BATTERY POST • Check for loose battery post.	NG ▶ OK ▶	REPLACE battery. Go to A2.
A2 CRACKED BATTERY COVER • Remove holddowns and shields. • Check for broken/cracked case or cover.	NG ▶ OK ▶	REPLACE battery. Go to A3.
A3 OPEN CIRCUIT VOLTAGE TEST • Turn headlights on for 15 seconds. • Turn headlights off for 2 minutes to allow battery voltage to stabilize. • Disconnect cables. • Read open circuit voltage.	NG ▶ OPEN CIRCUIT VOLTAGE UNDER 12.4 VOLTS OK ▶	CHARGE battery at 5 amps, then go to A3. Go to A4.
A4 LOAD TEST • Connect a load tester to the battery. • Load the battery at the recommended discharge rate (See LOAD TEST RATE CHART) for 15 seconds. • Rear voltage after 15 seconds, then remove load.	NG ▶ VOLTAGE IS LESS THAN MINIMUM LISTED OK ▶ VOLTAGE IS MORE THAN MINIMUM LISTED	REPLACE battery. Battery OK.

LOAD TEST RATE CHART

Load test (amps)	Cranking rating [−18°C (0°F)]	Reserve capacity	Application
210	420	111	65D23R
240	490	123	75D26R
310	622	159	95D31R

LOAD TEST CHART

Minimum voltage	Temperature	
	°C	°F
9.6	21 and above	70 and above
9.5	16	60
9.4	10	50
9.3	4	40
9.1	−1	30
8.9	−7	20
8.7	−12	10
8.5	−18	0

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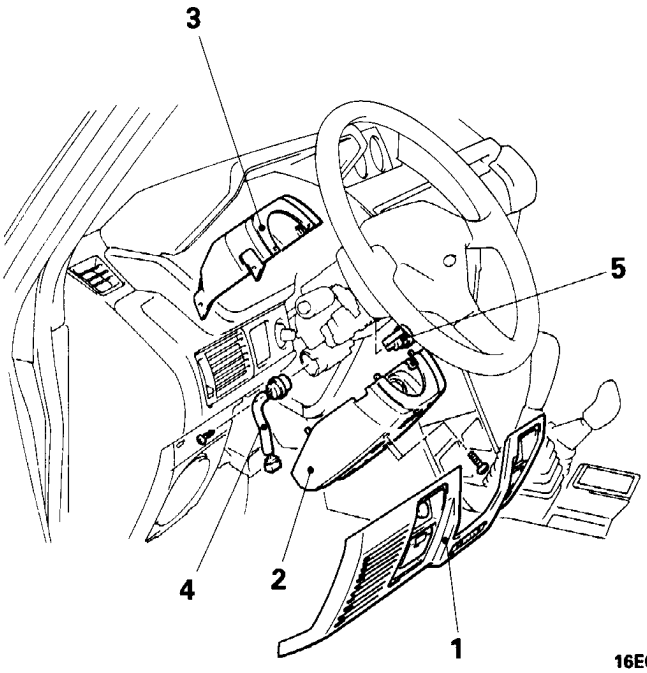
IGNITION SWITCH

E54DH--

IGNITION SWITCH

REMOVAL AND INSTALLATION



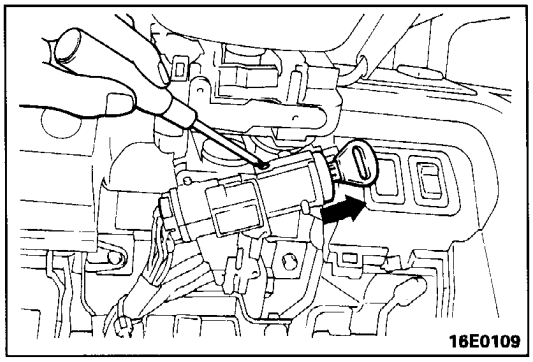
16E0110

Removal steps of ignition switch

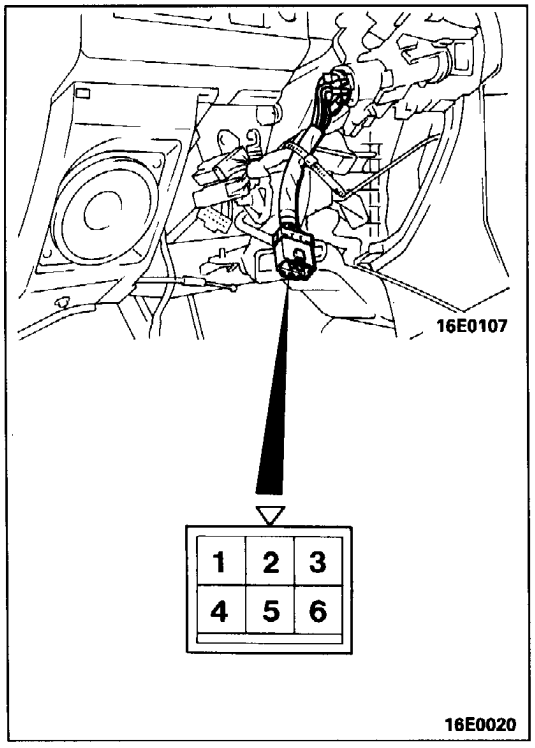
1. Instrument under cover
   (Refer to GROUP 52A – Instrument Panel)
2. Column cover lower
3. Column cover upper
4. Ignition switch

Removal steps of steering lock cylinder

2. Column cover lower
◆◆ 5. Stearing lock cylinder



16E0109



16E0107

16E0020

SERVICE POINT OF REMOVAL

E54DIAF

5. REMOVAL OF STEERING LOCK CYLINDER

(1) Insert the key in the steering lock cylinder and turn it to the "ACC" position.
(2) Using a cross-tip (+) screwdriver (small) or a similar tool, push the lock pin of the steering lock cylinder inward and then pull the steering lock cylinder toward you.

INSPECTION

E54DJAN

IGNITION SWITCH

(1) Remove the instrument under cover. (Refer to GROUP 52A – Instrument Panel.)
(2) Remove the column cover lower.
(3) Disconnect the wiring connector from the ignition switch, and connect an ohmmeter to the switch side connector.
(4) Operate the switch, and check the continuity between the terminals.

<Except L.H. drive vehicles with SRS>

Terminal / Position	1	2	3	4	5	6
LOCK						
ACC			○			○
ON		○	○	○		○
START	○			○	○	○

NOTE
○–○ indicates that there is continuity between the terminals.

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<L.H. drive vehicles with SRS>

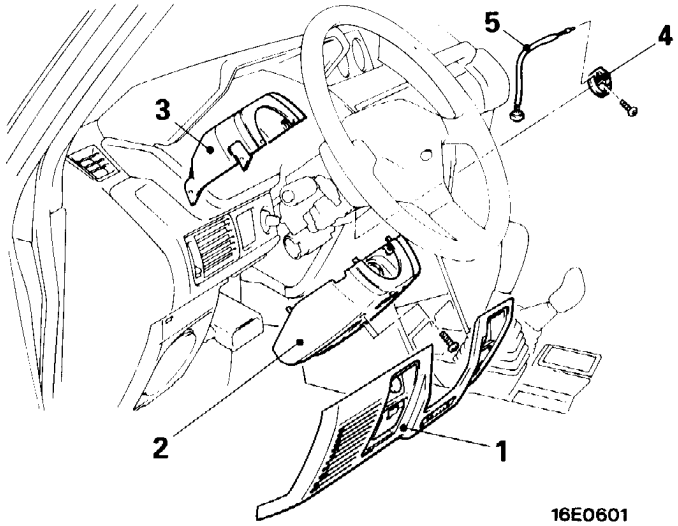
Position \ Terminal	1	2	3	4	5	6
LOCK						
ACC	○					○
ON	○	○		○		○
START	○	○	○		○	

NOTE
○—○ indicates that there is continuity between the terminals.

IGNITION KEY ILLUMINATION SYSTEM

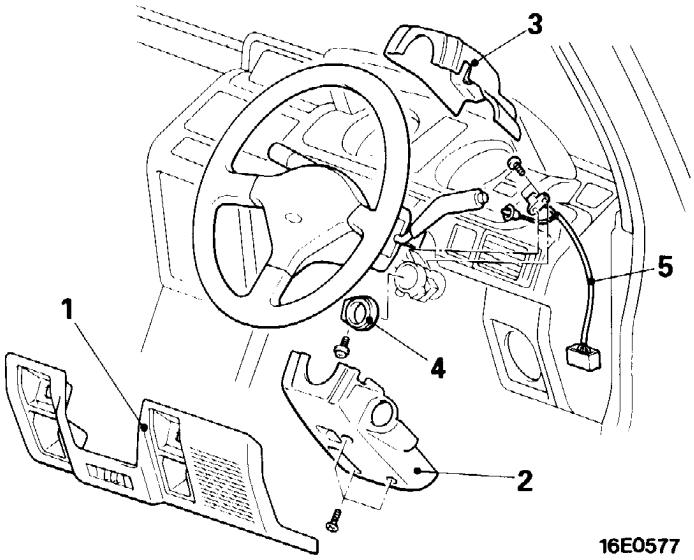
REMOVAL AND INSTALLATION

<L.H. drive vehicles>



16E0601

<R.H. drive vehicles>



16E0577

Removal steps

1. Instrument under cover (Refer to GROUP 52A – Instrument Panel)
2. Column cover lower
3. Column cover upper
4. Ignition key illumination ring
5. Key reminder switch or key hole illumination lamp

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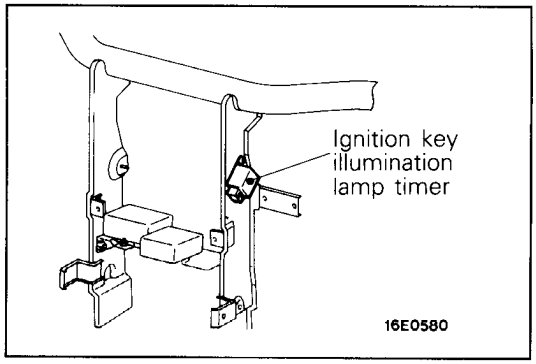
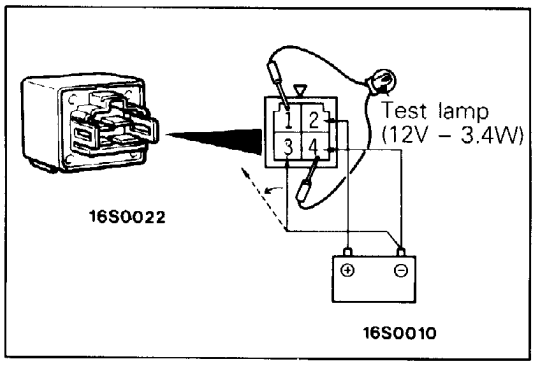


INSPECTION

IGNITION KEY ILLUMINATION LAMP TIMER

(1) Remove the instrument panel. (Refer to GROUP 52A – Instrument Panel)
(2) Remove the ignition key illumination lamp timer.



(3) Apply the battery voltage between the terminal No. ② and No. ④.
(4) Connect a test lamp between the terminal No. ① and No. ④.
(5) Check that the test lamp illuminates for 8 – 16 seconds when terminal ③ is earthed for 3 seconds or more and then disconnected from the earth.

METERS AND GAUGES

SPECIFICATION

SERVICE SPECIFICATIONS

E54EB--

Items	Specifications
Standard value	
Speedometer indication error km/h (mph)	
40 (20)	40–48 (20–25)
80 (40)	80–92 (40–47)
120 (60)	120–136 (60–69)
160 (80)	160–180 (80–91)
– (100)	– (100–114)
Tachometer indication error r/min	
<4G64, 6G72, 4D56>	
1,000	±100
3,000	±150
5,000	±250
6,000 (Petrol-powered vehicles)	±300
<6G74>	
700	±100
3,000	$^{+225}_{-100}$
5,000	$^{+325}_{-125}$
7,000	$^{+400}_{-100}$
<4M40>	
700	±100
3,000	±150
5,000	±250
Fuel gauge unit resistance Ω	
Float point "F"	3±2
Float point "E"	110±7
Fuel gauge unit float height mm (in.)	
Standard wheelbase	
A (Float point "F")	118.1 (4.64)
B (Float point "E")	263.1 (10.35)
Long wheelbase	
A (Float point "F")	119.3 (4.69)
B (Float point "E")	225.0 (10.03)
Fuel gauge resistance Ω	
<Vehicles built up to October, 1993>	
Power supply and earth	233±23.3
Power supply and fuel gauge	86±8.6
Fuel gauge and earth	147±14.7
<Vehicles built from November, 1993>	
Power supply and earth	115±11.5
Power supply and fuel gauge	79±7.9
Fuel gauge and earth	80±8.0

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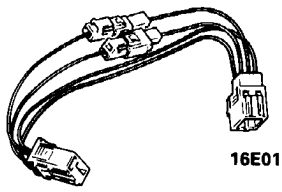
Items	Specifications
Engine coolant temperature gauge resistance Ω	147±14.7
<Vehicles built up to October, 1993>	
Power supply and engine coolant temperature gauge	75±7.5
Power supply and earth	147±14.7
Engine coolant temperature gauge and earth	222±22.2
<Vehicles built from November, 1993>	
Power supply and engine coolant temperature gauge	145±14.5
Power supply and earth	115±11.5
Engine coolant temperature gauge and earth	246±24.6
Inside temperature sensor and outside temperature sensor resistance Ω	
20°C (68°F)	Approx. 1,200
40°C (104°F)	Approx. 500

SPECIAL TOOL

E54EF--

Tool	Number	Name	Use
 16E0169	MB991416	Inspection harness	Measuring the current between N-S terminals and E-W terminals of the electric compass

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NOTES

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TROUBLESHOOTING

E54E0AA

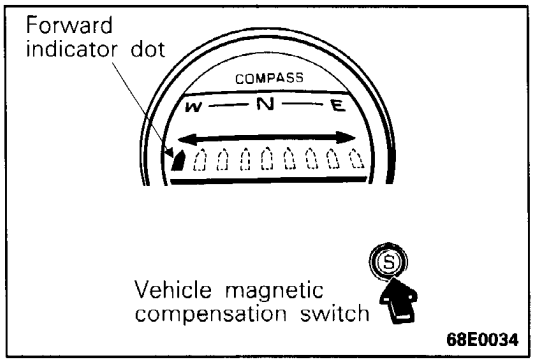
1. Bearing indicator is off when moving forward

When vehicle magnetic compensation is operated, does the bearing return to normal?

No → Refer to the [Vehicle magnetic compensation cannot be made] heading (P.54-7).

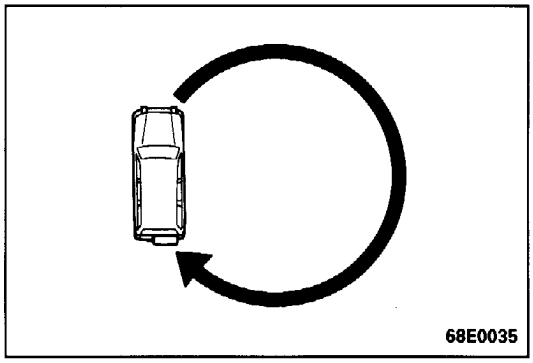
Yes → When the vehicle is running near areas that often cause magnetic disturbance, the vehicle magnetism will change, and this will cause the bearing to be off.

Areas that often cause magnetic disturbance are tunnels, railway crossings, railway tracks, elevated roads, buildings, and places above underground railways.



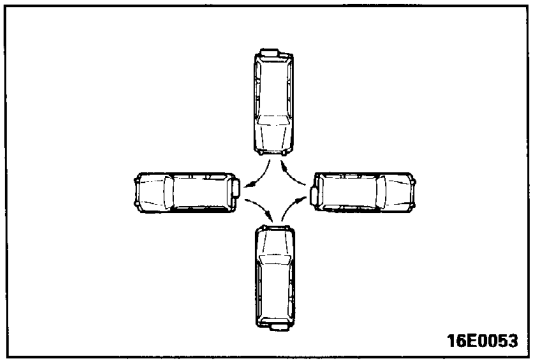
Vehicle magnetic compensation

(1) When the vehicle magnetic compensation (Azimuth adjustment) switch is pressed for 0.5 seconds or more, the direction indicator switches off, and the forward indicator dot will move step by step to the left or right.



(2) If the vehicle turns (slowly) in a 360° circle, compensation is automatically completed.

NOTE
Compensation is possible if the turn is made to either the left or right.



(3) If there is no place to turn the vehicle in a circle, turn the vehicle around by moving it backwards and forwards.

(4) After compensation is completed, a dot showing the current direction of movement will be illuminated.

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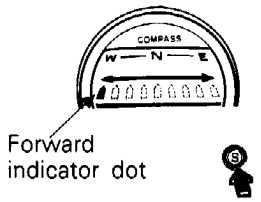
2. Vehicle magnetic compensation cannot be made

When the vehicle magnetic compensation switch is pressed, does the direction indicator switch off, and the forward indicator dot move step by step to the left or right?



No → Replace the display unit

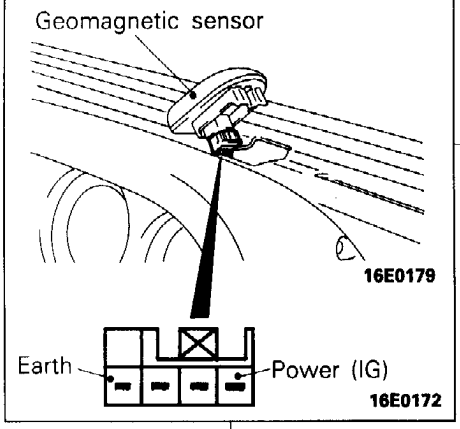
Yes

When the initial compensation direction is changed, or the vehicle position is changed, and the compensation restarts, can compensation be achieved?

Yes →
- Sometimes compensation is difficult because of the magnetic direction or the vehicle direction at the time compensation begins.
- Compensation is difficult in places where the magnetic field is being influenced by surrounding objects.

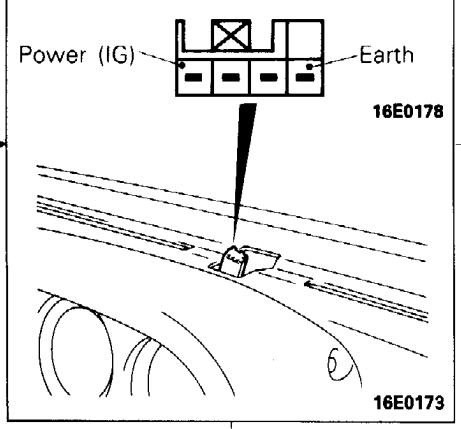
No

When the geomagnetic sensor and connector are connected, does a voltage of 10V or more show between the power and the earth?



No →

When the geomagnetic sensor connector assembly is disconnected, does a voltage of 10V or more show between the power and the earth?



No → Repair the harness or replace the display unit

Yes

Yes → Replace the geomagnetic sensor

To next page

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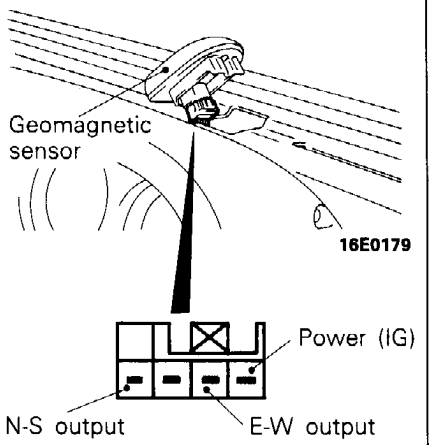
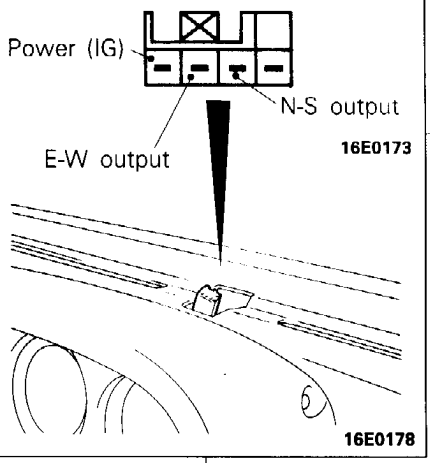
From previous page

When the geomagnetic sensor and connector are connected, does a voltage of 5V show between the power and the N-S output or between the power and the E-W output?



No

When the geomagnetic sensor connector assembly is disconnected, does a voltage of 5V show between the power and the N-S output or between the power and the E-W output?



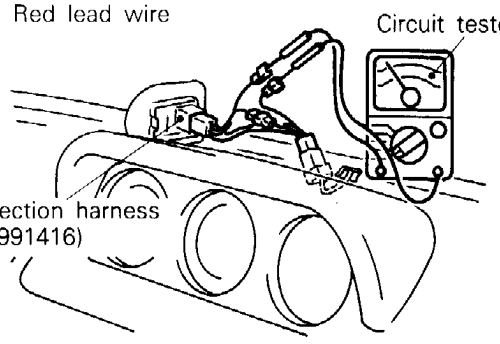
No

Repair the harness or replace the display unit

Yes

Replace the geomagnetic sensor

When using the special tool (Inspection harness: MB991416), do the maximum and minimum values for the current between the N-S terminal or the E-W terminal vary by 1mA or more when the vehicle is turned to set compensation?
N-S: Yellow lead wire
E-W: Red lead wire



No

Repair the harness or replace the geomagnetic sensor

Yes

Replace the display unit

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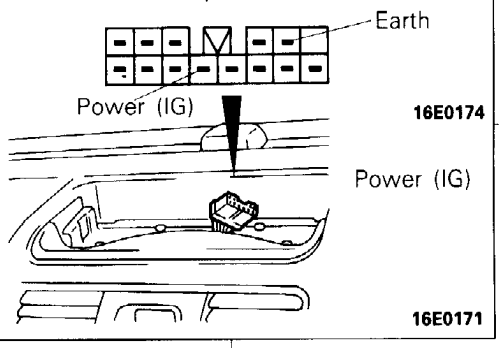
3. Display is hard to see or no display appears

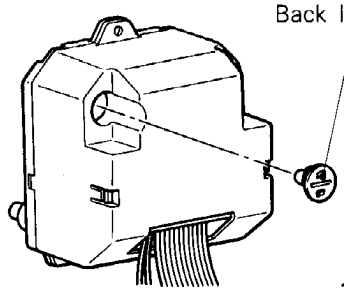
When the multi-meter assembly connector is removed, does a voltage of 10V or more show between the power and the earth?



No → Repair the harness

Yes ↓

Is the back lamp illuminated?



No → Replace the back lamp

Yes ↓

Replace the display unit

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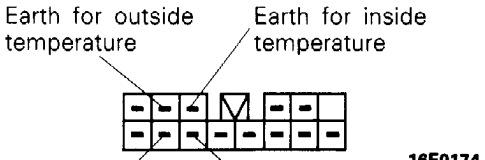
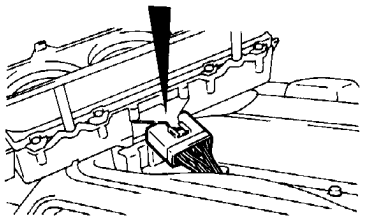
4. Discrepancy between the inside and outside temperatures and the display temperature

With the multi-meter connected to the connector, when the outside thermo sensor or the inside thermo sensor are showing the temperatures below, are the voltages between the outside temperature power and earth terminals, or between the inside temperature power and earth terminals, as shown in the table below?

Display temperature (°C(°F))	Terminal voltage (V)	
	Outside temperature	Inside temperature
0 (0)	3.42	3.42
20 (68)	2.46	2.23
40 (104)	1.61	1.43



16E0174



16E0177

Yes

Replace the display unit

No

Are the internal resistance values of the outside temperature sensor or inside temperature sensor at the standard values? (Refer to P.54-18.)

No

Replace the outside thermo sensor or inside thermo sensor

Yes

Repair the harness between the multi-meter and the outside thermo sensor or inside thermo sensor

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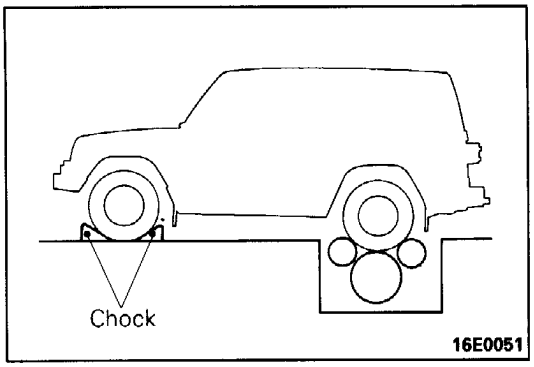


SERVICE ADJUSTMENT PROCEDURES

E54EGAT

SPEEDOMETER INSPECTION

(1) Adjust the pressure of the tyres to the specified level. (Refer to GROUP 31-General Specifications.)

(2) Place the vehicle on a speedometer tester and chock the front wheels

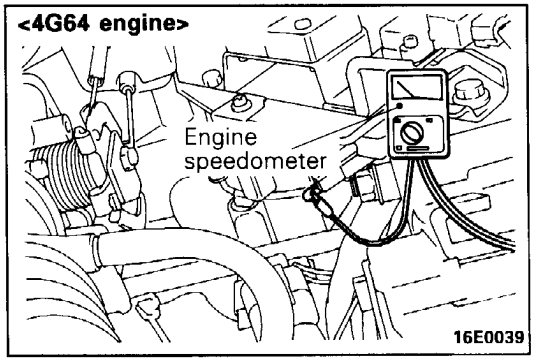
Caution
Always inspect with the transfer lever in the "2H" position.

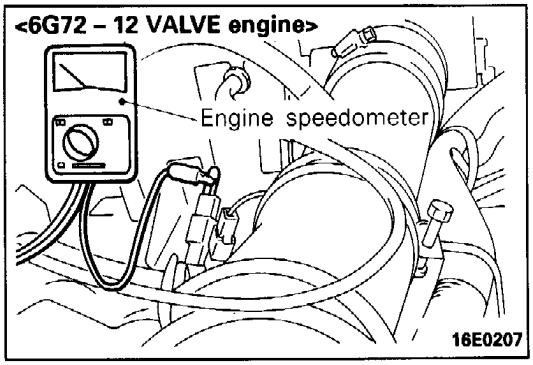
(3) Check if the speedometer indication range is within the standard values.

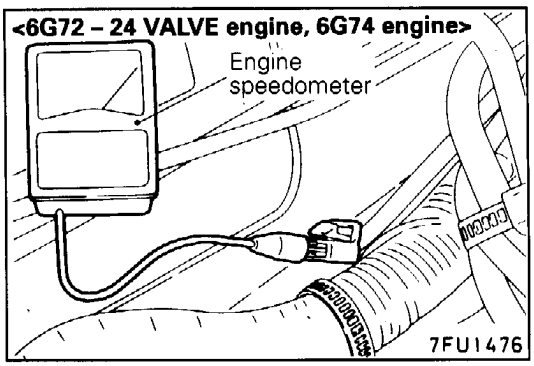
Caution
Do not operate the clutch suddenly or decrease speed rapidly while testing.

Standard value:

Standard indication km/h (mph)	Allowable range km/h (mph)
40 (20)	40–48 (20–25)
80 (40)	80–92 (40–47)
120 (60)	120–136 (60–69)
160 (80)	160–180 (80–91)
– (100)	– (100–114)







TACHOMETER INSPECTION

<Petrol-powered vehicles>

(1) Insert a paper clip in the connector from the harness side, and attach the engine speedometer.

NOTE
For tachometer inspection, use of a fluxmeter-type engine speedometer is recommended. (Because a fluxmeter only needs to be clipped to the high tension cable.)

(2) Compare the readings of the engine speedometer and the tachometer at every engine speed, and check if the variations are within the standard values.

Standard value:

	Engine speed r/min	Indicated variation r/min
4G64, 6G72	1000	±100
	3000	±150
	5000	±250
	6000	±300
6G74	700	±100
	3000	+225 −100
	5000	+325 −125
	7000	+400 −100

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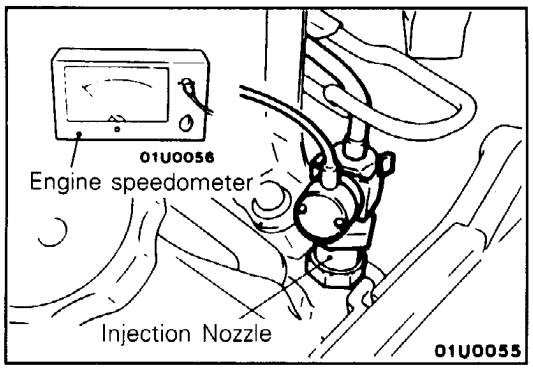


<Diesel-powered vehicles>

(1) Connect the engine speedometer to the injection pipe or injection nozzle.
(2) Compare the readings of the engine speedometer and the tachometer at every engine speed, and check if the variations are within the standard values.

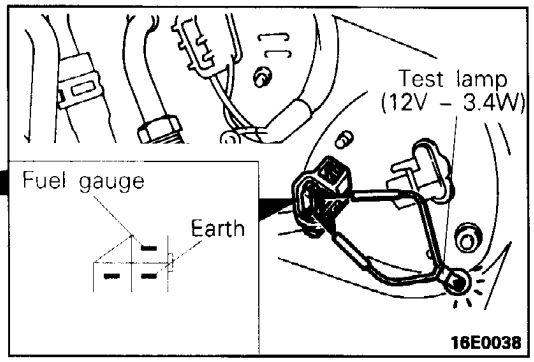
Standard value:

	Engine speed r/min	Indicated variation r/min
4D56	1000	±100
	3000	±150
	5000	±250
4M40	700	±100
	3000	±150
	5000	±250

FUEL GAUGE SIMPLE INSPECTION

Remove the fuel gauge unit assembly connector.

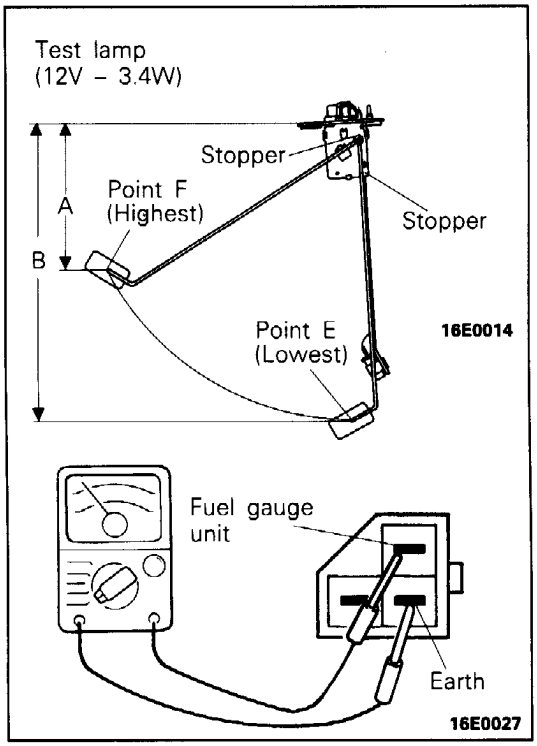
Connect a test lamp to the harness side connector.

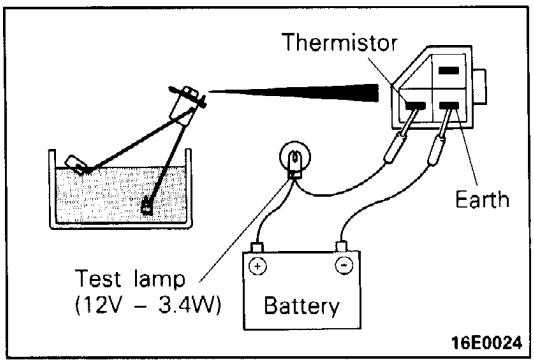


Turn the ignition switch to ON.

Check the condition of the test lamp and the gauge.

(1) Test lamp is illuminated (Gauge needle is not moving)	Replace the fuel gauge
(2) Test lamp is illuminated (Gauge needle is moving)	Replace the fuel gauge unit
(3) Test lamp is not illuminated (Gauge needle is not moving)	Repair the harness





FUEL GAUGE UNIT INSPECTION

To check, remove fuel gauge unit from fuel tank.
(Refer to GROUP 13 – Fuel Tank.)

Fuel Gauge Unit Resistance

(1) Check that resistance value between the fuel gauge terminal and earth terminal is at standard value when fuel gauge unit float is at point F (highest) and point E (lowest).

Standard value: **Point F** **3±2 Ω**
Point E **110±7 Ω**

(2) Check that resistance value changes smoothly when float moves slowly between point F (highest) and point E (lowest).

Fuel Gauge Unit Float Height

Move float and measure the height A at point F (highest) and B at point E (lowest) with float arm touching stopper.

Standard value:

Items \ Body type	Standard wheelbase	Long wheelbase
A mm (in.)	118.1 (4.64)	119.3 (4.96)
B mm (in.)	263.1 (10.35)	255.0 (10.03)

FUEL LEVEL SENSOR INSPECTION

Connect fuel gauge unit to battery via test lamp (12V-3.4W). Immerse in water. Condition good if lamp goes off when unit thermistor is in water and lights when unit is removed from water.

Caution
After completing this test, wipe the unit dry and install it in the fuel tank.

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ENGINE COOLANT TEMPERATURE GAUGE SIMPLE INSPECTION

Remove the engine coolant temperature gauge unit assembly connector.

↓

Earth the harness connector by connecting it to a test lamp.

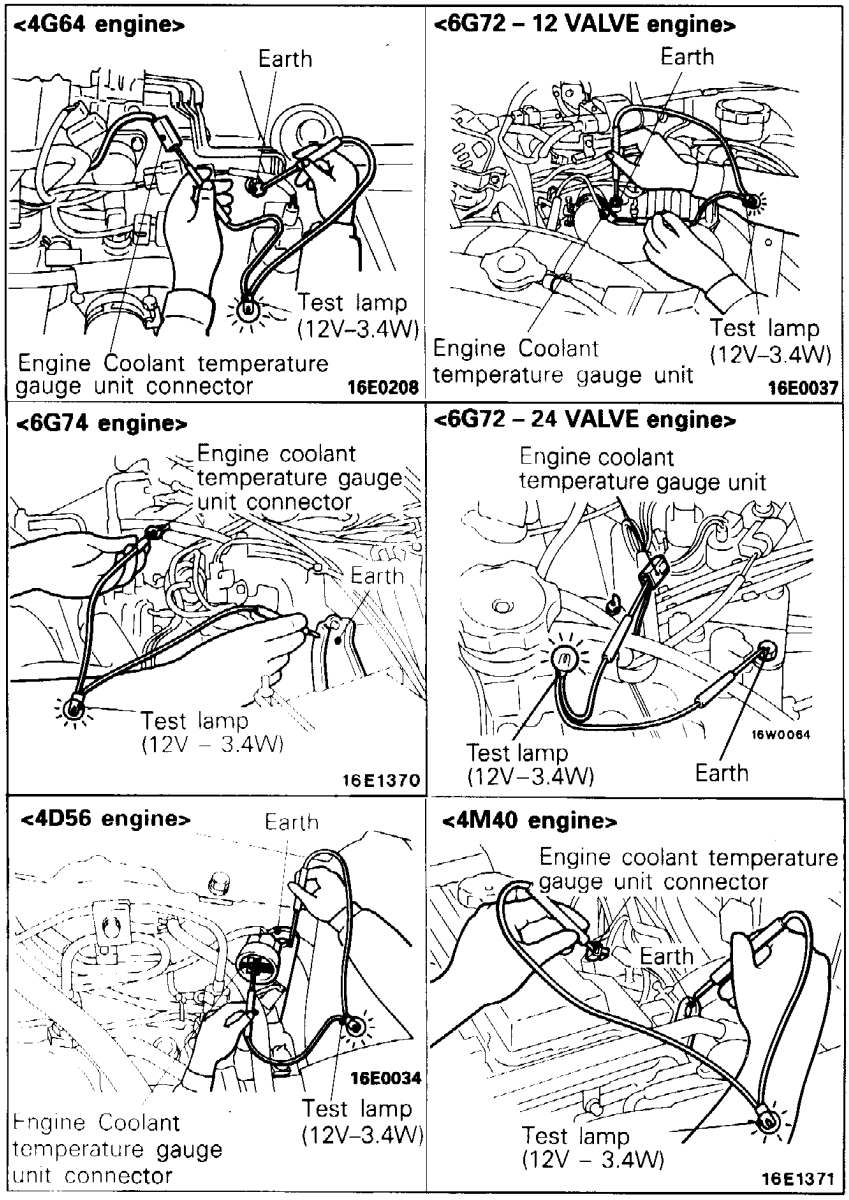
↓

Turn the ignition switch to ON.

↓

Check the condition of the test lamp and the gauge.

(1) Test lamp is illuminated (Gauge needle is not moving)	→ Replace the engine coolant temperature gauge
(2) Test lamp is illuminated (Gauge needle is moving)	→ Replace the engine coolant temperature gauge unit
(3) Test lamp is not illuminated (Gauge needle is not moving)	→ Repair the harness



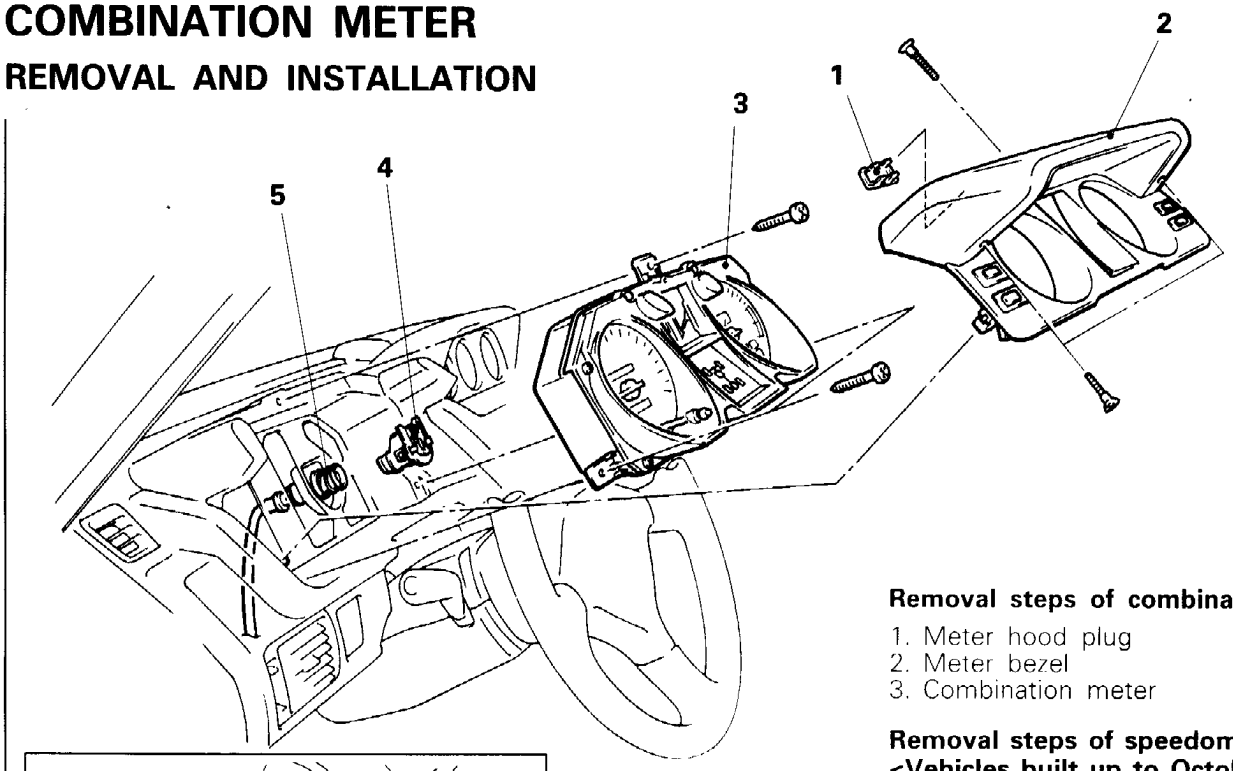
ENGINE COOLANT TEMPERATURE GAUGE UNIT INSPECTION

Refer to GROUP 14 – Engine Coolant Temperature Gauge Unit.

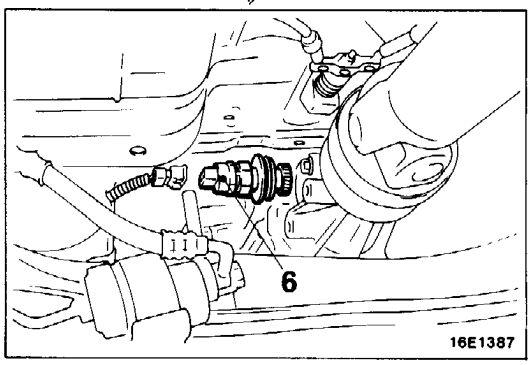
COMBINATION METER

E54EH--

REMOVAL AND INSTALLATION



16E0125



16E1387

Removal steps of combination meter

1. Meter hood plug
2. Meter bezel
3. Combination meter

Removal steps of speedometer cable <Vehicles built up to October, 1993>

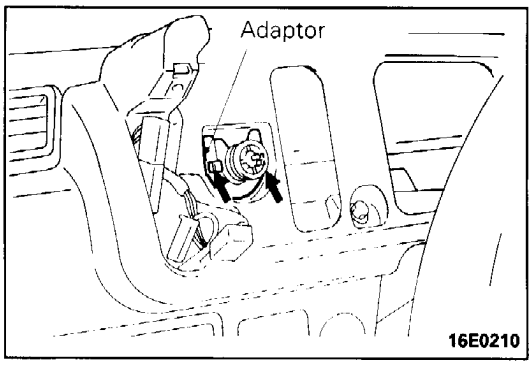
1. Meter hood plug
2. Meter bezel
3. Combination meter
4. Adapter

• Instrument panel (Refer to GROUP 52A – Instrument Panel.)

5. Speedometer cable

Removal steps of vehicle speed sensor <Vehicles built from November, 1993>

6. Vehicle speed sensor



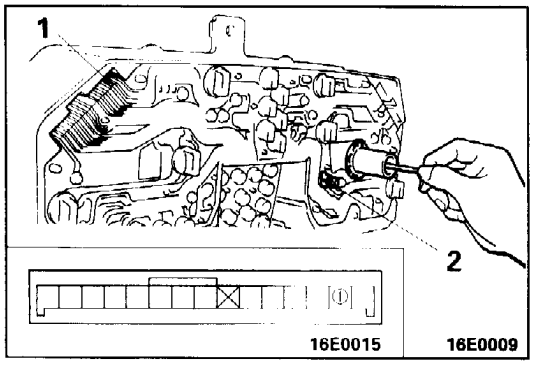
16E0210

SERVICE POINT OF REMOVAL

E54EIAJ

4. REMOVAL OF ADAPTER

(1) Disconnect the speedometer cable at the transmission end of the cable.
(2) Pull the speedometer cable slightly toward the vehicles interior, release the lock by turning the adapter to the left or right, and then remove the adapter.



16E0015 16E0009

INSPECTION

E54EJAQ

REED SWITCH

Using an ohmmeter, check that continuity and discontinuity alternates between terminals 1 and 2 four times at every rotation of the shaft of the speedometer cable connection.

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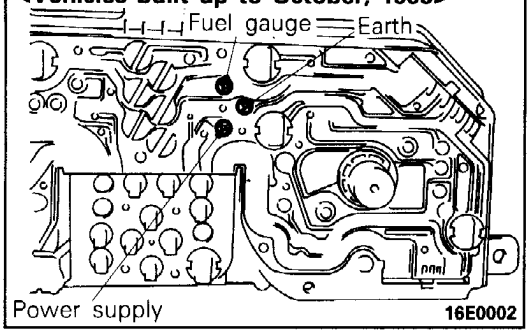
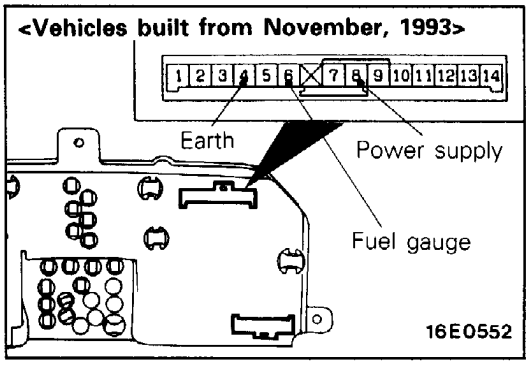
<Vehicles built up to October, 1993>



<Vehicles built from November, 1993>



FUEL GAUGE RESISTANCE

Measure resistance between terminals with circuit tester.

Standard value:

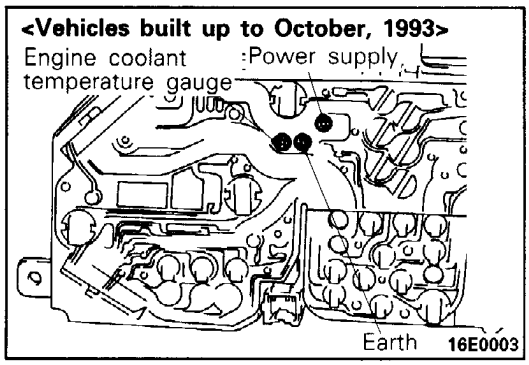
<Vehicles built up to October, 1993>

Power supply and earth	**233±23.3 Ω**
Power supply and fuel gauge	**86±8.6 Ω**
Fuel gauge and earth	**147±14.7 Ω**

<Vehicles built from November, 1993>

Power supply and earth	**115±11.5 Ω**
Power supply and fuel gauge	**79±7.9 Ω**
Fuel gauge and earth	**80±8.0 Ω**

<Vehicles built up to October, 1993>



ENGINE COOLANT TEMPERATURE GAUGE RESISTANCE

Measure resistance between terminals with circuit tester.

Caution
For inspection, use a circuit tester which uses a measurement current of 4mA or less.

Standard value:

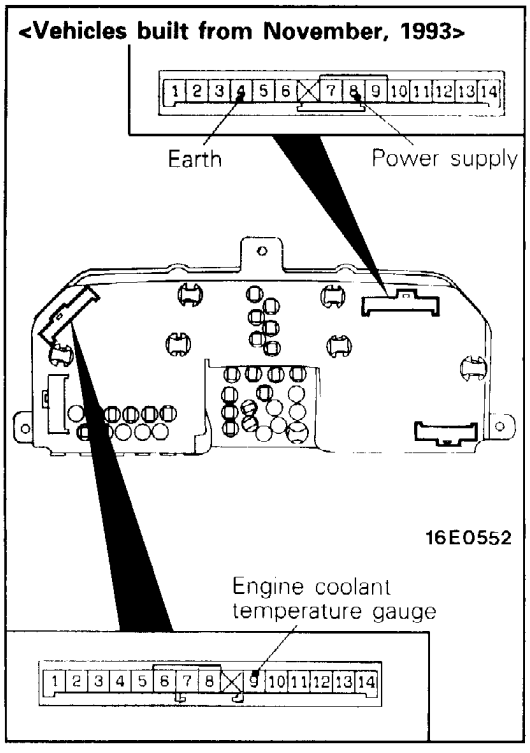
<Vehicles built up to October, 1993>

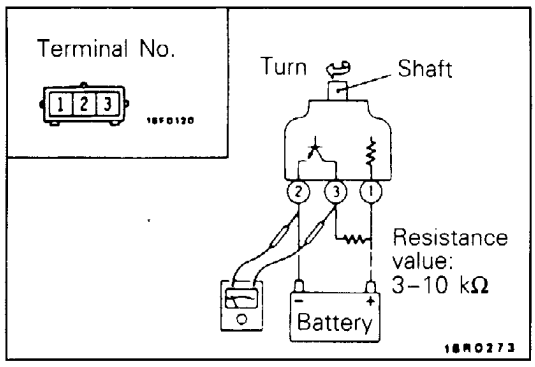
Power supply and engine coolant temperature gauge	**75±7.5 Ω**
Power supply and earth	**147±14.7 Ω**
Engine coolant temperature gauge and earth	**222±22.2 Ω**

<Vehicles built from November, 1993>

Power supply and engine coolant temperature gauge	**145±14.5 Ω**
Power supply and earth	**115±11.5 Ω**
Engine coolant temperature gauge and earth	**246±24.6 Ω**

<Vehicles built from November, 1993>



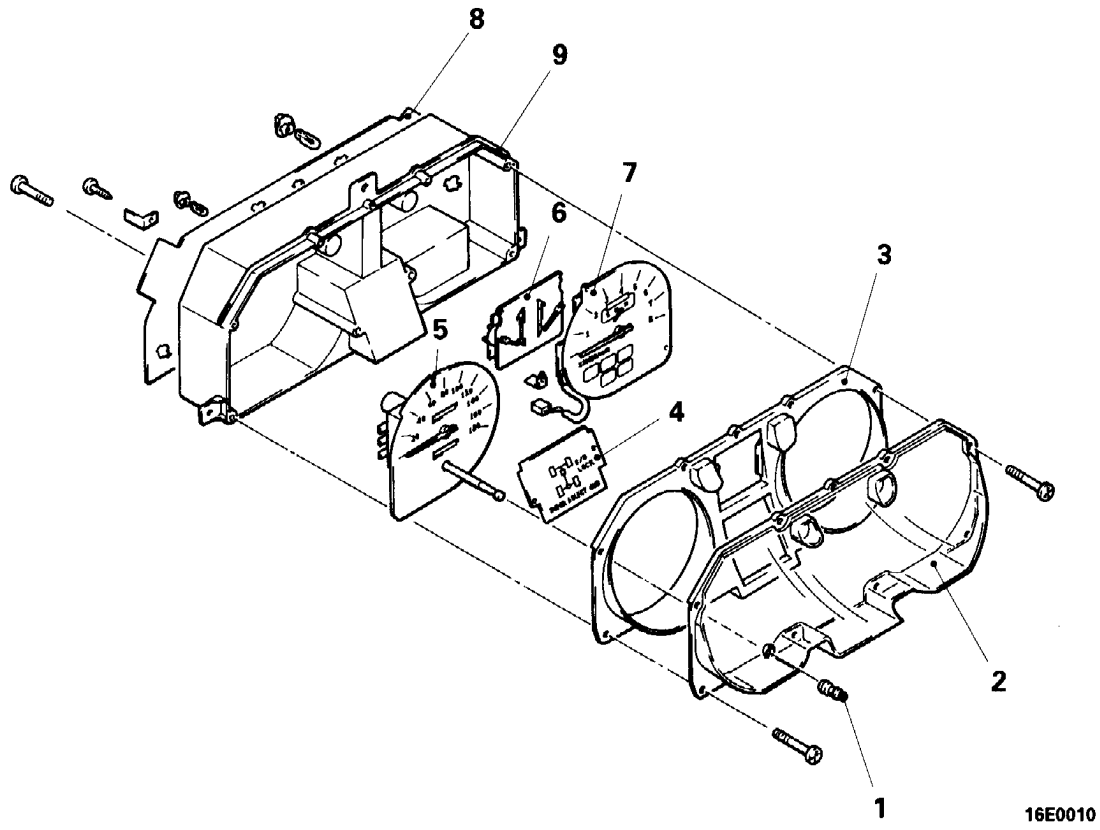


VEHICLE SPEED SENSOR

(1) Remove the vehicle speed sensor and connect a 3–10 kΩ resistance as shown in the illustration at left.
(2) Turn the shaft of the vehicle speed sensor and check to be sure that there is voltage between terminals 2 – 3. (1 turn = 4 pulses)

DISASSEMBLY AND REASSEMBLY

E54EL--



Disassembly steps

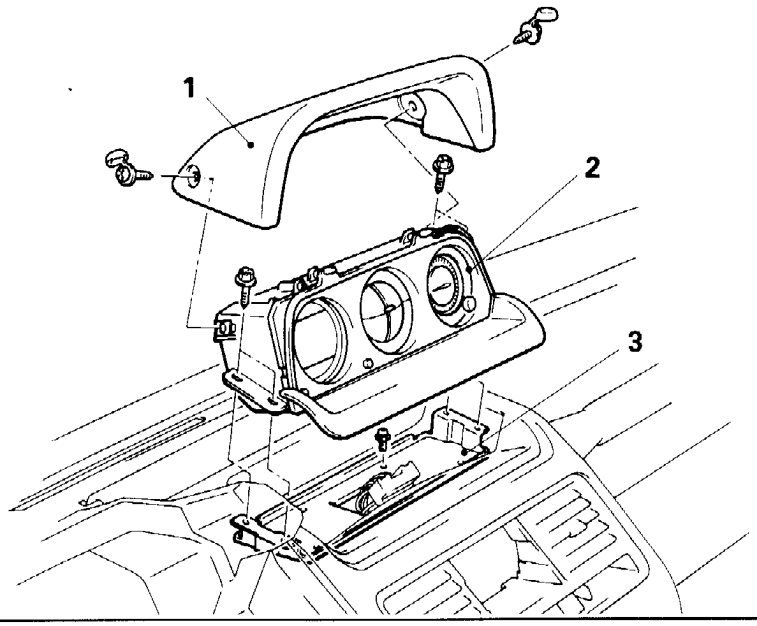
1. Boot
2. Meter glass
3. Window plate
4. Prism indicator lens
5. Speedometer
6. Fuel gauge and engine coolant temperature gauge
7. Tachometer
8. Printed-circuit board
9. Meter case

NOTES

MULTI-METER

E54EP--

REMOVAL AND INSTALLATION



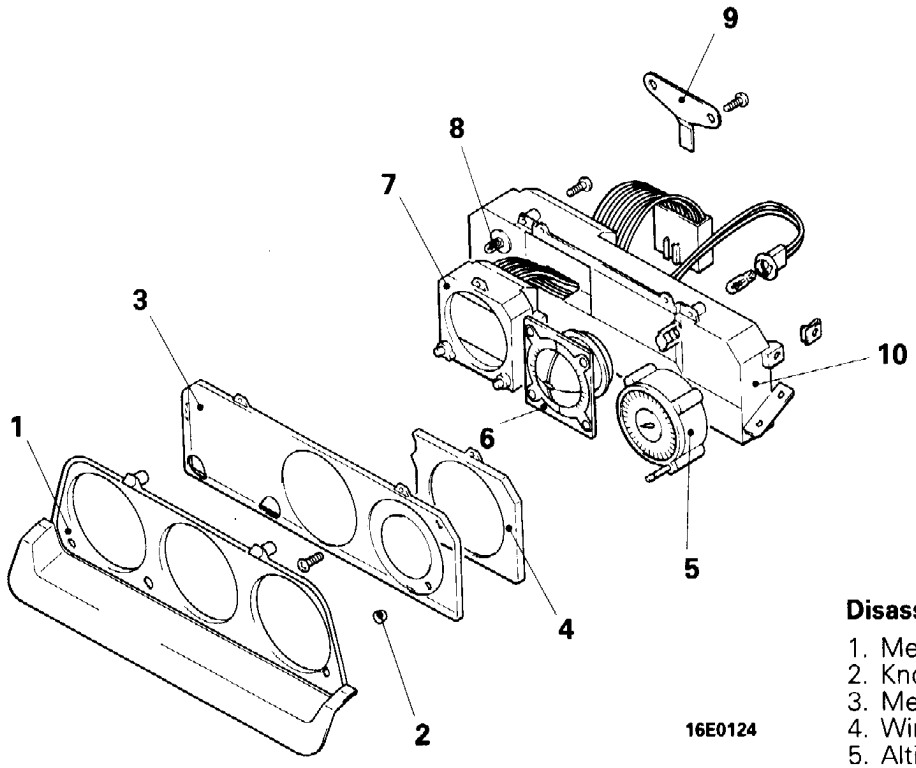
16E0126

Removal steps

1. Meter hood
2. Multi-meter
3. Meter bracket

DISASSEMBLY AND REASSEMBLY

E54EQ--



16E0124

Disassembly steps

1. Meter garnish
2. Knob
3. Meter glass
4. Window plate
5. Altimeter
6. Inclinometer
7. Electric compass & thermometer or thermometer
8. Back lamp bulb
9. Connector bracket
10. Meter case

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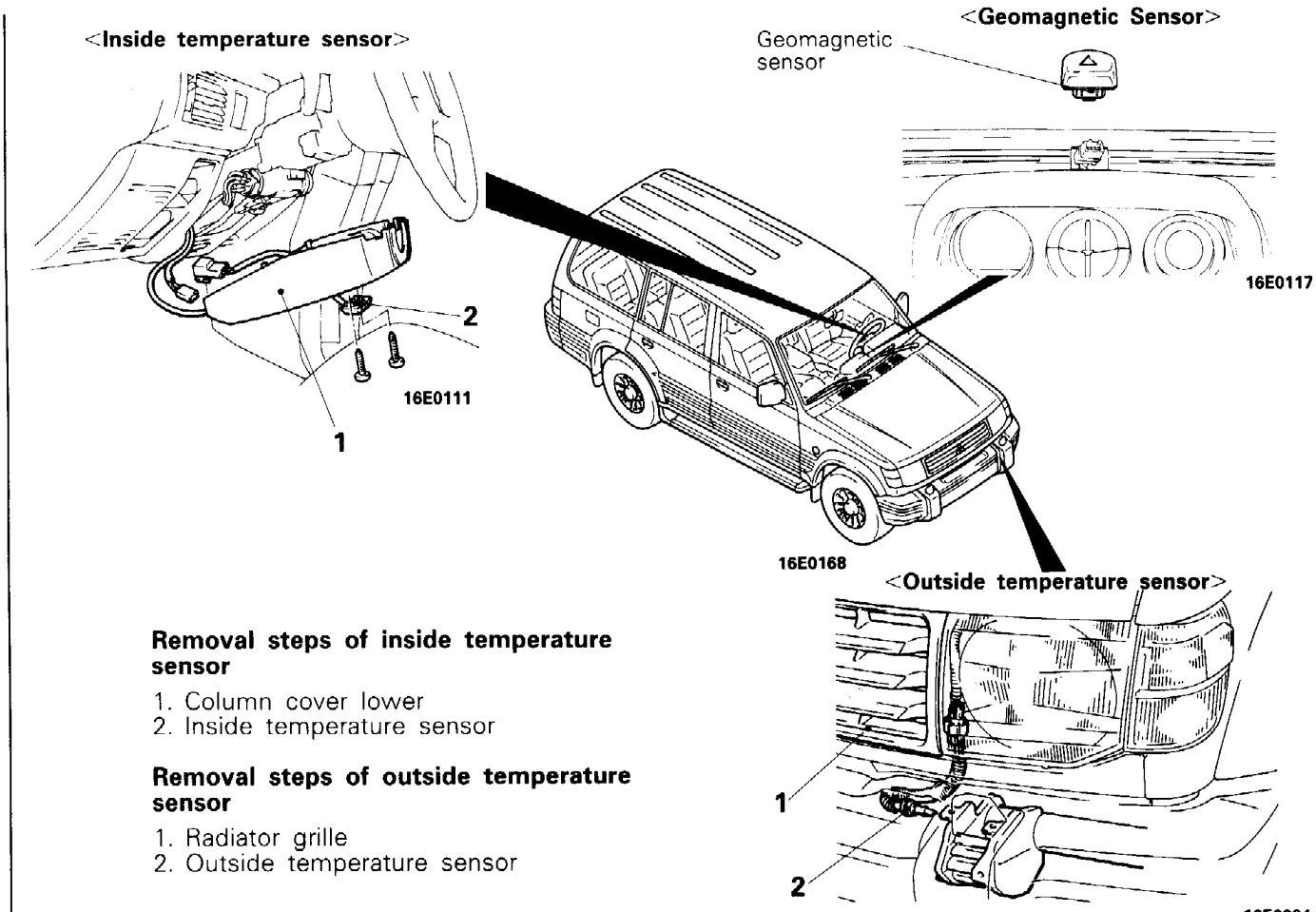
GEOMAGNETIC SENSOR, INSIDE TEMPERATURE SENSOR AND OUTSIDE TEMPERATURE SENSOR

E54ER--

REMOVAL AND INSTALLATION

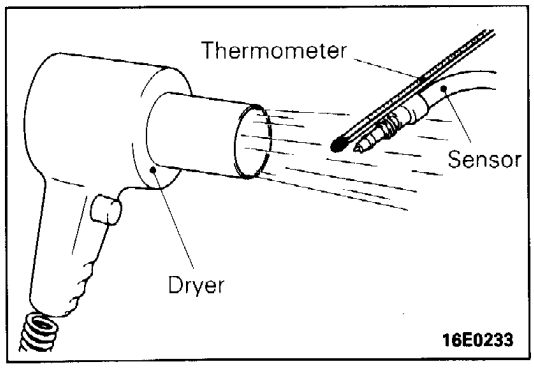


Removal steps of inside temperature sensor

1. Column cover lower
2. Inside temperature sensor

Removal steps of outside temperature sensor

1. Radiator grille
2. Outside temperature sensor



INSPECTION

E54ESAA

OUTSIDE TEMPERATURE SENSOR AND INSIDE TEMPERATURE SENSOR

Check that the internal resistance values of the outside temperature sensor or inside temperature sensor are at the standard values when each sensor shows temperatures of 20°C (68°F) and 40°C (104°F).

Standard value:	**20°C (68°F)**	**Approx. 1200 Ω**
	40°C (104°F)	**Approx. 500 Ω**

NOTE
For inspection of the geomagnetic sensor, refer to Troubleshooting (P.54-6).

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INDICATORS AND WARNING LAMPS

E54FBAD

Unit:W

Items	Specifications
Turn-signal indiation lamp	3.4
Upper-beam indiation lamp	1.12
Automatic transmission indication lamp	1.12
Variable shock absorber indication lamp	Light emitting diode (LED)
Diesel pre-heat indication lamp	1.12
Overdrive off indication lamp	1.12
4WD indication lamp	1.12
Cruise control indication lamp	1.12
Power/Hold changeover indicator lamp	1.12
Rear fog indication lamp	1.12
Door-ajar warning lamp	1.12
Oil pressure warning lamp	1.12
Charge warning lamp	1.12
Low engine oil warning lamp	1.12
Fuel filter warning lamp	1.12
Automatic transmission oil temperature warning lamp	1.12
Low headlamp washer fluid warning lamp	1.12
Low fuel warning lamp	3.4
Hazard fog indication lamp	1.12
Brake warning lamp	1.12
Check engine warning lamp	1.12
Anti-lock braking system warning lamp	1.12
Supplemental restraint system warning lamp	1.12

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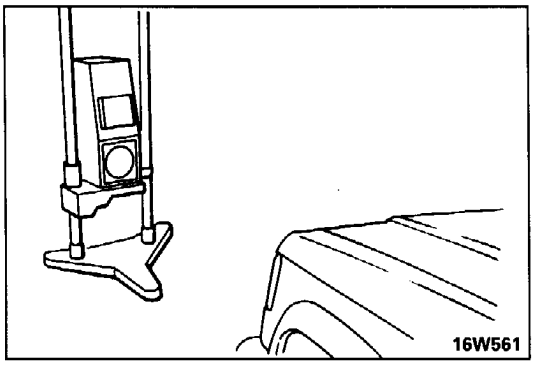
LIGHTING SYSTEM

E54GB--

SPECIFICATION

SERVICE SPECIFICATIONS

Items	Specifications
Standard value	
Headlamp aiming (for lower leam adjustment)	
Vertical direction	60 mm (2.36 in.) below the horizontal line (H)
Horizontal direction	Position where the 15° sloping section intersects the vertical line (V)
Resistance between resistor terminals <Vehicles with dim-dip lamp>	Approx. 1 Ω
Limit	
Headlamp intensity	30,000 cd or more



SERVICE ADJUSTMENT PROCEDURES

HEADLAMP AIMING

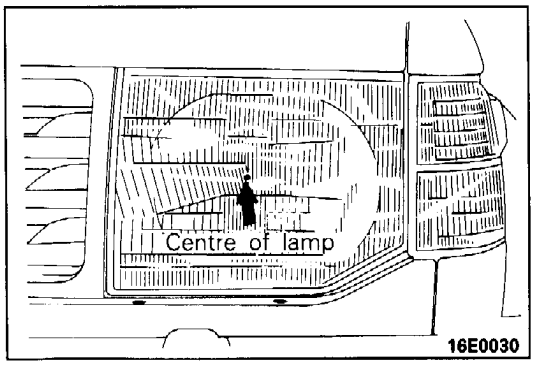
E54GGAX

<Adjustment Using Beamsetting Equipment>

(1) The headlamps should be aimed with the proper beamsetting equipment, and in accordance with the equipment manufacturer's instructions.

NOTE
If there are any regulations pertinent to the aiming of headlamps in the area where the vehicle is to be used, adjust so as to meet those requirements.

(2) Alternately turn the adjusting screw to adjust the headlamp aiming. (Refer to P.54-21)



<Adjustment Using Screen>

(1) Check the centre of the headlamp (□ mark) as shown in the illustration.
(2) Inflate the tyres to the specified pressures and remove the load from the vehicle (except a driver).
(3) For vehicles with the headlamp leveling system, set the headlamp leveling switch to "0".

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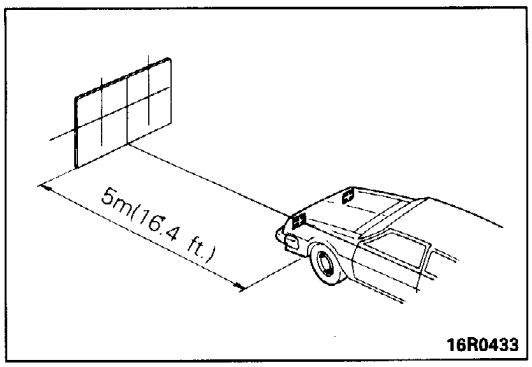
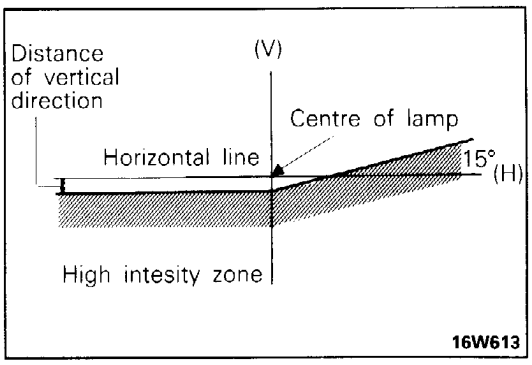


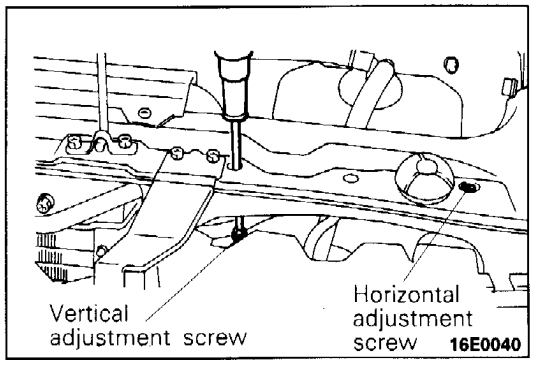
(4) Set the distance between the screen and the centre of the headlamps as shown in the illustration.
(5) With the engine running at 2,000 r/min. aim the headlamps.



(6) Check if the lower beam shining onto the screen is at the standard value.

Standard value:
<Vertical direction>
60 mm (2.36 in.) below the horizontal line (H)
<Horizontal direction>
Position where the 15° sloping section intersects the vertical line (V)

Caution
When making the aiming adjustment, be sure to mask those lamps which are not being adjusted.
When it is difficult, because of outside light, to distinguish the light/dark dividing line, use a curtain, screen or similar material to reduce the effects of the outside light.



(7) Alternately turn the adjusting screw to adjust the headlamp aiming.

Caution
Be sure to adjust the aiming adjustment screw in the tightening direction.

INTENSITY MEASUREMENT

Using a photometer, and following its manufacturer's instruction manual, measure the headlamp intensity and check to be sure that the limit value is satisfied.

Limit: 30,000 cd or more

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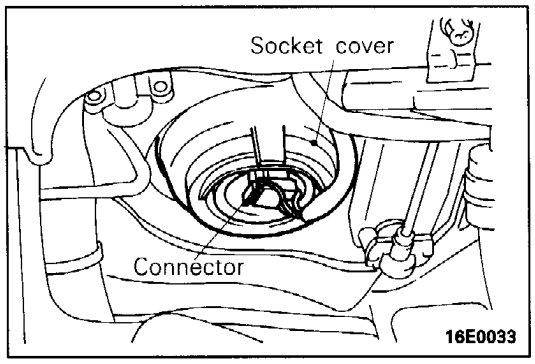
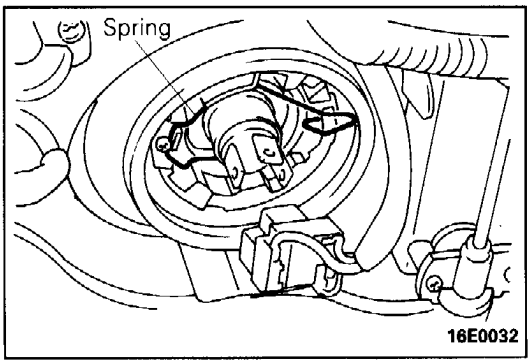
NOTE
1. When measuring the intensity, maintain an engine speed of 2,000 r/min., with the battery in the charging condition.
2. There may be special local regulations pertaining to headlamp intensity; be sure to make any adjustments necessary to satisfy such regulations.
3. If an illuminometer is used to make the measurements, convert its values to photometer values by using the following formula.
   $I = Er^2$
   Where: I = intensity (cd)
   E = illumination (lux)
   r = distance (m) from headlamps to illuminometer

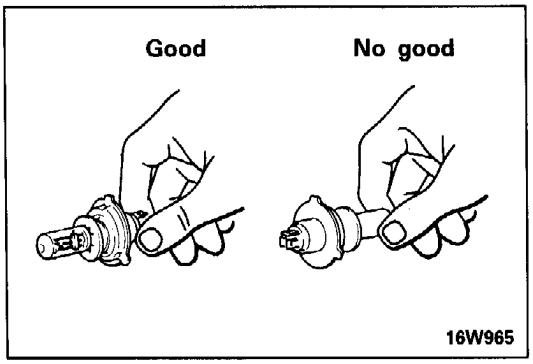


REPLACEMENT OF REPLACEABLE BULB

(1) Remove the engine coolant reserve tank. (left side only)
(2) Remove the air cleaner (Diesel-powered vehicles for right side only).
(3) Disconnect the harness connector, and then pull out the socket cover.



(4) Remove the bulb attaching spring and withdraw the bulb.



Caution
Never hold the halogen lamp bulb with a bare hand, dirty glove, etc.
If the glass surface is dirty, be sure to clean it with alcohol, paint thinner, etc., and install it after drying it thoroughly.

(5) Securely tighten the socket cover.

NOTE
If the socket cover is not securely installed, the lens will be out of focus, or water will get inside the lamp unit, so the cover should be securely installed.

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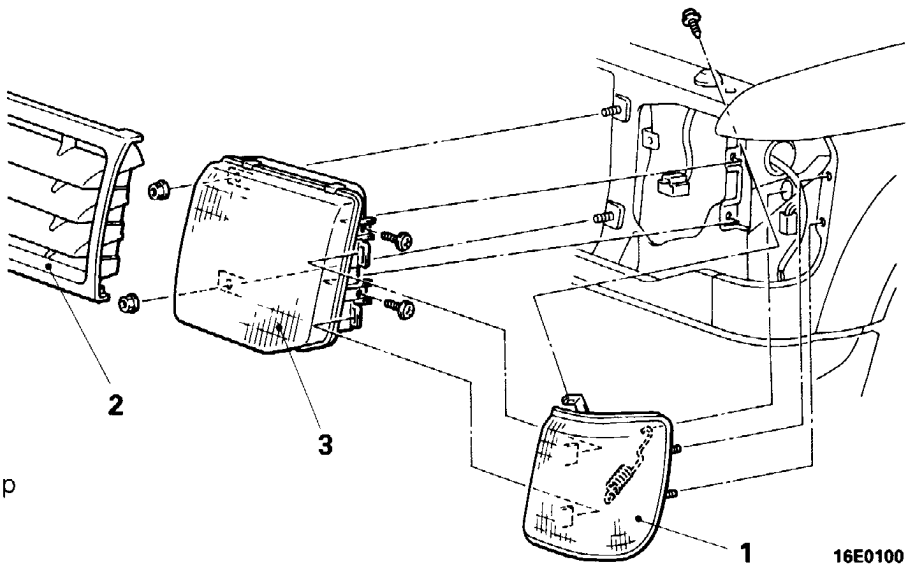
HEADLAMP AND FRONT COMBINATION LAMP

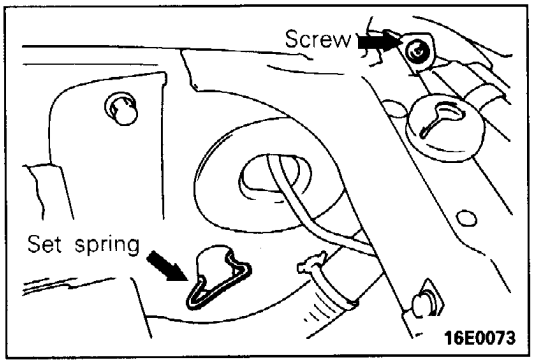
E54GHAN

REMOVAL AND INSTALLATION



Removal steps

1. Front combination lamp
2. Radiator grille
3. Headlamp

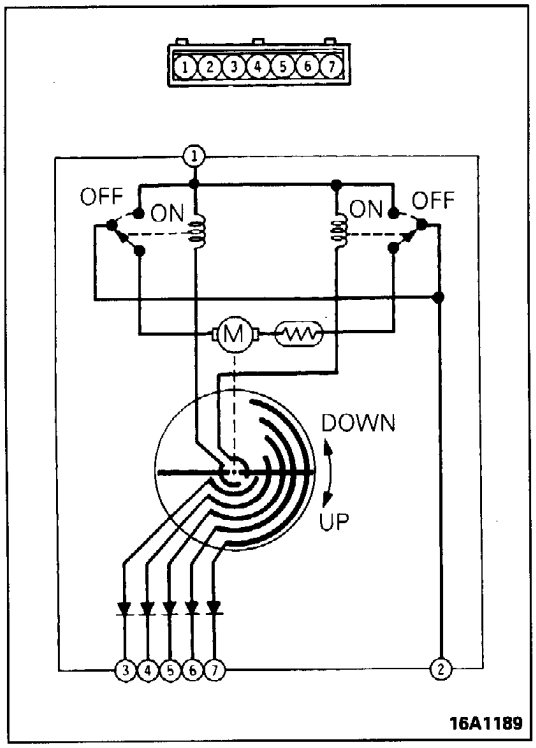


SERVICE POINT OF REMOVAL

1. REMOVAL OF FRONT COMBINATION LAMP

Remove the front combination lamp mounting screws and set spring, and remove the front combination lamp by pulling it towards the front of the vehicle.

NOTE
For the left side, before removing the front combination lamp, remove the engine coolant reserve tank in advance.



INSPECTION

HEADLAMP LEVELING UNIT

(1) After setting the headlamp levelling switch to the "0" position, remove the headlamp and inspect.
(2) Check to be sure there is no continuity between terminals (1) and (2).
(3) Connect terminal (1) to the battery and connect terminal (2) to earth ground.
(4) Check to make sure the motor is activated (headlamp reflector operates) for 0.6 to 1.0 second when terminals (4), (5), (6) and (7) are connected to earth in this order.
(5) Next, check to make sure the motor is activated [headlamp reflector operates in reverse order or (4) above] for 0.6 to 1.0 second when terminals (6), (5), (4) and (3) are connected to earth in this order.
(6) If the headlamp leveling unit is defective, replace the entire headlamp assembly.

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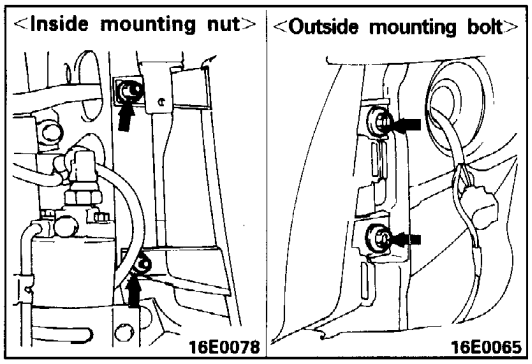
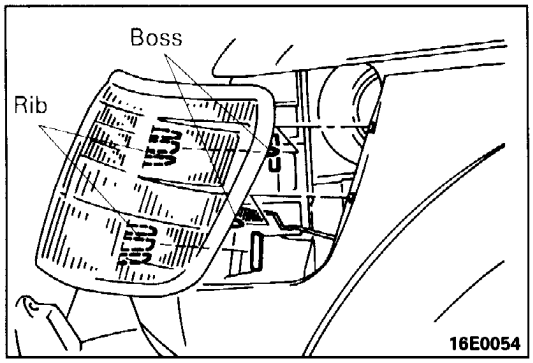


SERVICE POINTS OF INSTALLATION

3. INSTALLATION OF HEADLAMP

After tightening the outside mounting bolt, tighten the inside mounting nut.



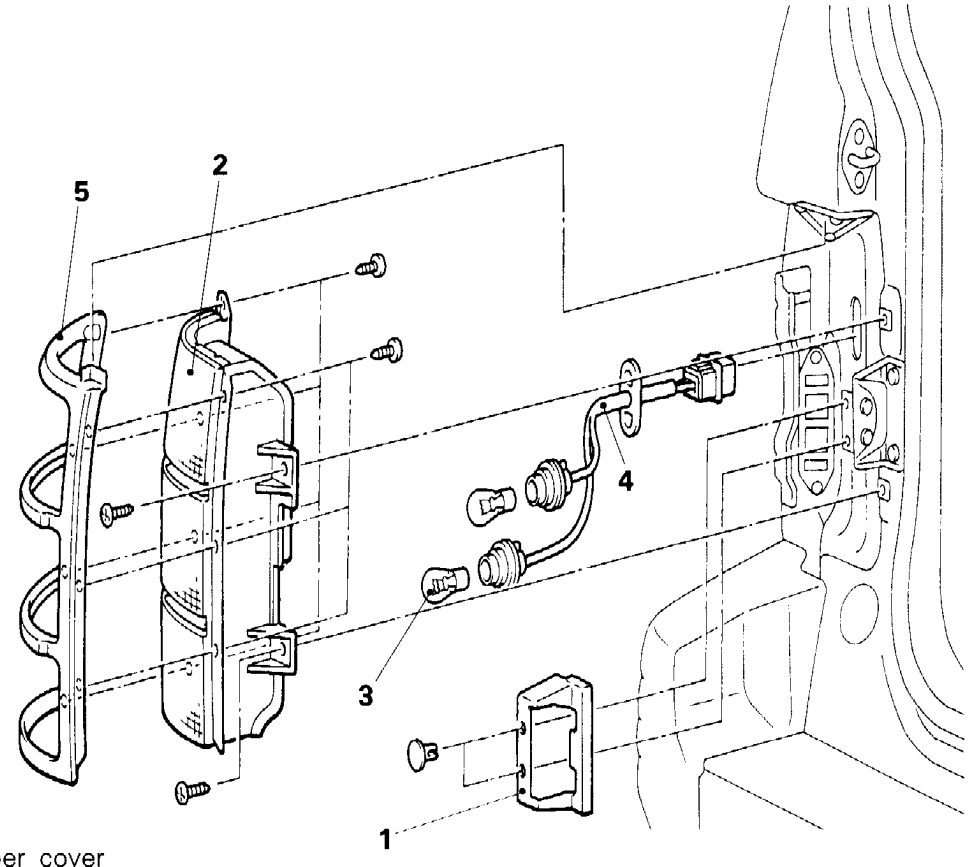
1. INSTALLATION OF FRONT COMBINATION LAMP

(1) Align the front combination lamp positioning bosses with the insertion holes in the fender, and align the ribs with the headlamp insertion holes.
(2) While pushing the front combination lamp in towards the rear of the vehicle, pull the set spring into the engine compartment to tighten it to the vehicle body, and then tighten with the screw.

REAR COMBINATION LAMP

E54GVAF

REMOVAL AND INSTALLATION



Removal steps

1. Back door bumper cover
2. Rear combination lamp unit
3. Bulb
● Quarter trim (Refer to GROUP 52–Trim)
4. Socket assembly
5. Rear combination lamp bezel

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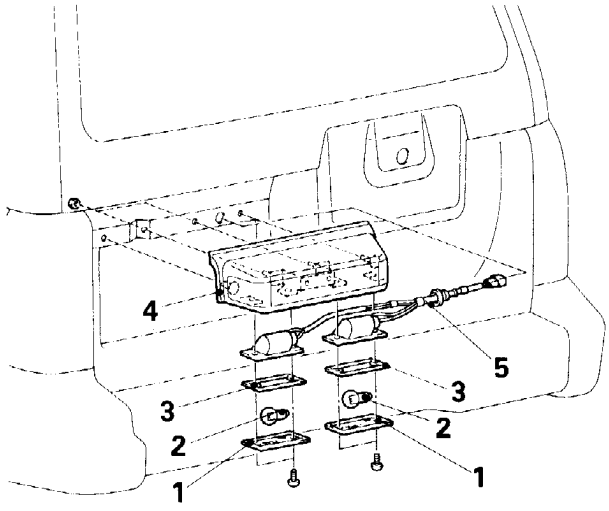
LICENCE PLATE LAMP

E54GTAE

REMOVAL AND INSTALLATION

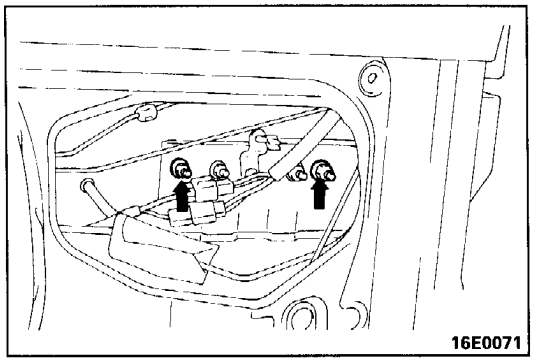


16E0101

Removal steps

1. Lens
2. Bulb
3. Lens gasket
- Back door trim (Refer to GROUP 42- Door Trim and Waterproof Film)

◀▶ 4. Licence lamp garnish
5. Socket assembly

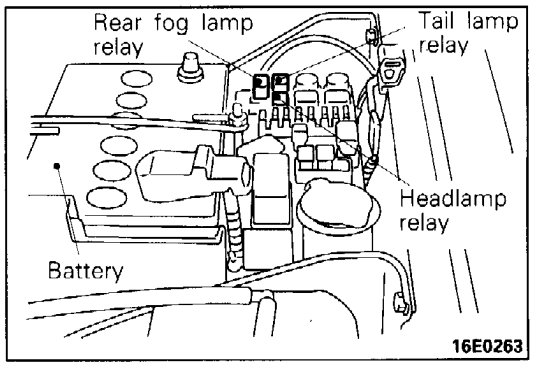


16E0071

SERVICE POINT OF REMOVAL

4. REMOVAL OF LICENCE LAMP GARNISH

(1) Take off the waterproof film and remove the licence lamp garnish mounting nuts.
(2) Remove the clips with a (–) screwdriver, and remove the licence lamp garnish together with the socket assembly.



16E0263

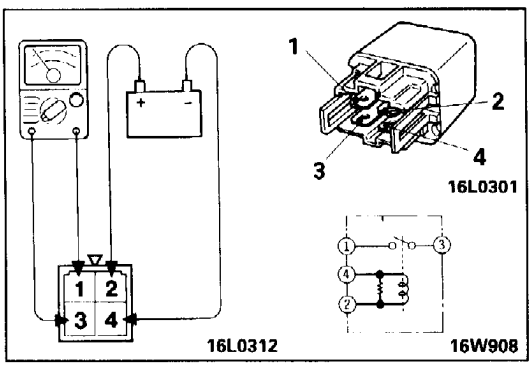
RELAY

E54GIAO

INSPECTION

Headlamp Relay, Tail Lamp Relay, Rear Fog Lamp Relay

(1) Remove the headlamp relay, tail lamp relay or rear fog lamp relay from the relay box in the engine compartment.



(2) Apply battery voltage to terminal (2), and check the continuity between the terminals when terminal (4) is earthed.

When power is supplied	Between terminals 1–3	Continuity
When power is not supplied	Between terminals 1–3	No continuity
	Between terminals 2–4	Continuity

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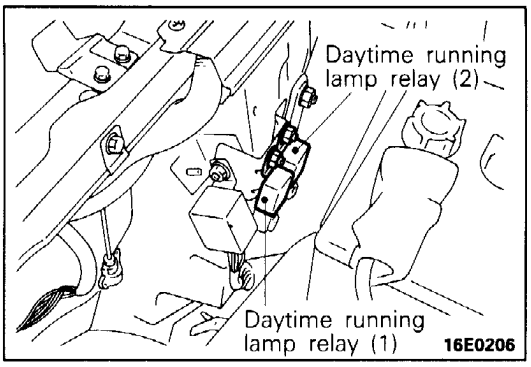
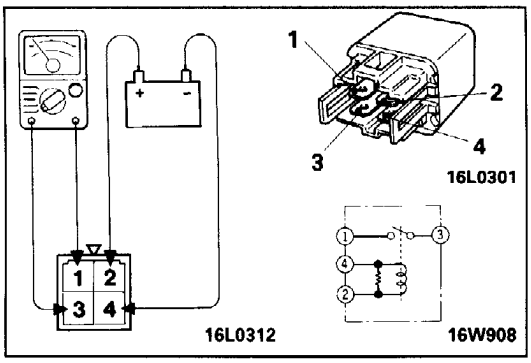
PWJE9086



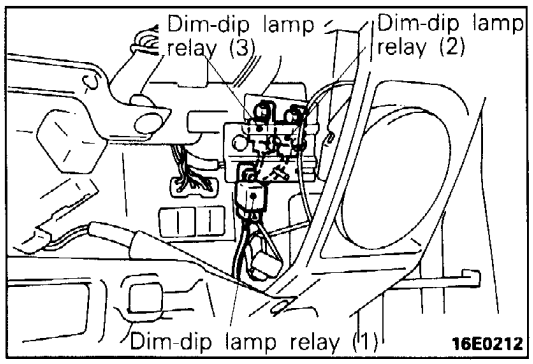
Daytime Running Lamp Relay (1), (2)
<Vehicles with daytime running lamp>

(1) Remove the daytime running lamp relay (1) or (2).



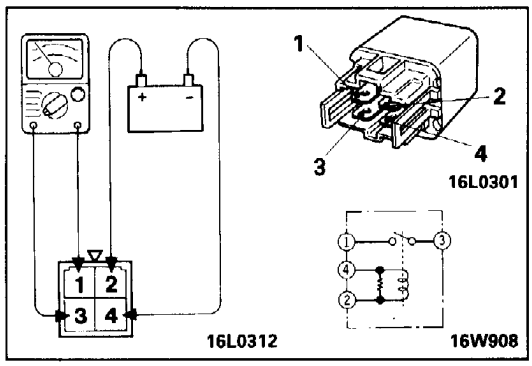
(2) Apply battery voltage to terminal (2), and check the continuity between the terminals when terminal (4) is earthed.

When power is supplied	Between terminals 1–3	Continuity
When power is not supplied	Between terminals 1–3	No continuity
	Between terminals 2–4	Continuity



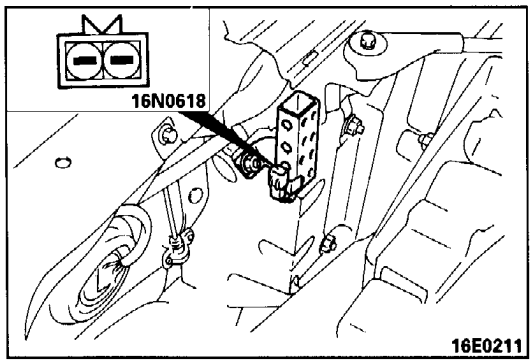
Dim-dip Lamp Relay (1), (2), (3)
<Vehicles with dim-dip lamp>

(1) Remove the instrument under cover, (Refer to GROUP 52-Instrument Panel)
(2) Remove the dim-dip lamp relay (1), (2) or (3).



(3) Apply battery voltage to terminal (2), and check the continuity between the terminals when terminal (4) is earthed.

When power is supplied	Between terminals 1–3	Continuity
When power is not supplied	Between terminals 1–3	No continuity
	Between terminals 2–4	Continuity



RESISTOR
<Vehicles with dim-dip lamp>

INSPECTION

Connect an ohmmeter to the resistor connector terminal and check if the resistance value is within the standard value.

Standard value: Approx. 1 Ω

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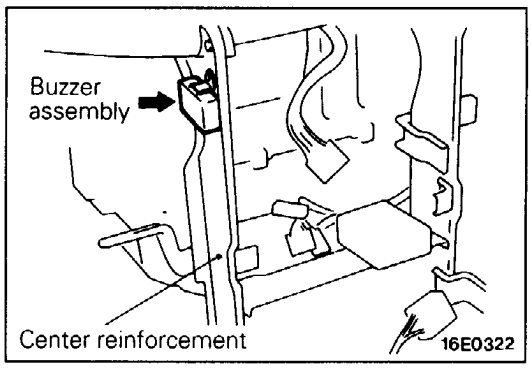
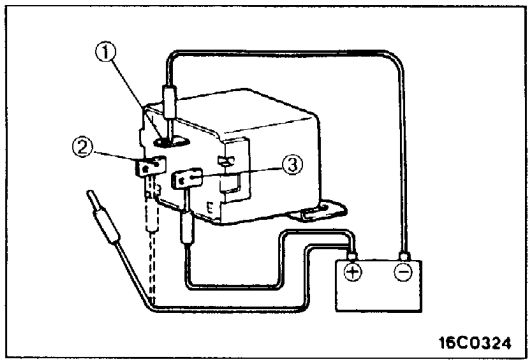


LIGHTING MONITOR BUZZER

INSPECTION

(1) Remove the instrument panel (Refer to GROUP 52-Instrument Panel).
(2) Remove the lighting monitor buzzer.



(3) Check to be sure that the buzzer sounds when battery voltage is applied to terminal ③ and terminal ① is earthed.
(4) Check to be sure that the buzzer stops sounding when battery voltage is applied to terminal ②.

NOTES

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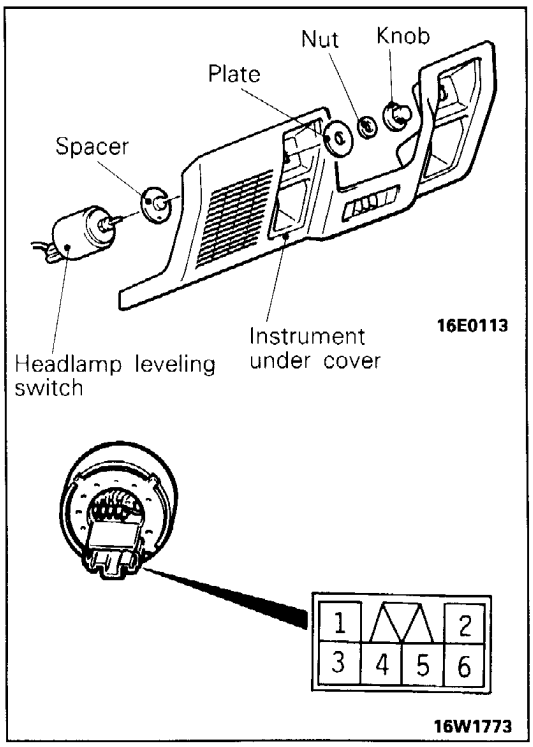


SWITCH

E54YBCA

INSPECTION

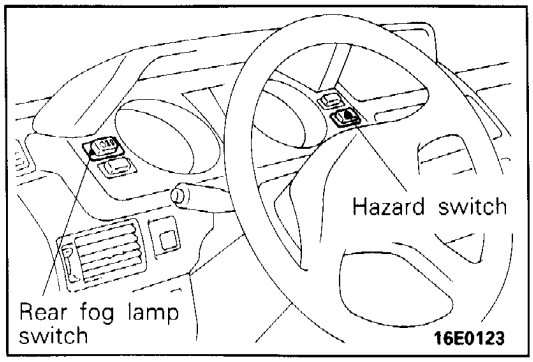
Headlamp levering switch

(1) Remove the instrument under cover. (Refer to GROUP 52A – Instrument Panel.)

(2) Operate the switch, and check the continuity between the terminals

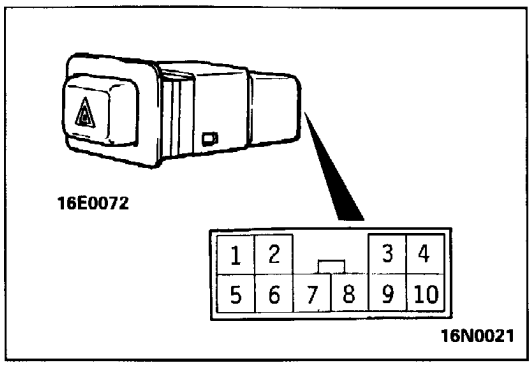
Switch position \ Terminal	1	2	3	4	5	6
0	○	○				
1	○					○
2	○				○	
3	○			○		
4	○		○			

NOTE
○–○ indicates that there is continuity between the terminals.



Rear Fog Lamp Switch and Hazard Switch

(1) Remove the rear fog lamp switch or hazard switch from the meter bezel.

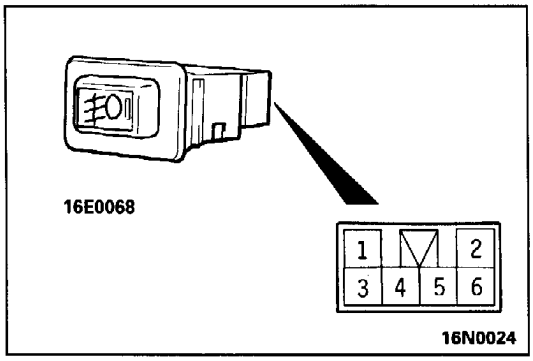


(2) Operate the switch, and check the continuity between the terminals.

<Hazard Switch>

Switch position \ Terminal	1	2	3	4	5	6	7	8	9		10
OFF					○		○	○	○		
ON	○	○	○	○	○	○				ILL	○

NOTE
○–○ indicates that there is continuity between the terminals.



<Rear Fog Lamp Switch>

Switch position \ Terminal	1		3	2	6		4
OFF	○	ILL	○	○	○		
ON						IND	○

NOTE
○–○ indicates that there is continuity between the terminals.

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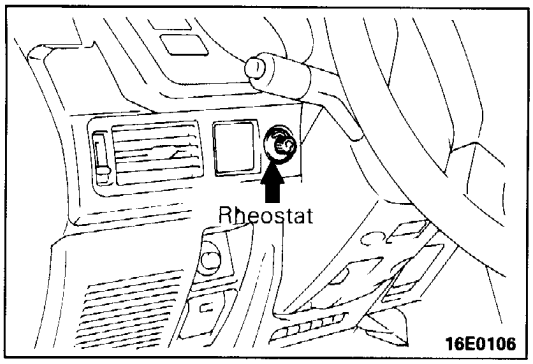
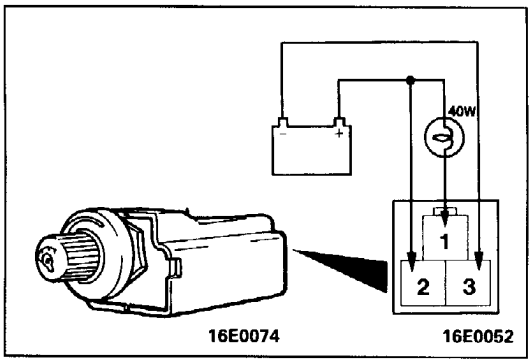


RHEOSTAT

E54GNAH

INSPECTION

(1) Instrument under cover. (Refer to GROUP 52A – Instrument Panel.)
(2) Remove the rheostat from the instrument panel.

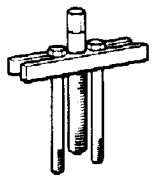


(3) Connect the battery and the test lamp (40W) as shown in the illustration.
(4) Operate the rheostat, and if the brightness changes smoothly without switching off, then the rheostat function is normal.

COLUMN SWITCH

SPECIAL TOOL

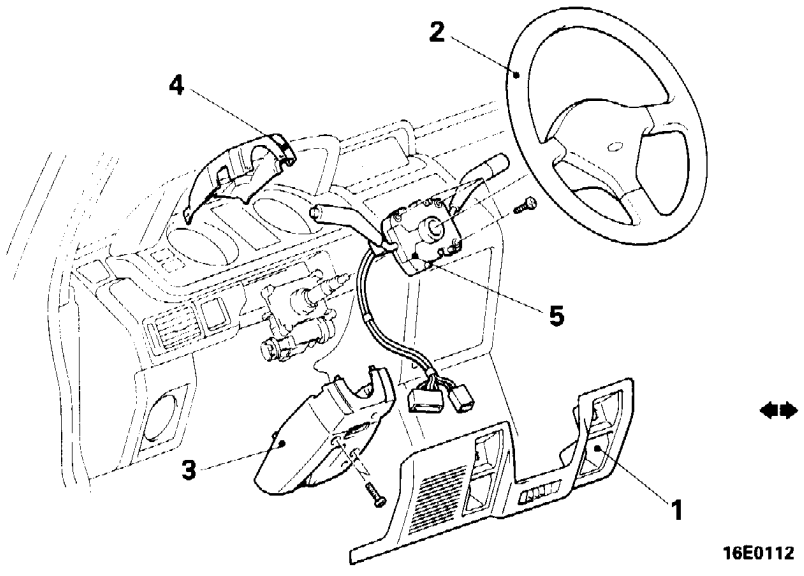
E54HF--

Tool	Number	Name	Use
	MB990803	Steering wheel puller	Removal of the steering wheel

COLUMN SWITCH <Vehicles without SRS>

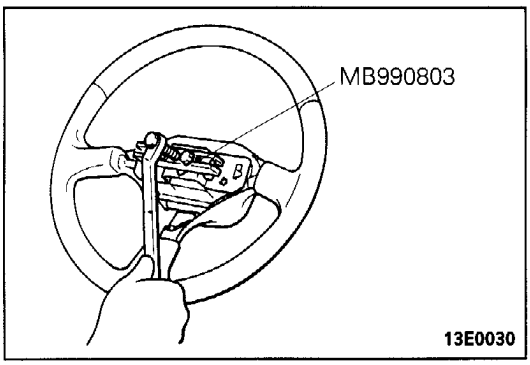
REMOVAL AND INSTALLATION

E54HH--



Removal steps

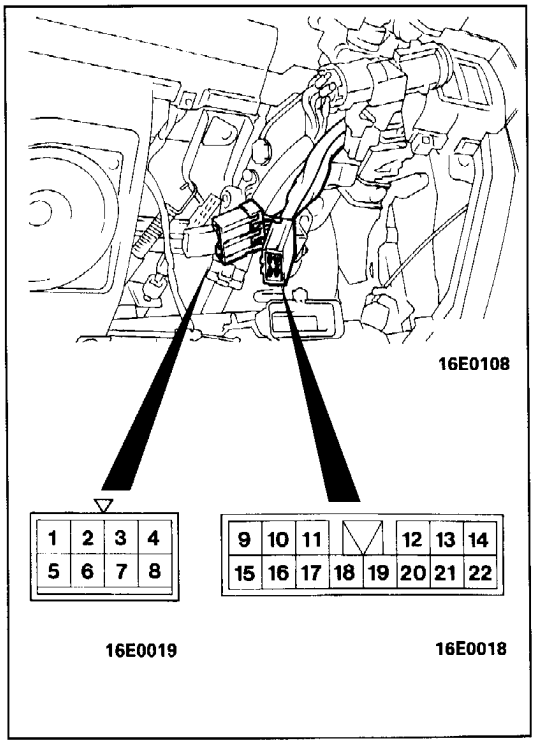
1. Instrument under cover (Refer to GROUP 52A – Instrument Panel.)
2. Steering wheel (Refer to GROUP 37 – Steering Wheel and Shaft.)
3. Column cover lower
4. Column cover upper
5. Column switch



SERVICE POINT OF REMOVAL

E54H1AG

2. REMOVAL OF STEERING WHEEL



INSPECTION

E54HJAP

(1) Remove the instrument under cover. (Refer to GROUP 52A – Instrument Panel.)
(2) Remove the column cover lower.
(3) Disconnect the connector at the column switch.
(4) Operate the switch, and check the continuity between the terminals.

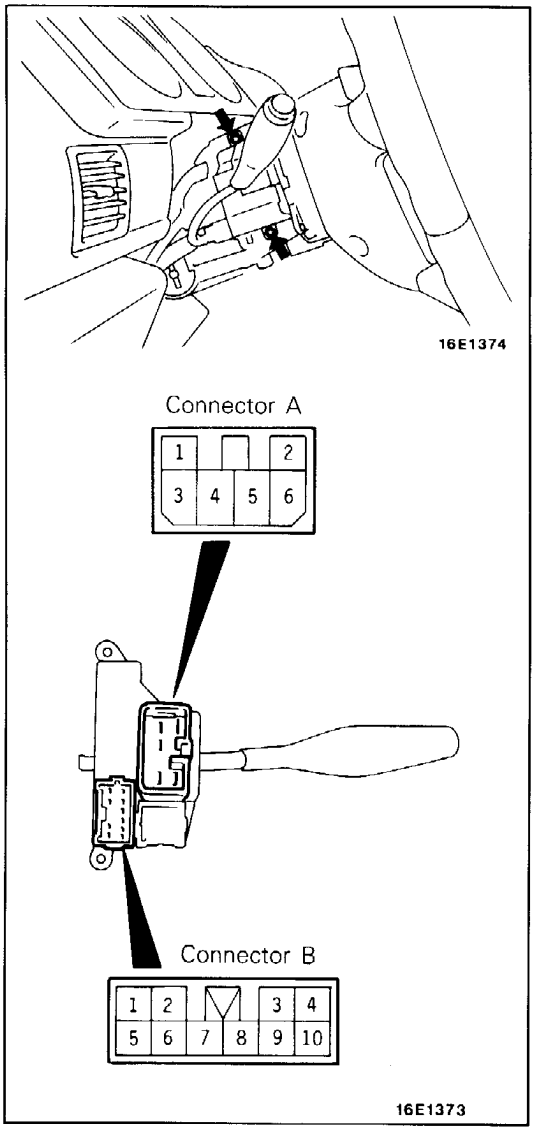
Switch position \ Terminal		1	5	6	11	14	17	18	19	20	22
Lighting switch	OFF										
	TAIL				○	—	—	—	—	—	○
	HEAD				○	—	○				○
Dimmer/ Passing switch	LOWER	○	—	○							
	UPPER		○	○			▲				
	PASSING		○	○	—	○					
Turn signal switch	RH							○	—	○	
	OFF										
	LH							○	○		

NOTE
(1) ○–○ indicates that there is continuity between the terminals.
(2) For inspection of the windshield wiper and washer switch, refer to GROUP 51 – Windshield Wiper and Washer.
(3) For inspection of the headlamp washer switch, refer to GROUP 51 – Headlamp Washer.

LIGHTING SWITCH, DIMMER/PASSING SWITCH, TURN-SIGNAL LAMP SWITCH <Vehicles with SRS>

INSPECTION

(1) Remove the column cover lower.
(2) Remove the column cover upper.
(3) Remove the screws indicated by arrows in the illustration, and then remove the switch.
(4) Operate the switch, and check the continuity between the terminals.



<Lighting switch>

Switch position \ Terminal	Connector A: 1	Connector B: 5	6	7
OFF				
TAIL		○		○
HEAD	○		○	
		○		○

<Dimmer/Passing switch>

Switch position	Terminal	Connector A: 1	2	3	4	6
LOWER				○	○	
UPPER					○	○
PASSING	LOWER	○	○			○
				○	○	
	UPPER	○	○			○
					○	○

<Turn-signal lamp switch>

Switch position \ Terminal	Connector B: 1	3	4	8	9	10
RH				○	○	
OFF						
LH		○		○		

NOTE
○—○ indicates that there is continuity between the terminals.

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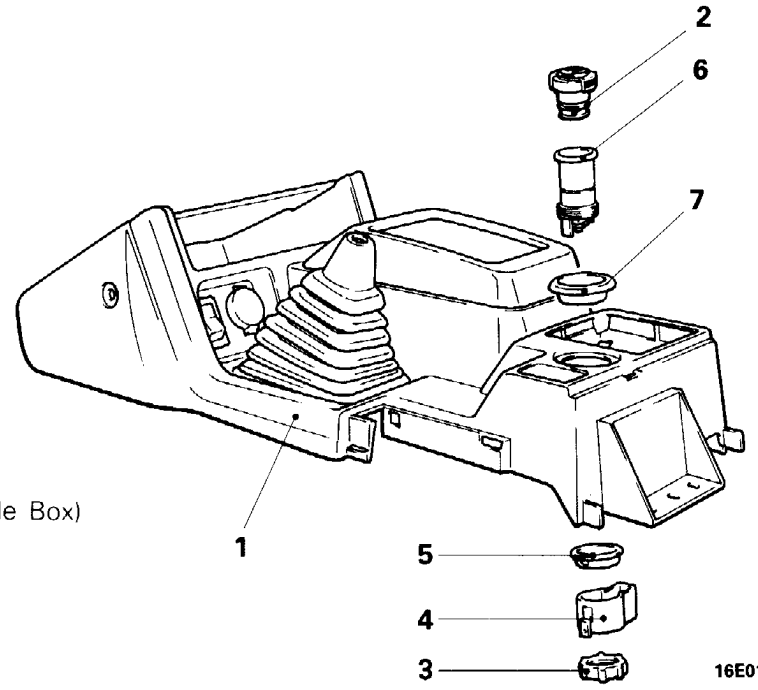
NOTES

CIGARETTE LIGHTER

E54JH--

REMOVAL AND INSTALLATION



Removal steps

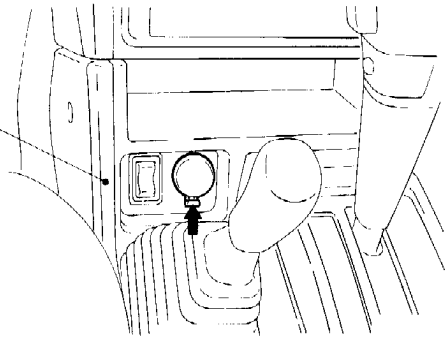
1. Front console box (Refer to GROUP 52A – Console Box)
2. Plug
3. Nut
4. Outer case
5. Washer
6. Socket
7. Protector

ACCESSORY SOCKET

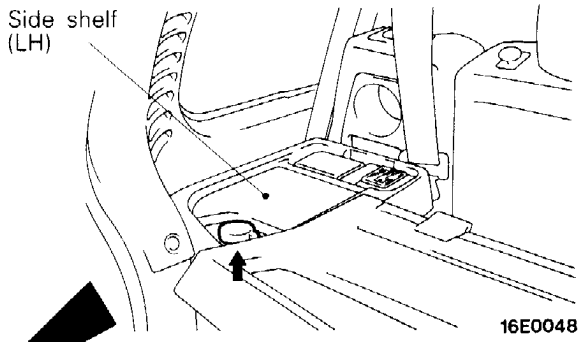
E54JBAA

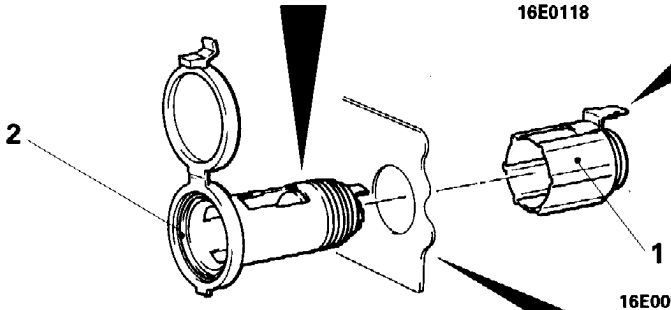
REMOVAL AND INSTALLATION

<For front seat>

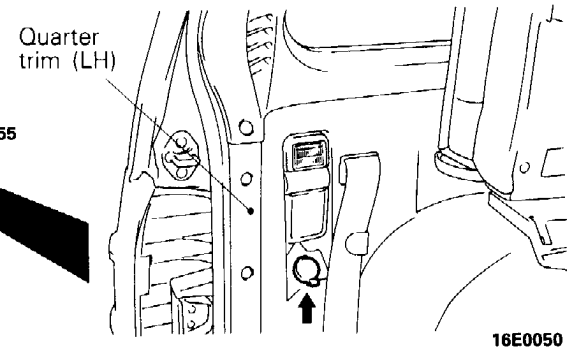


<For rear seat – Standard wheelbase>





<For rear seat – Long wheelbase>



Removal steps

- Front console box (Refer to GROUP 52A – Console Box)
- Quarter trim (LH) (Refer to GROUP 52A – Trim)

1. Socket
2. Outer case

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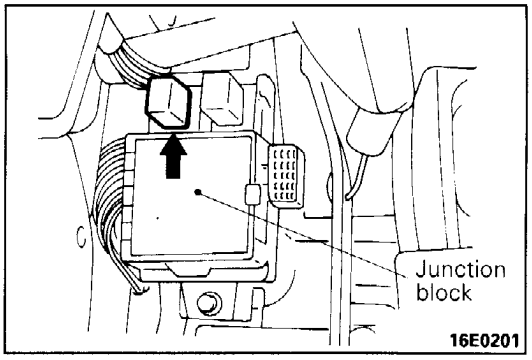
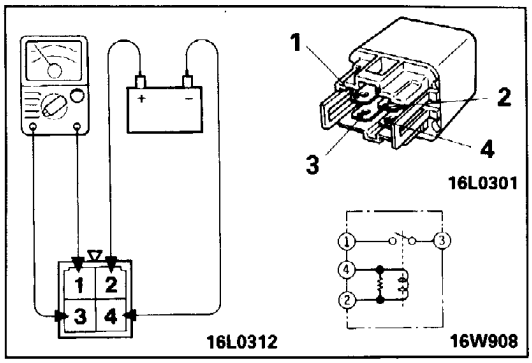


INSPECTION

(1) Remove the accessory socket relay from the junction block.



(2) Apply battery voltage to terminal (2), and check the continuity between the terminals when terminal (4) is earthed.

When power is supplied	Between terminals 1–3	Continuity
When power is not supplied	Between terminals 1–3	No continuity
	Between terminals 2–4	Continuity

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AUDIO SYSTEM

TROUBLESHOOTING

QUICK-REFERENCE TROUBLESHOOTING CHART

E54LC--

Item	Problem symptom	Relevant chart
Noise	Noise appears at certain places when traveling (AM).	A-1
	Noise appears at certain places when traveling (FM).	A-2
	Mixed with noise, only at night (AM).	A-3
	Broadcasts can be heard but both AM and FM have a lot of noise.	A-4
	There is more noise either on AM or on FM.	A-5
	There is noise when starting the engine.	A-6
	Some noise appears when there is vibration or shocks during traveling.	A-7
	Noise sometimes appears on FM during traveling.	A-8
	Ever-present noise.	A-9
Radio	When switch is set to ON, no power is available.	B-1
	No sound from one speaker.	B-2
	There is noise but no reception for both AM and FM or no sound from AM, or no sound from FM.	B-3
	Insufficient sensitivity.	B-4
	Distortion on AM or on both AM and FM.	B-5
	Distortion on FM only.	B-6
	Too few automatic select stations.	B-7
	Insufficient memory (preset stations are erased).	B-8
Cassette player	Casette tape will not insert.	C-1
	No sound.	C-2
	No sound from one speaker.	C-3
	Sound quality is poor, or sound is weak.	C-4
	Cassette tape will not eject.	C-5
	Uneven revolution. Tape speed is fast or slow.	C-6
	Automatic search does not work	C-7
	Faulty auto reverse.	C-8
	Tape gets caught in mechanism.	C-9
Motor antenna	Motor antenna won't extend or retract.	D-1
	Motor antenna extends and retracts but does not receive.	D-2

NOTE
Refer to problem symptoms of AM radio for LW and MW radio.

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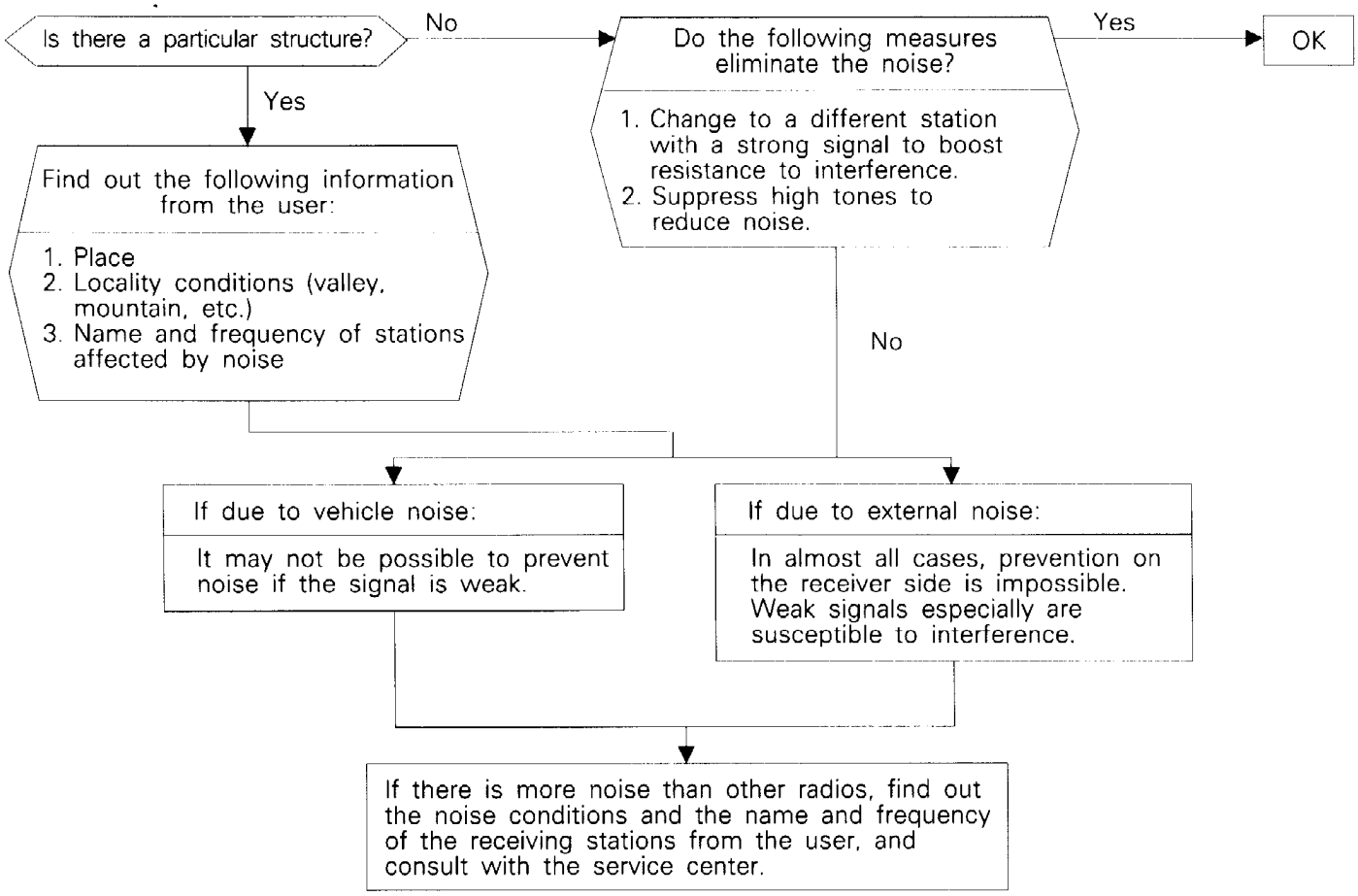
CHART

A. NOISE

A–1	Noise appears at certain places when traveling (AM).



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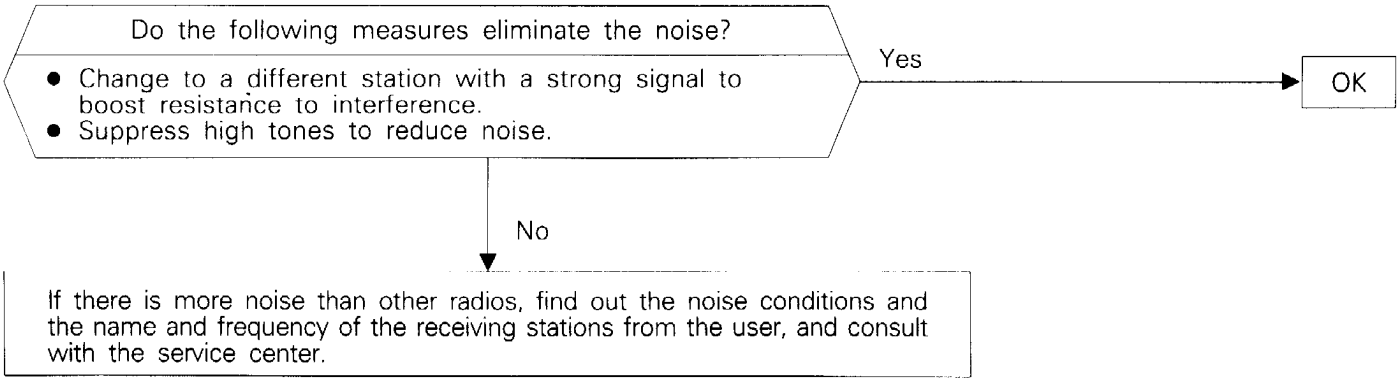
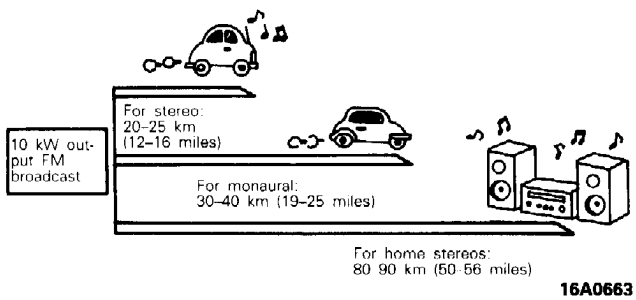
A–2	Noise appears at certain places when traveling (FM).



NOTE
About FM waves:
FM waves have the same properties as light, and can be deflected and blocked. Wave reception is not possible in the shadow of obstructions such as buildings or mountains.

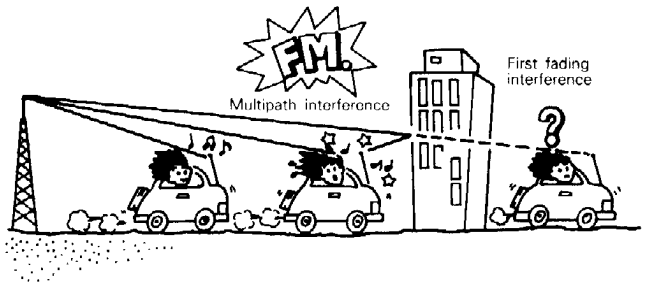
1. The signal becomes weak as the distance from the station's transmission antenna increases. Although this may vary according to the signal strength of the transmitting station and intervening geographical formations or buildings, the area of good reception is approx. 20–25 km (12–16 miles) for stereo reception, and 30–40 km (19–25 miles) for monaural reception.
2. The signal becomes weak when an area of shadow from the transmitting antenna (places where there are obstructions such as mountains or buildings between the antenna and the car), and noise will appear. <This is called first fading, and gives a steady buzzing noise>
3. If a direct signal hits the antenna at the same time as a signal reflected by obstructions such as mountains or buildings, interference of the two signals will generate noise. During traveling, noise will appear each time the vehicle's antenna passes through this kind of obstructed area. The strength and interval of the noise varies according to the signal strength and the conditions of deflection. <This is called multipath noise, and is a repetitious buzzing.>
4. Since FM stereo transmission and reception has a weaker field than monaural, it is often accompanied by a hissing noise.

FM Broadcast Good Reception Areas



16A0663

FM Signal Characteristics and Signal Interference



16A0664

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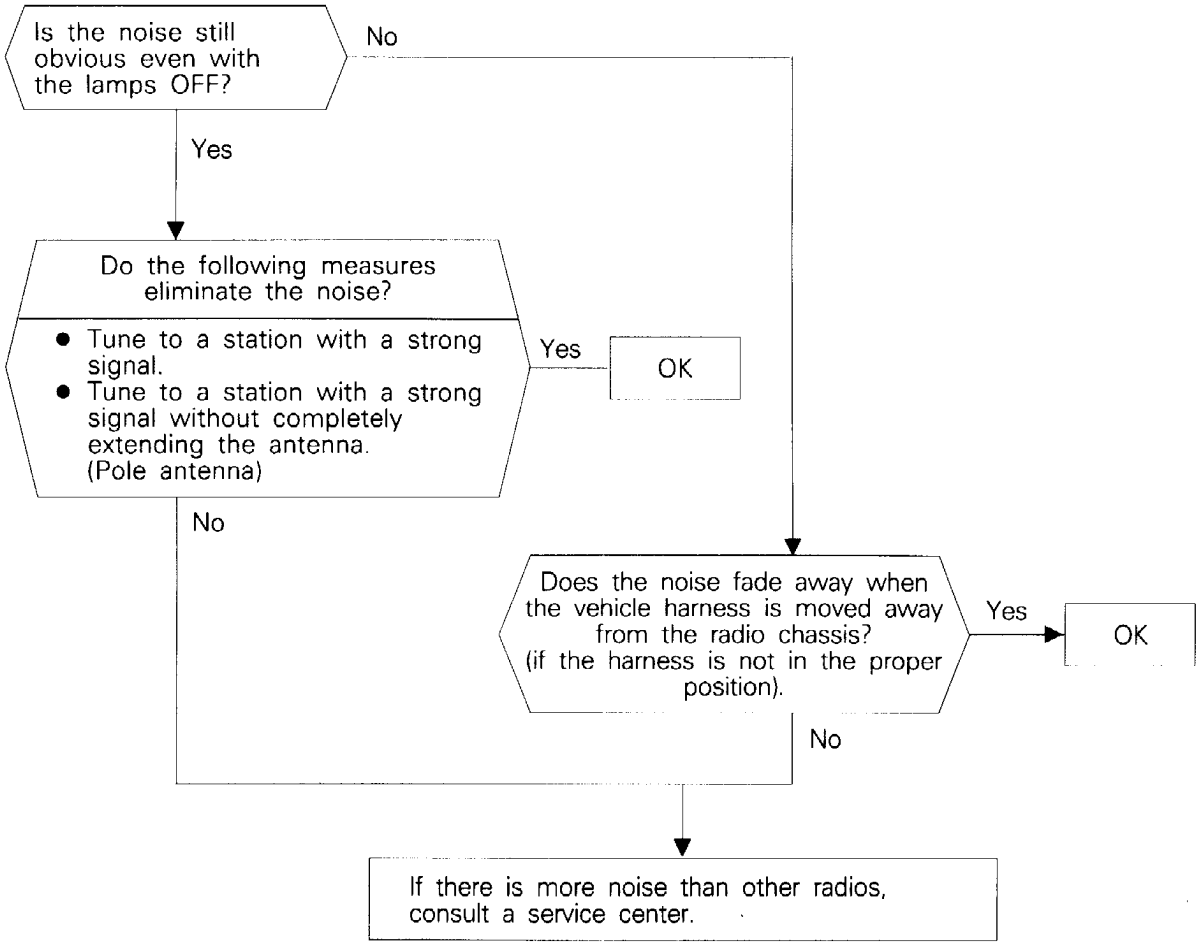
A–3	Mixed with noise, only at night (AM).

The following factors can be considered as possible causes of noise appearing at night.

1. Factors due to signal conditions: Due to the fact that long-distance signals are more easily received at night, even stations that are received without problem during the day may experience interference in a general worsening of reception conditions. The weaker a station is the more susceptible it is to interference, and a change to a different station or the appearance of a beating sound* may occur.
   Beat sound*: Two signals close in frequency interfere with each other, creating a repetitious high-pitched sound. This sound is generated not only by sound signals but by electrical waves as well.
2. Factors due to vehicle noise: Alternator noise may be a cause.



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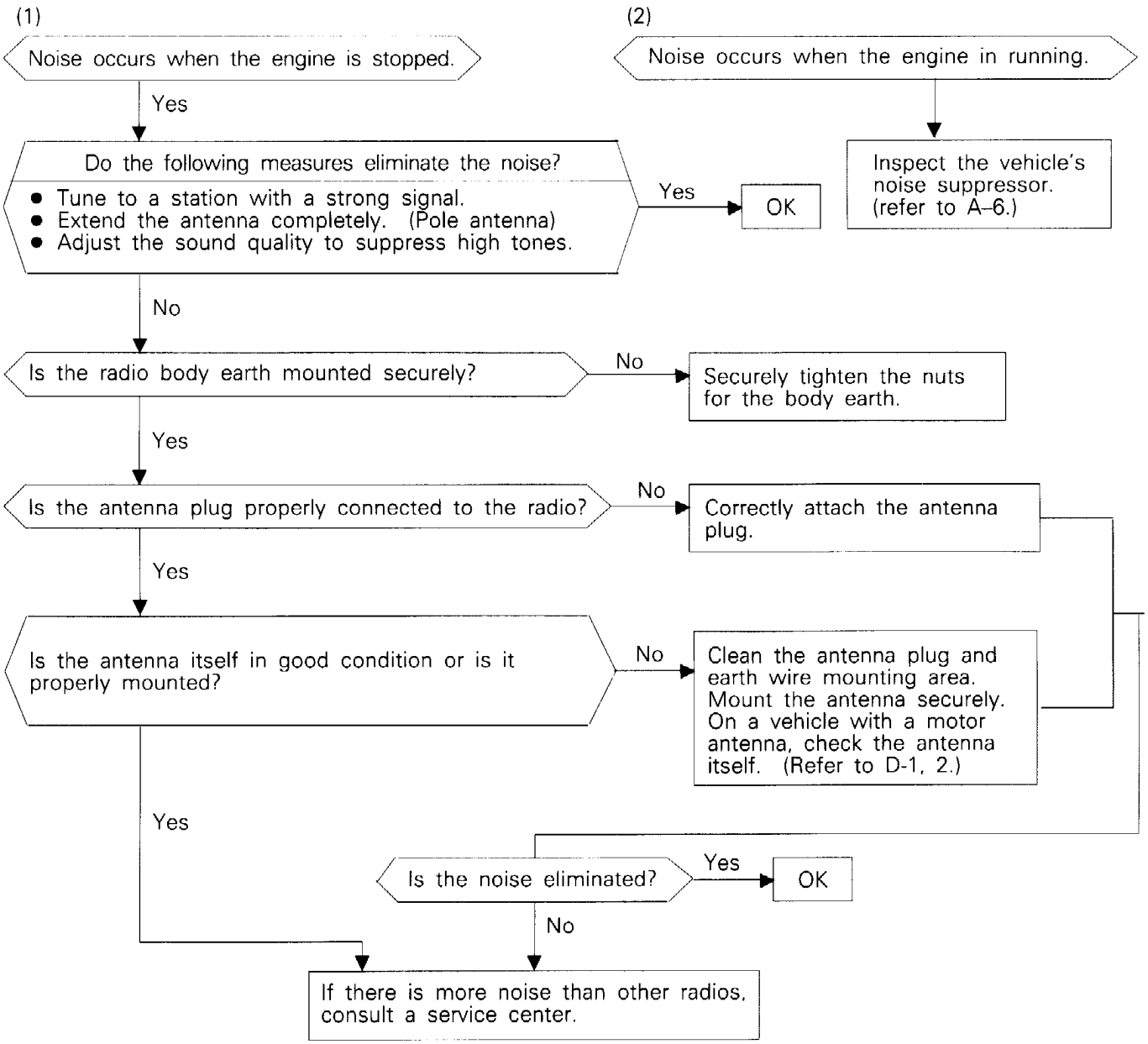
A–4	Broadcast can be heard but both AM and FM have a lot of noise.



NOTE
About noise encountered during FM reception only. Due to differences in FM and AM system, FM is not as susceptible as AM to interference from engines, power lines, lightning, etc. On the other hand, there are cases due to the characteristics of FM waves of noise or distortion generated by typical noise interference (first fading and multipath). (Refer to A-2.)
<Noise (hissing) occurs in weak signal areas such as mountainous regions, but this is not due to a problem with the radio.>

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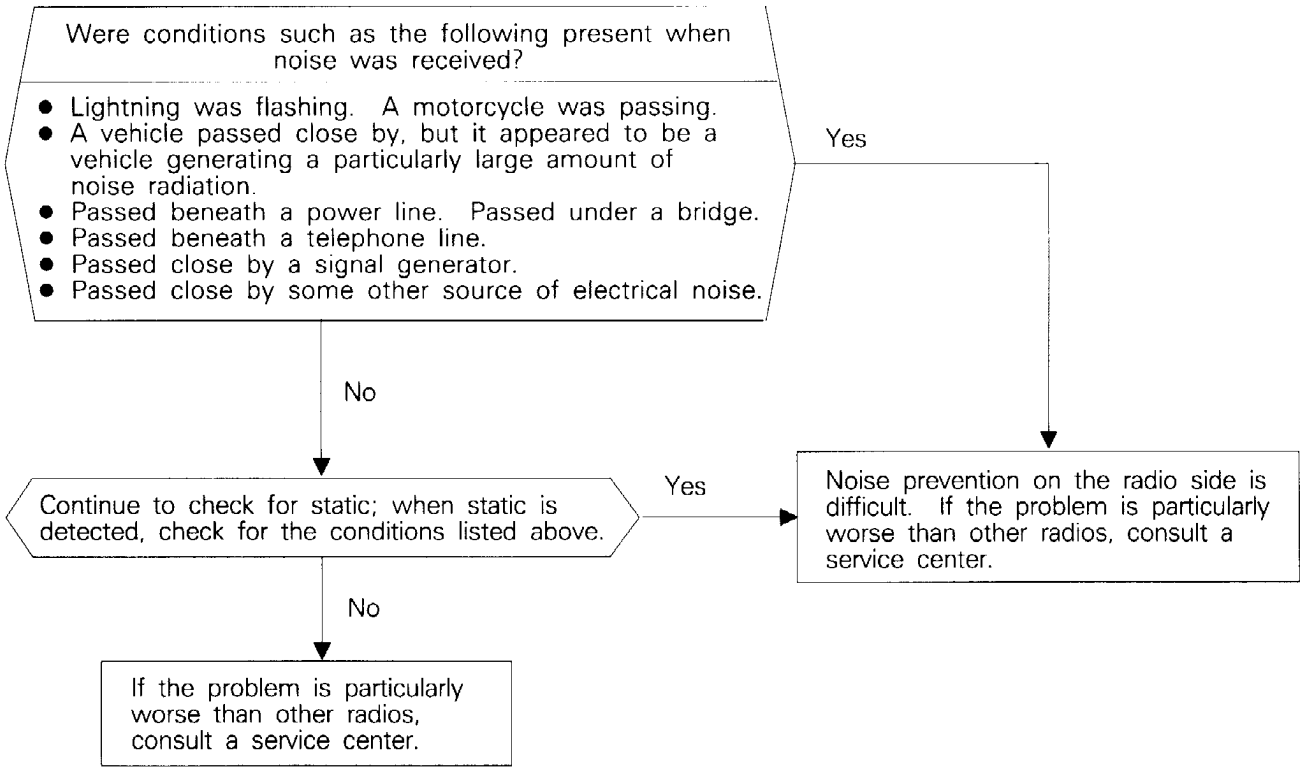
A–5	There is more noise either on AM or on FM.

1. There is much noise only on AM
   Due to differences in AM and FM systems, AM is more susceptible to noise interference.



2. There is much noise only on FM
   Due to differences in FM and AM systems, FM is not as susceptible as AM to interference from engines, power lines, lightning, etc. On the other hand, there are cases due to the characteristics of FM waves of noise or distortion generated by typical noise interference (first fading and multipath). (Refer to A–2) <Noise (hissing) occurs in weak signal areas such as mountainous regions, but this is not due to a problem with the radio.>

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A–6	There is noise when starting the engine.

Noise type Sounds are in parentheses ( ).	Conditions	Cause	Inspection or replacement	
			Noise-preventive part	Mounting place (next page)
AM, FM: Ignition noise (Popping, Snapping, Cracking, Buzzing)	• Increasing the engine speed causing the popping sound to speed up, and volume decreases. • Disappears when the ignition switch is turned to ACC.	• Mainly due to the spark plugs. • Due to the engine noise.	• Noise filter • Earth cable • Noise capacitor	2 1, 3 2
Other electrical components	–	Noise may appear as electrical components become older.	Repair or replace electrical components.	
Static electricity (Cracking, Crinkling)	• Disappears when the vehicle is completely stopped. • Severe when the clutch is engaged.	Occurs when parts or wiring move for some reason and contact metal parts of the body.	Return parts or wiring to their proper position.	
	• Various noises are produced depending on the body part of the vehicle.	Due to detachment from the body of the front hood, bumpers, exhaust pipe and muffler, suspension, etc.	Earth parts by bonding. Cases where the problem is not eliminated by a single response to one area are common, due to several body parts being imperfectly earthed.	

Caution

1. **Connecting a high tension cable to the noise filter may destroy the noise filter and should never be done.**
2. **Check that there is no external noise. Since failure due this may result in misdiagnosis due to inability to identify the noise source, this operation must be performed.**
3. **Noise prevention should be performed by suppressing strong sources of noise step by step.**

NOTE

1. Capacitor
   The capacitor does not pass D.C. current, but as the number of waves increases when it passes A.C. current, impedance (resistance against A.C.) decreases, and current flow is facilitated. A noise suppressing condenser which takes advantage of this property is inserted between the power line for the noise source and the earth. This suppressed noise by earthing the noise component (A.C. or pulse signal) to the body of the vehicle.
2. Coil
   The coil passes D.C. current, but impedance rises as the number of waves increases relative to the A.C. current. A noise suppressing coil which takes advantage of this property is inserted into the power line for the noise source, and works by preventing the noise component from flowing or radiating out of the line.

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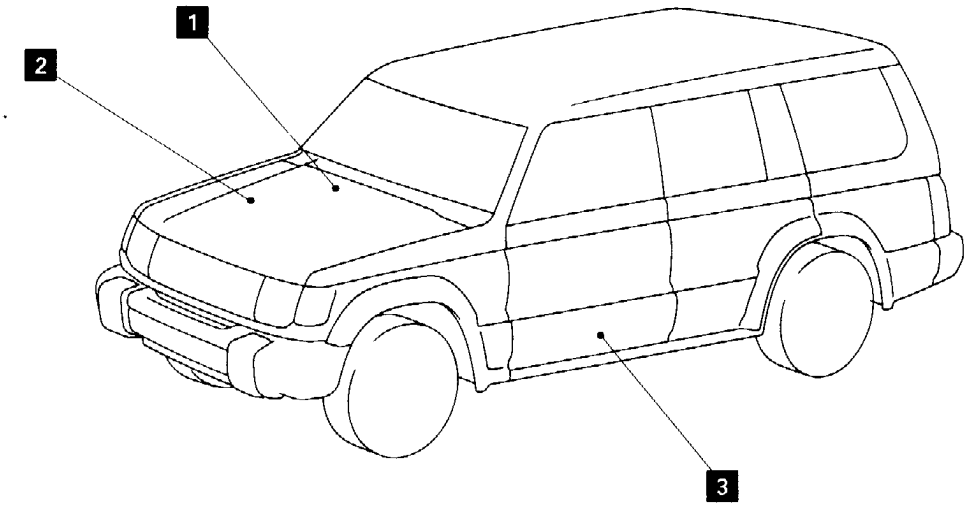
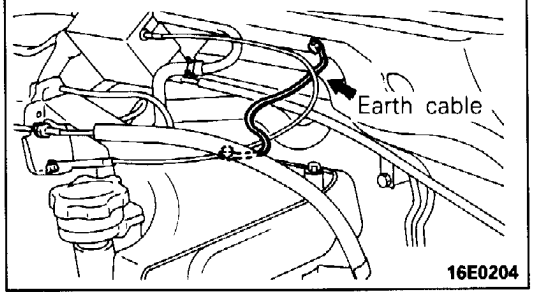
NOISE SUPPERSSOR MOUNTING LOCATION

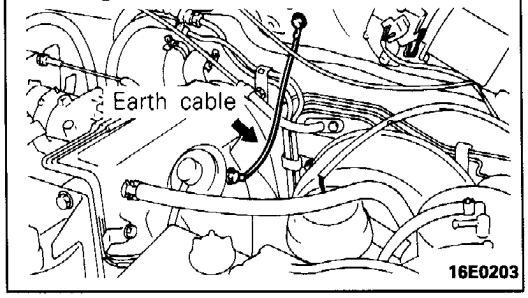


18E0003

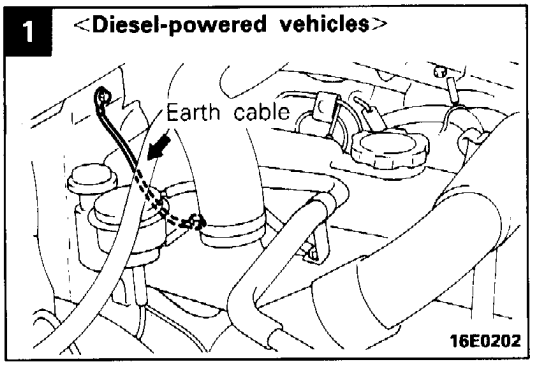
1 <Petrol-powered vehicles with 6G72 engine>



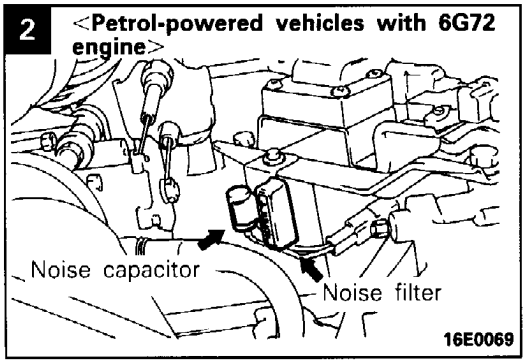
1 <Petrol-powered vehicles with 4G64 engine>



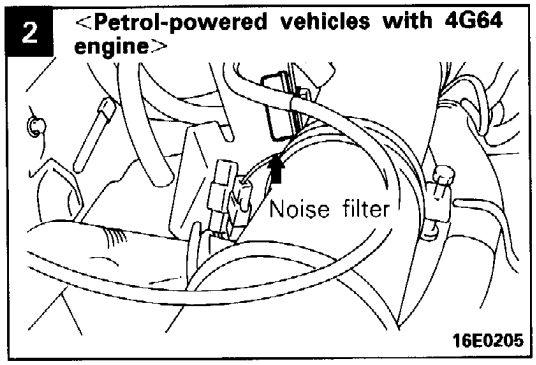
1 <Diesel-powered vehicles>



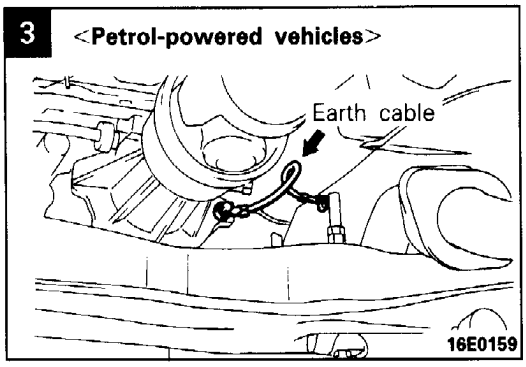
2 <Petrol-powered vehicles with 6G72 engine>



2 <Petrol-powered vehicles with 4G64 engine>



3 <Petrol-powered vehicles>



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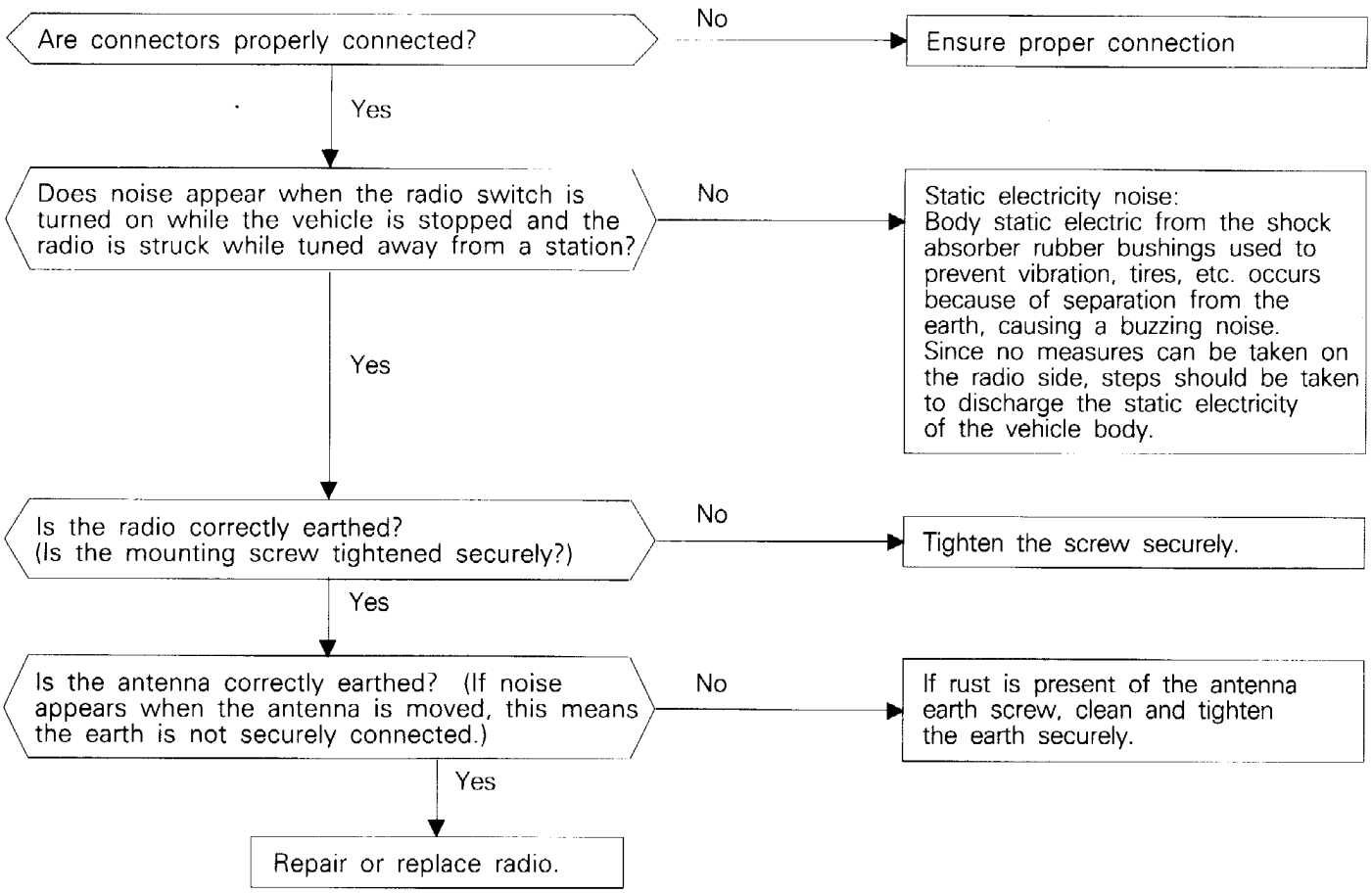
A–7 Some noise appears when there is vibration or shocks duringt traveling.



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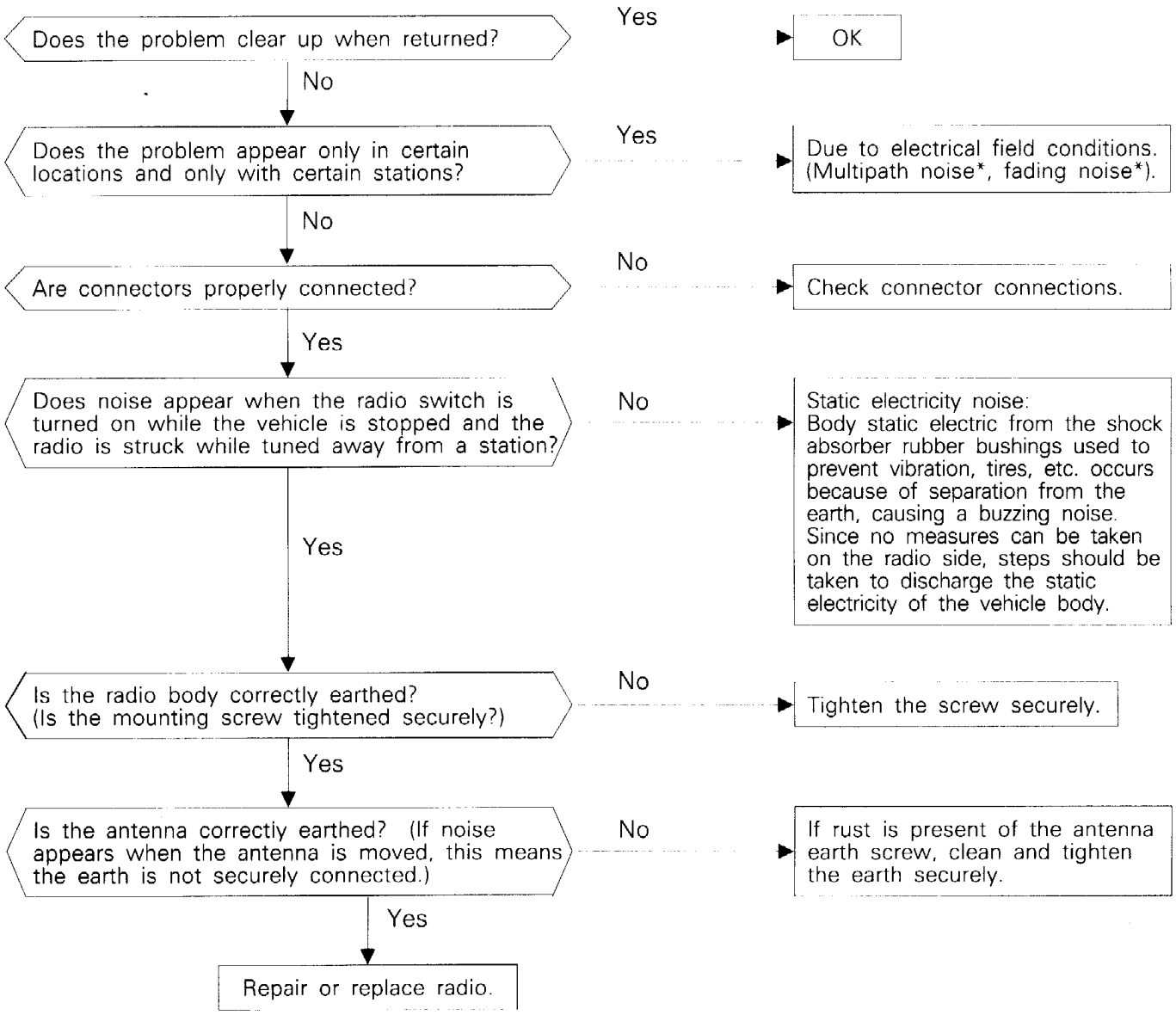
A-8 Noise sometimes appears on FM during traveling.



* About multipath noise and fading noise
Because the frequency of FM waves is extremely high, it is highly susceptible to effects from geological formations and buildings. These effects disrupt the broadcast signal and obstruct reception in several ways.

- Multipath noise
  This describes the echo that occurs when the broadcast signal is reflected by a large obstruction and enters the receiver with a slight time delay relative to the direct signal (repetitious buzzing).
- Fading noise
  This is a buzzing noise that occurs when the broadcast beam is disrupted by obstructing objects and the signal strength fluctuates intricately within a narrow range.

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A–9	Ever-present noise.

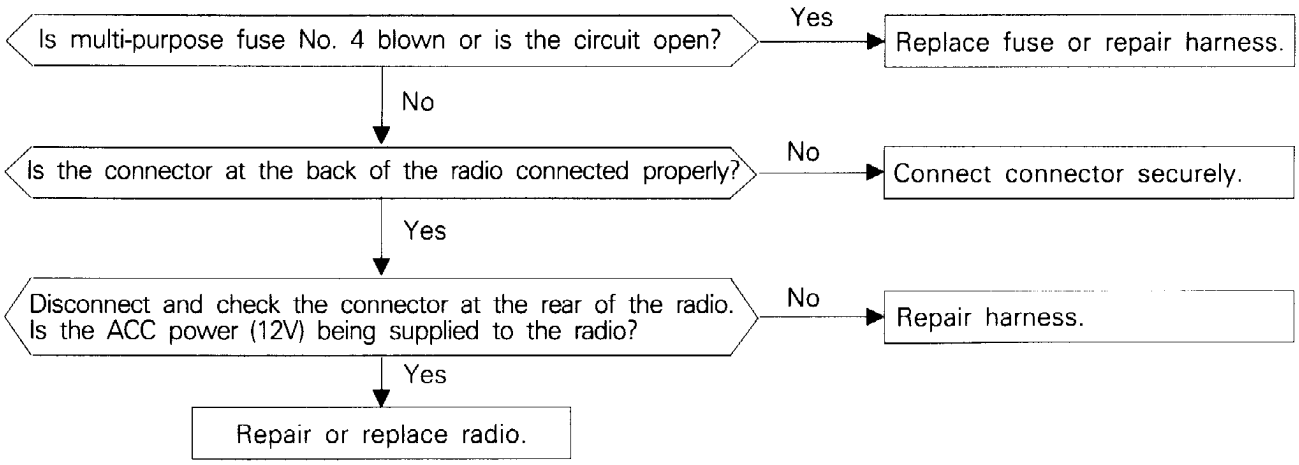
Noise is often created by the following factors, and often the radio is OK when it is checked individually.

- Traveling conditions of the vehicle
- Terrain of area traveled through
- Surrounding buildings
- Signal conditions
- Time period

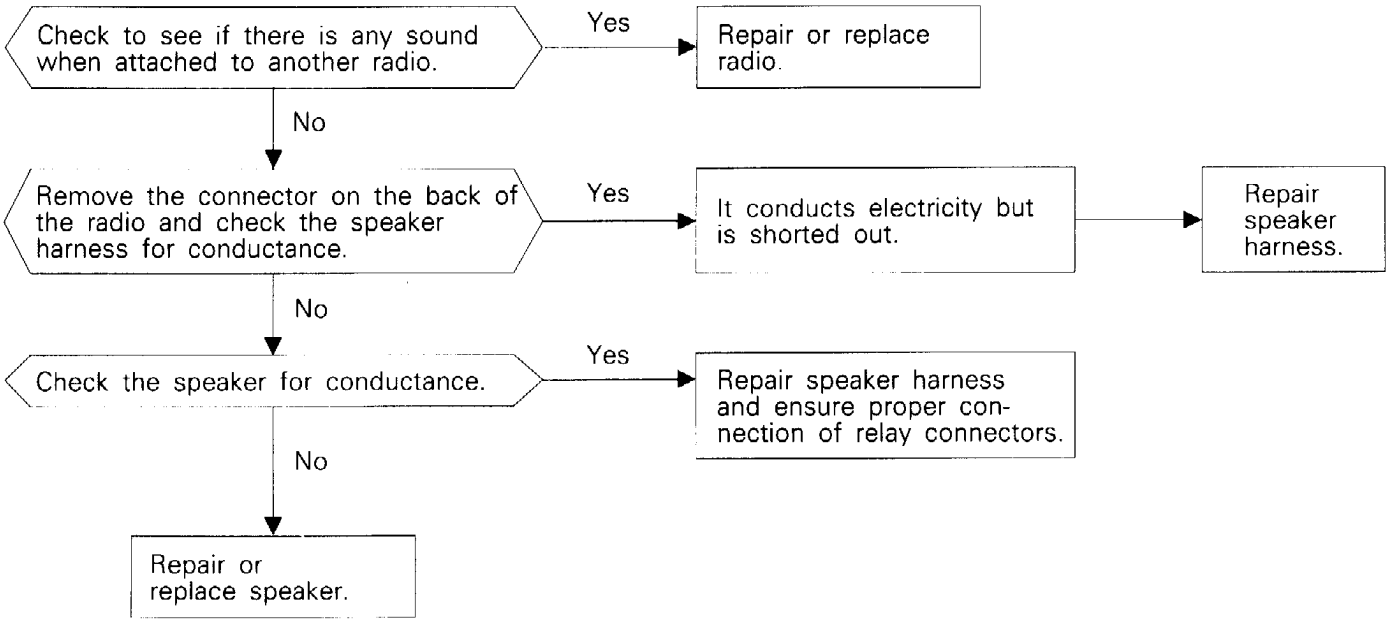
For this reason, if there are still problems with noise even after the measures described in steps A–1 to A–8 have been taken, get information on the factors listed above as well as determining whether the problem occurs with AM or FM, the station names, frequencies, etc., and contact a service center.

B. RADIO

B–1	No power is supplied when the switch is set to ON.



B–2	No sound from one speaker.



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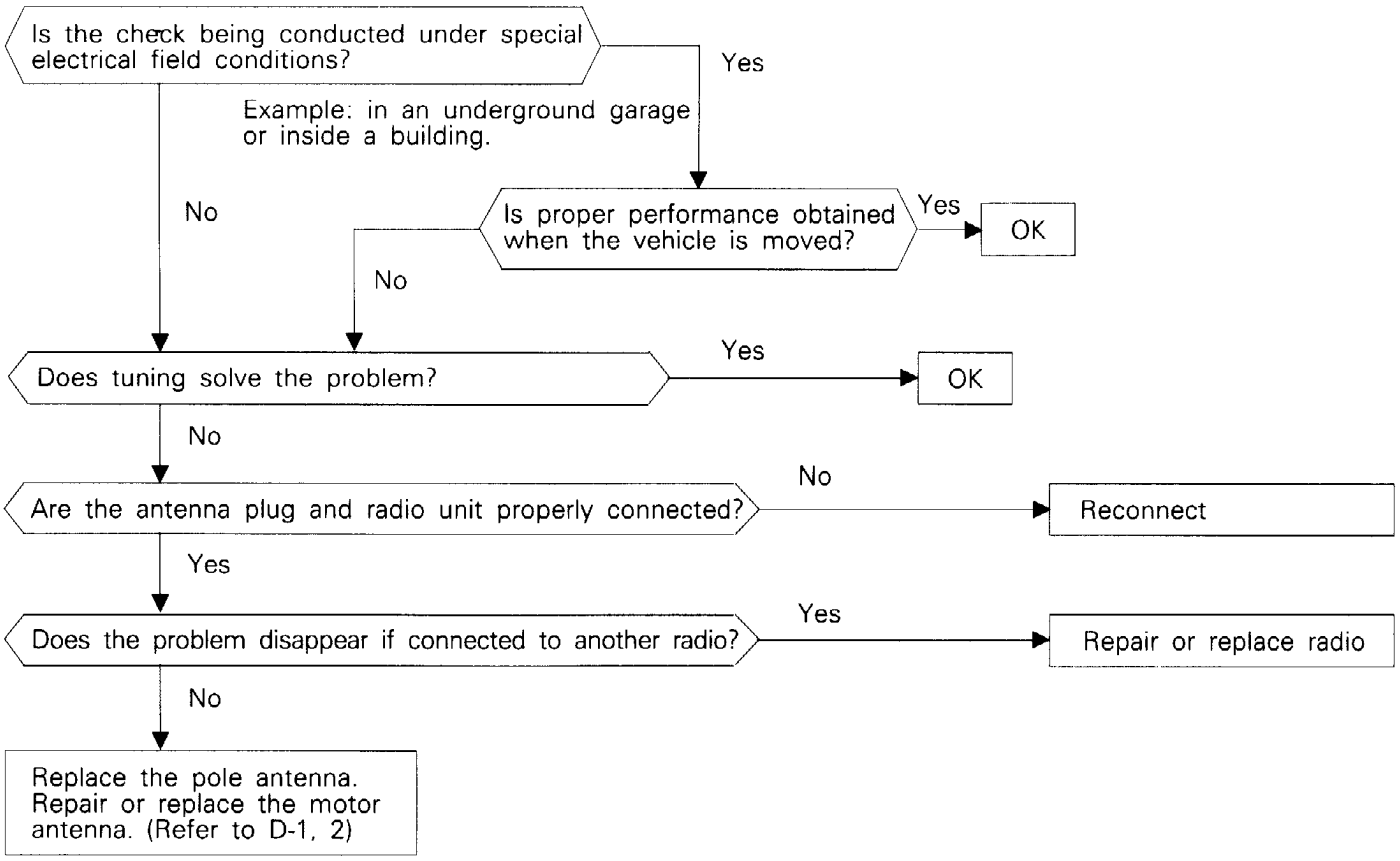
B–3	**There is noise but no reception for both AM andFM or no sound from AM, or no sound from FM.**



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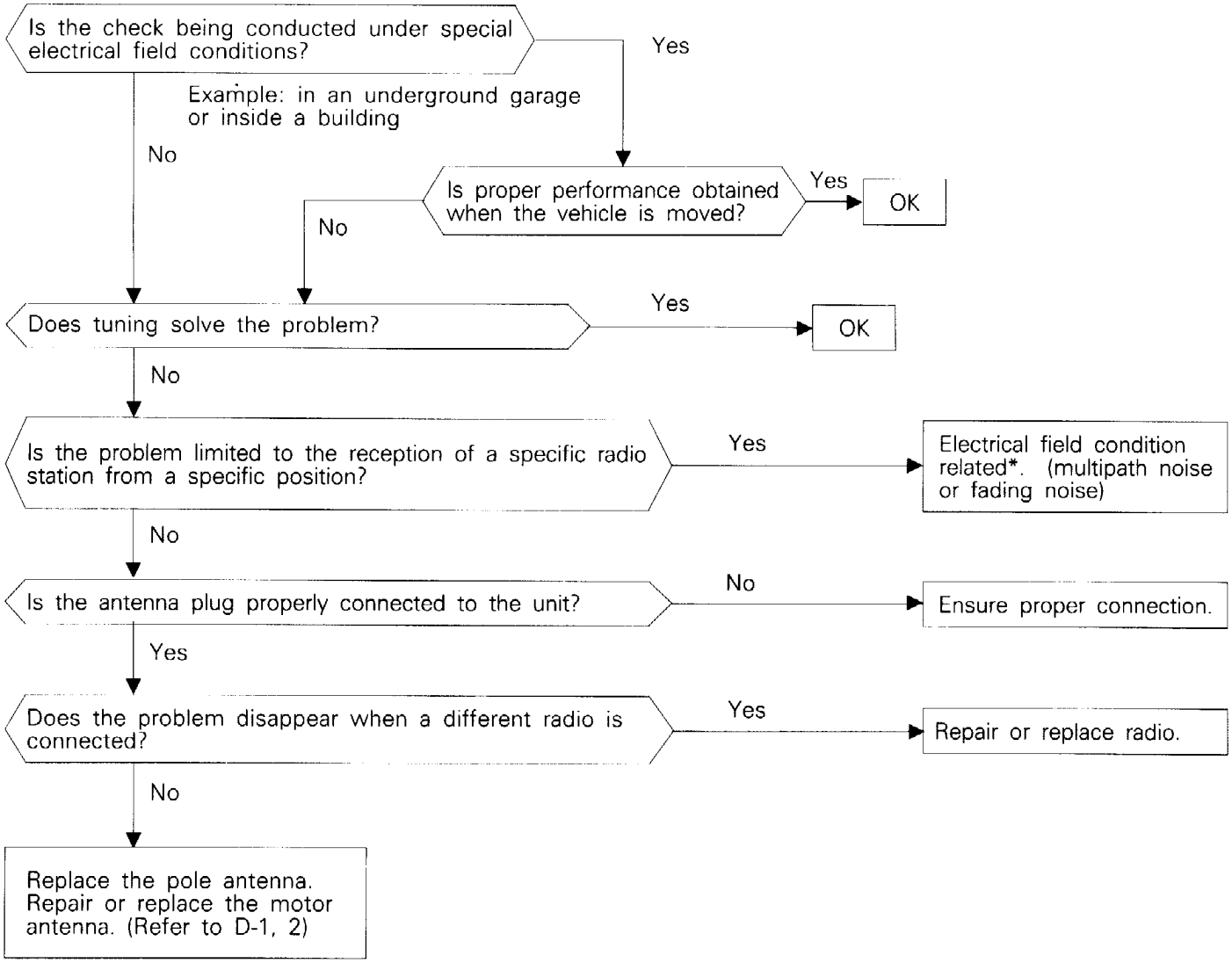
B–4 Unsufficient sensitivity.



* For multipath noise and fading noise problems, refer to P.54-41.

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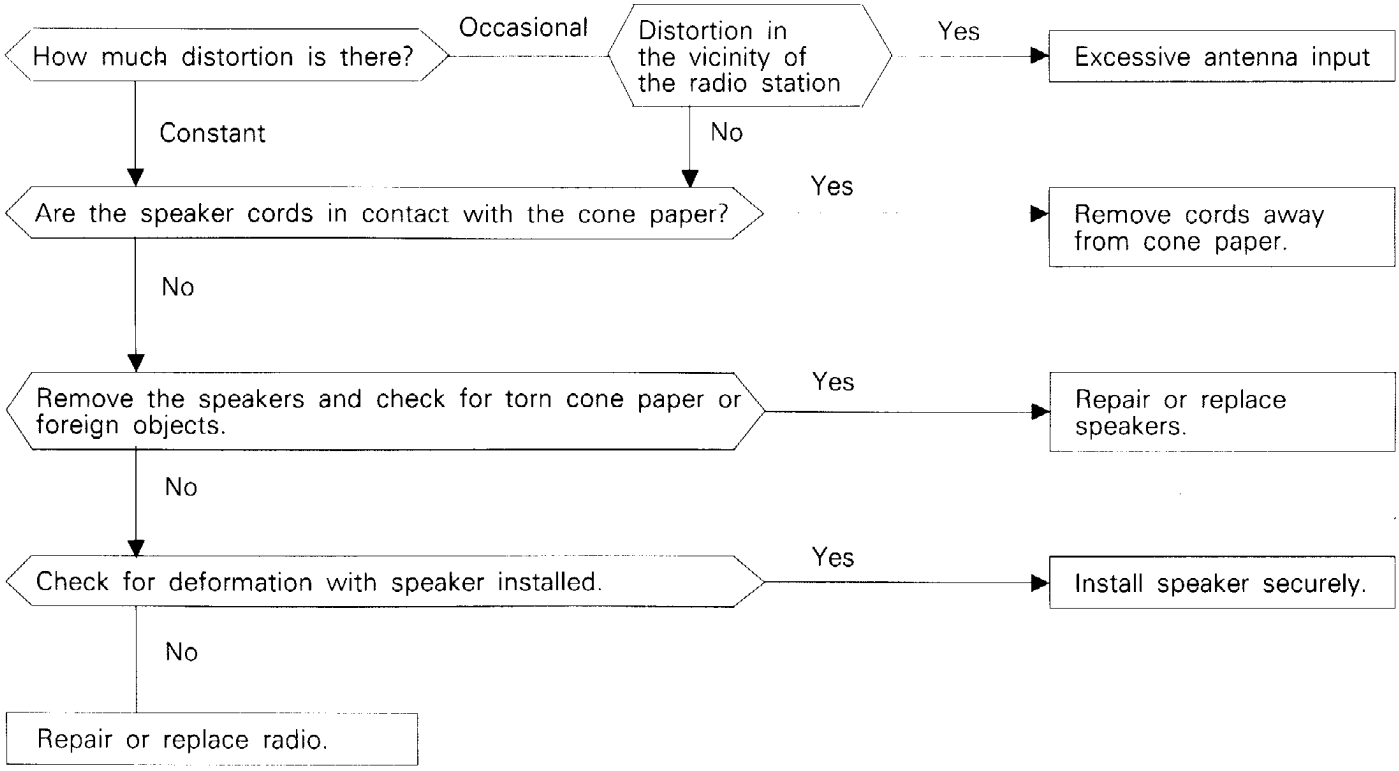
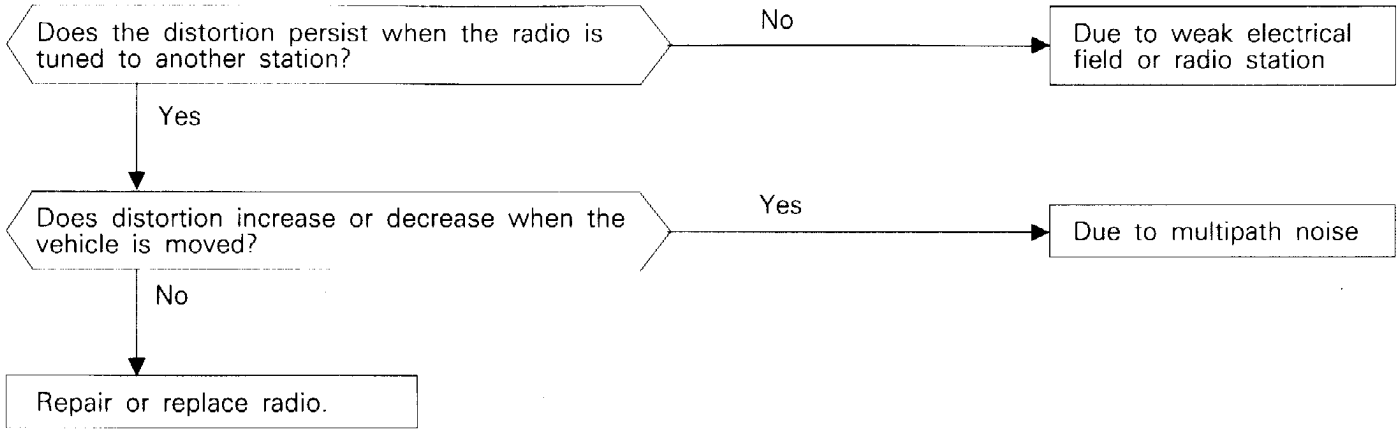
B–5 Distortion on AM or on both AM and FM.



B–6 Distortion on FM only.



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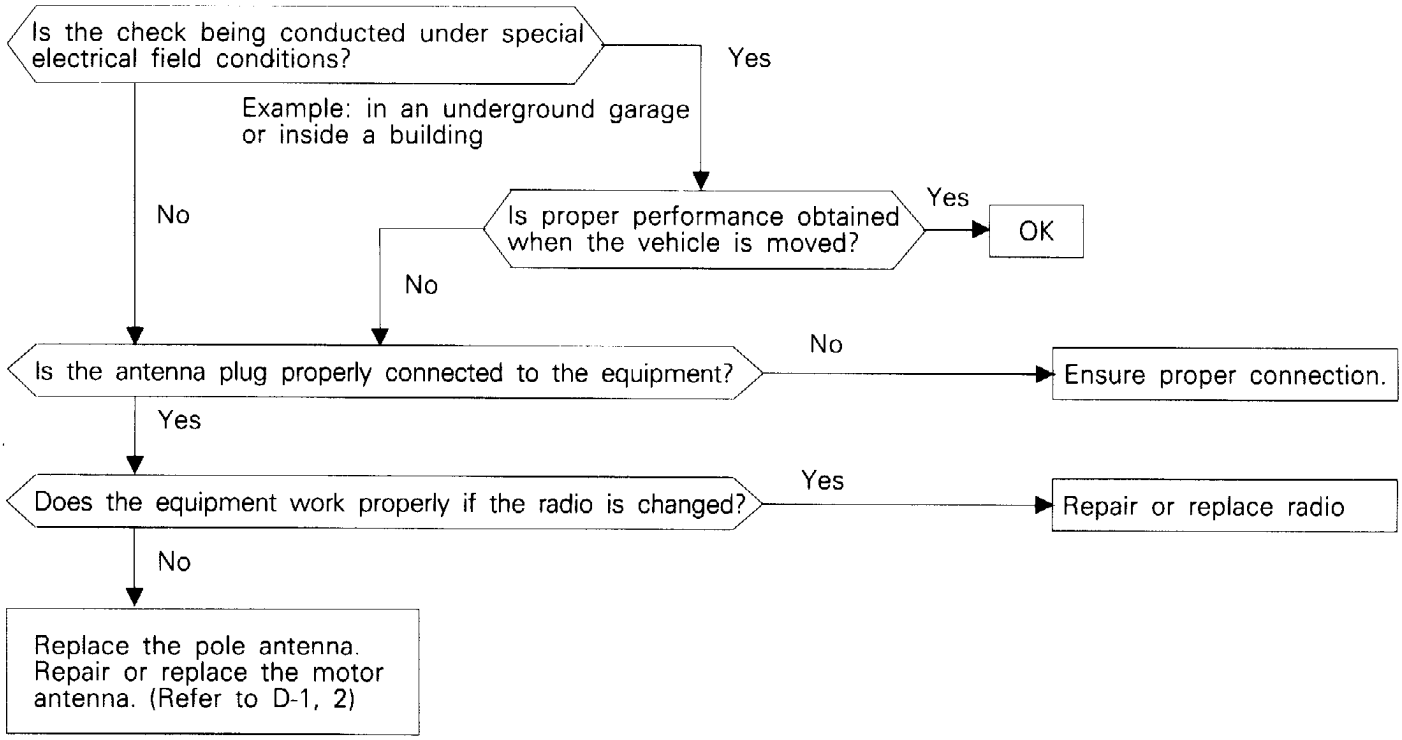
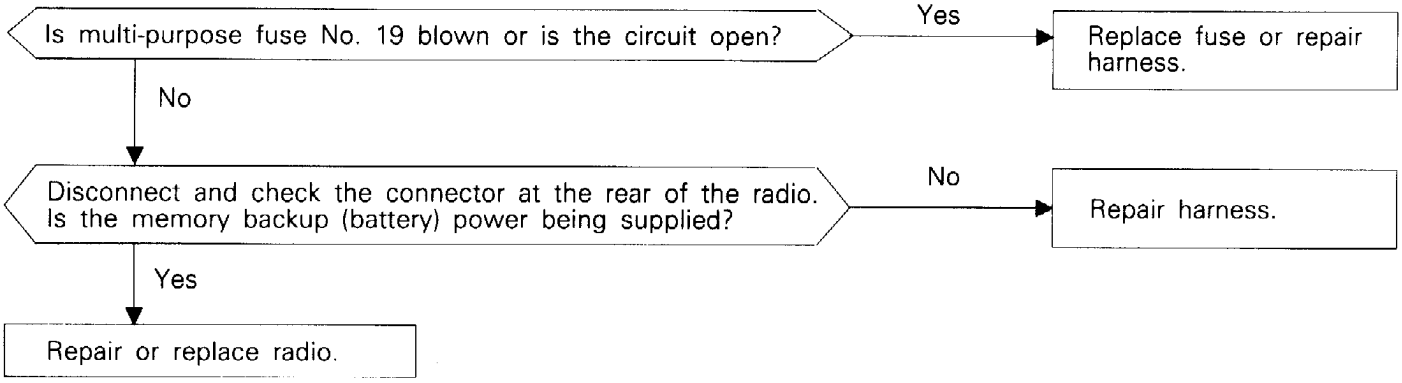
B–7 Too few automatic select stations.



B–8 Insufficient memory (preset stations are erased).



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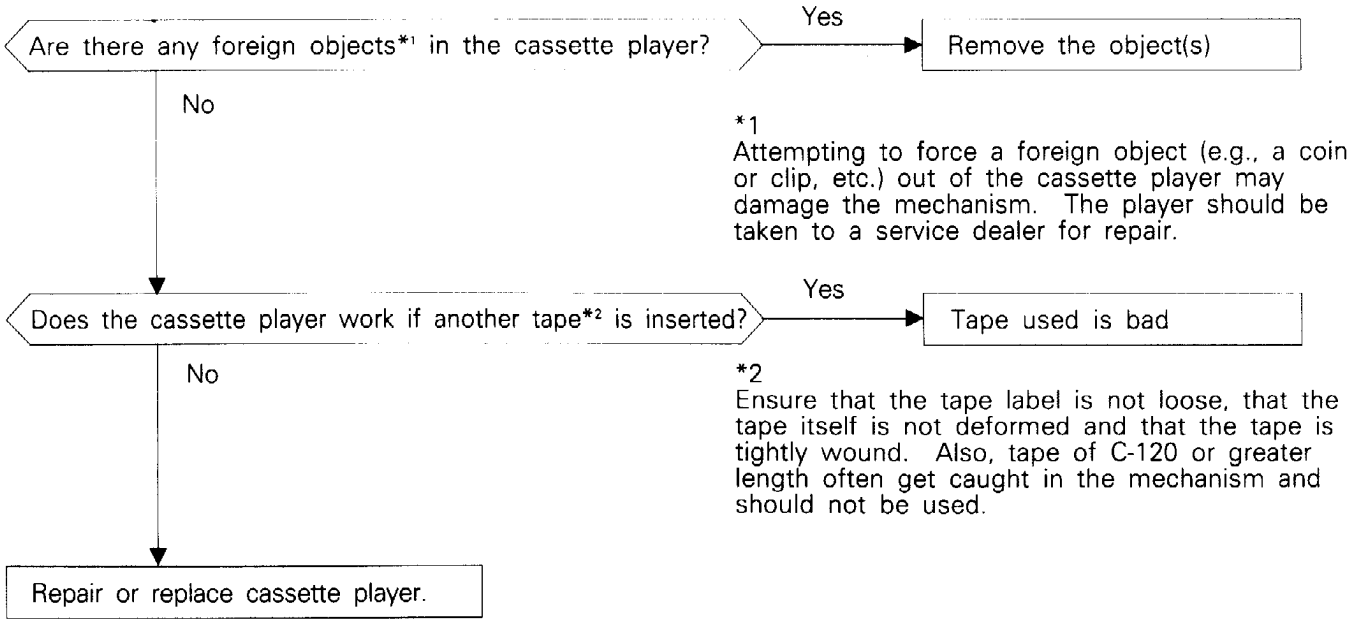
C. CASSETTE PLAYER

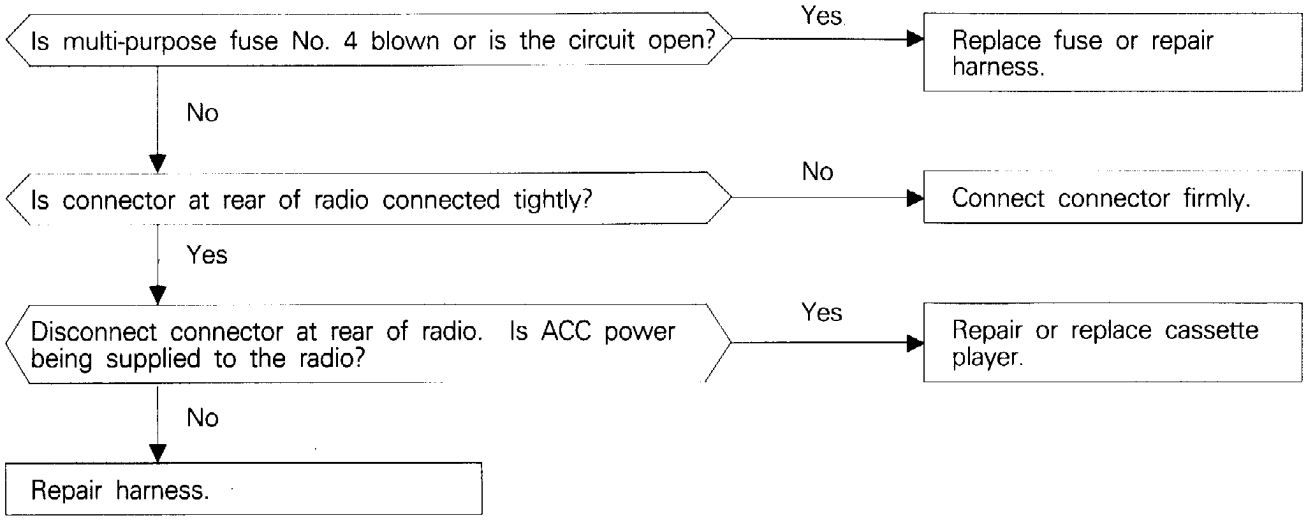
C-1 Cassette tape will not be inserted.



*1
Attempting to force a foreign object (e.g., a coin or clip, etc.) out of the cassette player may damage the mechanism. The player should be taken to a service dealer for repair.

*2
Ensure that the tape label is not loose, that the tape itself is not deformed and that the tape is tightly wound. Also, tape of C-120 or greater length often get caught in the mechanism and should not be used.

C-2 No sound (even after a tape has been inserted).



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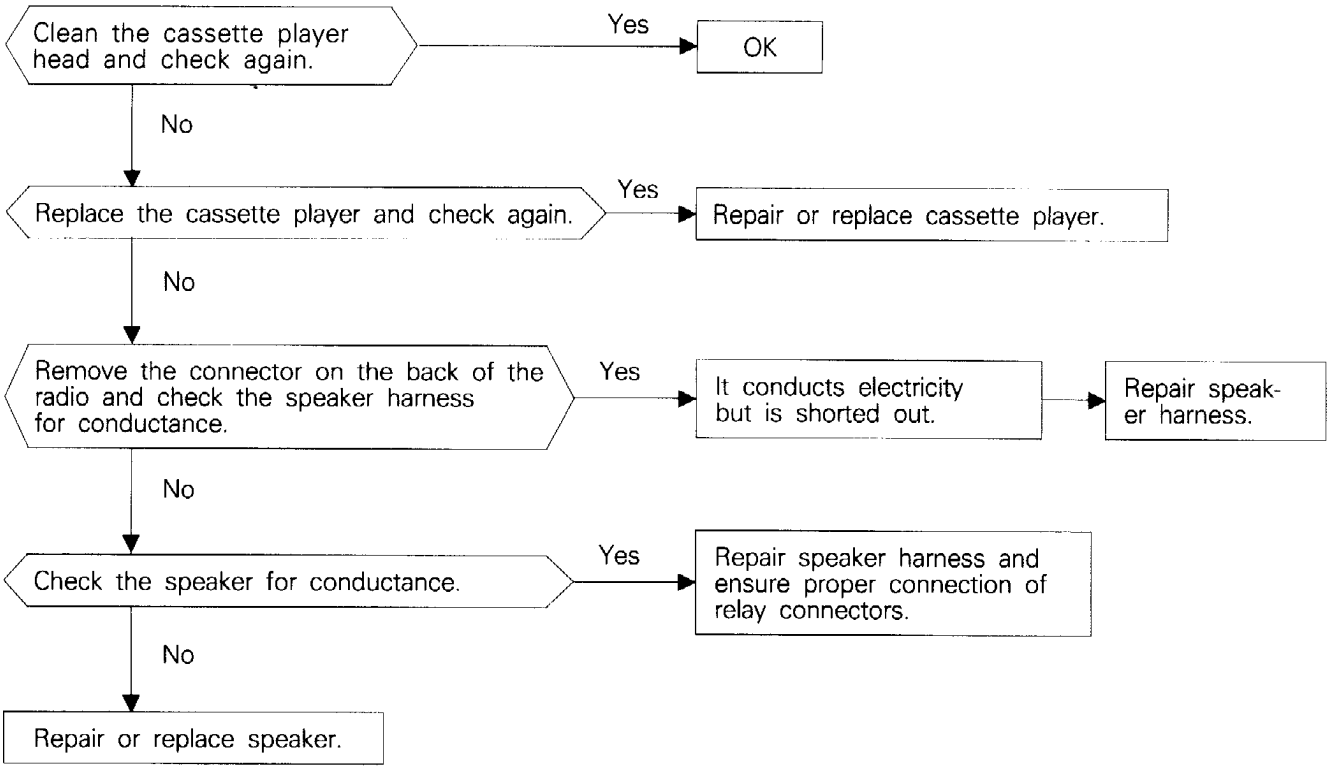
C–3	No sound from one speaker.



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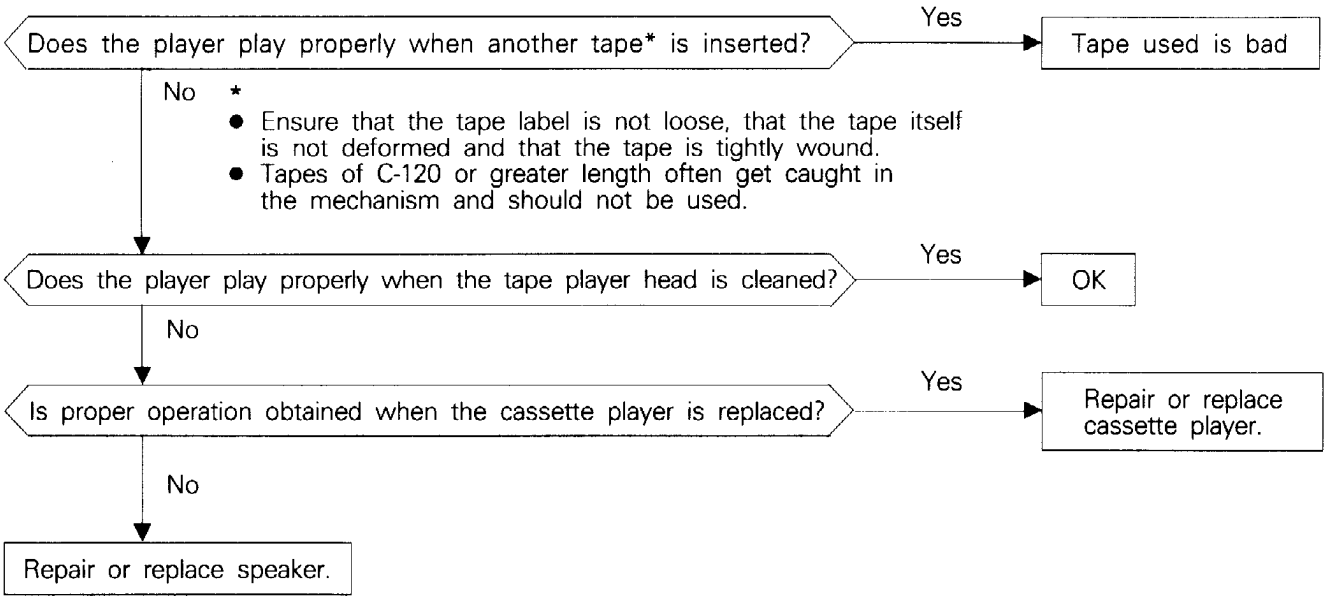
C–4 Sound quality is poor, or sound is weak.



C–5 Cassette tape will not eject.

The problems covered here are all the result of the use of a bad tape (deformed or not properly tightened) or of a malfunction of the cassette player itself. Malfunctions involving the tape becoming caught in the mechanism and ruining the case are also possible, and attempting to force the tape out of the player can cuse damage to the mechanism. The player should be taken to a service dealer for repair.

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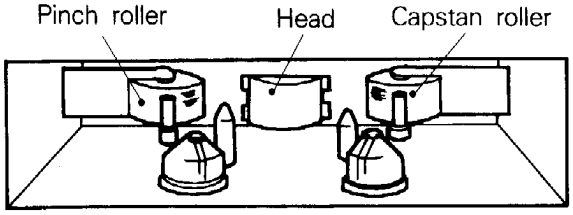
C-6 Uneven revolution. Tape speed is fast or slow.

Does the player play OK if the tape*1 is changed?
- Yes → Tape used is bad
- No ↓

Are there any foreign objects*2 inside the cassette player?
- Yes → Remove the object(s).
- No ↓

Is the head or capstan roller dirty?



- Yes → Clean.
- No ↓

Repair or replace cassette player.

*1
Ensure that the tape label is not loose, that the tape itself is not deformed and that the tape is tightly wound. Also, tape of C-120 or greater length often get caught in the mechanism and should not be used.

*2
Attempting to force a foreign object (e.g., a coin or clip, etc.) out of the cassette player may damage the mechanism. The player should be taken to a service dealer for repair.

C-7 Automatic search does not work.

Does the MSS (automatic search) button*1 depress properly?
- No → Button improperly operated.
- Yes ↓

Does the player play OK if the tape *2 is changed?
- Yes → Tape used is bad.
- No ↓

Repair or replace the cassette player

*1
- When the time between songs on a tape is less than three seconds, or when there is a three second period in the middle of a song in which the volume level is extremely low, the automatic search function may not work properly.

*2
- Ensure that the tape label is not loose, that the tape itself is not deformed and that the tape is tightly wound. Also, tapes of C-120 or greater length often get caught in the mechanism and should not be used.

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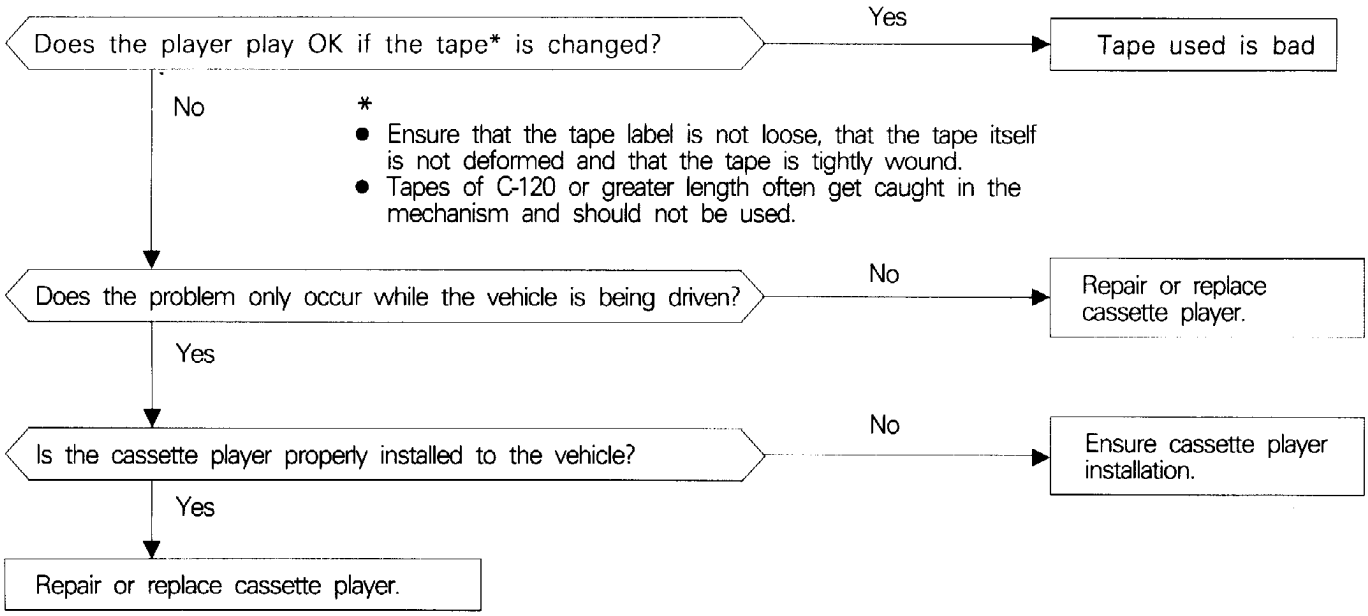
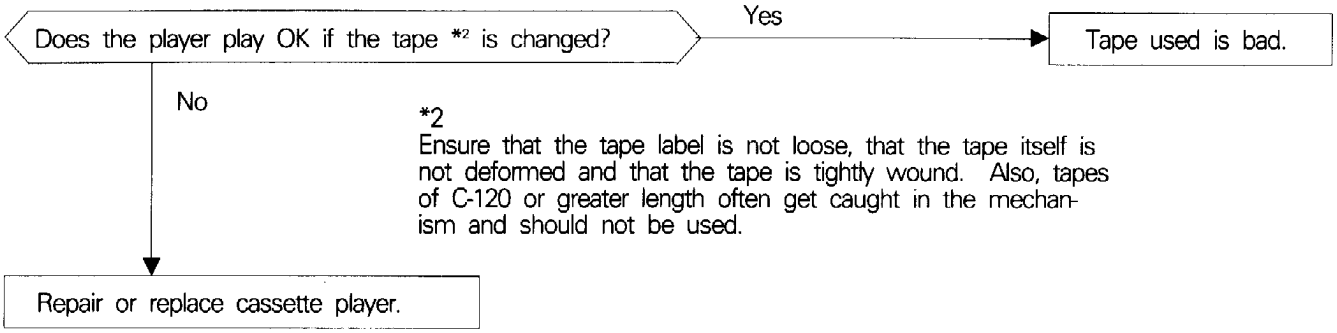
C–8 Faulty auto reverse.



C–9 Tape gets caught in mechanism*1.

*1
When the tape is caught in the mechanism, the case may not eject. When this occurs, do not try to force the tape out as this may damage the tape player mechanism. Take the cassette to a service dealer for repair.



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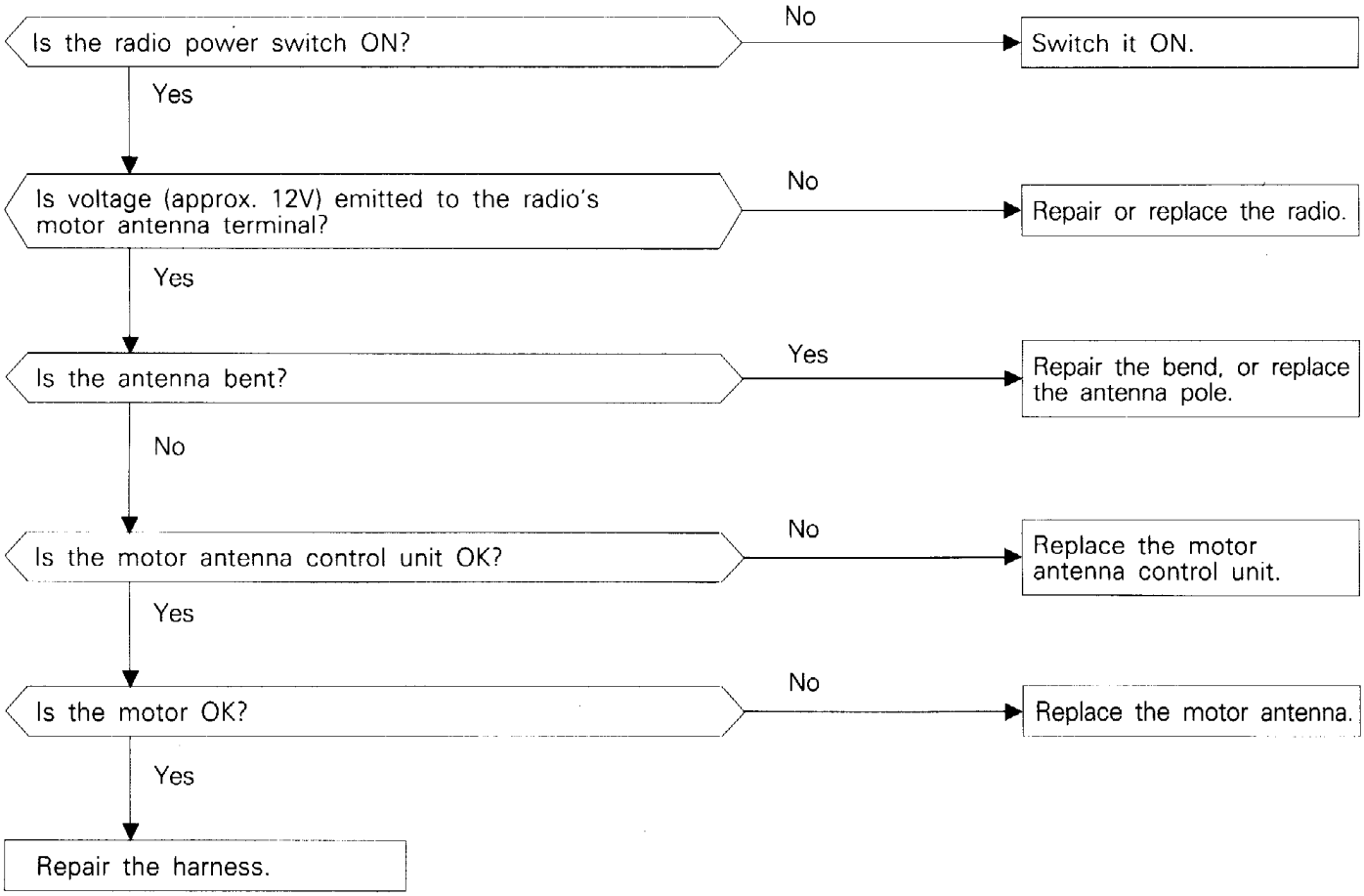
D. MOTOR ANTENNA

D–1	Motor antenna won't extend or retract.

Clean and polish the surface of the antenna pole.



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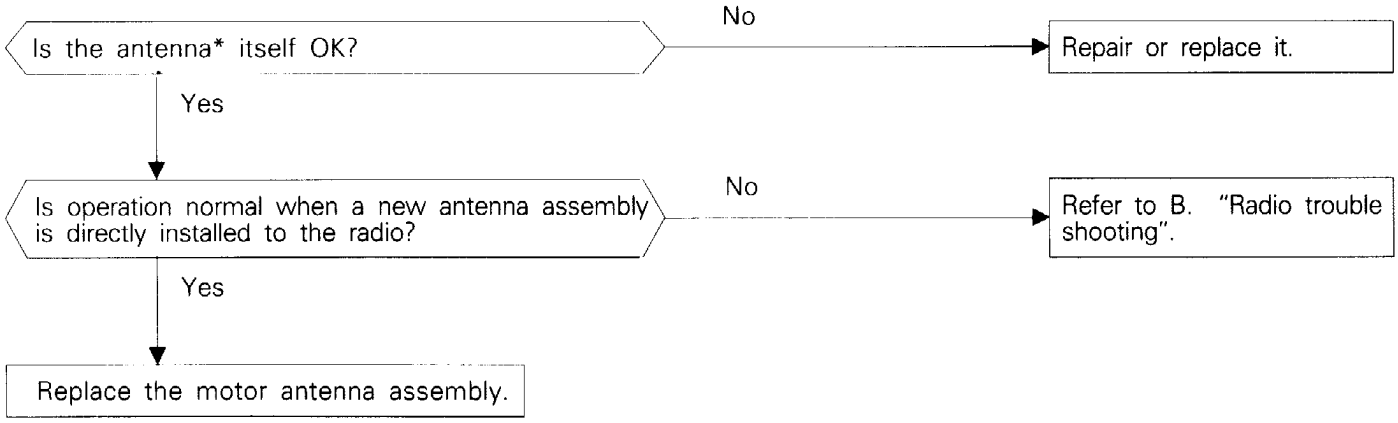
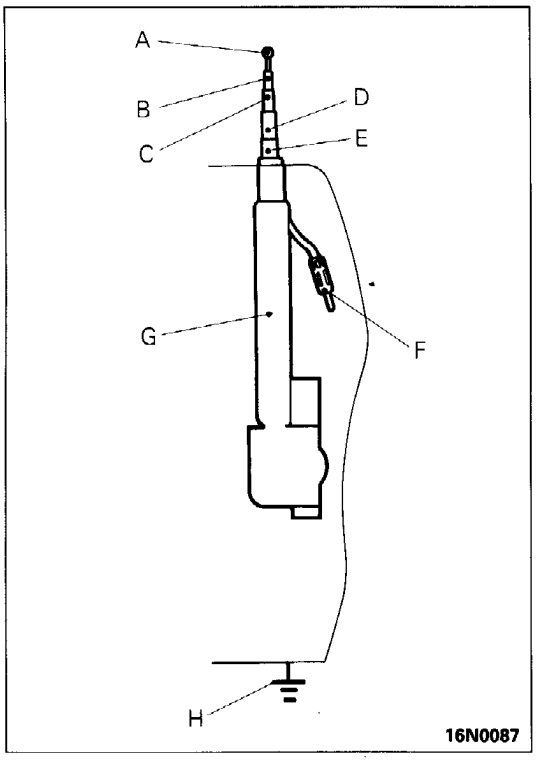
D-2 Motor antenna extends and retracts but does not receive.





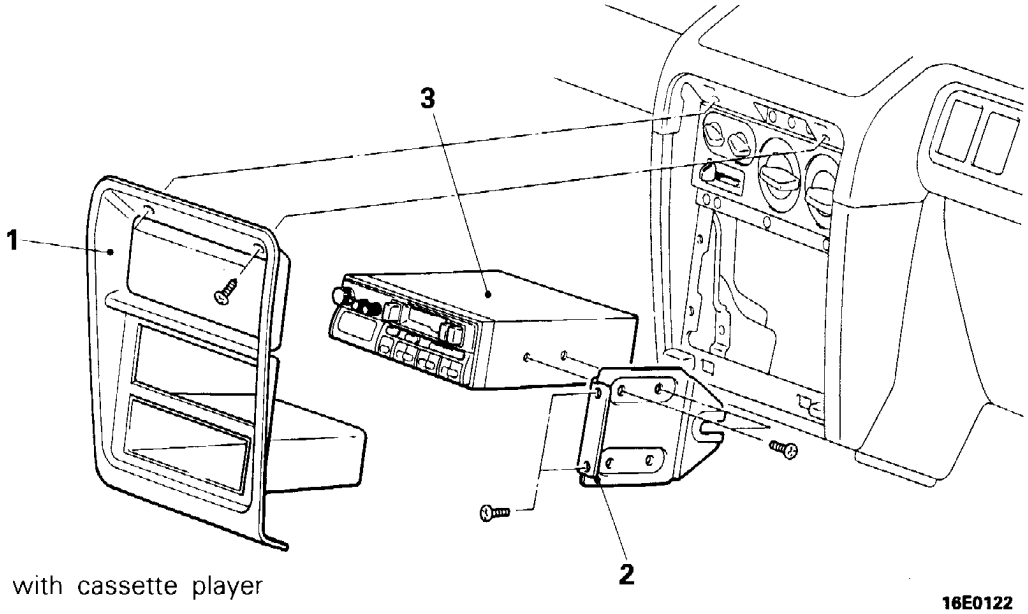
Checking the antenna*

Ohmmeter measurement locations	Result
Circuits from F to A, B, C, D and E	Continuity
Circuit between G and H	Continuity
Circuits from H to A, B, C, D and E	No continuity

RADIO OR RADIO WITH CASSETTE PLAYER

E54LHAM

REMOVAL AND INSTALLATION



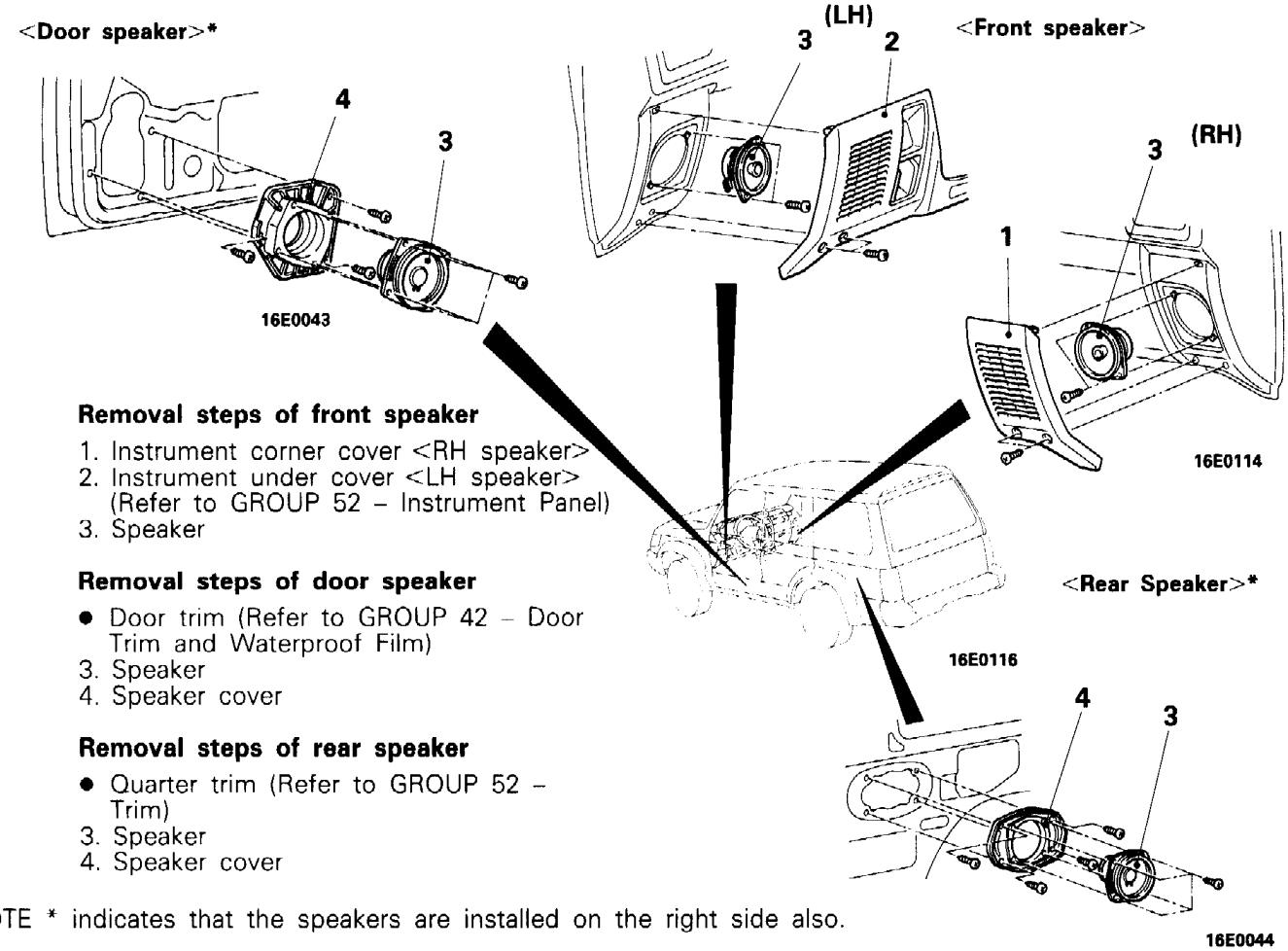
Removal steps
1. Audio panel
2. Bracket
3. Radio or radio with cassette player

16E0122

SPEAKER

E54LIAI

REMOVAL AND INSTALLATION



Removal steps of front speaker
1. Instrument corner cover <RH speaker>
2. Instrument under cover <LH speaker> (Refer to GROUP 52 – Instrument Panel)
3. Speaker

Removal steps of door speaker
- Door trim (Refer to GROUP 42 – Door Trim and Waterproof Film)

3. Speaker
4. Speaker cover

Removal steps of rear speaker
- Quarter trim (Refer to GROUP 52 – Trim)

3. Speaker
4. Speaker cover

NOTE * indicates that the speakers are installed on the right side also.

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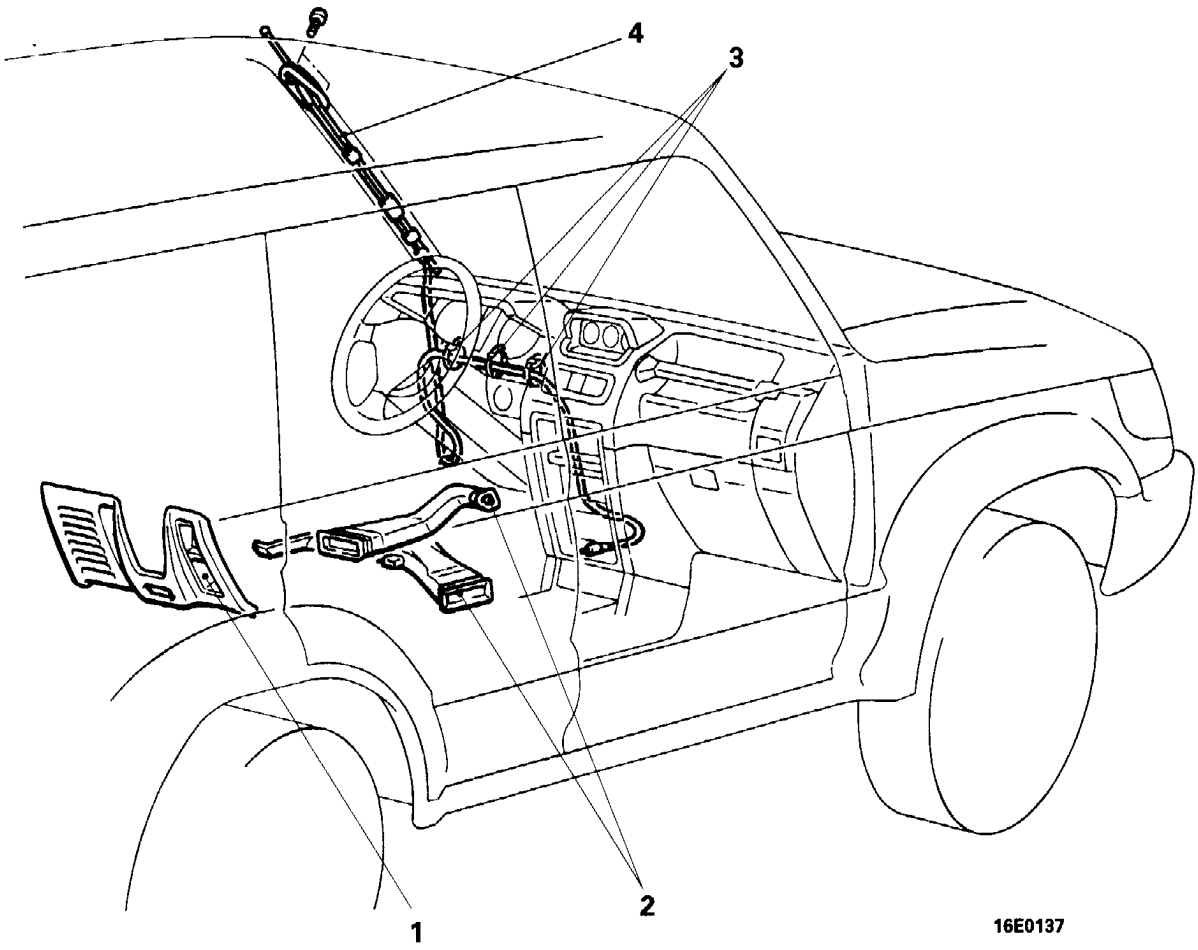
POLE ANTENNA AND ANTENNA FEEDER CABLE

REMOVAL AND INSTALLATION

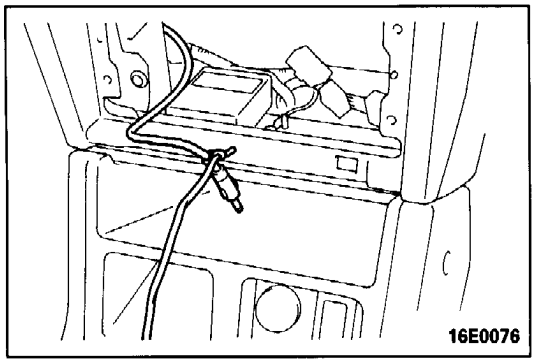
E54LJAH



Removal steps

1. Instrument under cover
(Refer to GROUP 52 – Instrument Panel)
2. Foot shower duct (LH) and lap cooler duct (A)
3. Cable band
- Radio or radio with cassette player
(Refer to P.54-54.)

◆◆ 4. Pole antenna and antenna feeder cable



SERVICE POINT OF REMOVAL

4. REMOVAL OF POLE ANTENNA AND ANTENNA FEEDE CABLE

To facilitate installation, tie a rope [approx. 3m (9.84 ft.) to the feeder cable, and pull out the pole antenna and antenna feeder cable.

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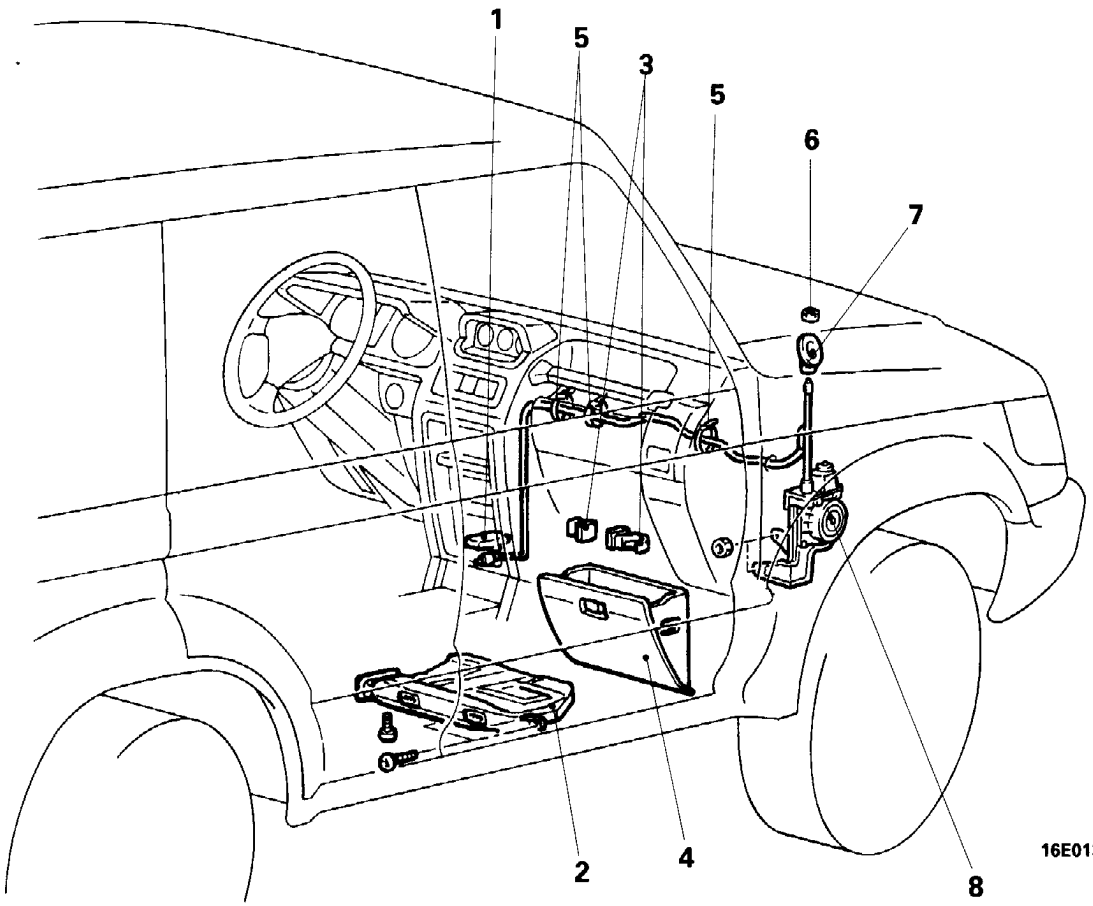
MOTOR ANTENNA AND ANTENNA FEEDER CABLE

E54LJBE

REMOVAL AND INSTALLATION



Removal steps of motor antenna control unit

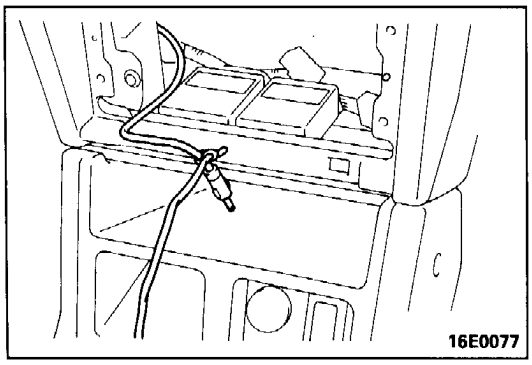
- Radio or radio with cassette player (Refer to P.54-54)

1. Motor antenna control unit

Removal steps of motor antenna and antenna feeder cable

- Radio or radio with cassette player (Refer to P.54-54)

2. Foot shower duct
3. Glove box stopper
4. Glove box assembly
5. Cable band
6. Ring nut
7. Base
8. Motor antenna and antenna feeder cable



SERVICE POINT OF REMOVAL

8. REMOVAL OF MOTOR ANTENNA AND ANTENNA FEEDER CABLE

To facilitate installation, tie a rope [approx. 3m (9.84 ft.) to the feeder cable, and pull out the motor antenna and antenna feeder cable.

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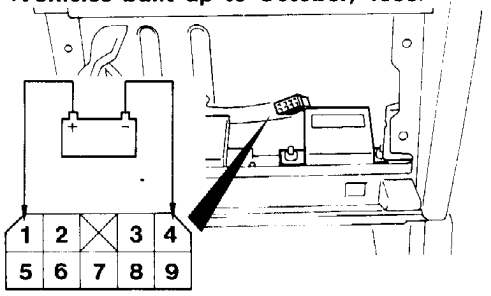
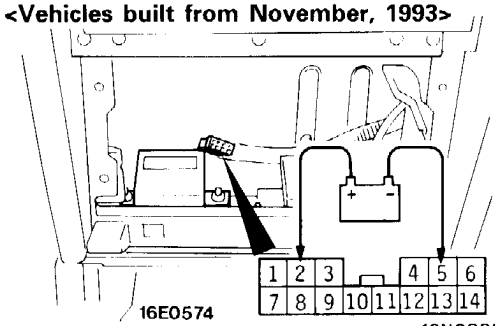
<Vehicles built up to October, 1993>



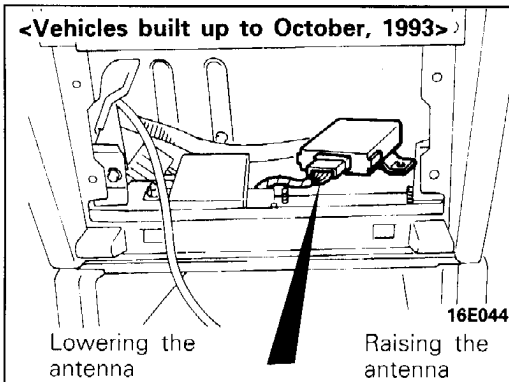
16E0022 16E0444

<Vehicles built from November, 1993>



16E0574 16N0085

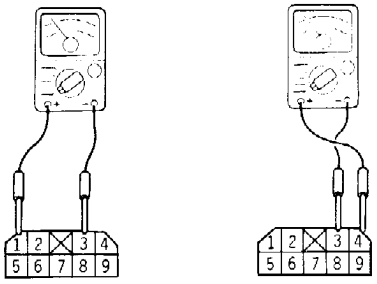
<Vehicles built up to October, 1993>



16E0445

Lowering the antenna

Raising the antenna



16E0025 16E0026

INSPECTION

MOTOR ANTENNA INSPECTION

<Vehicles built up to October, 1993>

(1) Remove the radio or radio with cassette player. (Refer to P.54-54)
(2) Remove the motor antenna control unit connector and check if the antenna goes up when the battery (+) side is connected to terminal (1), and the battery (–) side to terminal (4), and check if it goes down when the connections are reversed.

<Vehicles built from November, 1993>

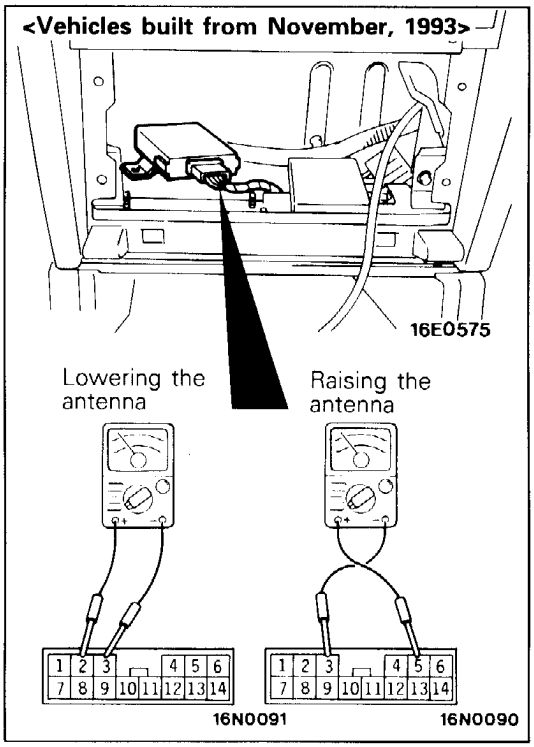
(1) Remove the radio or radio with cassette player. (Refer to P.54-54)
(2) Remove the motor antenna control unit connector and check if the antenna goes up when the battery (+) side is connected to terminal (2), and the battery (–) side to terminal (5), and check if it goes down when the connections are reversed.

MOTOR ANTENNA CONTROL UNIT INSPECTION

<Vehicles built up to October, 1993>

(1) Remove the radio or radio with cassette player (Refer to P.54-54.)
(2) Remove the motor antenna control unit mounting bolt.
(3) With the ignition switch turned to ACC or ON, operate the radio switch and check the voltage between the terminals while raising and lowering the antenna.

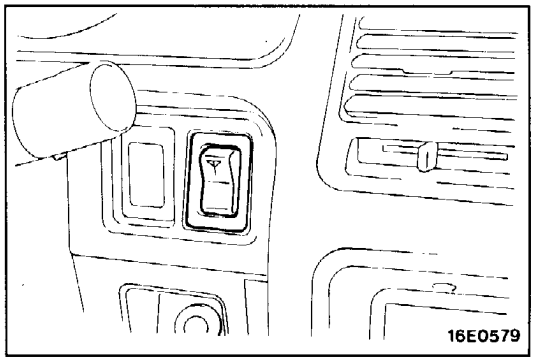
Antenna operation direction	Measurement terminals	Voltage (V)
Lowering	1–3	10–13
Raising	4–3	10–13



<Vehicles built from November, 1993>

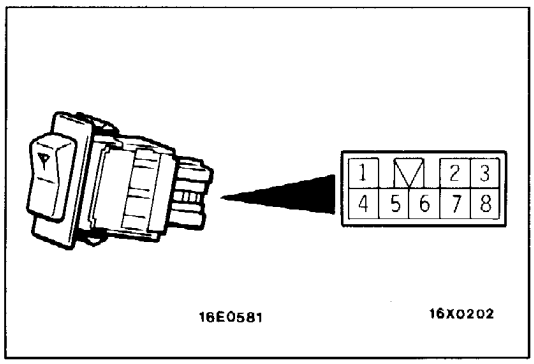
(1) Remove the radio or radio with cassette player (Refer to P.54-54.)
(2) Remove the motor antenna control unit mounting bolt.
(3) With the ignition switch turned to ACC or ON, operate the radio switch and check the voltage between the terminals while raising and lowering the antenna.

Antenna operation direction	Measurement terminals	Voltage (V)
Lowering	2–3	10–13
Raising	5–3	10–13



ANTENNA SWITCH INSPECTION

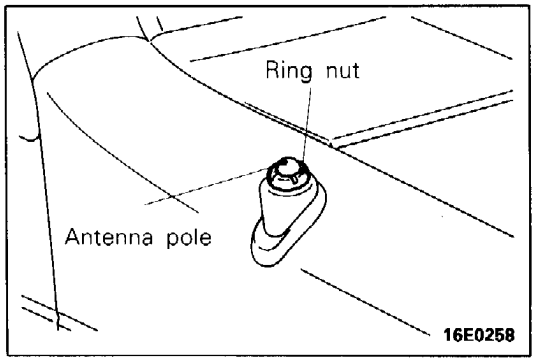
(1) Remove the antenna switch.



(2) Operate the switch to check continuity between terminals.

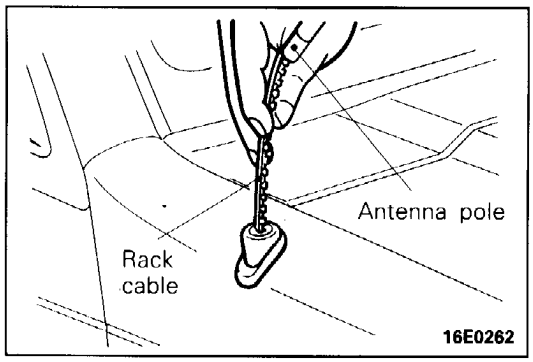
Switch position \ Terminal	1		7	2	4	6
FULL	○	ILL	○	○		○
HALF				○	○	

NOTE
○—○ indicates that there is continuity between the terminals.

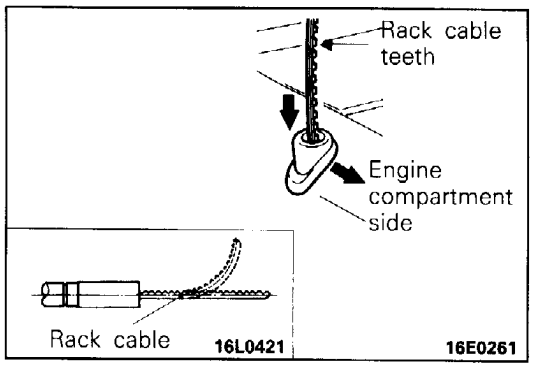


ANTENNA POLE REPLACEMENT

(1) Remove the ring nut.

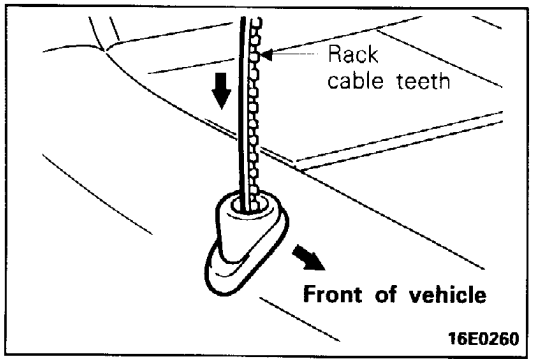


(2) After turning the ignition switch to ACC or ON, turn the radio switch to ON to raise the antenna pole, and remove it, together with the rack cable.



(3) Draw out the antenna pole to the maximum extension.
NOTE
If there is a bend in the motor end of the rack cable, remove the bend.

(4) Insert the rack cable into the motor assembly with the rack cable teeth facing the engine compartment side.

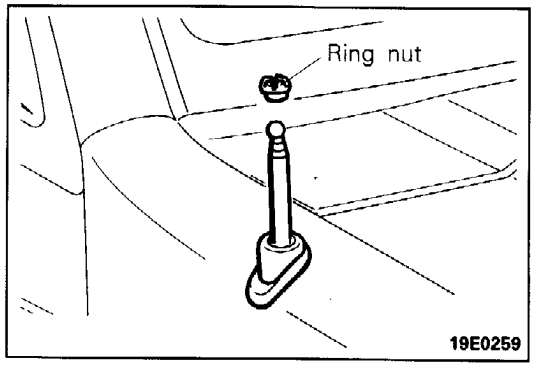


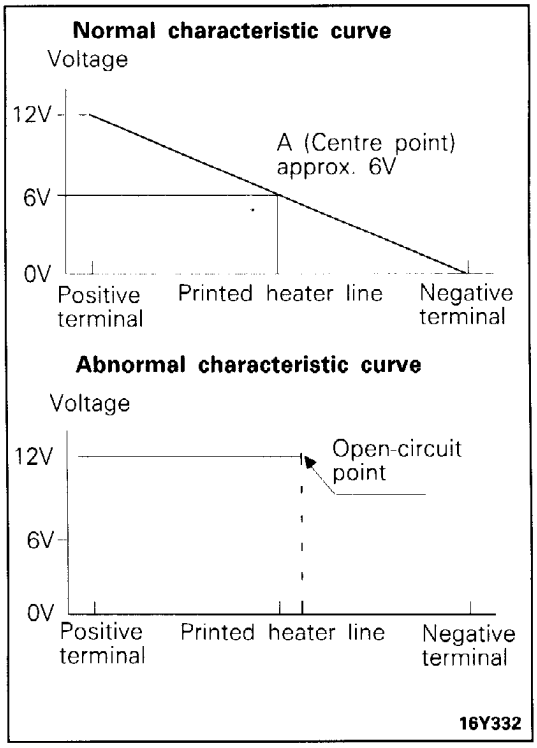
(5) Turn the rack cable teeth towards the front of the vehicle (90° to right) so that the rack cable meshes with the motor gear.

(6) If the rack cable pulls out with no resistance when it is lightly pulled, then the cable is not meshed with the motor gear, so check that there are no bends in the end of the rack cable, and then repeat steps (3) and (4) above.

(7) Set the antenna pole vertically and turn the radio switch OFF to wind up the rack cable. Insert the antenna to the motor antenna side to align it with the wound-up rack cable.

(8) After tightening the ring nut, check the movement of the antenna by turning the radio switch ON and OFF.





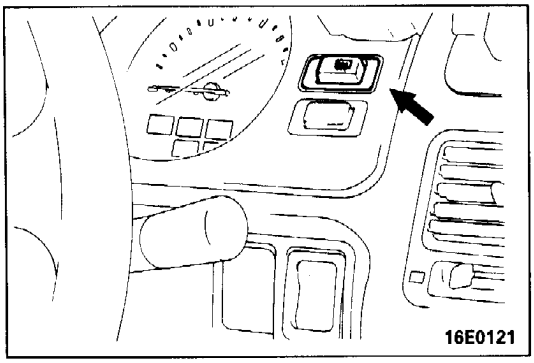
REAR WINDOW DEFOGGER

SERVICE ADJUSTMENT PROCEDURES

E54MLAA

THE PRINTED-HEATER LINES CHECK

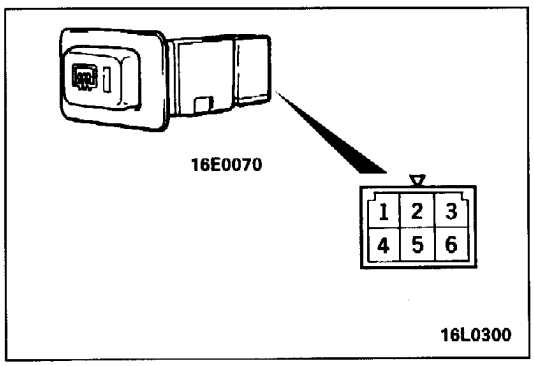
(1) Run engine at 2,000 r/min. Check heater element with battery at full.
(2) Turn ON rear window defogger switch. Measure heater element voltage with circuit tester at rear window glass centre A.
Condition good if indicating about 6V.
(3) If 12 V is indicated at A, there is a break in the negative terminals from A.
Move test bar slowly to negative terminal to detect where voltage changes suddenly (0 V).
(4) If 0 V is indicated at A, there is a break in the positive terminals from A. Detect where the voltage changes suddenly (12 V) with the same method described.



INSPECTION

E54MOAC

(1) Remove the rear window defogger switch from the meter bezel.



(2) Operate the switch, and check the continuity between the terminals.

Switch position \ Terminal	1	4		3	2		5
OFF						ILL	
ON	○—○		IND	○			

NOTE
○—○ indicates that there is continuity between the terminals.

HEATER, AIR CONDITIONER AND VENTILATION

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SUPPLEMENTAL RESTRAINT SYSTEM (SRS) – AIR BAG

(1) An SRS air bag for the driver's side seat is optional equipment in this vehicle.
(2) The SRS includes the following components: impact sensors, SRS diagnosis unit: SRS warning lamp, air bag module, clock spring, interconnecting wiring. Other SRS-related components (that may have to be removed/installed in connection with SRS service or maintenance) air indicated in the table of contents by an asterisk (*).

WARNING!

(1) Improper service or maintenance of any component of the SRS, or any SRS-related component, can lead to personal injury or death to service personnel (from inadvertent firing of the air bag) or to the driver (from rendering the SRS inoperative).
(2) Service or maintenance of any SRS component or SRS-related component must be performed only at an authorized MITSUBISHI dealer.
(3) MITSUBISHI dealer personnel must thoroughly review this manual, and especially its GROUP 52B – Supplemental Restraint System (SRS), before beginning any service or maintenance of any component of the SRS or any SRS-related component.

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AIR CONDITIONER 25

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NOTES

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HEATER

SPECIFICATIONS

GENERAL SPECIFICATIONS

E55CA-1

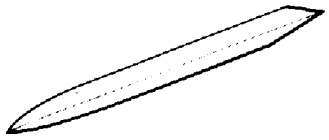
Items	Specifications
Type	
Front	Three-way-flow full-air-mix system
Rear	Air-mix system
Performance kJ/h (kcal/h,B.T.U./h)	
Front <6G72, 4G64, 6G74>	16.744 (4,000, 15,873)
<4D56, 4M40>	17.581 (4,200, 16,666)
Rear	5.860 (1,400, 5,555)

SERVICE SPECIFICATIONS

E55CB-1

Items	Standard value	Remarks
Resistance value of temperature adjustment selector Ω <Vehicles with dual air conditioner>		
At MAX. COOL	0–4	Between terminals 3–4
At MAX. HOT	2400	Between terminals 5–6
Resistance value of resistor (for blower motor) Ω	1.96 ± 7%	Between terminals 2–4
	0.95 ± 7%	Between terminals 1–2
	0.33 ± 7%	Between terminals 2–3
Resistance value of resistor (for rear heater) Ω	4.3 ± 7%	Between terminals 2–3
	1.2 ± 7%	Between terminals 1–2

SPECIAL TOOL

Tool	Number	Name	Use
	MB990784	Ornament remover	Removal of side defroster grille

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TROUBLESHOOTING

E55EAAP

Symptom	Probable cause	Remedy
Improper heat	Obstructed floor outlets	Correct
	Changeover dampers improperly adjusted or binding	Correct
	Obstructed heaters hoses	Replace
	Improperly adjusted control cables	
	Damper motor malfunction <Vehicles with dual air conditioner>	Replace
	Control switch is defective	Replace
	Plugged partially plugged heater core	Clearn or replace
No ventilation even when mode selection lever is operated	Incorrect adjustment of changeover dampers	Adjust
	Incorrect installation mode selection control wire	Adjust
	Ducts are incorrectly incompletely connected,crushed, bent or clogged.	Repair or replace

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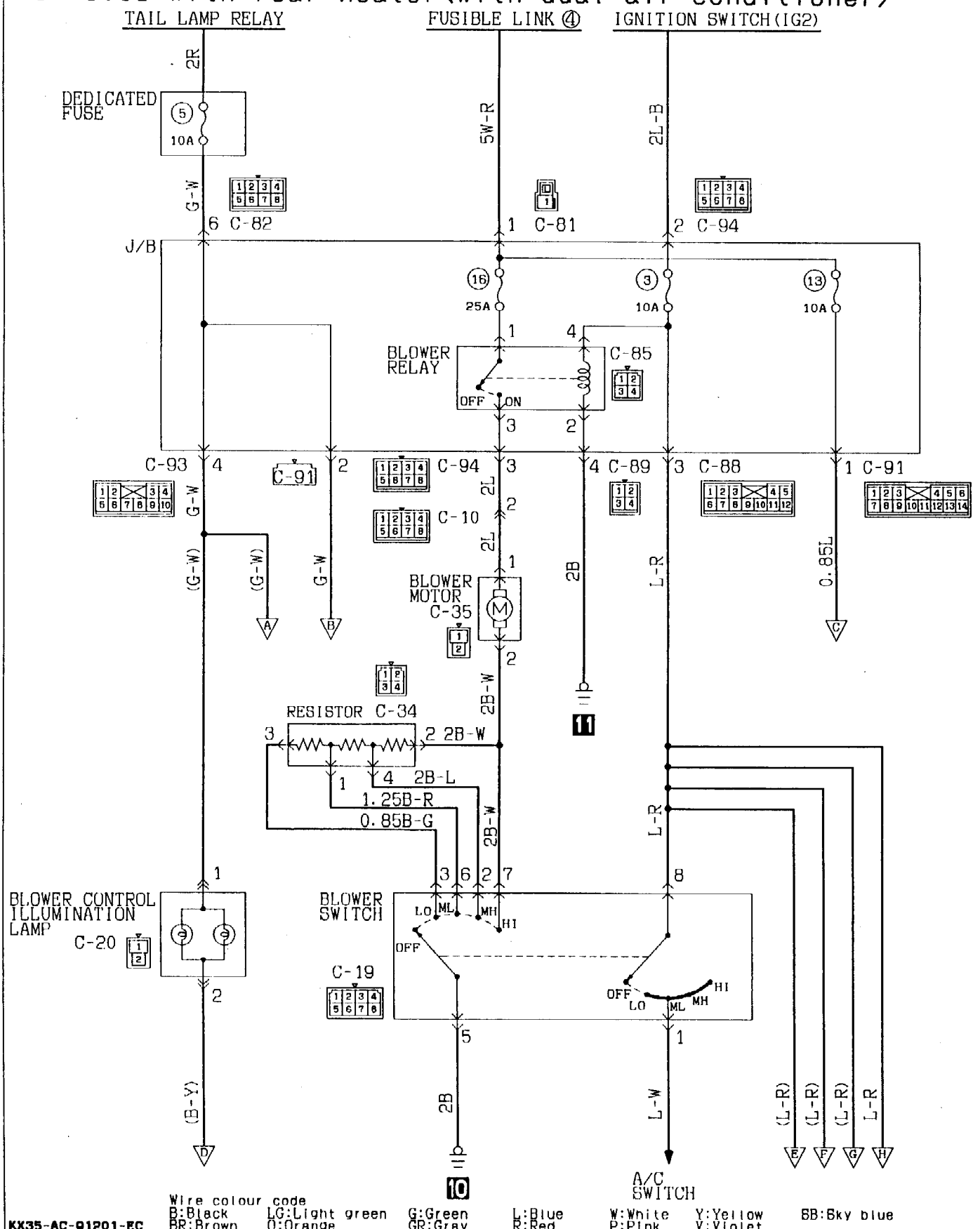
HEATER

<Vehicles built up to October, 1993>

Vehicles with rear heater<with dual air conditioner>



Wire colour code

B:Black	LG:Light green	G:Green	L:Blue	W:White	Y:Yellow	SB:Sky blue	
BR:Brown	O:Orange	GR:Gray	R:Red	P:Pink	V:Violet		

KX35-AC-01201-EC

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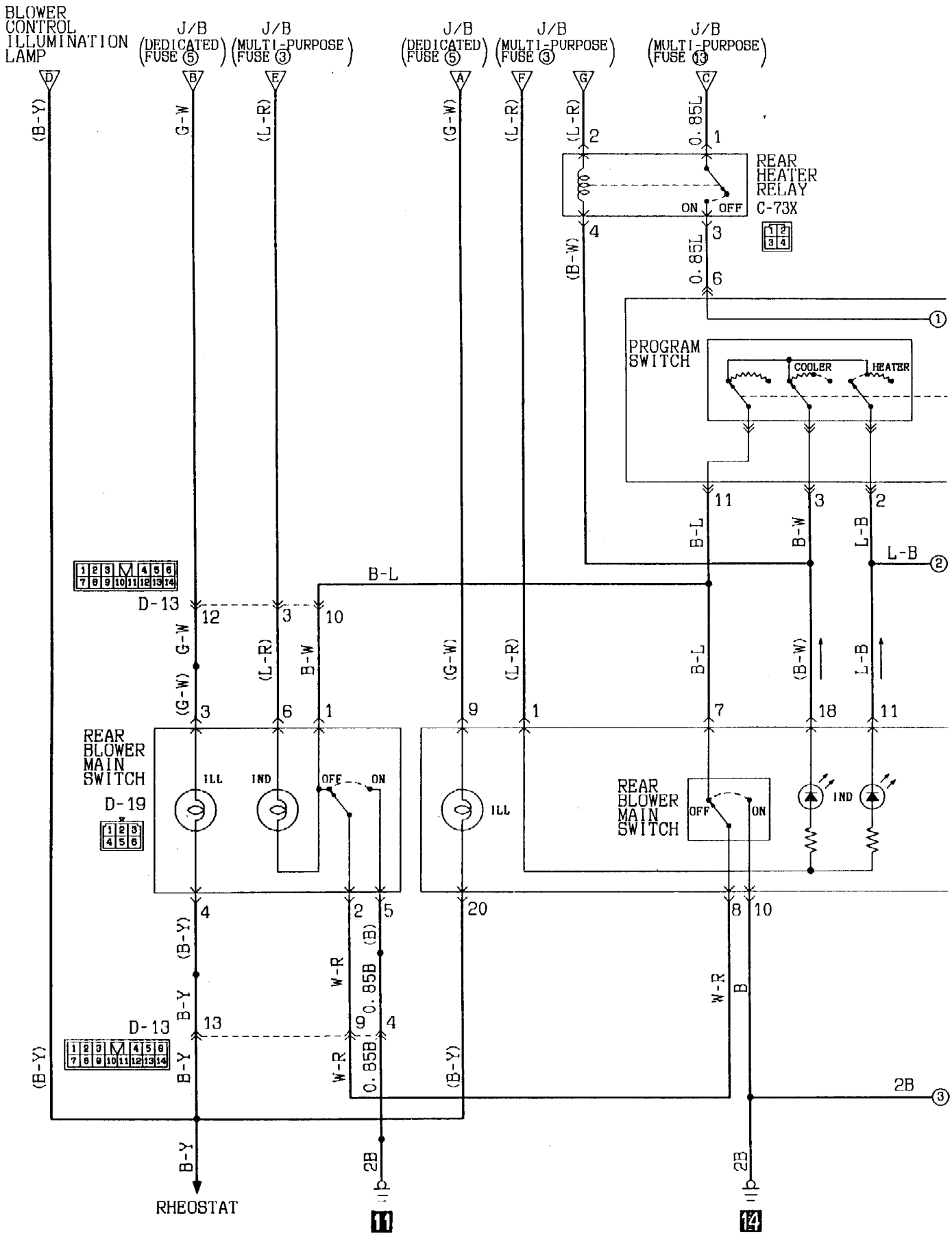

KX35-AC-91201A-EC

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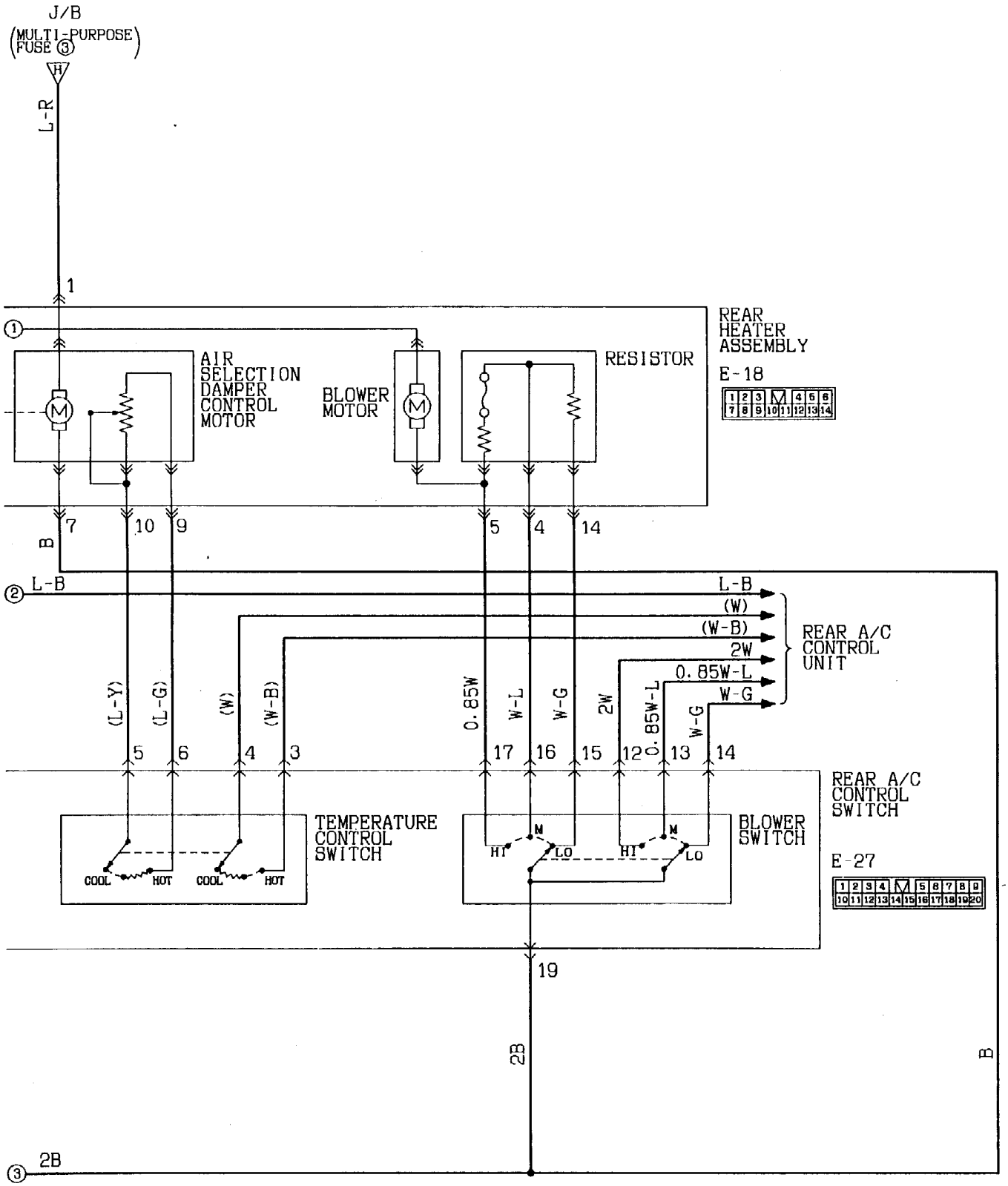

Wire colour code

B:Black	LG:Light green	G:Green	L:Blue	W:White	Y:Yellow	SB:Sky blue
BR:Brown	O:Orange	GR:Gray	R:Red	P:Pink	V:Violet	

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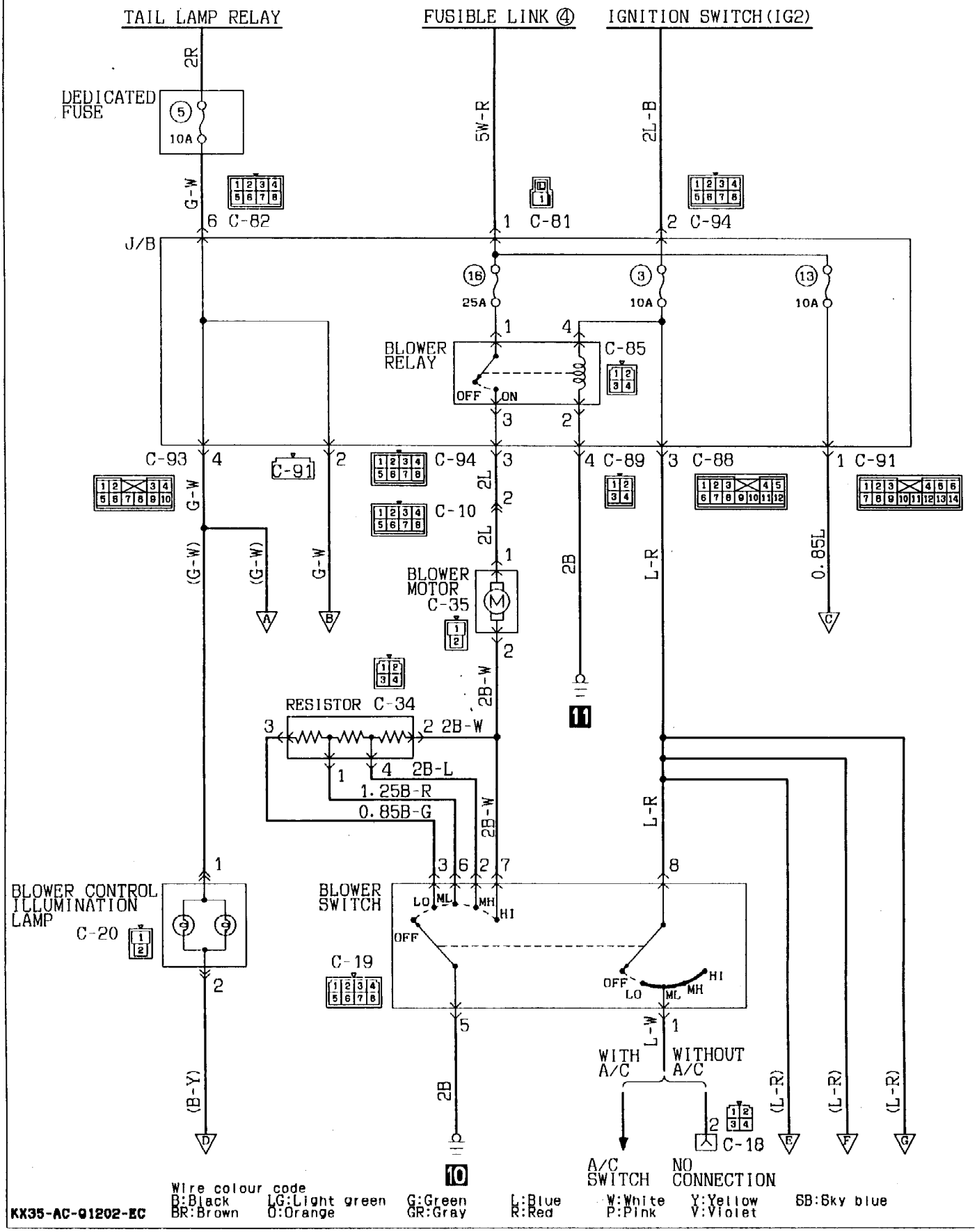
Vehicles with rear heater〈without dual air conditioner〉



Wire colour code

B:Black	LG:Light green	G:Green	L:Blue	W:White	Y:Yellow	SB:Sky blue	
BR:Brown	O:Orange	GR:Gray	R:Red	P:Pink	V:Violet		

KX35-AC-01202-EC

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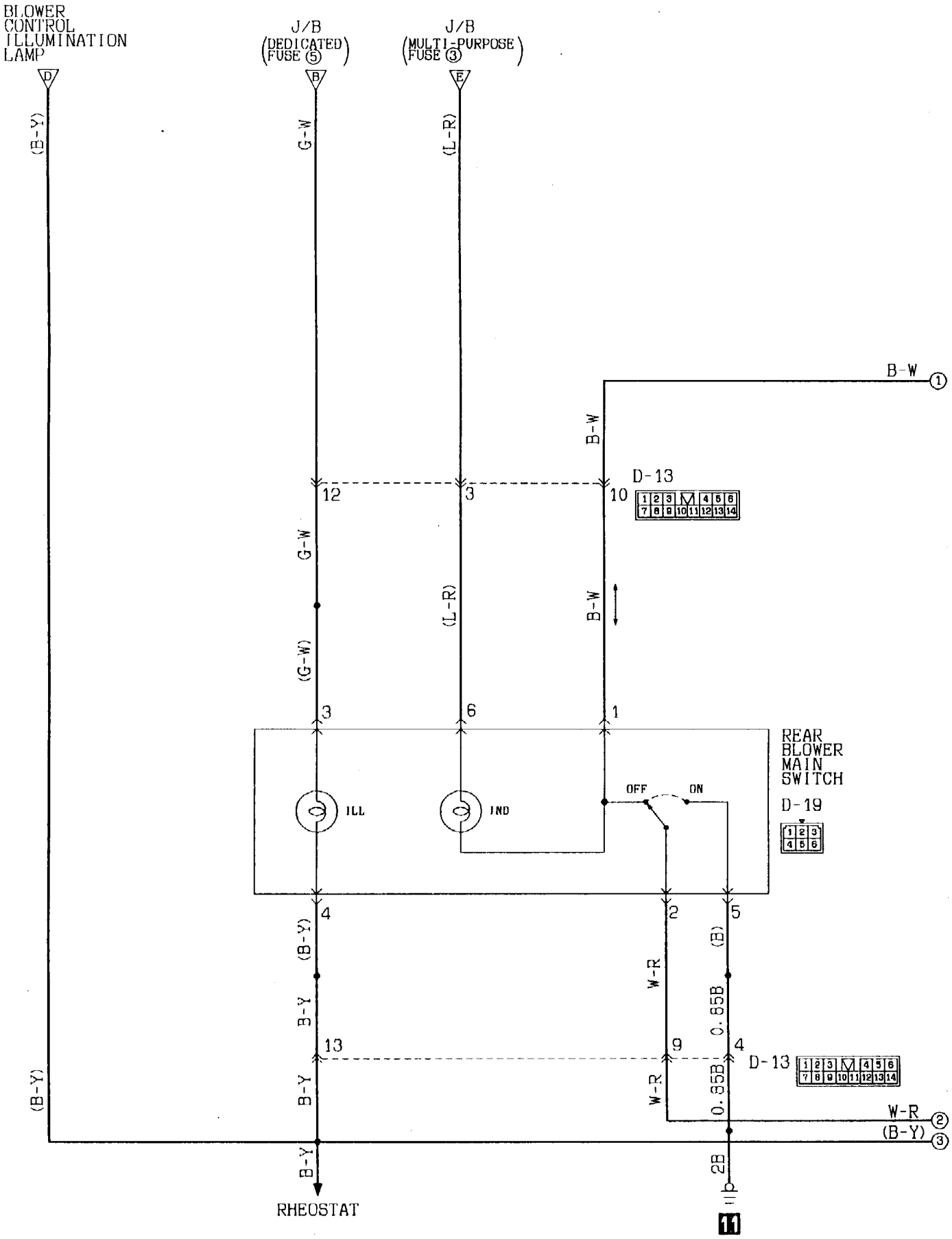

KX35-AC-01202A-EC

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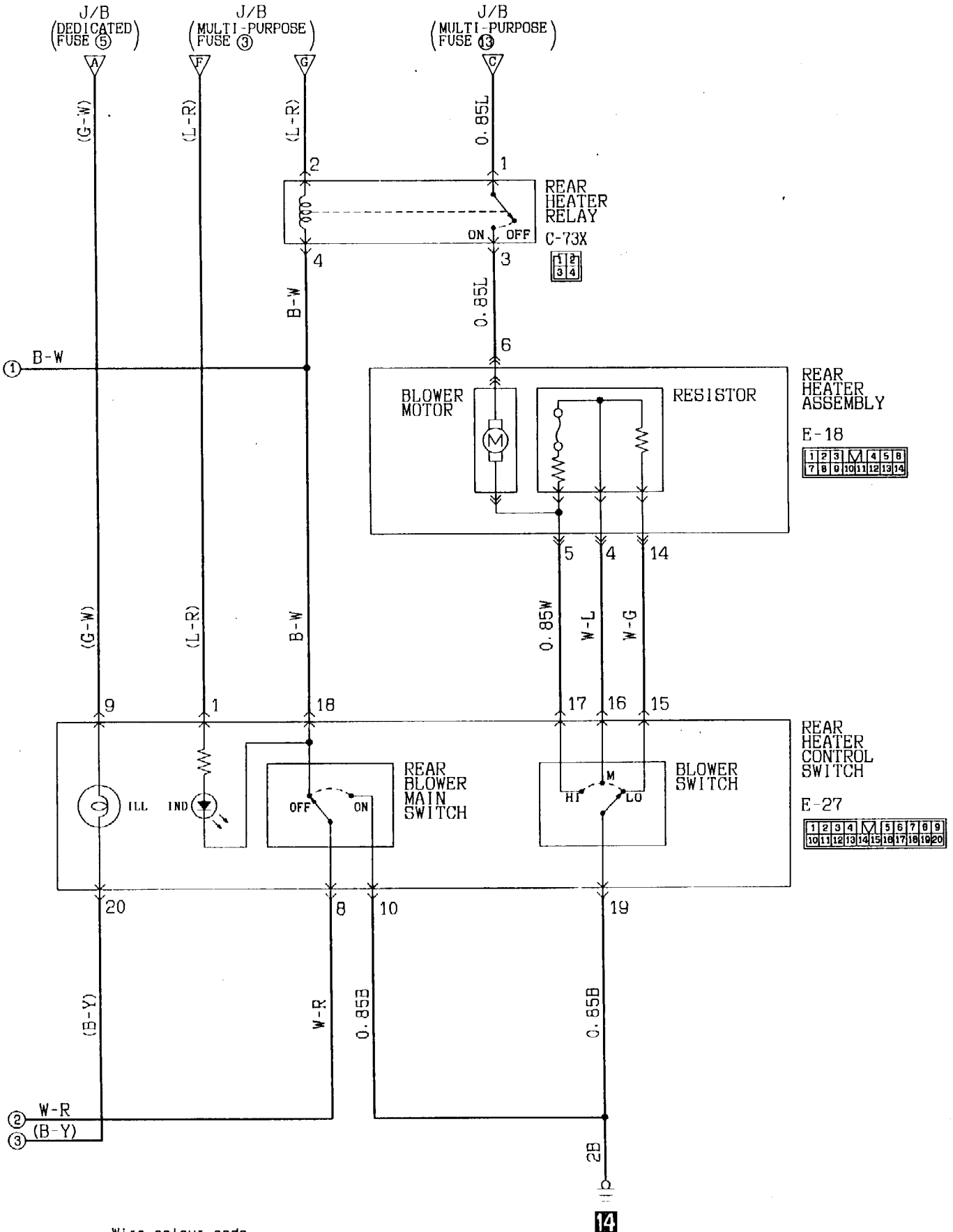

Wire colour code

B:Black	LG:Light green	G:Green	L:Blue	W:White	Y:Yellow	SB:Sky blue
BR:Brown	O:Orange	GR:Gray	R:Red	P:Pink	V:Violet	

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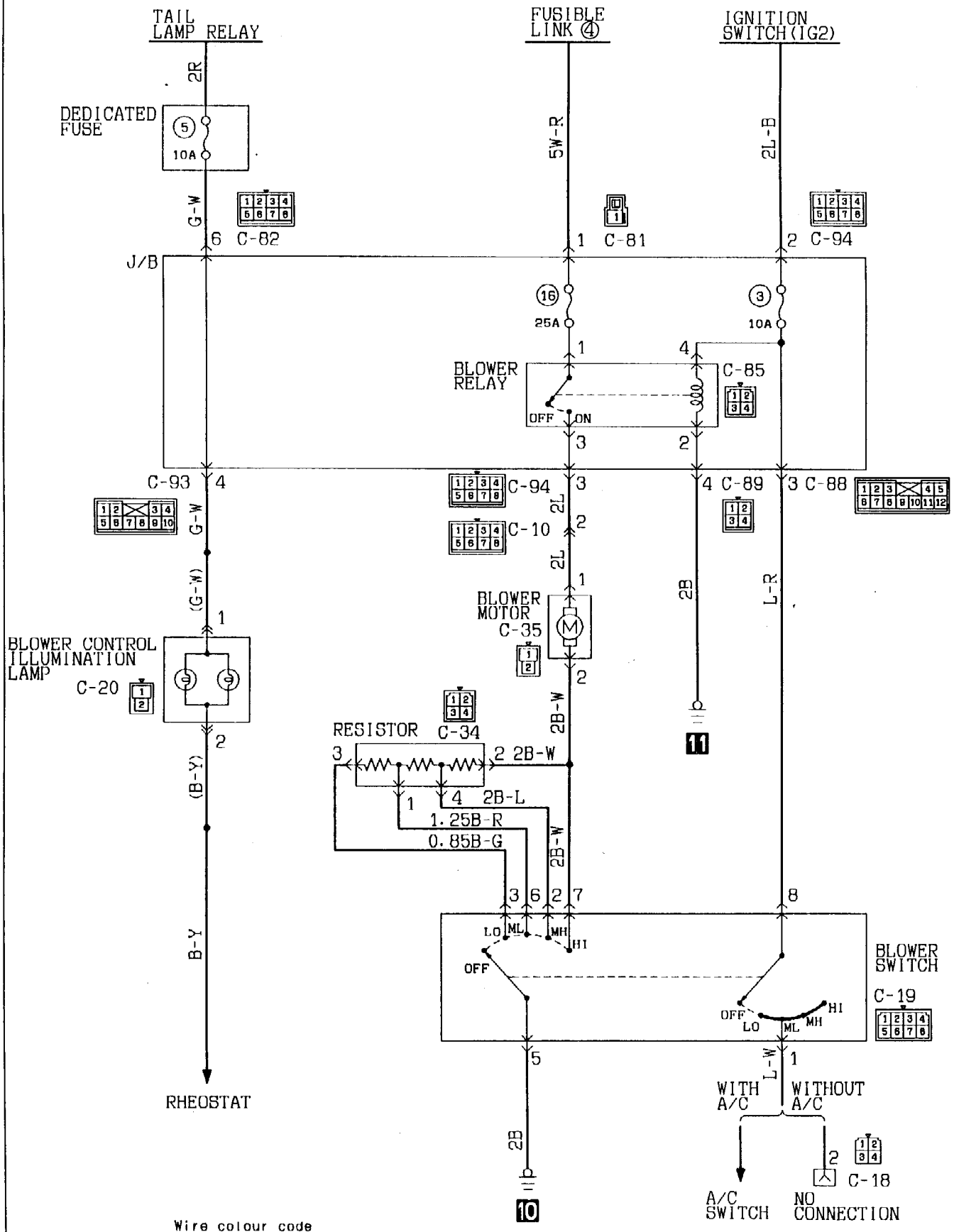
Vehicles without rear heater



KX35-AC-91209-EC

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HEATER

<Vehicles built from November, 1993>

Refer to "HEATER" of '94 PAJERO Workshop Manual Electrical Wiring (Pub No. PHJE9026).

NOTES

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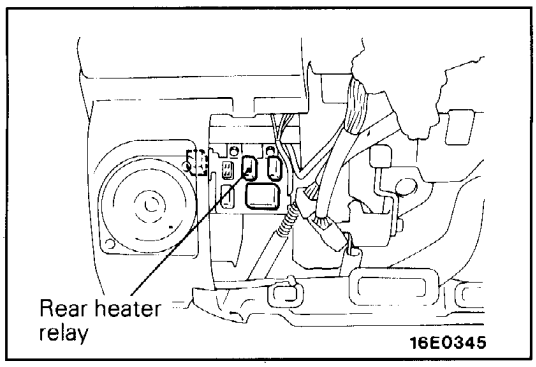


SERVICE ADJUSTMENT PROCEDURES

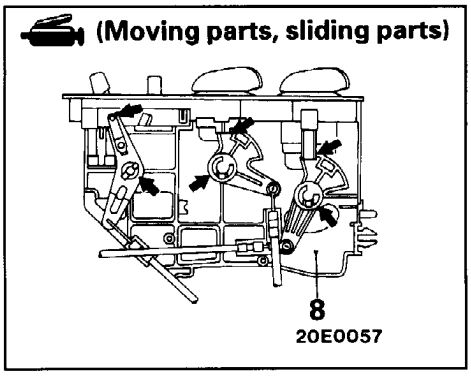
POWER RELAY CHECK

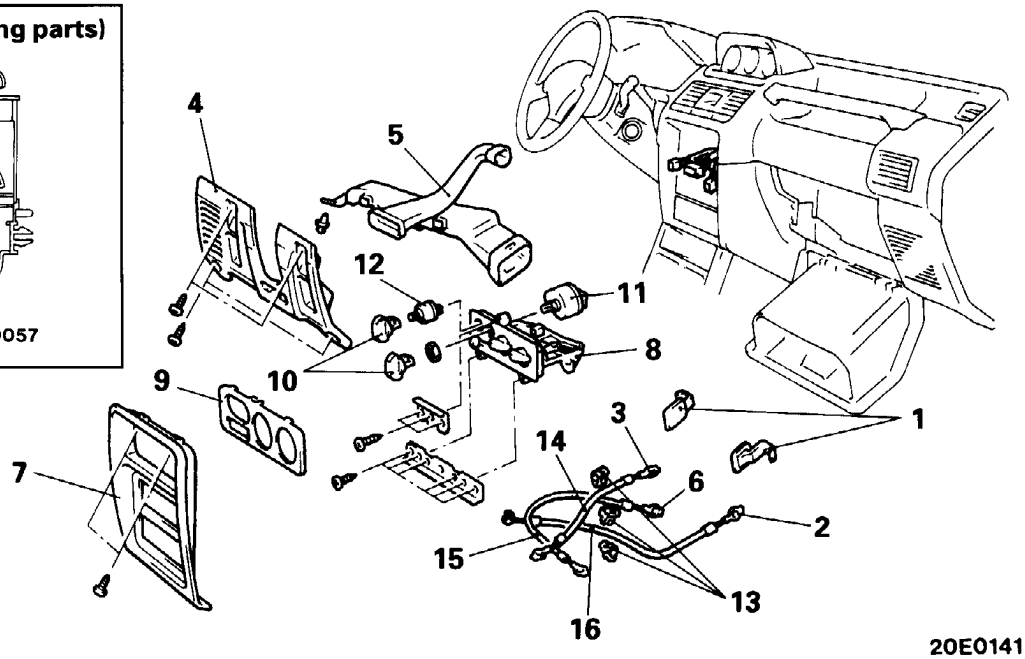
(1) Remove each power relay.
  ① Remove the heater relay from the junction block located at the left lower of the instrument panel.
  ② Remove the rear heater relay from the relay box.
(2) Check the continuity between the each terminal.

HEATER CONTROL ASSEMBLY

REMOVAL AND INSTALLATION

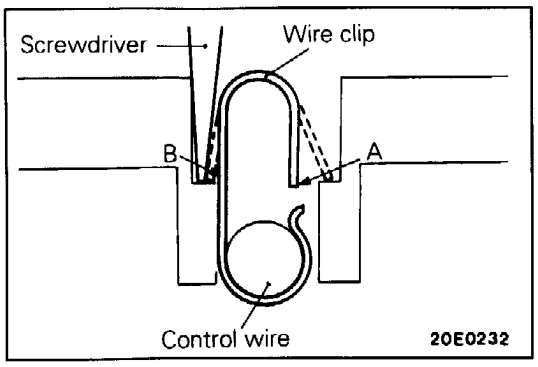
E55GA--





Removal steps

1. Stopper
2. Connection for the air-selection control wire (Blower case side)
3. Connection for the temperature control wire (Heater unit side)
4. Instrument under cover (Refer to Group 52 – Instrument Panel)
5. Lap cooler duct A and foot shower duct (LH)
6. Connection for the mode selection control wire (Heater unit side)
7. Center panel
8. Heater control assembly
9. Bezel
10. Knob
11. Blower switch
12. Air conditioner switch
13. Wire clip
14. Temperature control wire
15. Mode selection control wire
16. Air-selection control wire



SERVICE POINT OF REMOVAL

E55GBAL

13. REMOVAL OF WIRE CLIP

Remove the wire clip by inserting a screwdriver in the position shown in the illustration and pushing the wire clip in the directions A and B.

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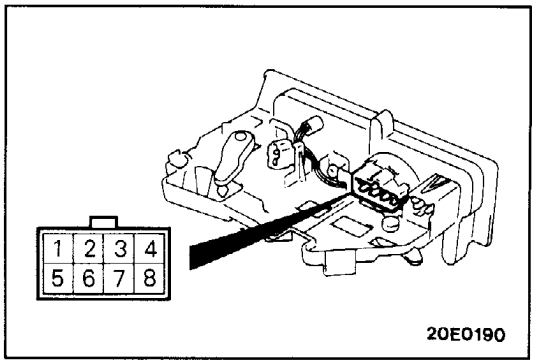

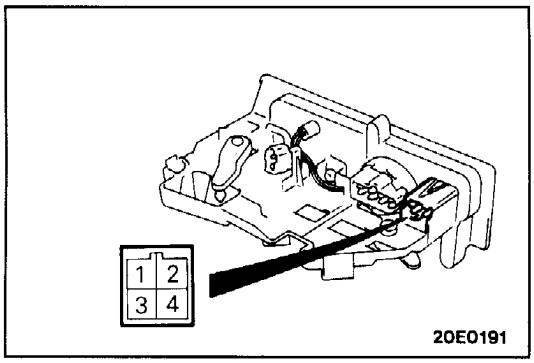

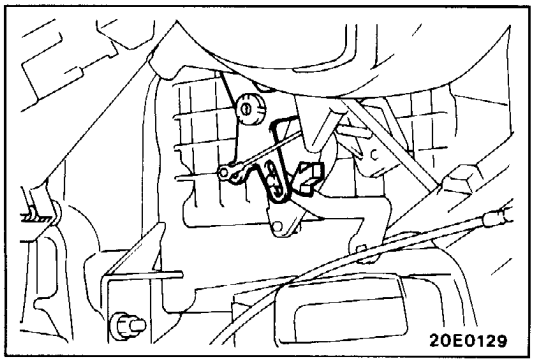

INSPECTION E55GCAL

BLOWER SWITCH CHECK

Operate the switch and use a circuit tester to check the continuity between the terminals.

Terminal No. / Switch position	5	3	6	2	7	8	1	4	Remark
(LO) •	○	○				○	○		○—○ indicates that there is a continuity between the terminals.
(ML) •	○	—	○			○	○		
(MH) ●	○	—	—	○		○	○	○	
(HI) ●	○	—	—	—	○	○	○	○	

AIR CONDITIONER SWITCH CHECK
<Vehicles with air conditioner>

Operate the switch and use a circuit tester to check the continuity between the terminals.

Terminal No. / Switch position	1	3	4	Remark
ECONO	○	— ○		○—○ indicates that there is a continuity between the terminals
A/C	○	— ○	— ○	

SERVICE POINTS OF INSTALLATION E55GDAM

6. INSTALLATION OF MODE SELECTION CONTROL WIRE (HEATER UNIT SIDE)

Connect the mode selection control wire to the mode selection damper lever by following the steps below.

(1) Move the mode selection lever to the position.

(2) With the air selection damper lever pressed inward in the direction indicated by the arrow, connect the inner cable of the mode selection control wire to the end of the mode selection lever, and then secure the outer cable by using a clip.

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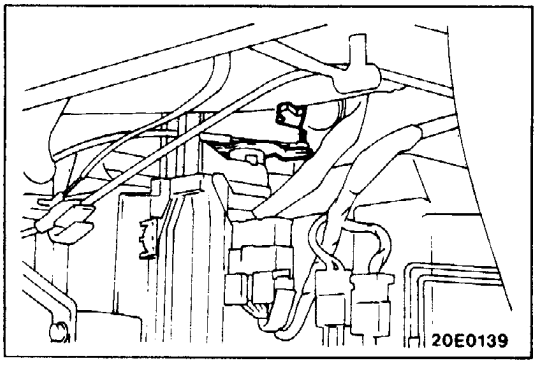
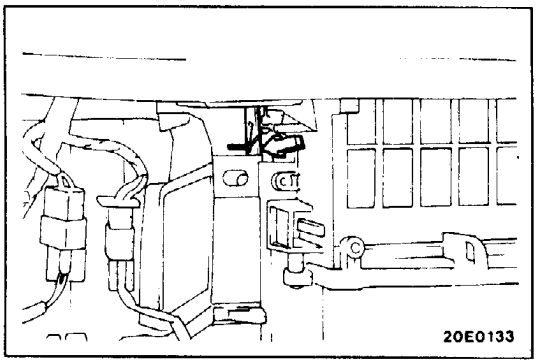


3. INSTALLATION OF TEMPERATURE CONTROL WIRE (HEATER UNIT SIDE)

Connect the temperature control wire to the blend air damper lever by following the steps below.
(1) Move the temperature control lever to the rightmost position. ("HOT" POSITION)
(2) With the blend air damper lever pressed completely downward in the direction indicated by the arrow, connect the inner cable of the temperature control wire to the end of the blend air damper lever, and then secure the outer cable by using a clip.



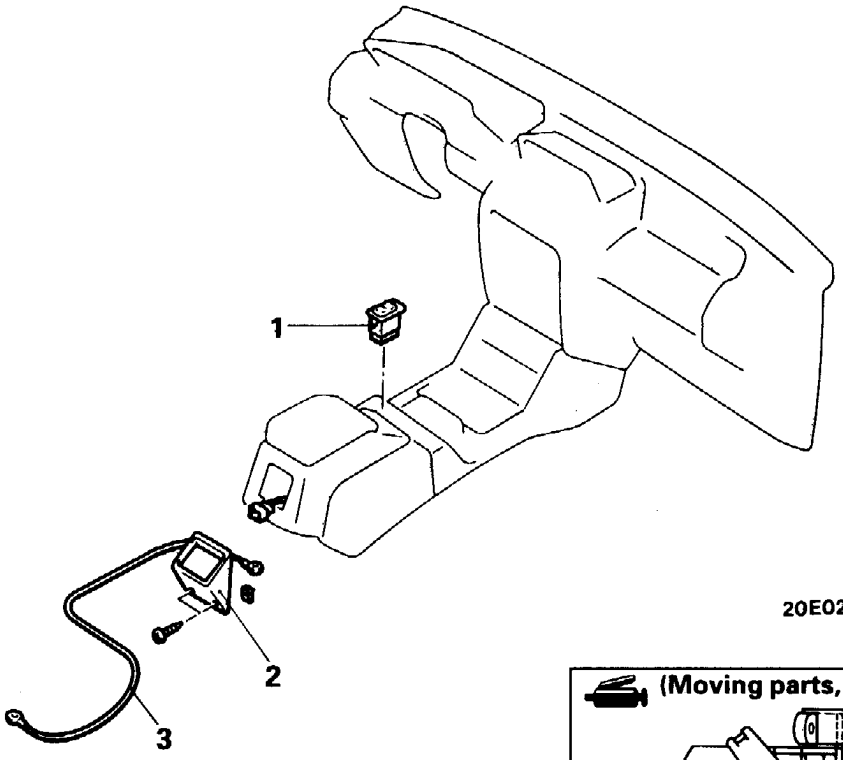
2. INSTALLATION OF AIR SELECTION CONTROL WIRE (BLOWER CASE SIDE)

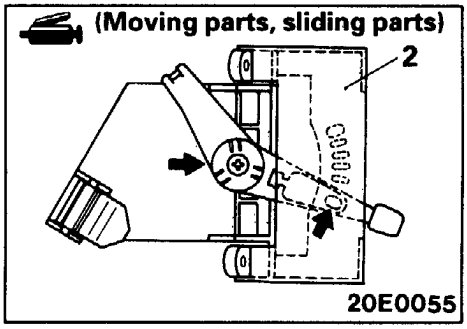
Connect the air selection control wire to the air selection damper lever by following the steps below.
(1) Move the air selection control lever to the position.
(2) With the air selection damper lever pressed inward in the direction indicated by the arrow, connect the inner cable of the air selection lever, and then secure the outer cable by using a clip.

REAR BLOWER SWITCH

REMOVAL AND INSTALLATION

E55TA-C





1. Rear blower main switch (Floor console side)

Removal steps of rear heater control assembly

2. Rear heater control assembly
3. Connection for the rear heater temperature control wire (Rear heater control assembly side) <Except for vehicles with dual A/C>

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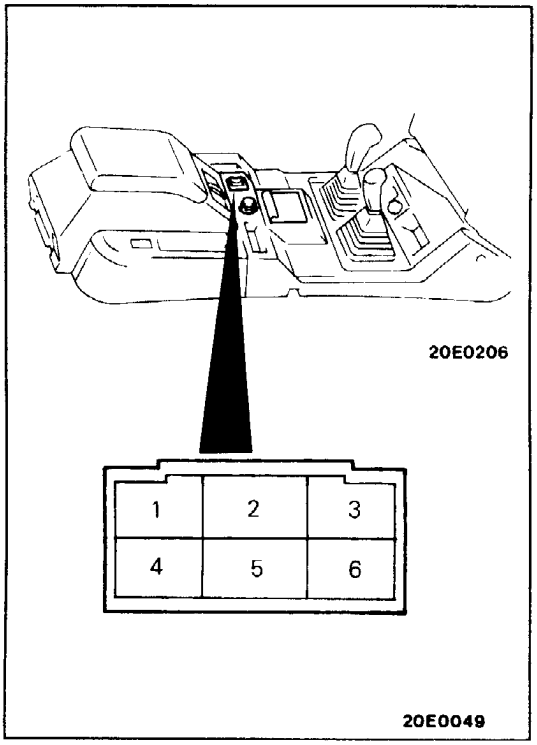


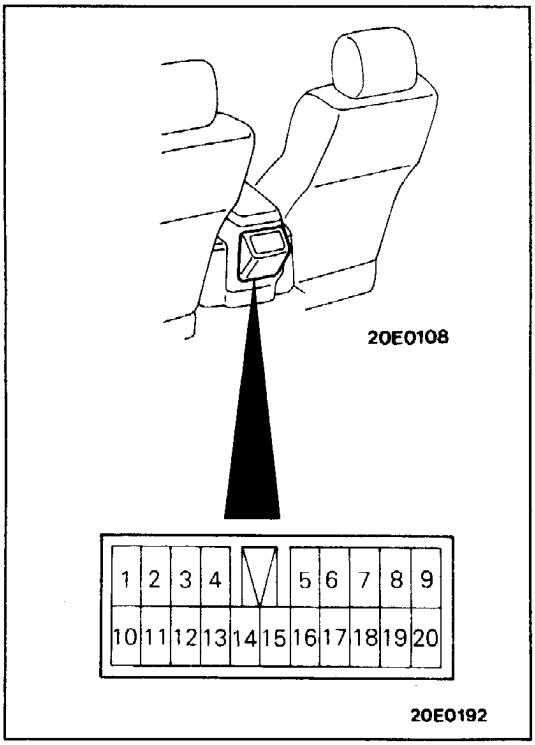
INSPECTION

E55TCBB

REAR BLOWER MAIN SWITCH CHECK (FLOOR CONSOLE SIDE)

Operate the switch and use a circuit tester to check the continuity between the switch terminals.

Terminal No. / Switch position	1	2	5	6	3	4	Remark
✻	○—○			○	○—○		○—○ indicates that there is a continuity between the terminals
REAR		○—○			○—○		



REAR BLOWER SWITCH AND REAR BLOWER MAIN SWITCH CHECK (REAR HEATER CONTROL ASSEMBLY SIDE)

Operate the switch and use a circuit tester to check the continuity between the terminals.

<Vehicles without dual A/C>

Terminal No. / Switch position	7	8	10	15	16	17	19	Remark
▬		○—○						○—○ indicates that there is a continuity between the terminals.
■	○—○							
• (Lo)				○			○	
● (Me)					○		○	
● (Hi)						○—○		

<Vehicles with dual A/C>

Terminal No. / Switch position	7	8	10	12	13	14	15	16	17	19	Remark
▬		○—○									○—○ indicates that there is a continuity between the terminals.
■	○—○										
• (Lo)						○	○			○	
● (Me)					○			○		○	
● (Hi)				○					○	○	

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TEMPERATURE ADJUSTMENT SELECTOR CHECK <Vehicles with dual A/C>

(1) Operate the switch and use a circuit tester to check the continuity between the terminals.

Switch position	
At MAX. COOL	No continuity between terminals 3–4
At MAX. HOT	No continuity between terminals 5–6

(2) Operate the switch and measure the resistance between the terminals.

Switch position	Standard value Ω
At MAX. COOL	Between terminals 3–4: 0–4
At MAX. HOT	Between terminals 5–6: 2400

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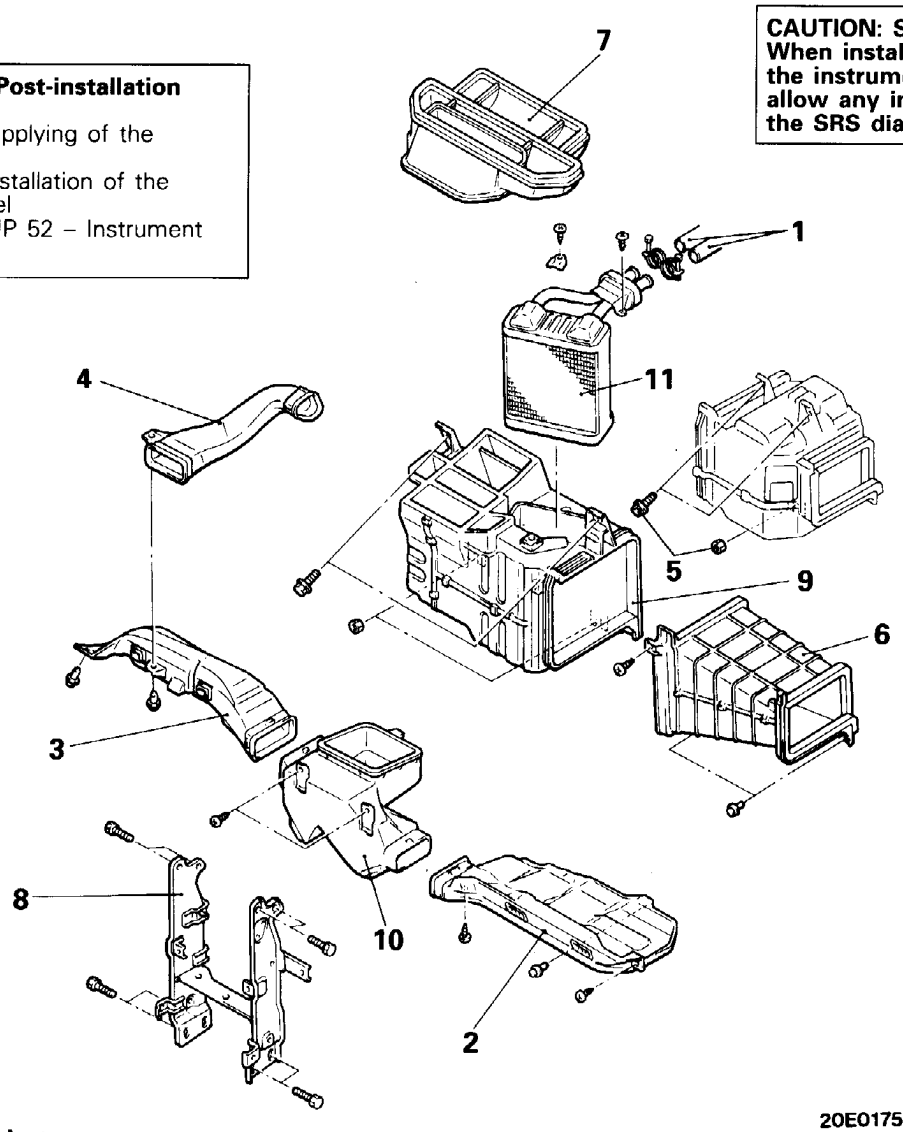
HEATER UNIT

REMOVAL AND INSTALLATION

E55IA--

Per-removal and Post-installation Operation
- Draining and Supplying of the Coolant
- Removal and Installation of the Instrument Panel (Refer to GROUP 52 – Instrument Panel.)

CAUTION: SRS
When installing or removing the instrument panel, don't allow any impact or shock to the SRS diagnosis unit.



20E0175

Removal steps
1. Connection for water hoses
2. Foot shower duct (RH)
3. Foot shower duct (LH)
4. Lap cooler duct A
5. Evaporator mounting bolt and nut <Vehicles with air conditioner>
6. Joint duct <Vehicles without A/C>
7. Center duct assembly
8. Center reinforcement
9. Heater unit
10. Foot distribution duct
11. Heater core

INSPECTION

E55ICAI

- Check the operation of dampers and link mechanism.
- Check the heater core for clogging and water leakage.

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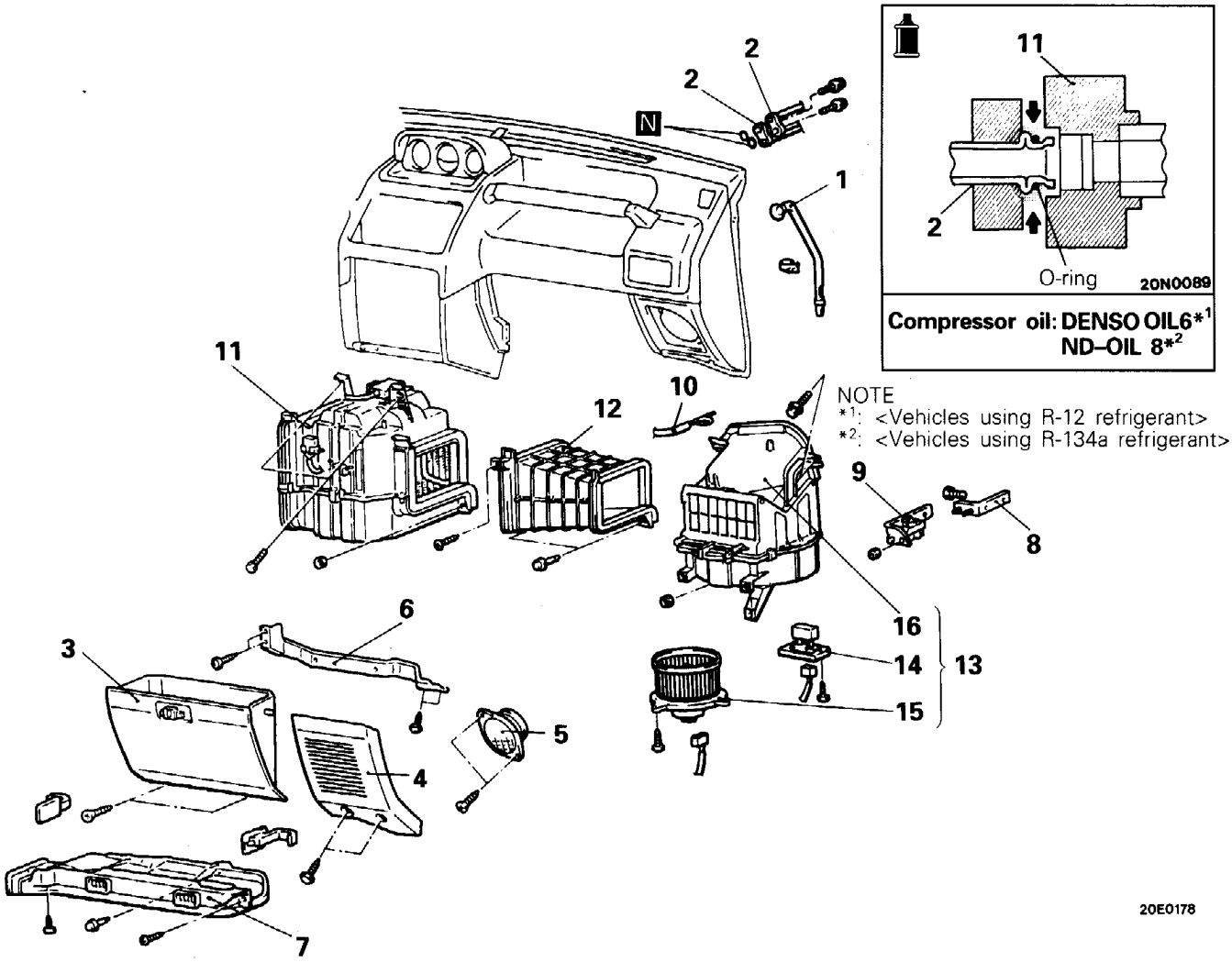
BLOWER ASSEMBLY

REMOVAL AND INSTALLATION

E55KA--



Removal steps

- Discharge and Charging of Refrigerant (Refer to P.55-62, 67.) <Vehicles with air conditioner>

1. Drain hose <Vehicles with air conditioner>
2. Connection for liquid pipe and suction hose <Vehicles with air conditioner>
3. Glove box
4. Speaker garnish
5. Speaker
6. Lower frame
7. Foot shower duct <RH>
8. Engine control relay assembly <Petrol-powered vehicles> or fuel line heater relay assembly <Vehicles with fuel line heater>
9. Bracket <Petrol-powered vehicles and vehicles with fuel line heater>
10. Connection for the air-selection control wire
11. Evaporator <Vehicles with air conditioner>
12. Joint duct <Vehicles without A/C>
13. Blower assembly
14. Resistor
15. Blower motor assembly
16. Blower case assembly

Removal steps of blower motor assembly

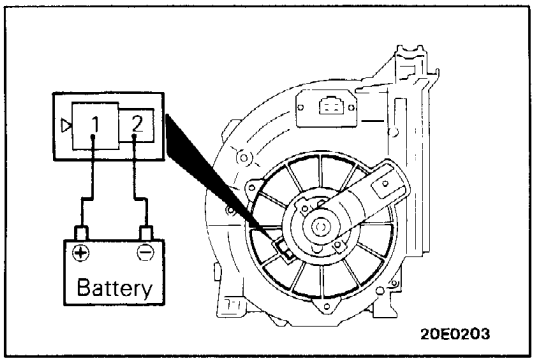
7. Foot shower duct <RH>
15. Blower motor assembly

Removal steps of resistor

7. Foot shower duct <RH>
14. Resistor

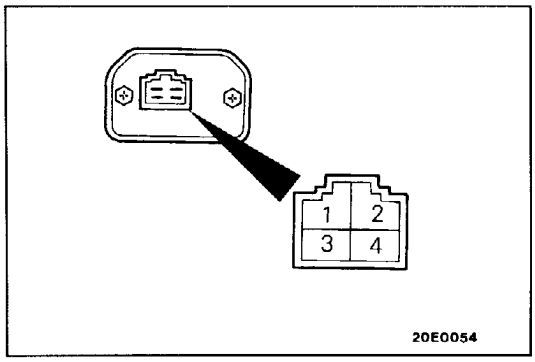
INSPECTION E55KCAM

- Check for bending or abnormal deflection of the rotating shaft of the blower motor assembly.
- Check for damage to the fan.
- Check for damage of the blower case.
- Check the operation of the inside/outside air-selection damper, and for damage.



BLOWER MOTOR ASSEMBLY CHECK

(1) Connect the blower motor terminals directly to the battery and check that the blower motor operates smoothly.
(2) Next, reverse the polarity and check that the blower motor operates smoothly in the reverse direction.



RESISTOR CHECK

Using a circuit tester, measure the resistance between the terminals indicated below.
The condition can be considered satisfactory if the value measured at this time is equivalent to the standard value.

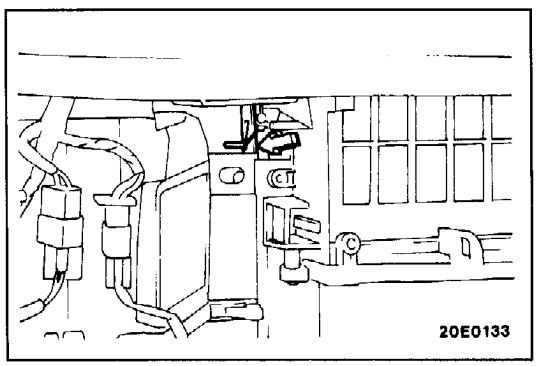
Standard value

Terminals measured	Standard value Ω
Between terminals ②–④	Approx. 1.96 ± 7%
Between terminals ①–②	Approx. 0.95 ± 7%
Between terminals ②–③	Approx. 0.33 ± 7%

SERVICE POINT OF INSTALLATION E55KDAF

10. INSTALLATION OF AIR SELECTION CONTROL WIRE

Connect the air selection control wire to the air selection damper lever by following the steps below.
(1) Move the air selection control lever to the position.
(2) With the air selection damper lever pressed inward in the direction indicated by the arrow, connect the inner cable of the air selection control wire to the end of the air selection lever, and then secure outer cable by using a clip.



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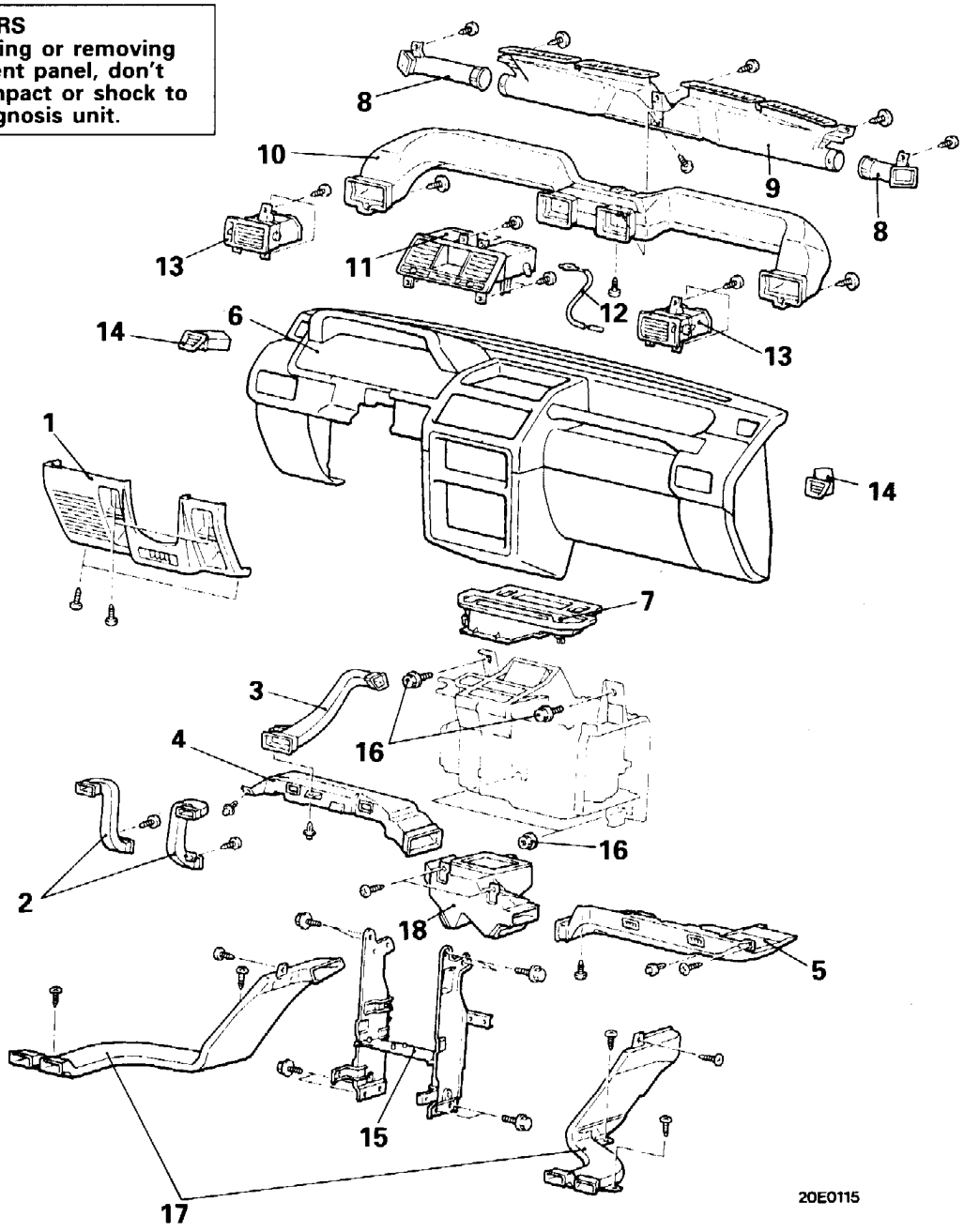
VENTILATORS (INSTRUMENT PANEL AND FLOOR)

REMOVAL AND INSTALLATION

E55MA-1

CAUTION: SRS
When installing or removing the instrument panel, don't allow any impact or shock to the SRS diagnosis unit.



Removal steps

1. Instrument under cover (Refer to GROUP 52 – Instrument panel)
2. Lap cooler duct B
3. Lap cooler duct A
4. Foot shower duct (LH)
5. Foot shower duct (RH)
6. Instrument panel (Refer to GROUP 52 – Instrument panel)
7. Center duct assembly
8. Side defroster duct
9. Defroster nozzle
10. Distribution duct
11. Center outlet assembly
12. Ventilation control wire
13. Side outlet assembly
14. Side defroster grille
15. Center reinforcement
16. Heater unit mounting bolts and nuts
17. Rear heater duct
18. Foot distribution duct

SERVICE POINT OF REMOVAL E55MBBE

17. REMOVAL OF REAR HEATER DUCT

Remove the front seat, front scuff plate and cowl side trim, and after taking out the floor carpet, remove the rear heater duct.
(Refer to GROUP 52 – Seats and Trims.)

SERVICE POINT OF INSTALLATION E55MCBA

17. INSTALLATION OF REAR HEATER DUCT

After installing the duct, replace the floor carpet and install the front seat, front scuff plate and cowl side trim.
(Refer to GROUP 52 – Seats and Trims.)

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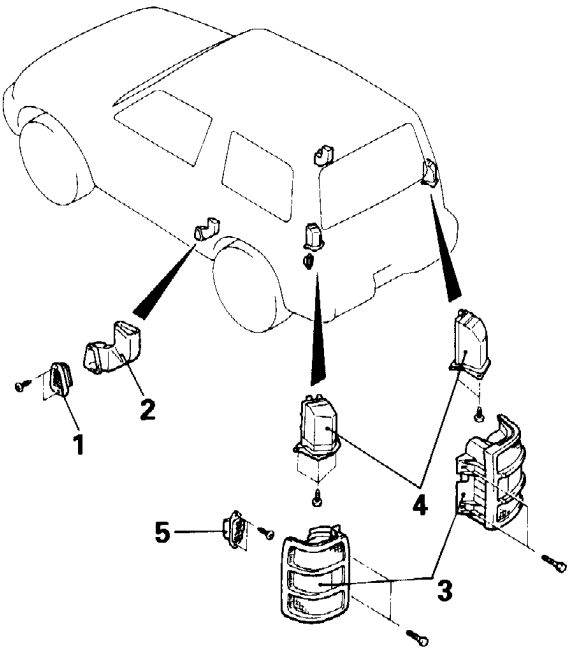
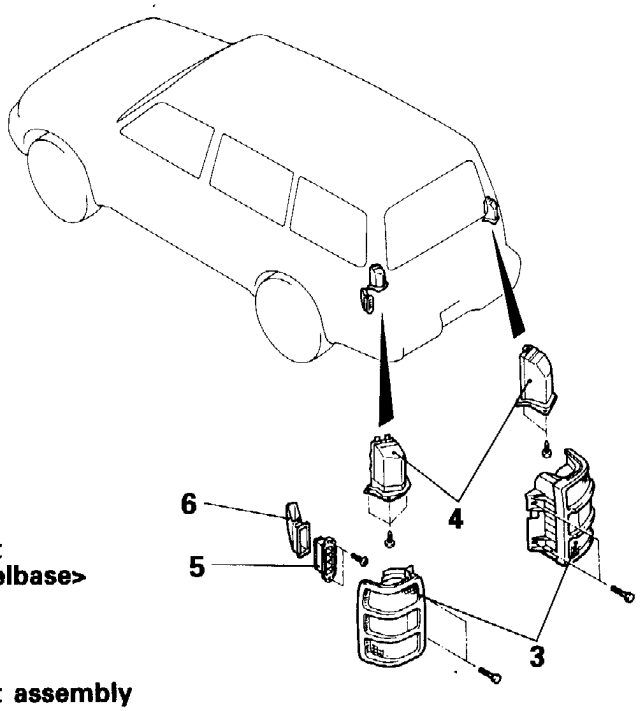
VENTILATORS (AIR OUTLET)

REMOVAL AND INSTALLATION

E55MA-2



20E0112



20E0113

Removal steps of rear ventilator duct <Except for Vehicles with Long Wheelbase>

1. Rear ventilator garnish
2. Rear ventilator duct

Removal steps of rear ventilator duct assembly <Except for Canvas Top>

3. Rear combination lamp assembly (Refer to Group 54 – Rear Combination Lamp)
4. Rear ventilator duct assembly
5. Air outlet garnish assembly
6. Air outlet duct <Long Body>

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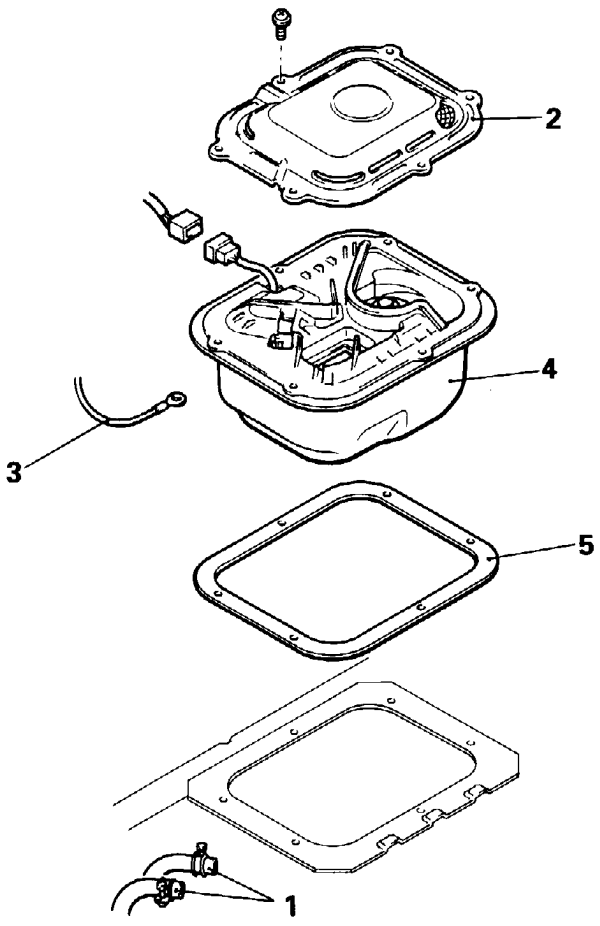
REAR HEATER

REMOVAL AND INSTALLATION

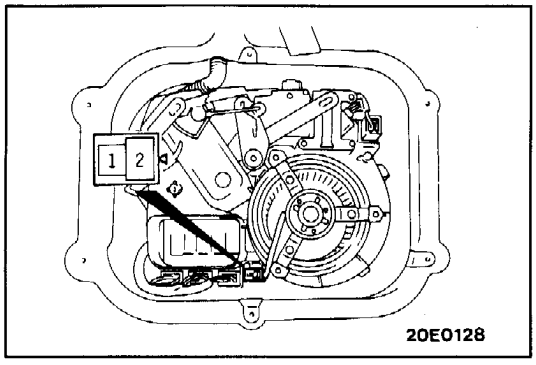
E55RA--

Pre-removal and Post-installation Operation
- Draining and Supplying of the Coolant
- Removal and Installation of the Rear Seat (Refer to GROUP 52 – Seat) <Except for Long Body Wagon>
- Removal and Installation of the Rear Differential Lock Control Unit (Refer to GROUP 27 – Rear Differential Lock) <Long Body>

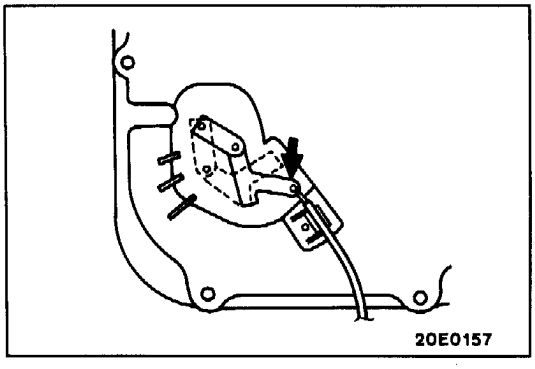


20E0183

Removal steps
1. Connection for water hoses
2. Cover
◆◆ 3. Connection for rear heater temperature control wire <Vehicles without A/C>
4. Rear heater unit
5. Seal



20E0128



20E0157

INSPECTION

E55RCAC

- Check the operation of dampers and link mechanism.
- Check the heater core for clogging and water leakage.

REAR HEATER FAN MOTOR CHECK

When battery voltage is applied between the terminals, check that the motor turns without making any abnormal noise.

SERVICE POINT OF INSTALLATION

E55RDAD

3. INSTALLATION OF REAR HEATER TEMPERATURE CONTROL WIRE

Connect the rear heater temperature control wire to the blend air damper lever by following the steps below.

(1) Move the rear heater temperature control lever to the rightmost position. ("HOT" position)

(2) With the blend air damper lever pressed completely downward in the direction indicated by the arrow, connect the inner cable of the rear heater temperature control wire to the end of the blend air damper lever, and then secure the outer cable by using a clip.

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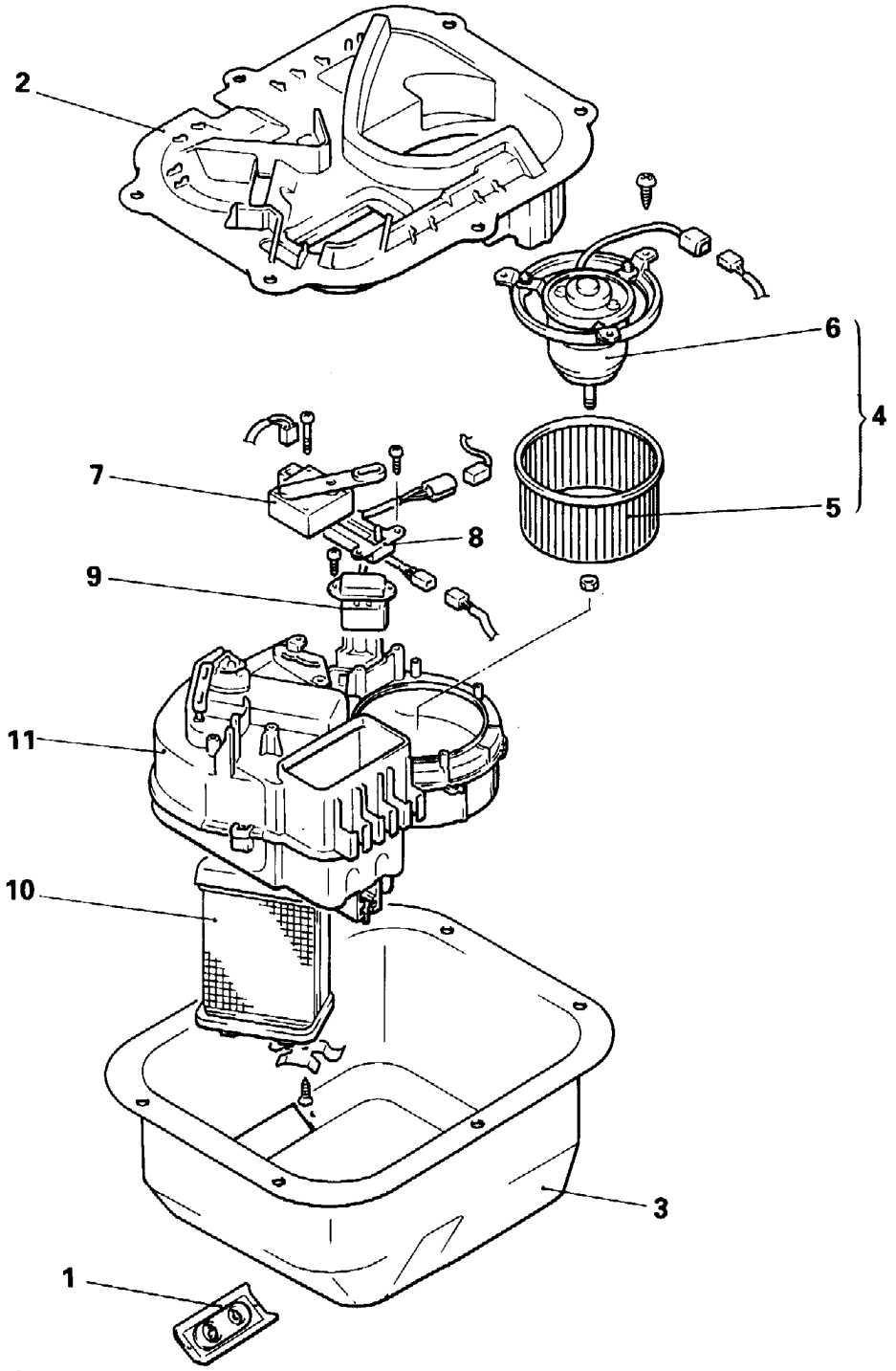
DISASSEMBLY AND REASSEMBLY

E55UA--



20E0233

Disassembly steps

1. Plate
2. Air guide
3. Rear heater cover
4. Rear heater fan motor assembly
5. Rear heater fan
6. Rear heater fan motor
7. Rear air mix damper motor assembly
8. Control switch assembly
9. Resistor
10. Rear heater core
11. Rear heater case

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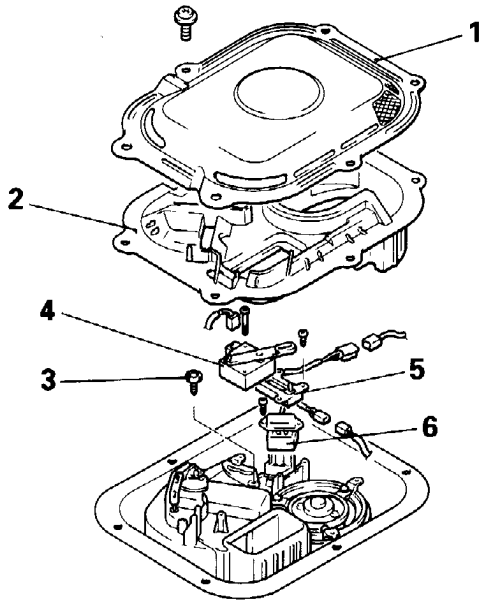
REAR AIR MIX DAMPER MOTOR ASSEMBLY, CONTROL SWITCH AND RESISTOR

REMOVAL AND INSTALLATION

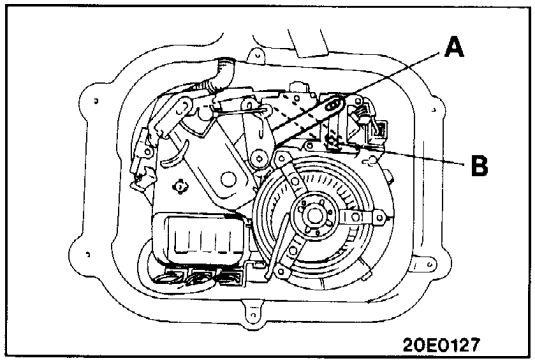
E55REAA

Pre-removal and Post-installation Operation
- Removal and Installation of the Rear Seat
  (Refer to GROUP 52 – Seat)
  <Except for Long Body Wagon>



20E0146

Removal steps
1. Cover
2. Air guide
3. Linkage mounting screw
4. Rear air mix damper motor assembly
   <Vehicles with dual A/C>
5. Control switch assembly
   <Vehicles with dual A/C>
6. Resistor



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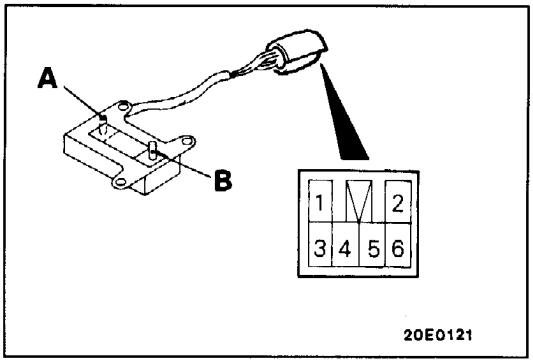
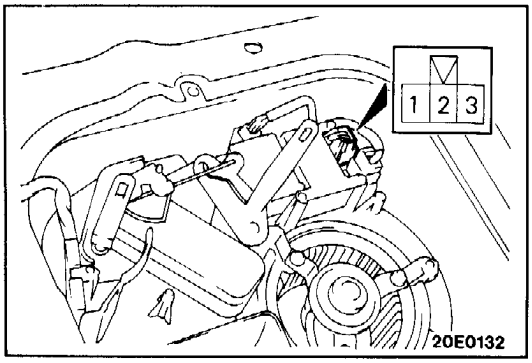


20E0121



20E0132

INSPECTION

E55REBA

REAR AIR MIX DAMPER MOTOR ASSEMBLY CHECK

(1) Check that the temperature adjustment selector is normal. (Refer to P.55-15.)
(2) After the engine has warmed up, check that the link of the damper motor is at position A when the temperature adjustment selector is at the MAX.COOL position, and that it is at position B when the temperature adjustment selector is at the MAX.HOT position.

CONTROL SWITCH CHECK

Operate the switch and use a circuit tester to check the continuity between the terminals in both the A and B positions.

Terminal No. / Switch position	1	4	3	2	6	Remark
A position	○		○			○—○ indicates that there is a continuity between the terminals.
B position	○	○		○	○	

RESISTOR CHECK

Use a circuit tester to measure the resistance between the terminals shown below. Check that the values measured are within the standard values.

Standard value:

Measurement terminal	Standard value Ω
Between terminals ②–③	4.3 ± 7%
Between terminals ①–②	1.2 ± 7%

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AIR CONDITIONER

SPECIFICATIONS

GENERAL SPECIFICATIONS

E55CA-2

<Vehicles using R-12 refrigerant>

Items	4G64 and 6G72	4D56
Compressor		
Model	10PA 15 Inclined-plate type	10PA 15 Inclined-plate type
No. of cylinders and displacement	10 cylinders	10 cylinders
cm^3 (cu.in.)	155.3 (9.5)	155.3 (9.5)
Compressor oil	DENSO oil 6	DENSO oil 6
cm^3 (cu.in.)	80 ± 20 (4.9 ± 1.2)	80 ± 20 (4.9 ± 1.2)
	150 ± 20 (9.2 ± 1.2)*	150 ± 20 (9.2 ± 1.2)*
Protective equipment		
Dual pressure switch kPa (kg/cm^2, psi)		
Lower-pressure side		
OFF	210 ± 20 (2.1 ± 0.2 , 30 ± 3)	210 ± 20 (2.1 ± 0.2 , 30 ± 3)
Differential	25 (0.25 , 3.6) or less	25 (0.25 , 3.6) or less
High-pressure side		
OFF	2,700 ± 200	2,700 ± 200
	(27 ± 2 , 384 ± 28)	(27 ± 2 , 384 ± 28)
ON	2,100 ± 200	2,100 ± 200
	(21 ± 2 , 299 ± 28)	(21 ± 2 , 299 ± 28)
Engine coolant temperature switch °C(°F)		
Air conditioner switch off		
OFF	15 ± 3 (239 ± 5)	116 ± 2 (2,44 ± 4)
ON	108 (226)	109 (224)
Condenser fan		
OFF	—	97 (204)
ON	—	102 ± 3 (212 ± 6)
Freezer prevention		
Air thermo sensor °C(°F)		
OFF	3 (37)	3 (37)
ON	4 (39)	4 (39)
Fusible plug		
(Burn out Temperature) °C(°F)	103 ± 3 (217 ± 5)	103 ± 3 (217 ± 5)
Refrigerant and quantity g (lbs.)	R-12 (CFC-12) 750–850 (1.6–1.9)	R-12(CFC-12) 750–850(1.6–1.9)
	1,200–1,300 (2.6–2.9)*	1,200–1,300 (2.6–2.9)*

NOTE
* : Vehicles with dual A/C

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<Vehicles using R-134a refrigerant>

Items	Specifications
Compressor	
Model	10PA 15 Inclined-plate type
No. of cylinders and displacement 10 cylinders	
cm^3 (cu.in.)	155.3 (9.5)
Compressor oil	ND-OIL 8
cm^3 (cu.in.)	80 ± 20 (4.9 ± 1.2), 150 ± 20 (9.2 ± 1.2)
Protective equipment	
Dual pressure switch kPa (kg/cm^2, psi)	
Lower-pressure side	
OFF	200 ± 20 (2.0 ± 0.2, 28 ± 3)
Differential	20 (0.20, 28) or less
High-pressure side	
OFF	3,200 ± 200 (32 ± 2, 455 ± 28)
ON	2,600 ± 200 (26 ± 2, 370 ± 28)
Engine coolant temperature switch °C (°F)	
Air conditioner switch off	
OFF	115 ± 3 (239 ± 4) <Except 4D56 engine> 116 ± 2 (244 ± 4) <4D56>
ON	108 (226) <Except 4D56 engine> 109 (244) <4D56>
Condenser fan	
OFF	97 (204)
ON	102 ± 3 (212 ± 6)
Freezer prevention	
Air thermo sensor °C (°F)	
OFF	3 (37)
ON	4 (39)
Refrigerant and quantity g (lbs.)	R134a (HFC-134a) 500–550 (1.1–1.2), 850–900 (1.9–2.0)* <4M40> 600–650 (1.3–1.4), 1,000–1,050 (2.2–2.3)* <Except 4M40 engine>

NOTE
*: Vehicles with dual A/C

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NOTES

SERVICE SPECIFICATIONS

E55CB-2

Items	Standard value	Remarks
Engine coolant temperature switch °C (°F)		
(For air conditioner cut)	More than 112–118 (234–244)	Except 4D56 engine
	More than 114–118 (237–244)	4D56
(For condenser fan)		
ON	More than 99–105 (210–221)	
OFF	Less than 97 (206)	
Idle speed r/min		"N" or "P" range for A/T
6G72, 6G74	700 ± 100	
4D56, 4G64	750 ± 100	
4M40	800 ± 30	
Idle-up speed r/min	900 ± 100	
Resistance between idle-up solenoid valve terminals Ω	Approx. 40	
Resistance value of temperature adjustment selector Ω		
<Vehicles with dual air conditioner>		
At MAX. COOL	0–4	Between terminals 3–9
At MAX. HOT	3000	Between terminals 3–9
<Vehicles with dual air conditioner and rear heater>		
At MAX. COOL	0–4	Between terminals 3–4
At MAX. HOT	2400	Between terminals 5–6
Resistance value of resistor	Approx. 0.8	Between terminals 2–3
(for rear cooling unit) Ω	Approx. 2.98	Between terminals 3–4
	Approx. 4.57	Between terminals 1–3
Shaft starting torque Nm (kgm, ft.lbs.)	5.0 (0.5, 3.6)	
Clutch clearance mm (in)	0.35–0.65 (0.0138–0.0256)	

LUBRICANTS

E55CD--

Items	Specified lubricants	Quantity
<Vehicles using R-12 refrigerant>		
Each connection of refrigerant line	DENSO OIL 6	As required
Compressor refrigerant unit lubricant cm^3 (cu.in.)		80 (4.9), 150 (9.2)*
<Vehicles using R-134a refrigerant>		
Each connection of refrigerant line	ND–OIL 8	As required
Compressor refrigerant unit lubricant cm^3 (cu.in.)		80 (4.9), 150 (9.2)*

NOTE
* : Vehicles with dual A/C

SEALANT

E55CE--

Items	Specified sealant and adhesive	Remarks
Engine coolant temperature switch threaded part	3M Nut Locking Part No. 4171 or equivalent	Drying sealant

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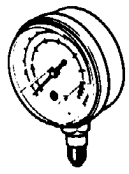
SPECIAL TOOLS

E55DA--

Tool	Number	Name	Use
	MB 991402	Vacuum gauge	Vacuum check
	MB991403 (for high pressure) MB991404 (for low pressure)	Adaptor valve	Supplying refrigerant gas Replenishment of refrigerant gas Draining of refrigerant gas Performance test
	MB990784	Ornament remover	Removal of air outlet grille

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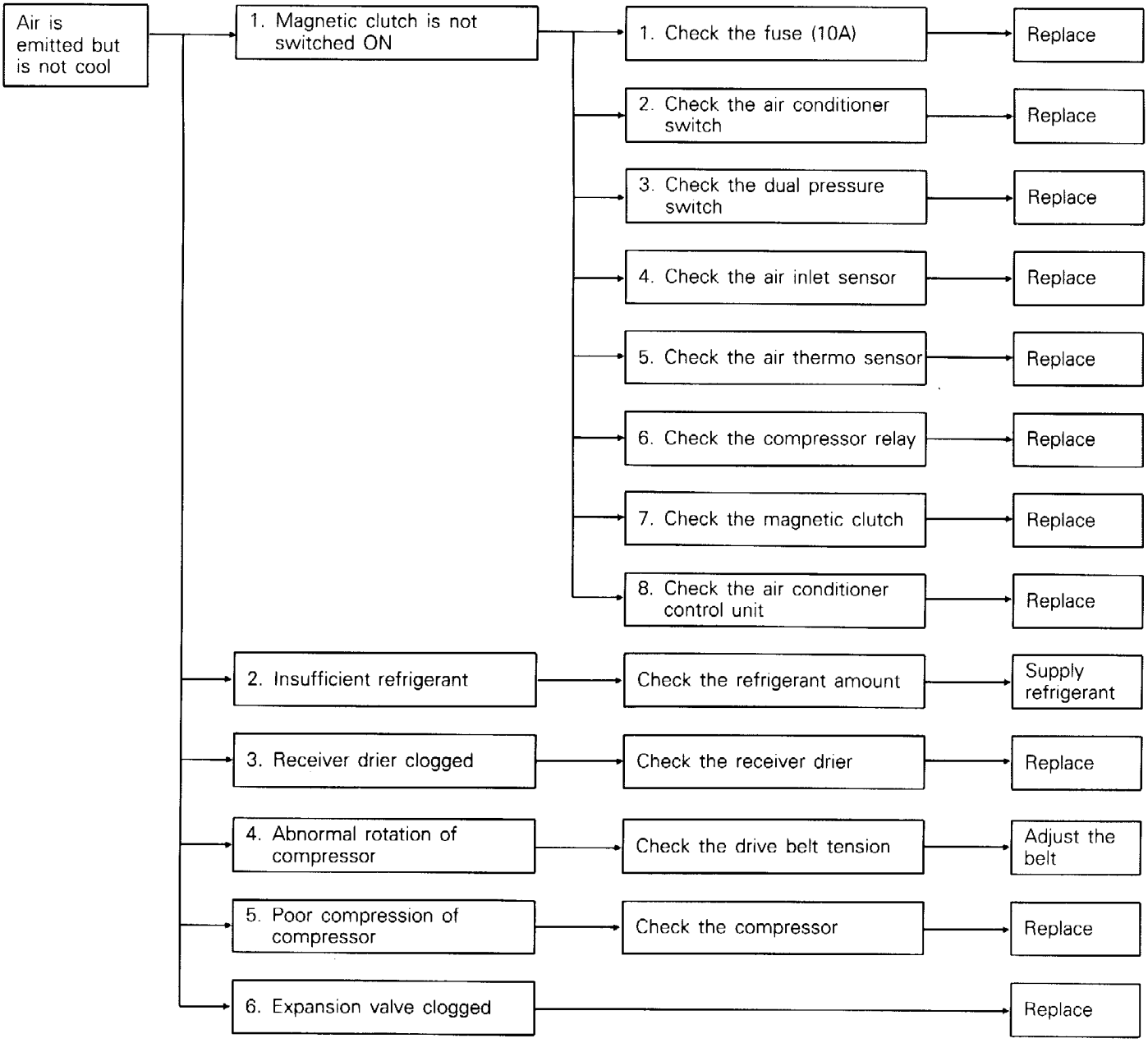
TROUBLESHOOTING

E55EAAQ

Before replacing or repairing air conditioning components,first determine if the malfunction is; due to refrigerant charge, air flow, or compressor related.
The following diagnostic charts have been developed as a "quick reference" and in determining the cause of malfunction. If these charts do not satisfactorily describe the problem, refer to appropriate section for detailed explanation.
After correcting the malfunction, check out the complete system to assure satisfactory performance.

MALFUNCTION CAUSES AND REMEDIES (Numbers indicate checking/inspection order.)



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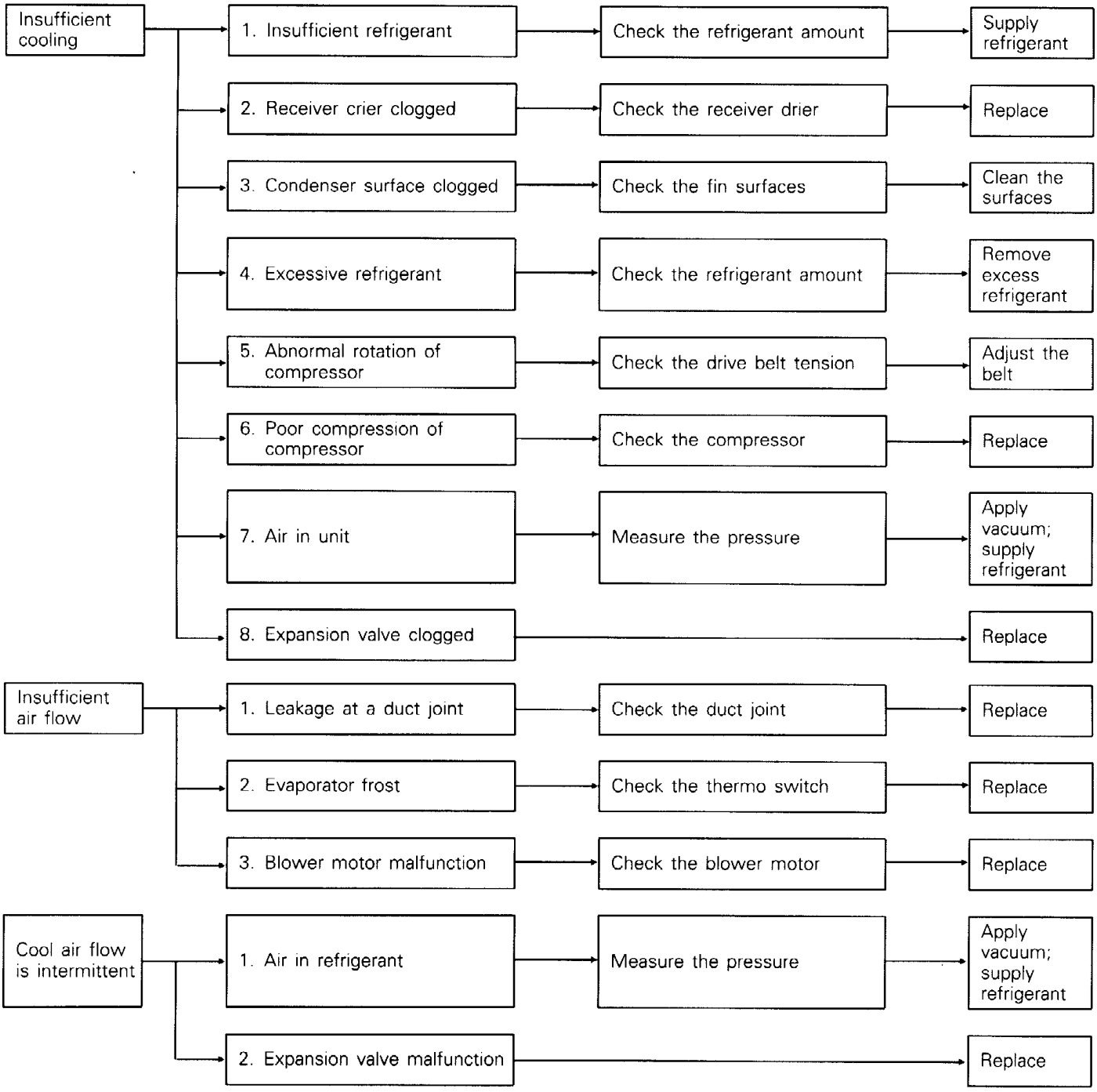

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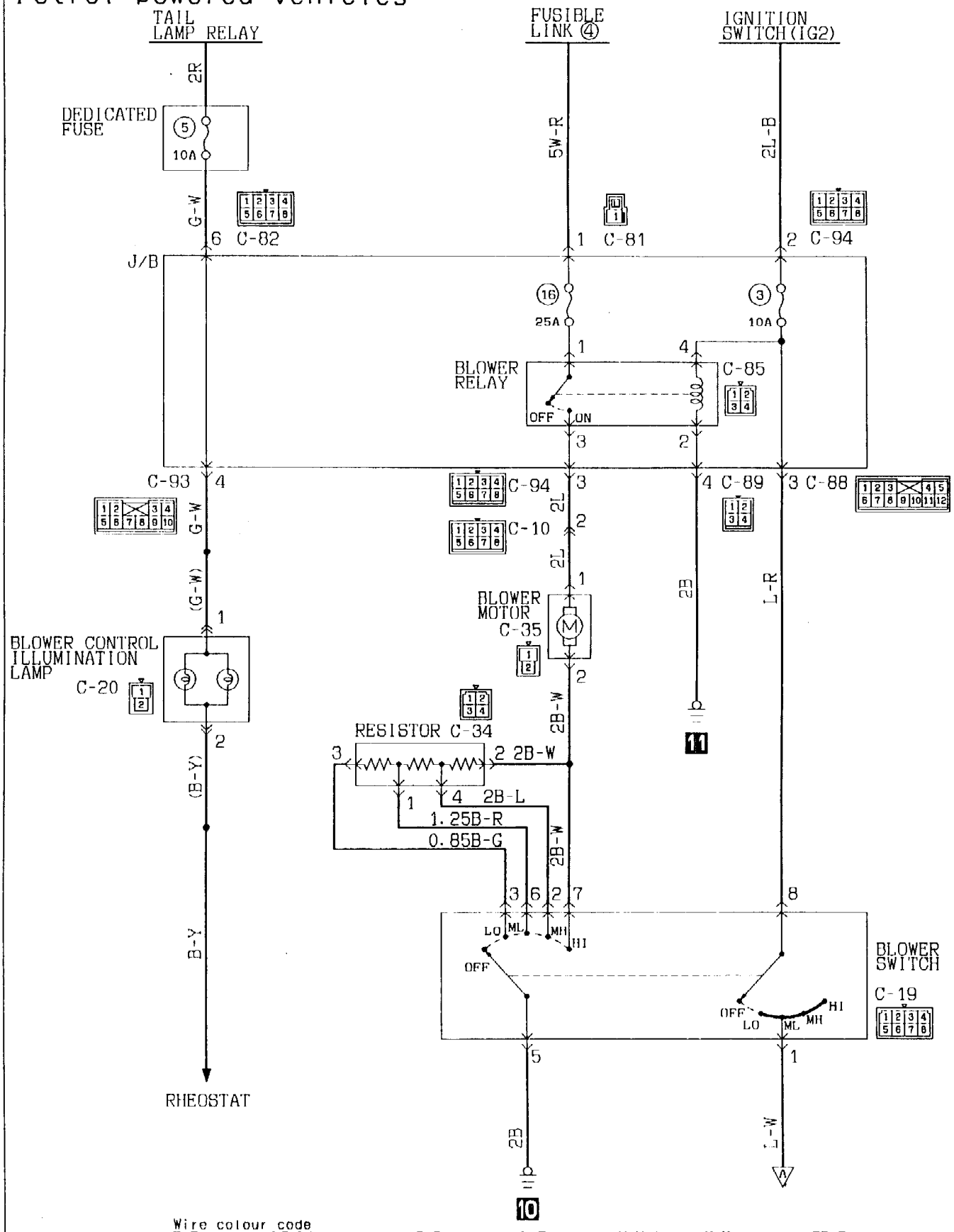
SINGLE AIR CONDITIONER

<Vehicles built up to October, 1993>

Petrol-powered vehicles



Wire colour code

B:Black	LG:Light green	G:Green	L:Blue	W:White	Y:Yellow	SB:Sky blue	
BR:Brown	O:Orange	GR:Gray	R:Red	P:Pink	V:Violet		

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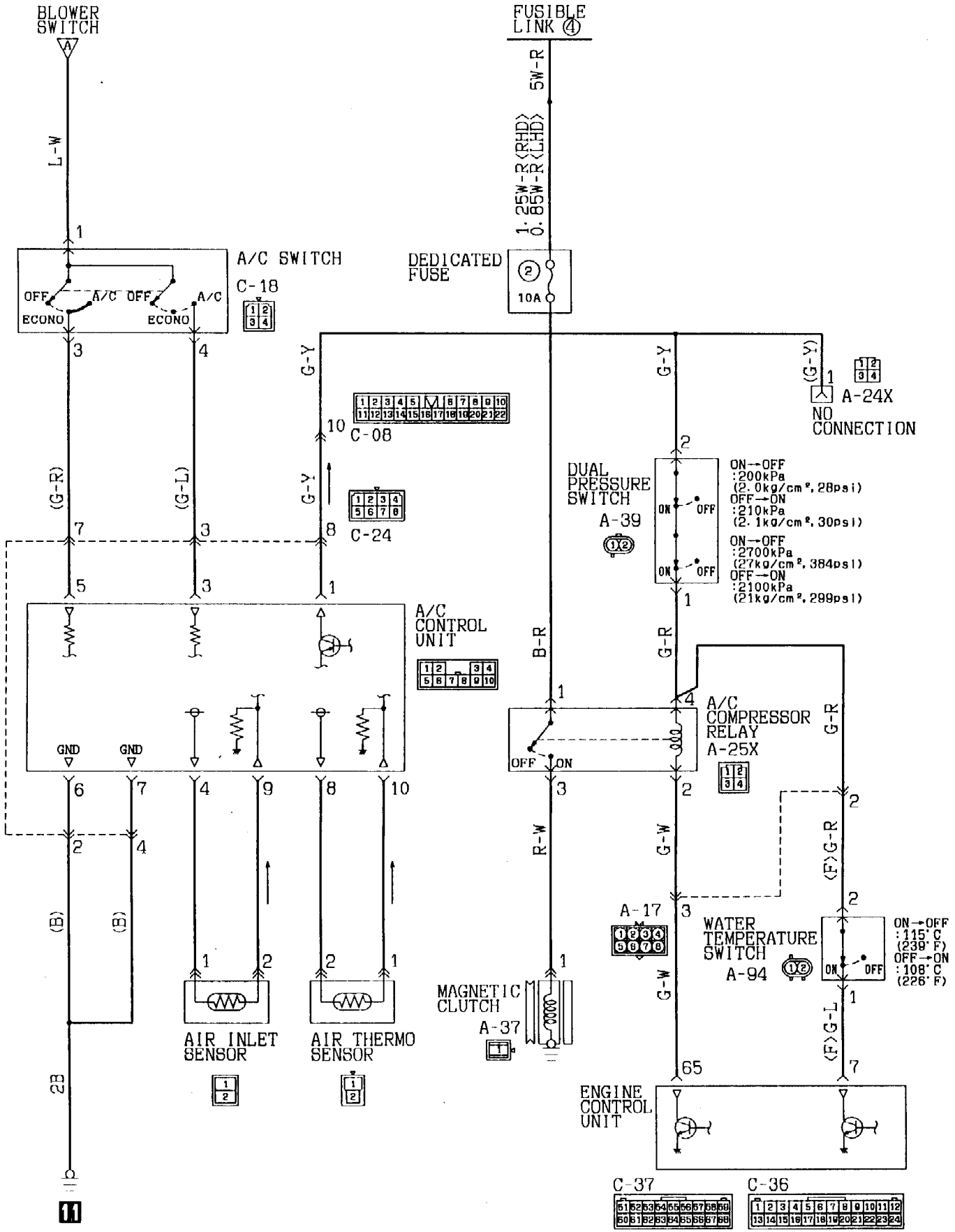

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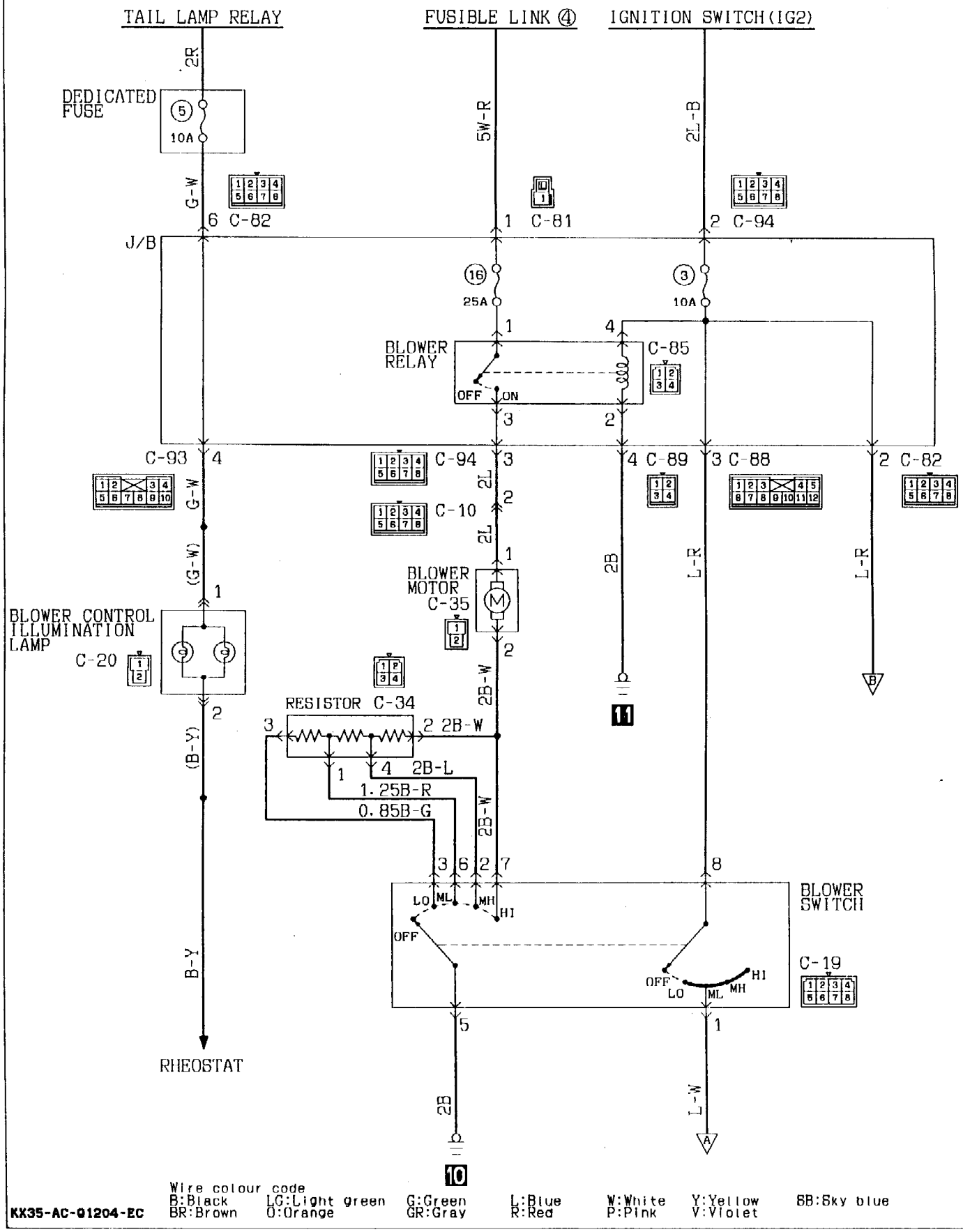
Diesel-powerd vehicles



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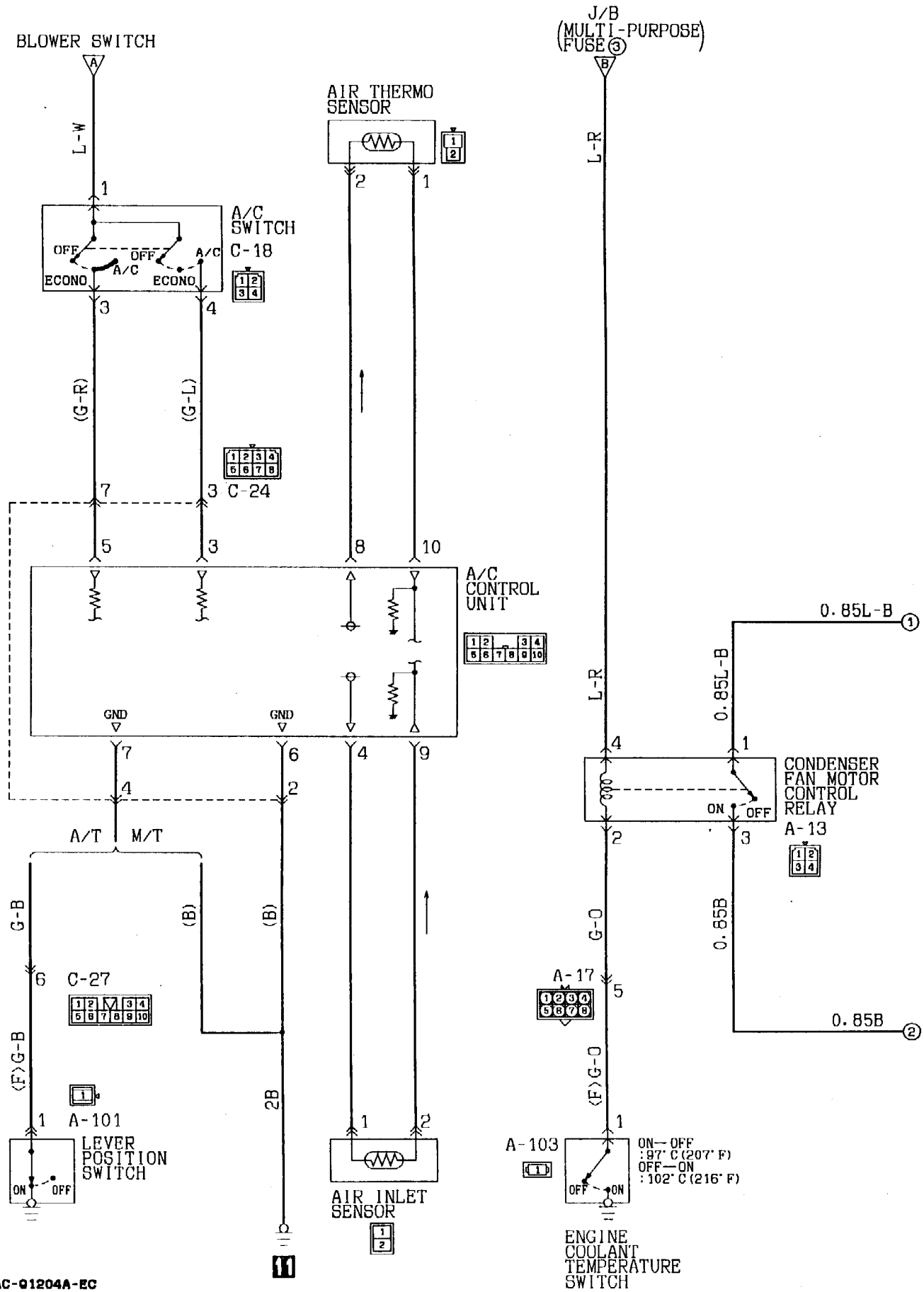

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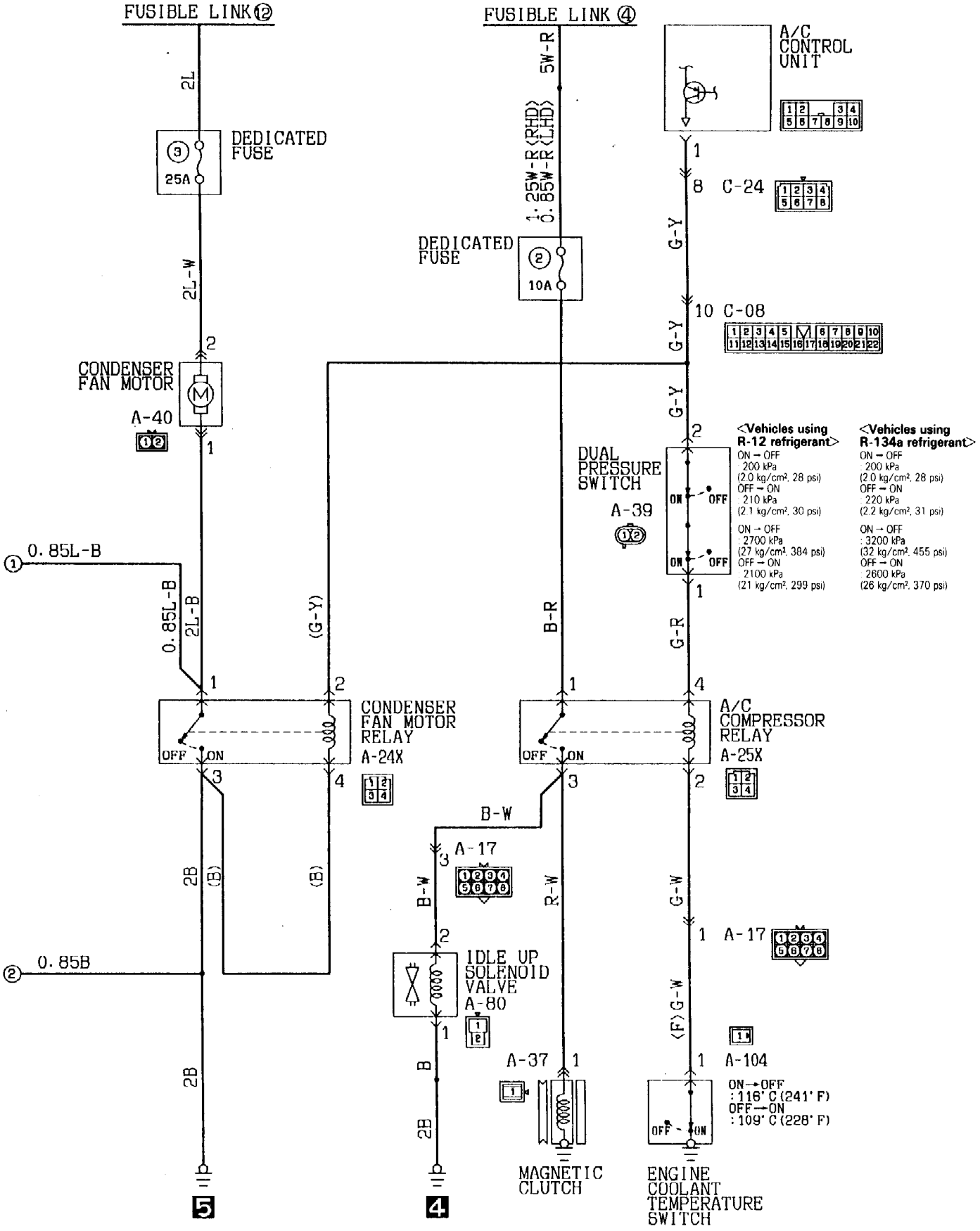

FUSIBLE LINK⑫
FUSIBLE LINK ④
A/C CONTROL UNIT
DEDICATED FUSE
25A
10A
2L
2L-W
5W-R
1.25W-R <RHD>
0.85W-R <LHD>
G-Y
B-R
G-R
(G-Y)
CONDENSER FAN MOTOR
A-40
DUAL PRESSURE SWITCH
A-39
<Vehicles using R-12 refrigerant>
ON → OFF : 200 kPa (2.0 kg/cm², 28 psi)
OFF → ON : 210 kPa (2.1 kg/cm², 30 psi)
ON → OFF : 2700 kPa (27 kg/cm², 384 psi)
OFF → ON : 2100 kPa (21 kg/cm², 299 psi)
<Vehicles using R-134a refrigerant>
ON → OFF : 200 kPa (2.0 kg/cm², 28 psi)
OFF → ON : 220 kPa (2.2 kg/cm², 31 psi)
ON → OFF : 3200 kPa (32 kg/cm², 455 psi)
OFF → ON : 2600 kPa (26 kg/cm², 370 psi)
0.85L-B
2L-B
CONDENSER FAN MOTOR RELAY
A-24X
A/C COMPRESSOR RELAY
A-25X
OFF
ON
B-W
A-17
R-W
G-W
IDLE UP SOLENOID VALVE
A-80
2B
(B)
0.85B
A-37
A-104
(F)G-W
ON→OFF : 116° C (241° F)
OFF→ON : 109° C (228° F)
MAGNETIC CLUTCH
ENGINE COOLANT TEMPERATURE SWITCH
C-24
C-08
5
4

SINGLE AIR CONDITIONER

<Vehicles built from November, 1993>

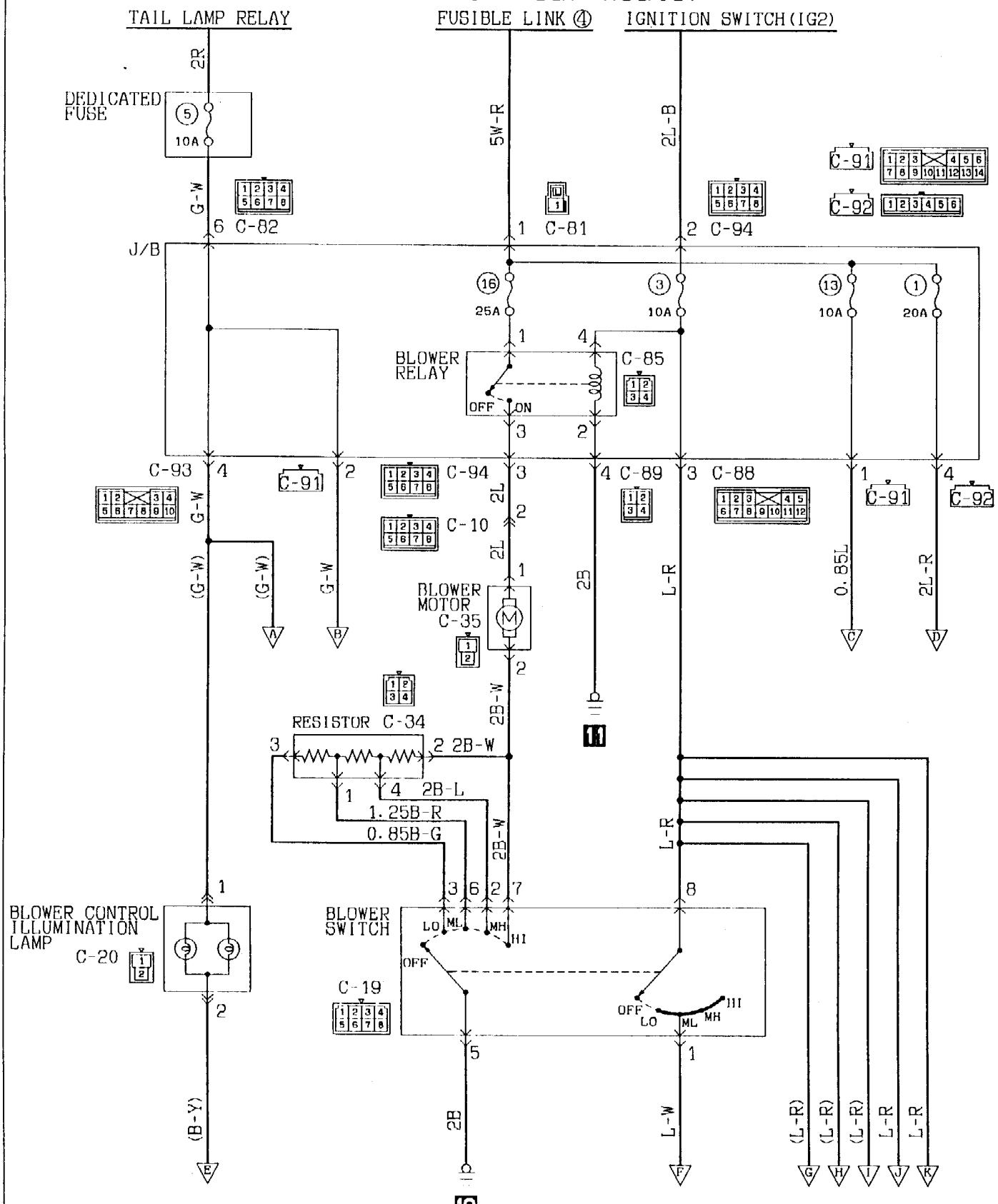
Refer to "SINGLE AIR CONDITIONER" of '94 PAJERO Workshop Manual Electrical Wiring (Pub No. PHJE9026).

NOTES

DUAL AIR CONDITIONER

<Vehicles built up to October, 1993>

Petrol-powered vehicles with rear heater



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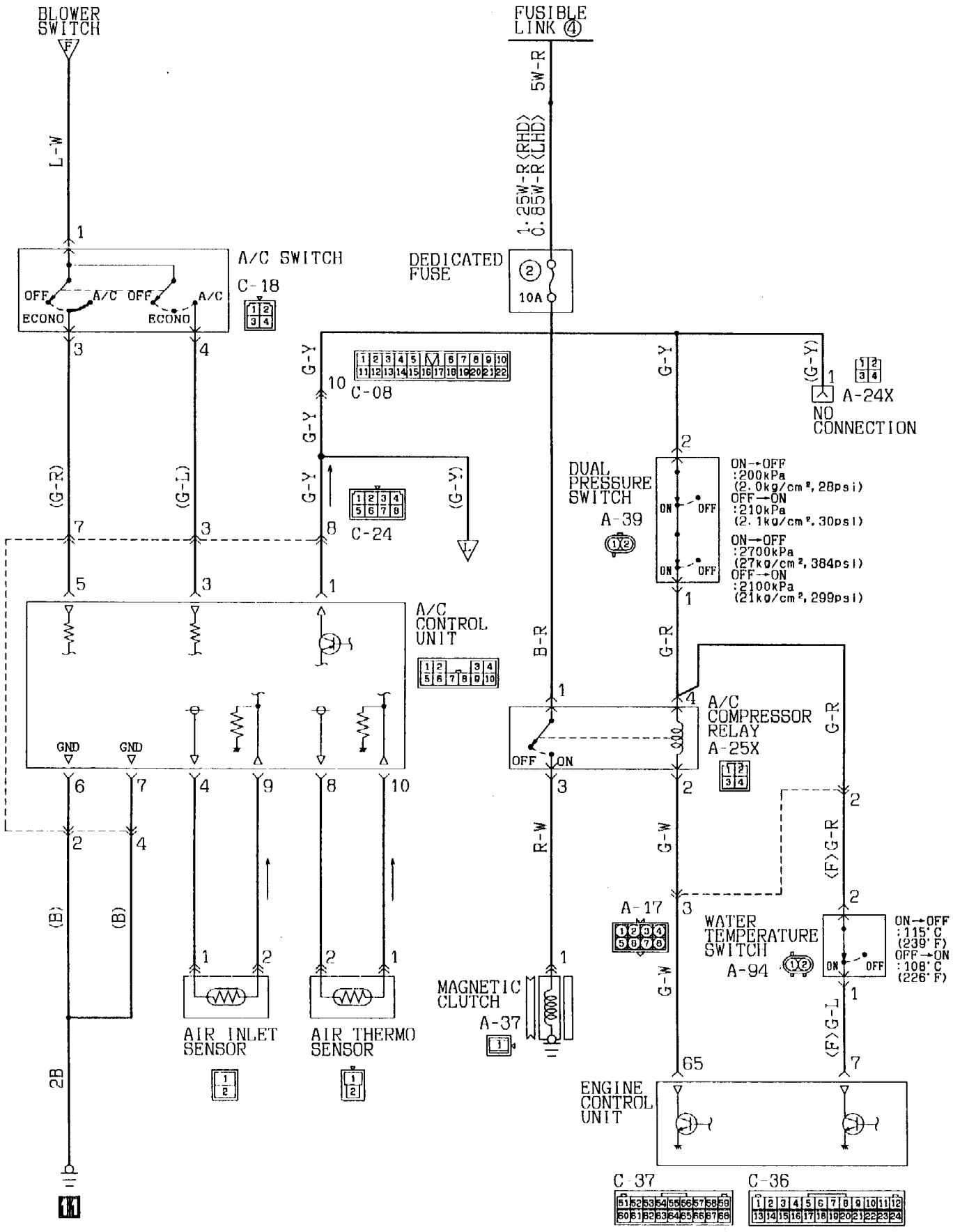

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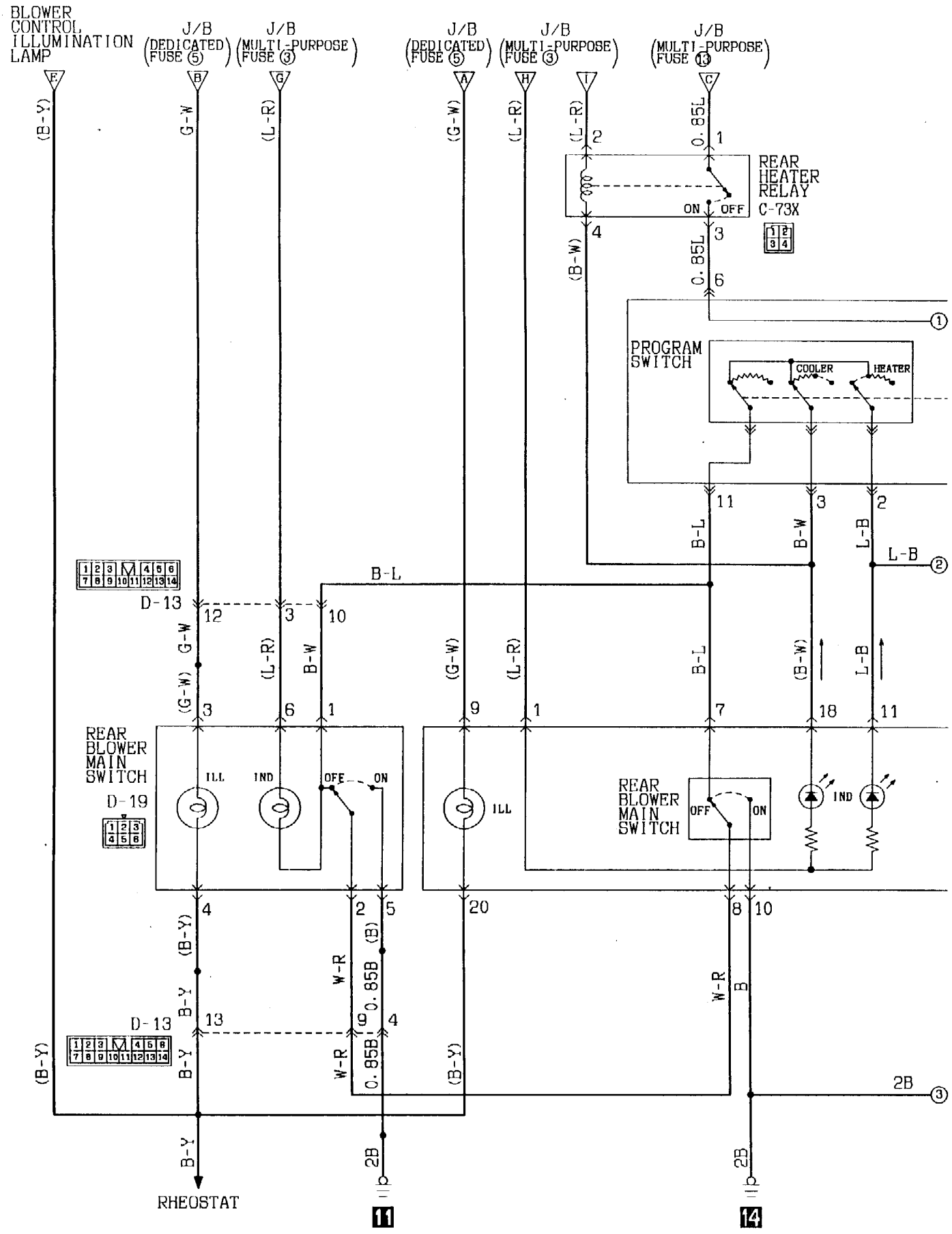

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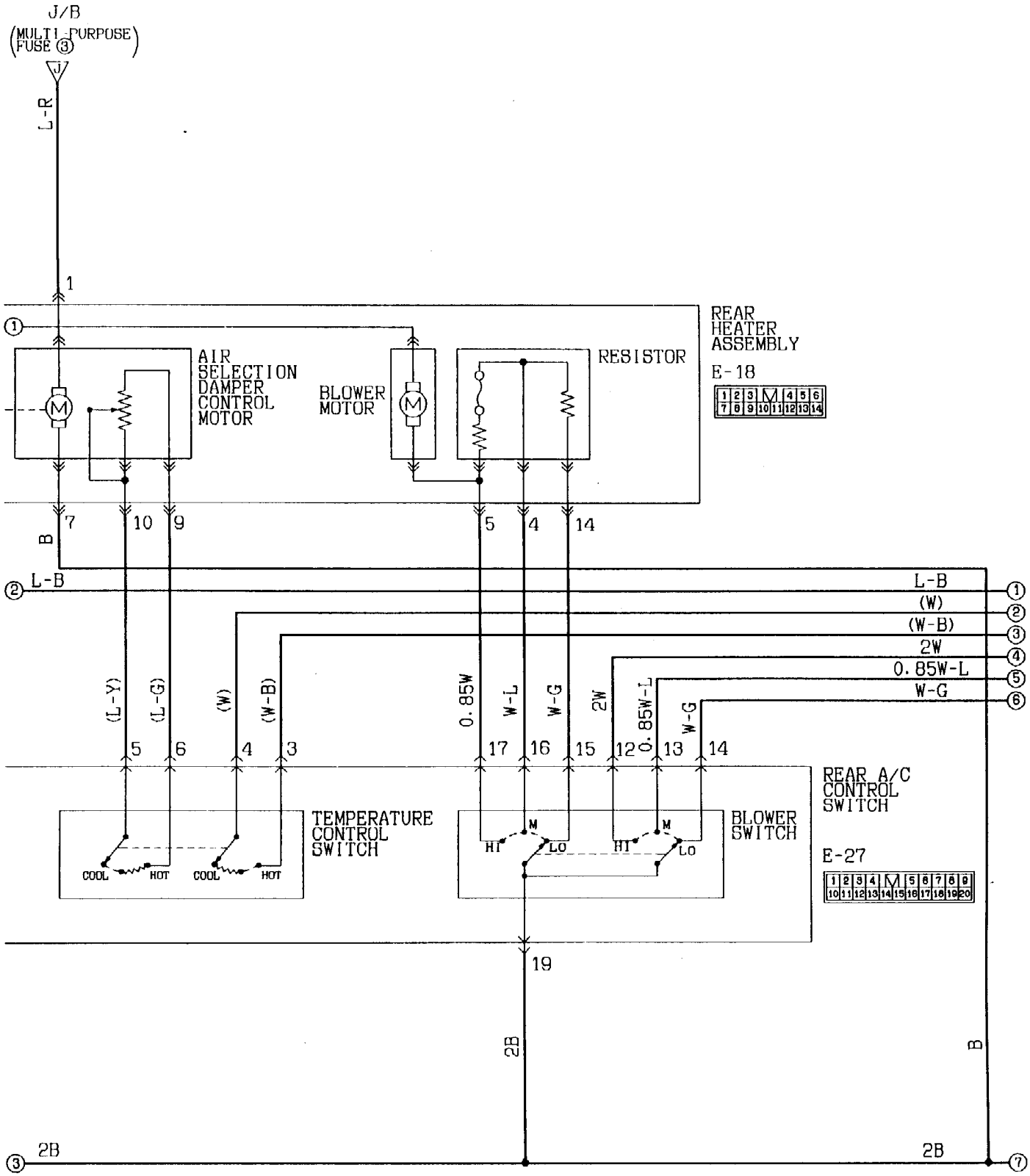

Wire colour code

B:Black	LG:Light green	G:Green	L:Blue	W:White	Y:Yellow	SB:Sky blue
BR:Brown	O:Orange	GR:Gray	R:Red	P:Pink	V:Violet	

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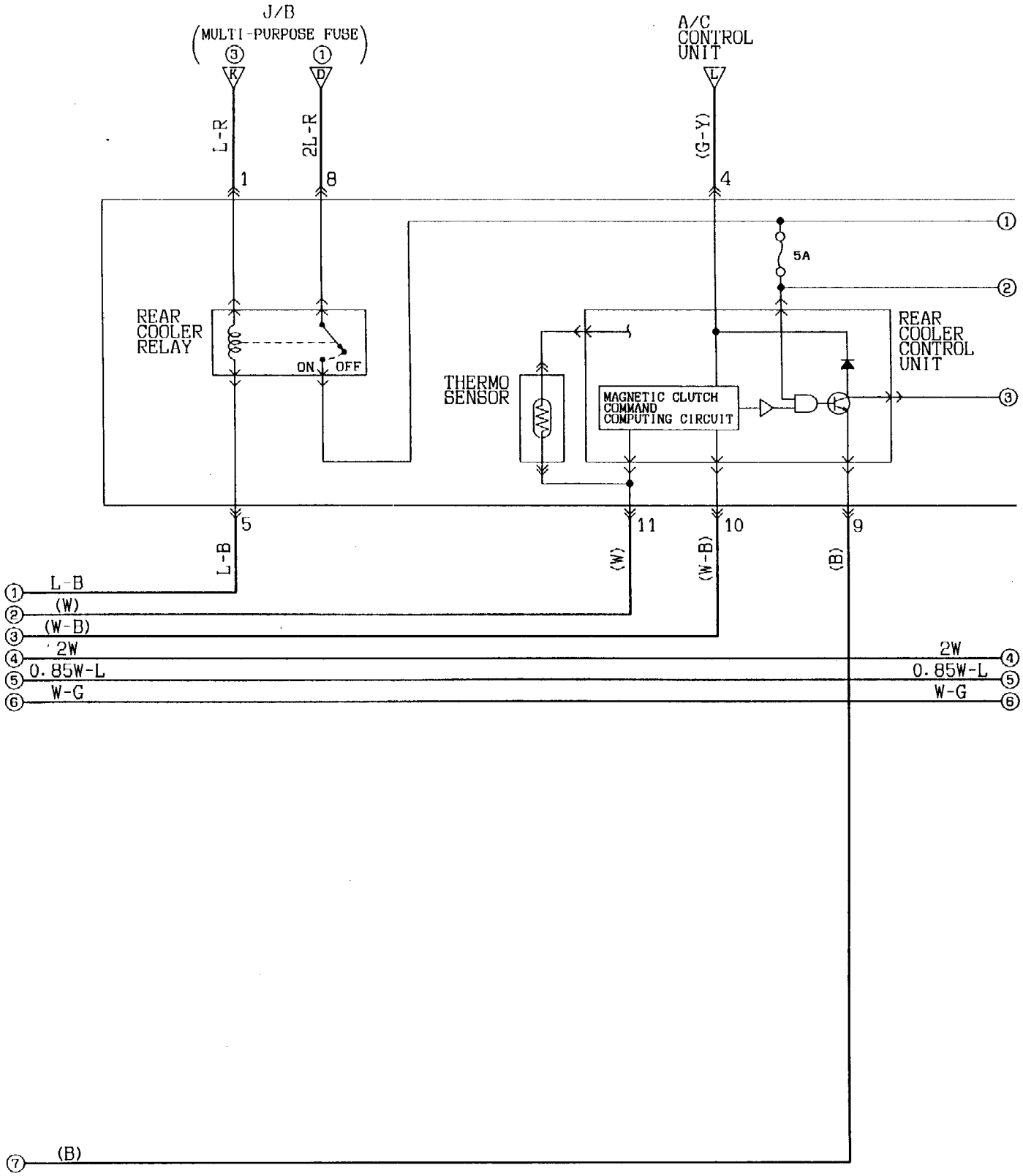

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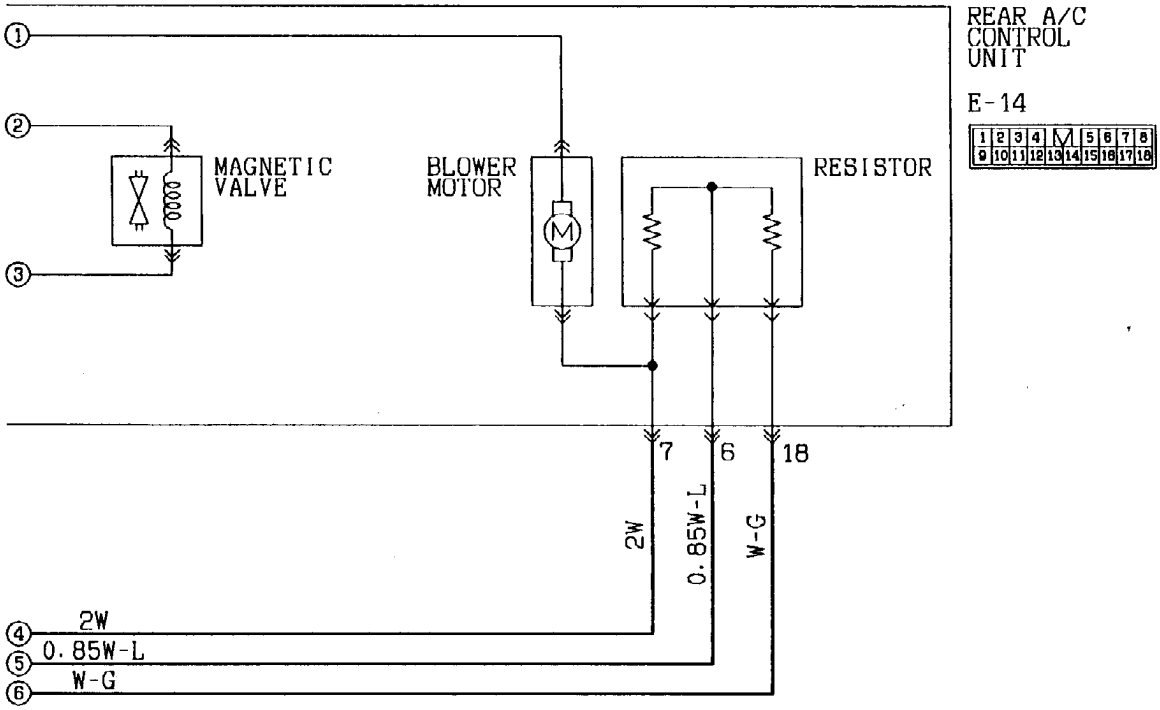

Wire colour code

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BR:Brown	O:Orange	GR:Gray	R:Red	P:Pink	V:Violet	

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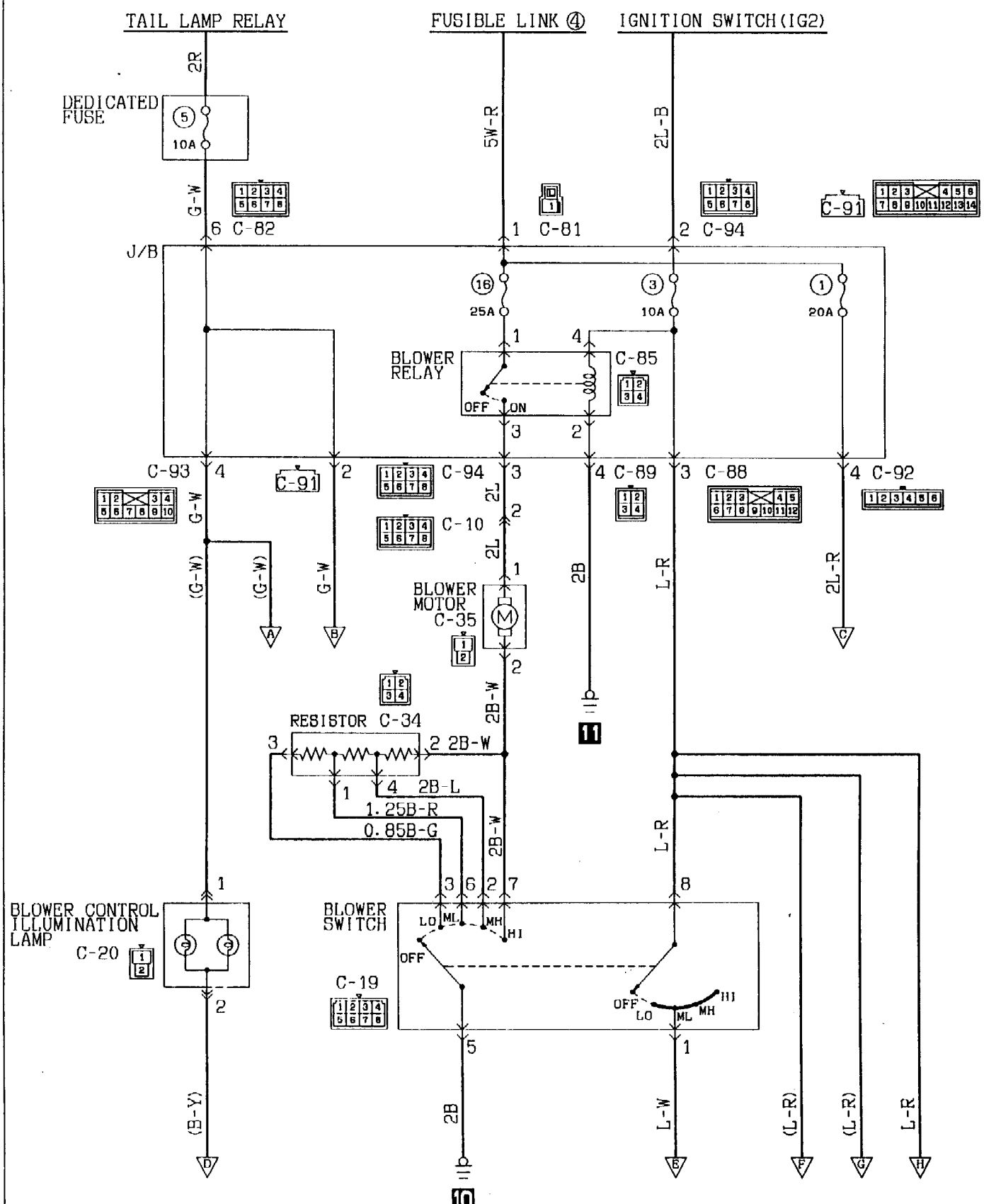
Petrol-powered vehicles without rear heater



Wire colour code
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BR:Brown O:Orange GR:Gray R:Red P:Pink V:Violet

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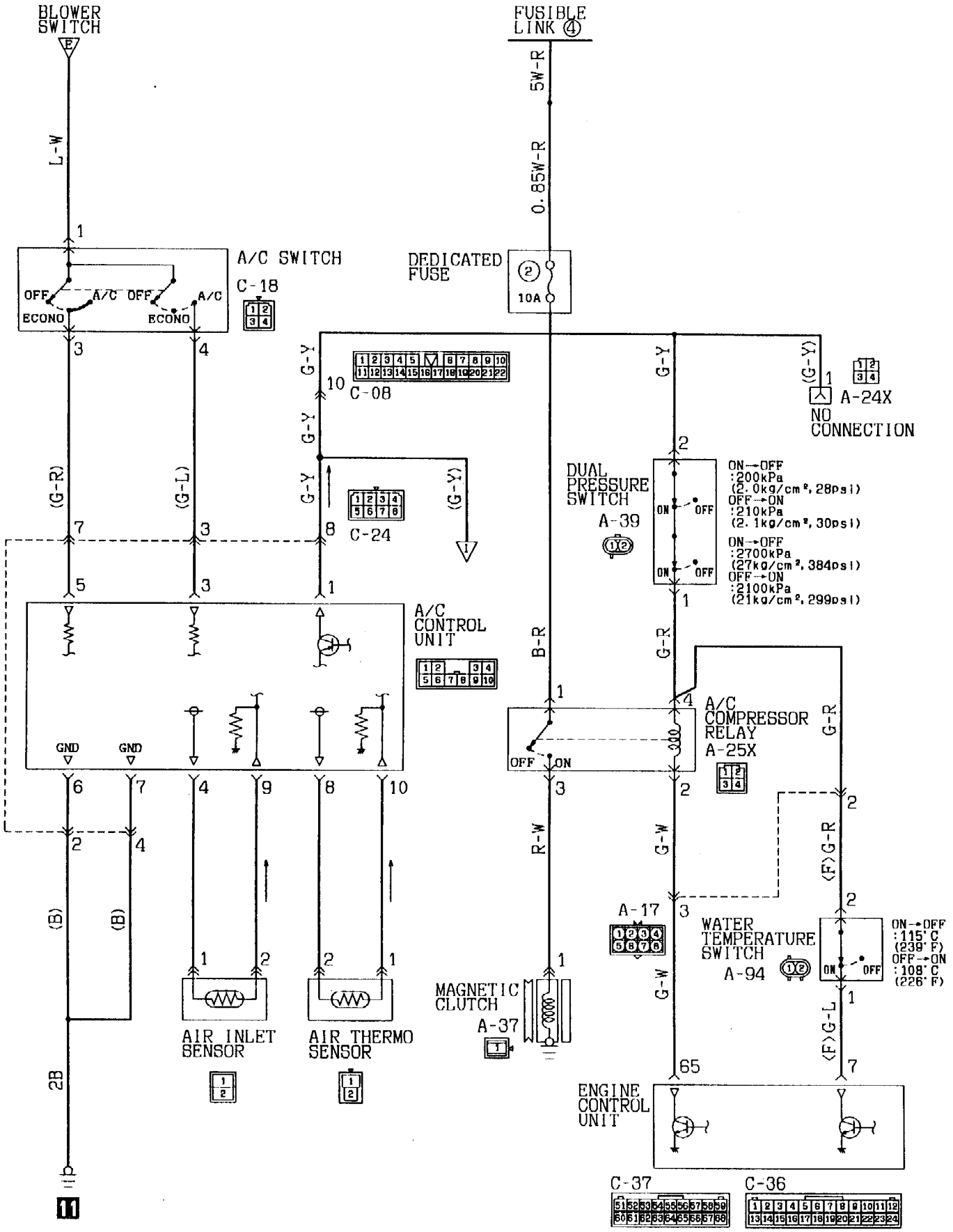

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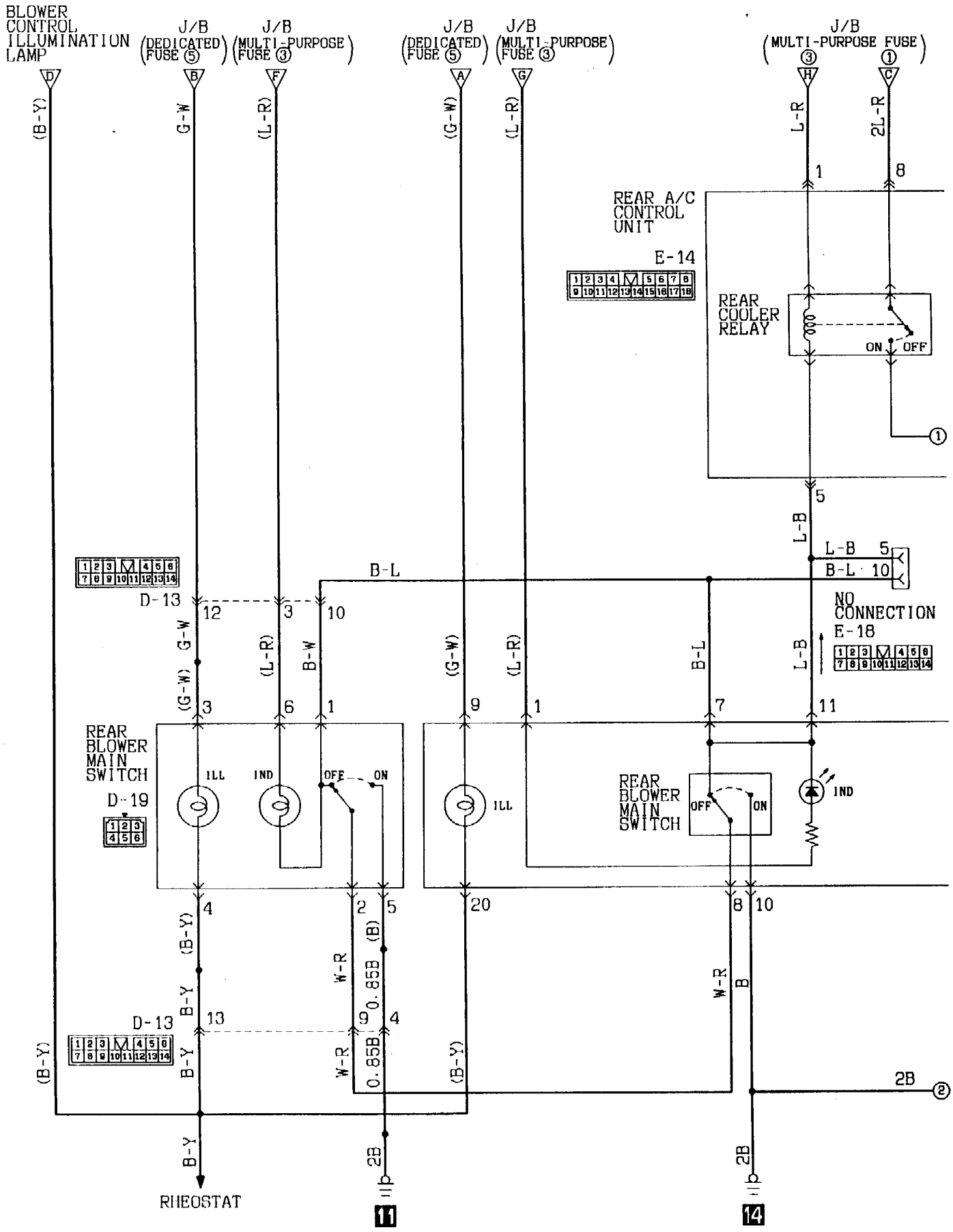

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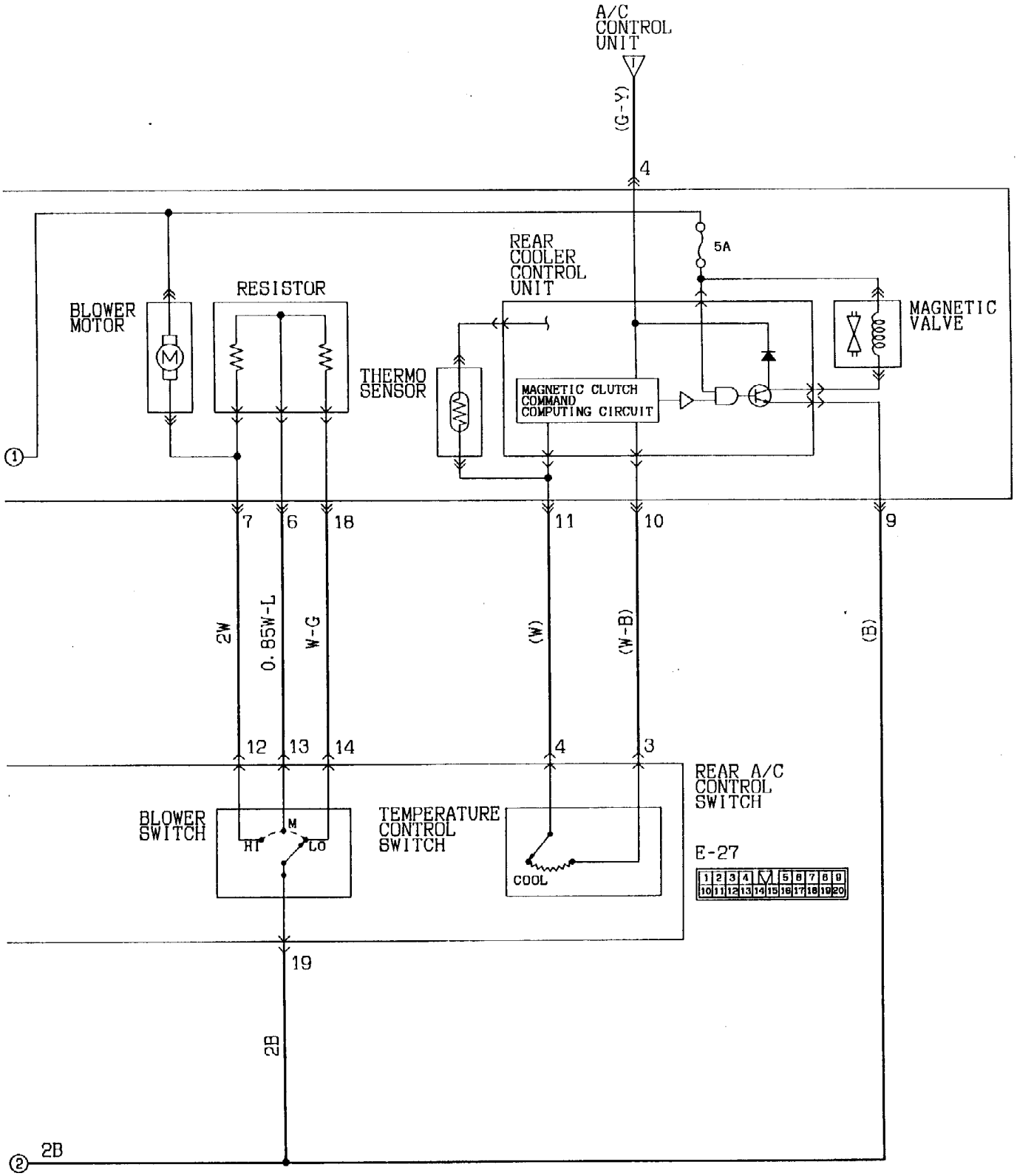

Wire colour code

B:Black	LG:Light green	G:Green	L:Blue	W:White	Y:Yellow	SB:Sky blue
BR:Brown	O:Orange	GR:Gray	R:Red	P:Pink	V:Violet	

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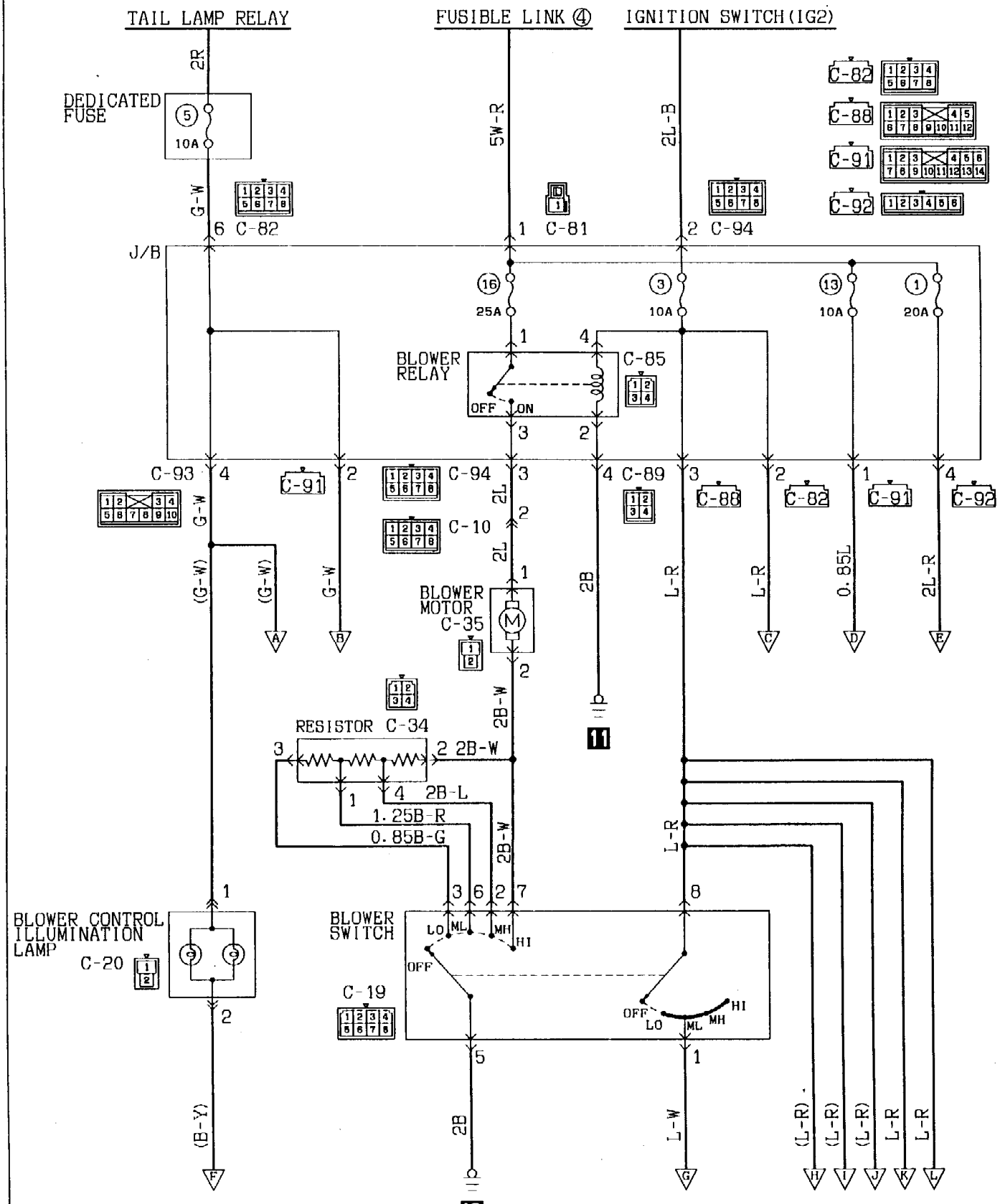
Diesel-powerd vehicles with rear heater



Wire colour code

B:Black	LG:Light green	G:Green	L:Blue	W:White	Y:Yellow	SB:Sky blue	
BR:Brown	O:Orange	GR:Gray	R:Red	P:Pink	V:Violet		

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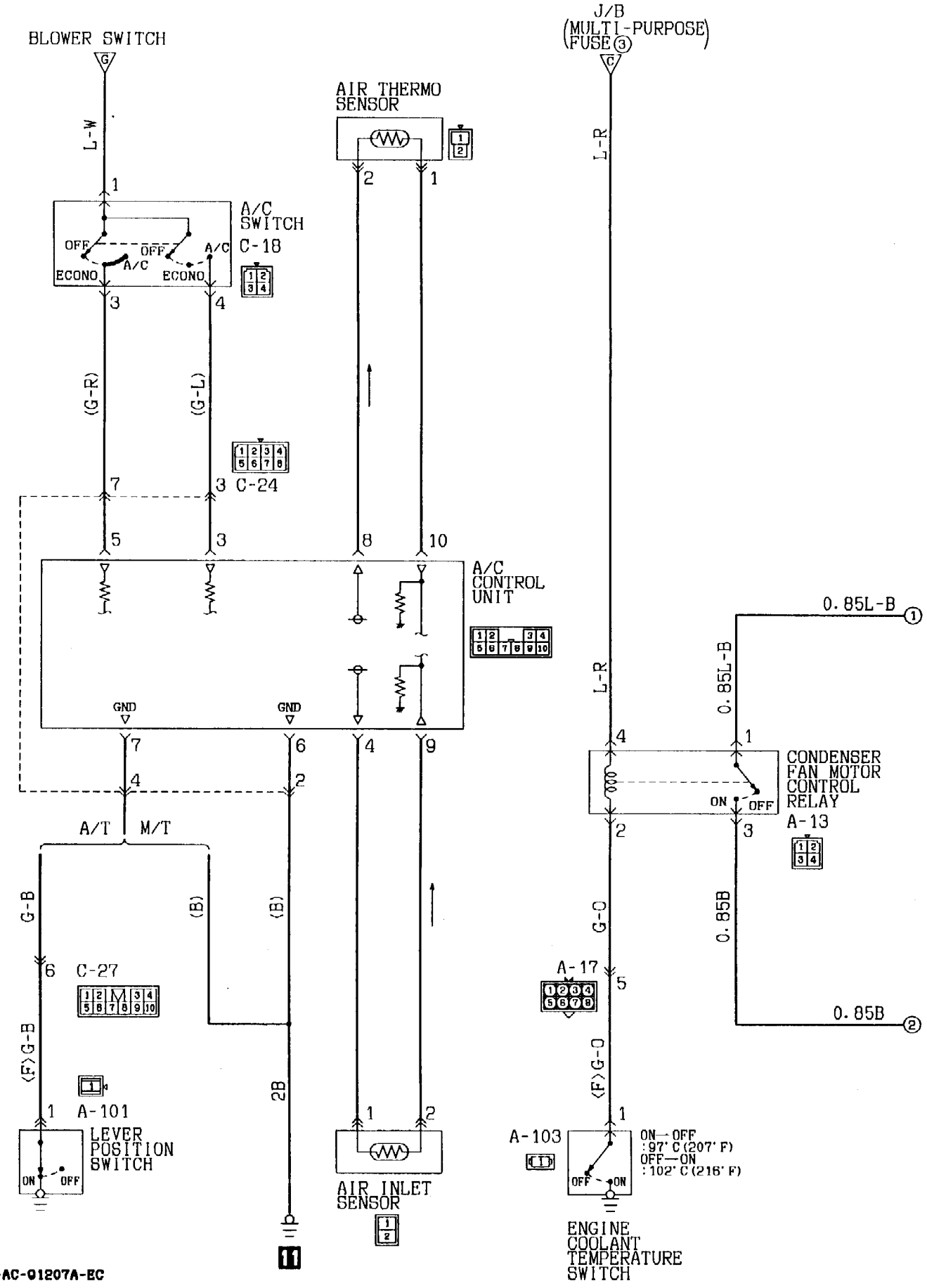

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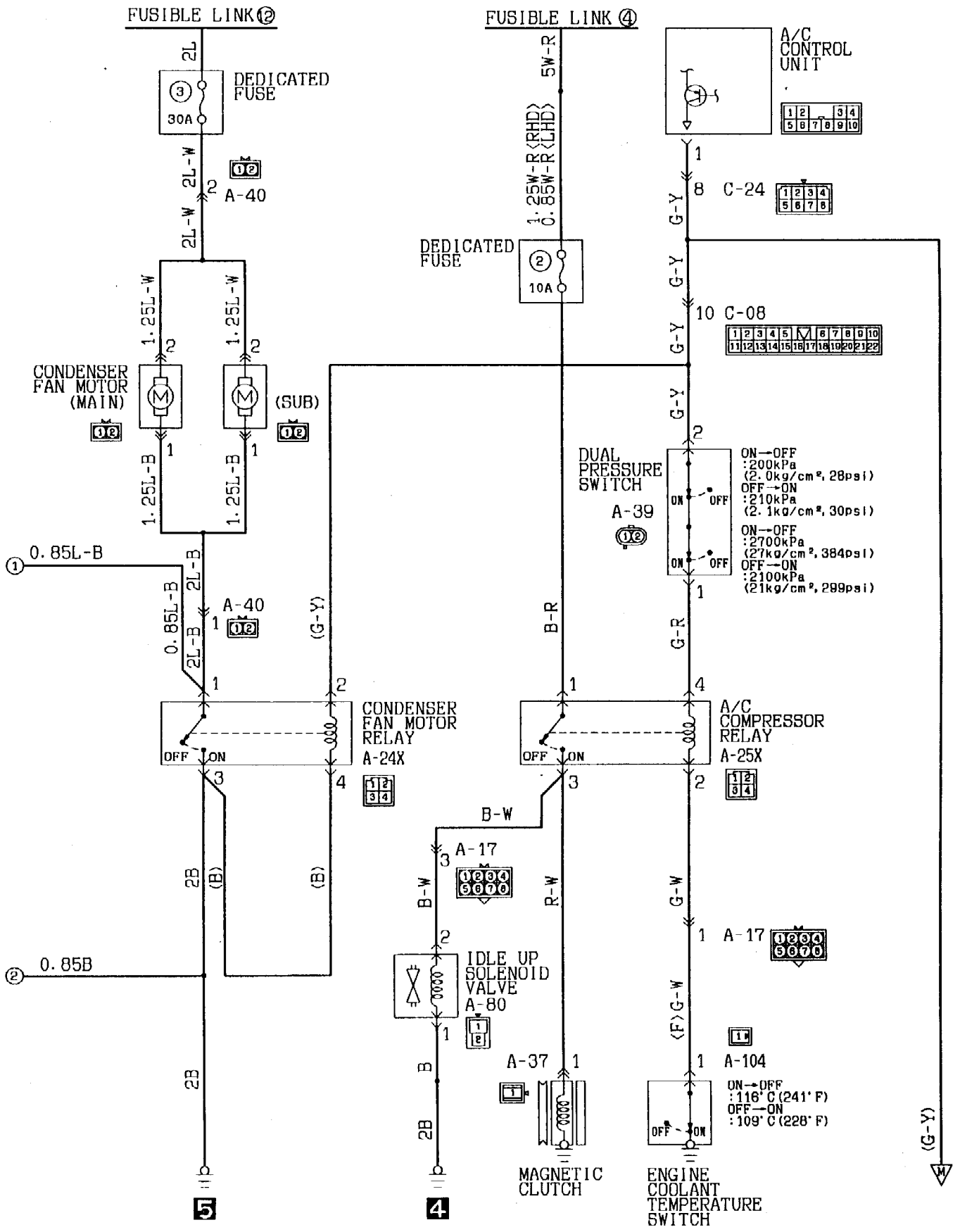
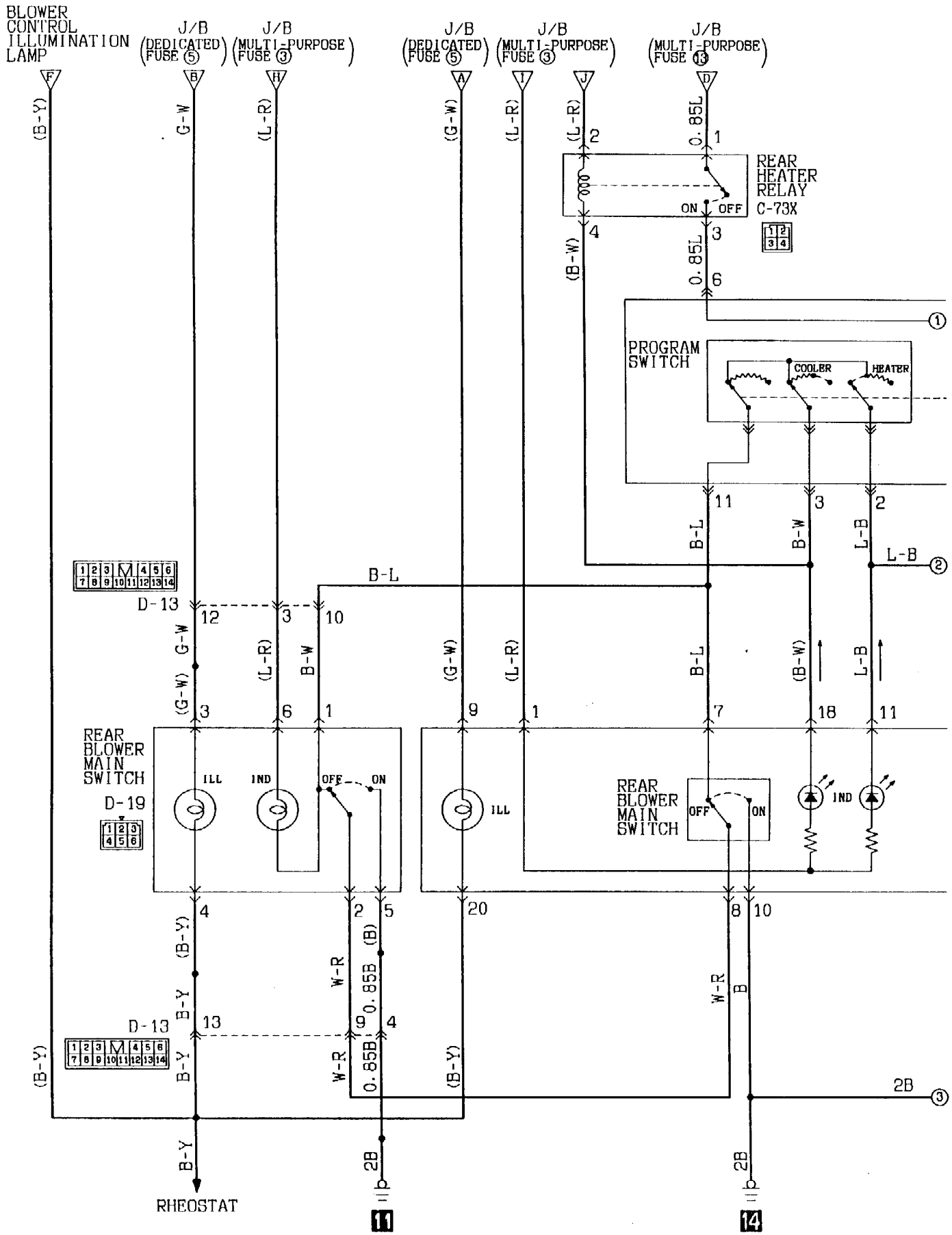

FUSIBLE LINK⑫
2L
③
30A
DEDICATED FUSE
2L-W
2
A-40
1.25L-W
1.25L-B
CONDENSER FAN MOTOR (MAIN)
(SUB)
0.85L-B
2L-B
(G-Y)
CONDENSER FAN MOTOR RELAY
A-24X
OFF
ON
2B
(B)
0.85B
5
FUSIBLE LINK④
5W-R
1.25W-R〈RHD〉
0.85W-R〈LHD〉
DEDICATED FUSE
②
10A
A/C CONTROL UNIT
8 C-24
10 C-08
G-Y
DUAL PRESSURE SWITCH
A-39
ON→OFF :200kPa (2.0kg/cm², 28psi)
OFF→ON :210kPa (2.1kg/cm², 30psi)
ON→OFF :2700kPa (27kg/cm², 384psi)
OFF→ON :2100kPa (21kg/cm², 299psi)
B-R
G-R
A/C COMPRESSOR RELAY
A-25X
B-W
A-17
R-W
G-W
IDLE UP SOLENOID VALVE
A-80
B
A-37
MAGNETIC CLUTCH
4
〈F〉G-W
A-104
ON→OFF :116°C (241°F)
OFF→ON :109°C (228°F)
ENGINE COOLANT TEMPERATURE SWITCH
(G-Y)



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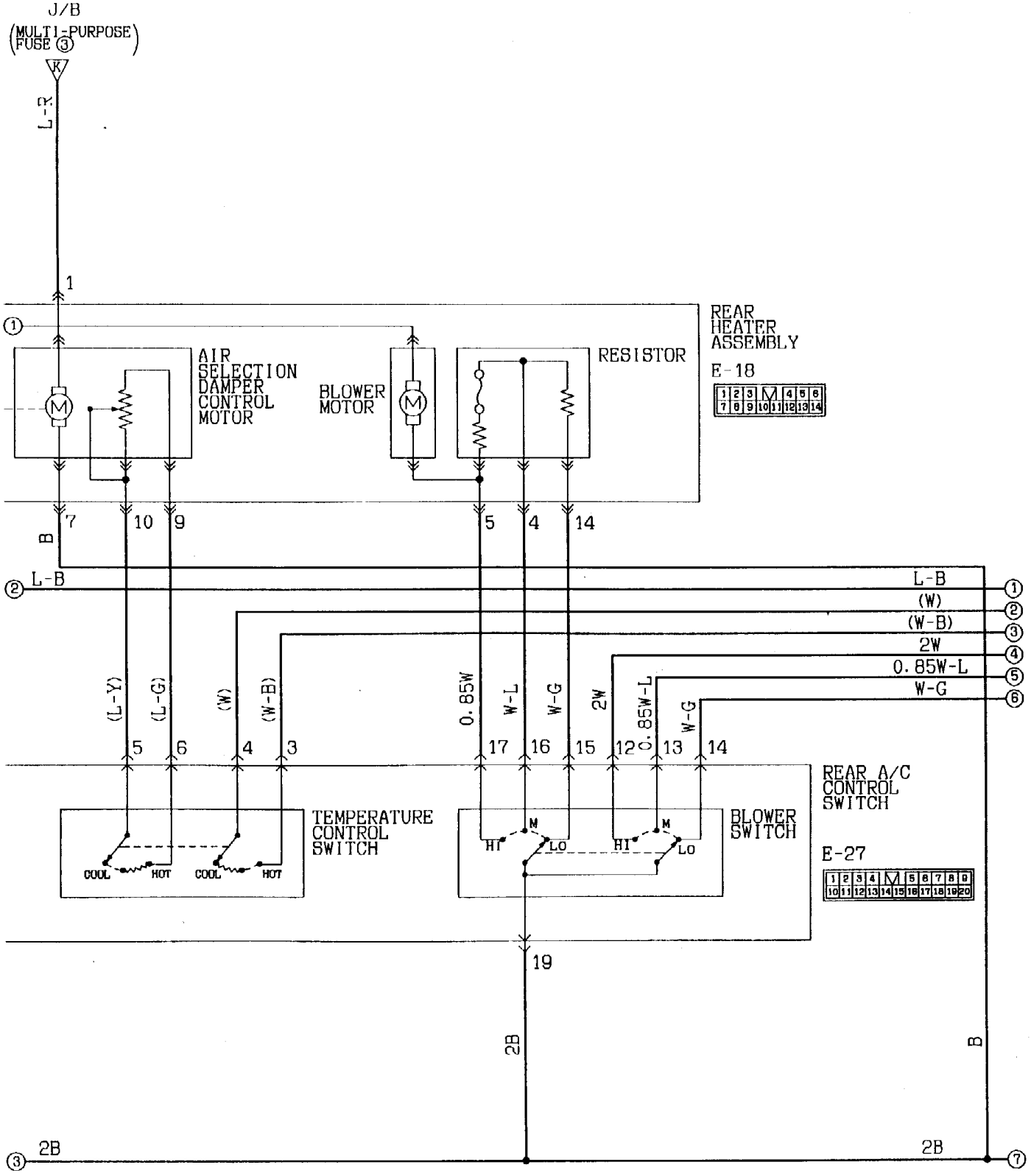

Wire colour code

B:Black	LG:Light green	G:Green	L:Blue	W:White	Y:Yellow	SB:Sky blue
BR:Brown	O:Orange	GR:Gray	R:Red	P:Pink	V:Violet	

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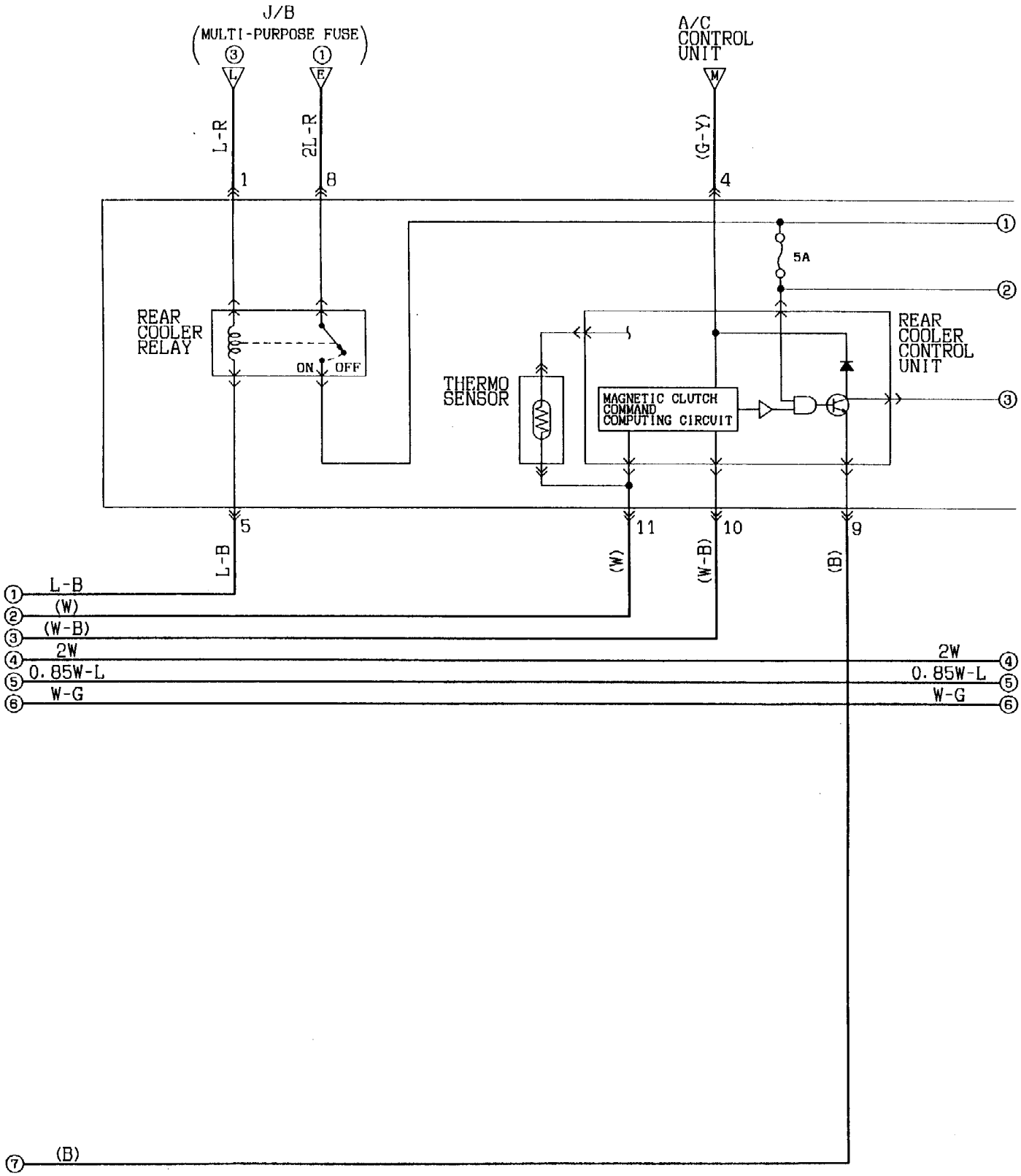

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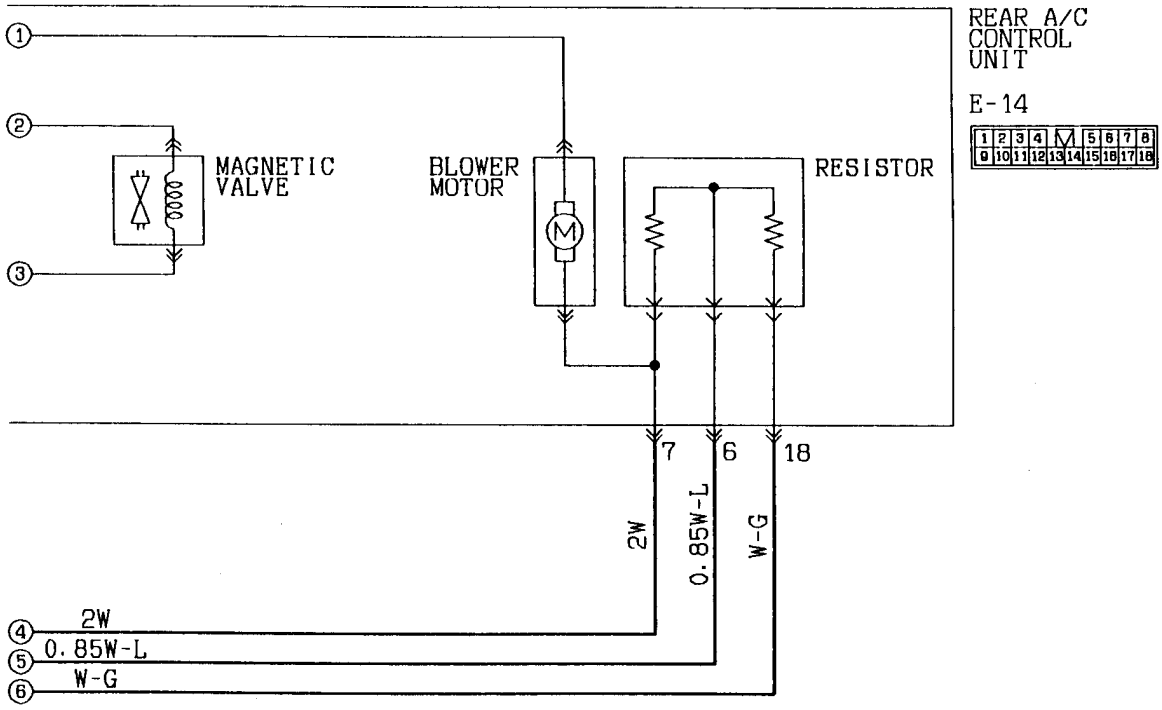

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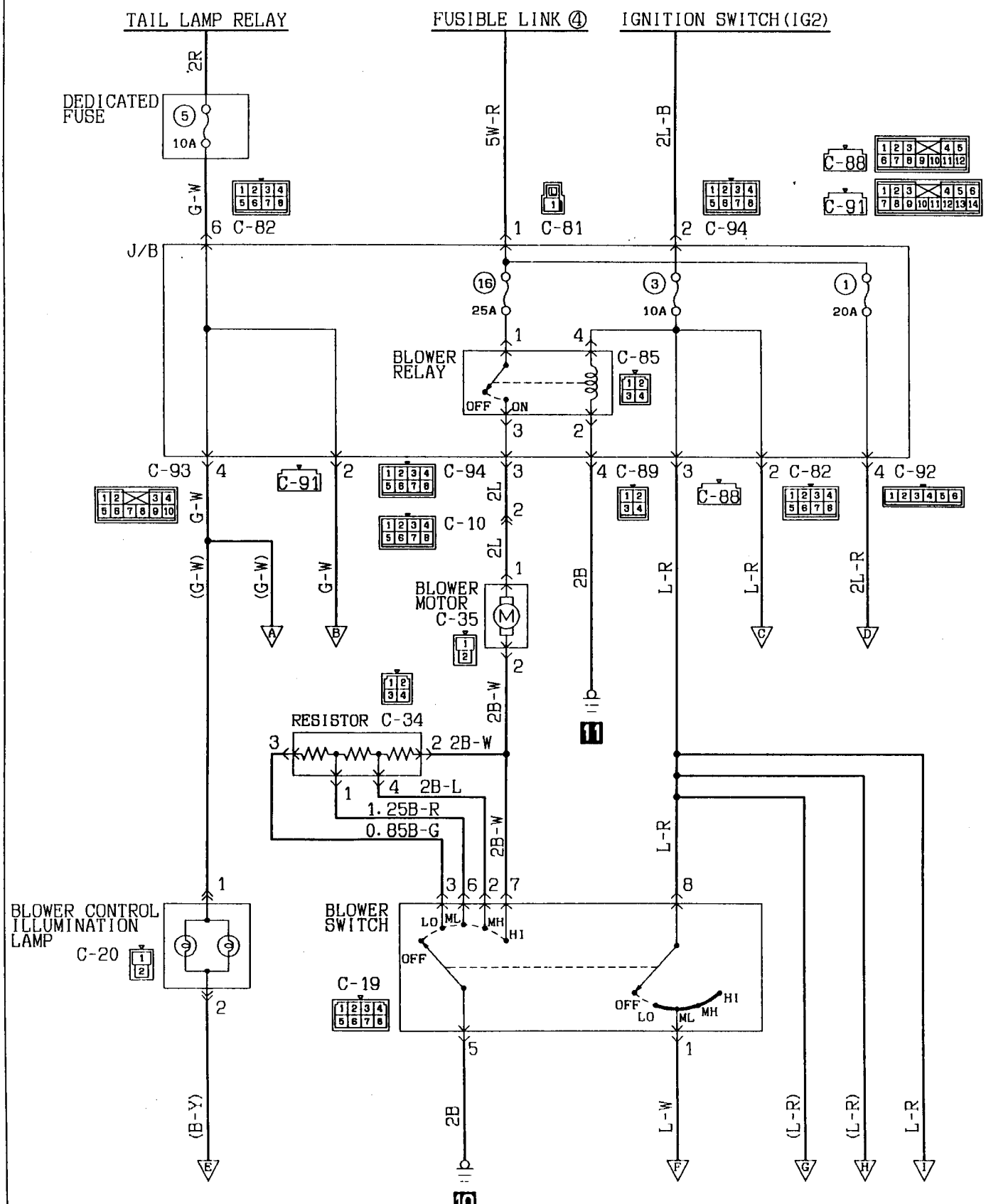
Diesel-powered vehicles without rear heater



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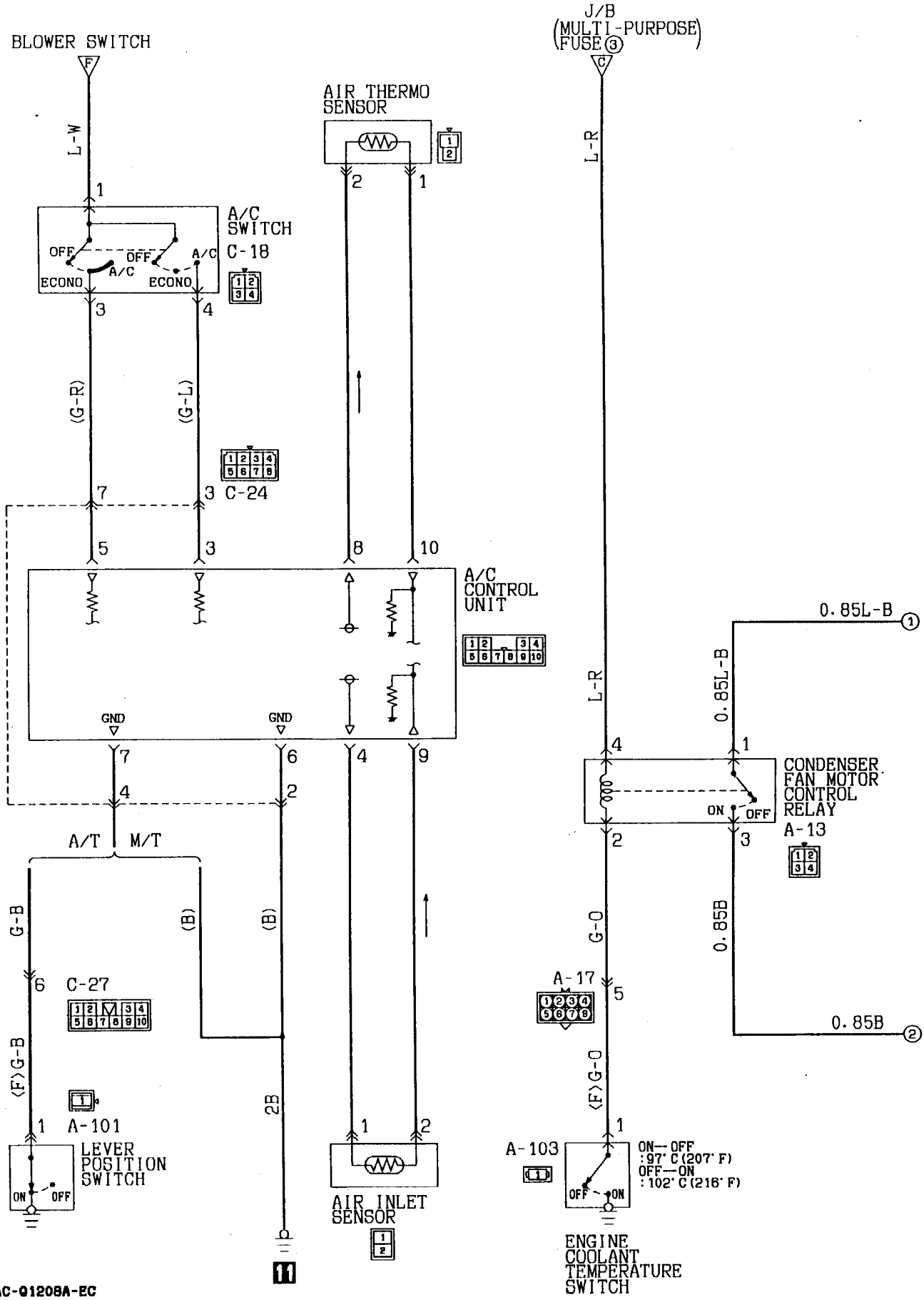

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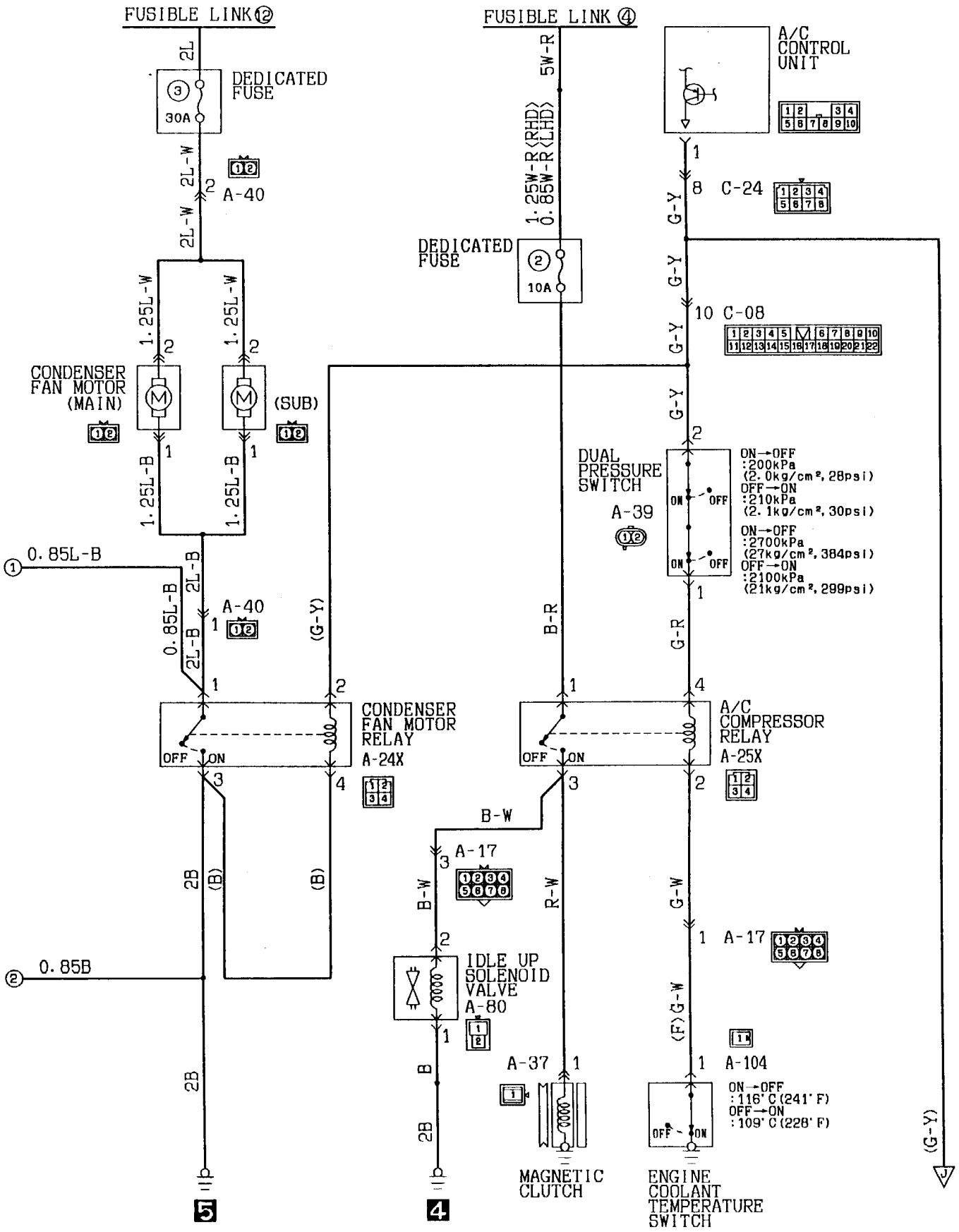

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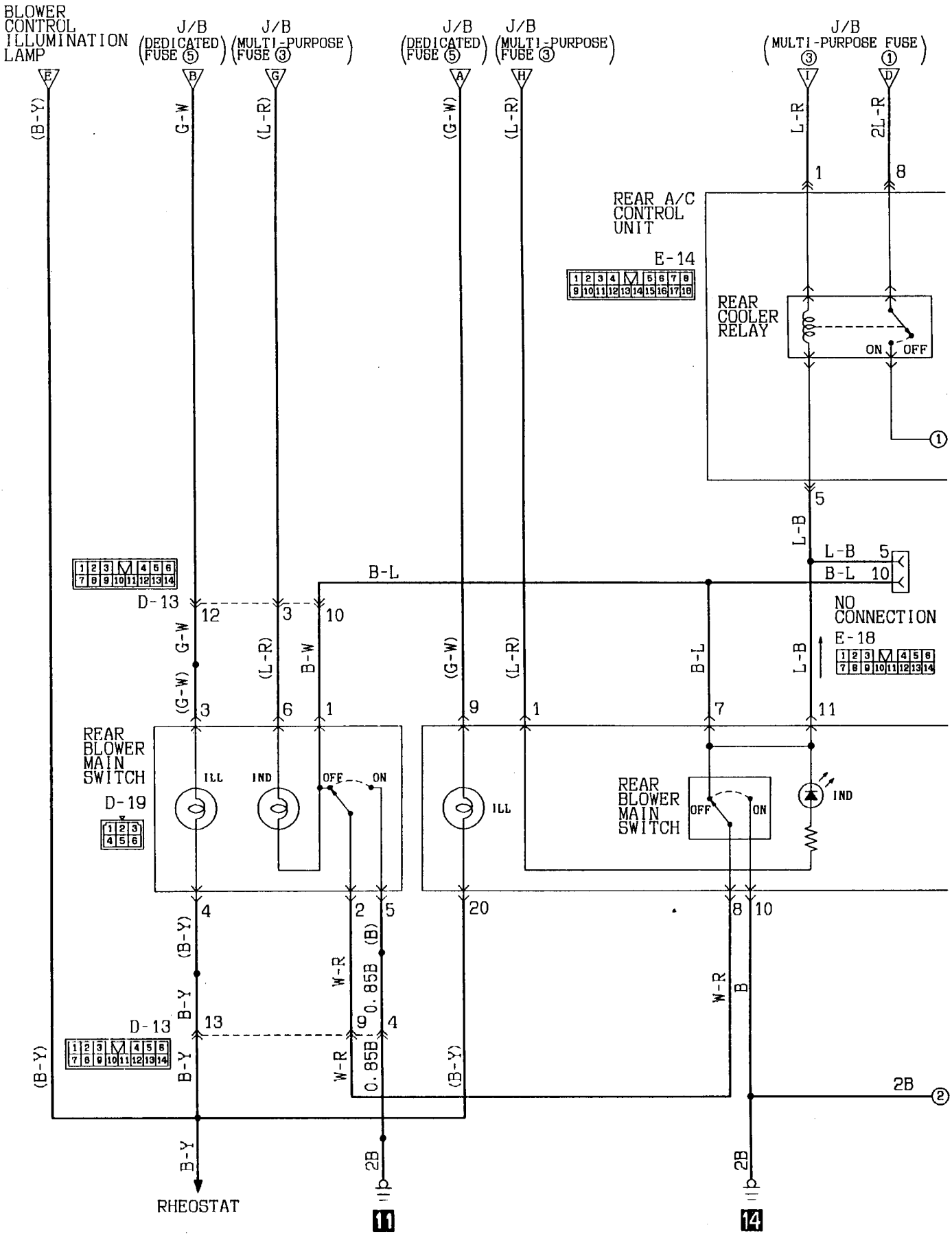

KX35-AC-91206B-EC

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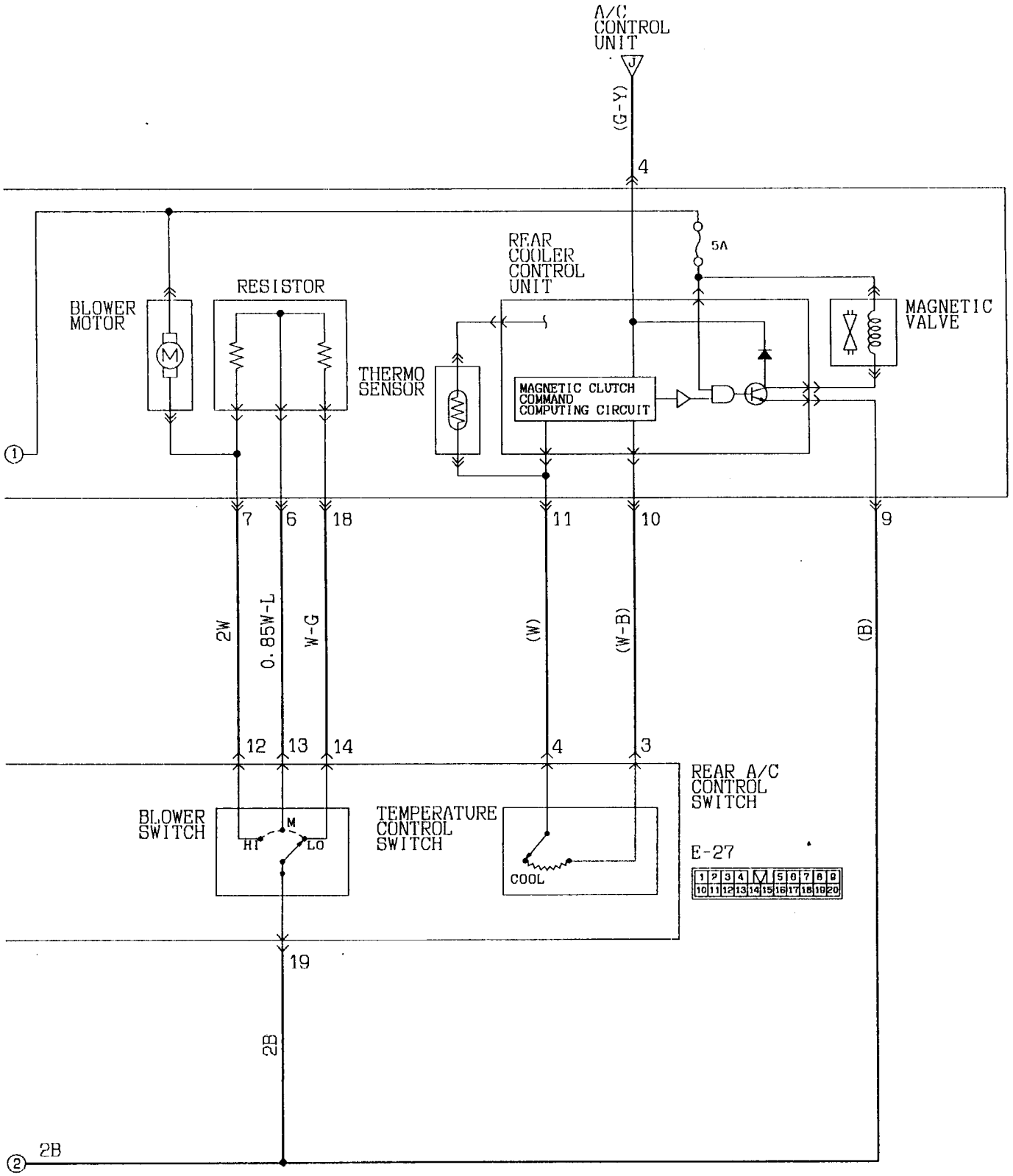

Wire colour code

B:Black	LG:Light green	G:Green	L:Blue	W:White	Y:Yellow	SB:Sky blue
BR:Brown	O:Orange	GR:Gray	R:Red	P:Pink	V:Violet	

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DUAL AIR CONDITIONER

<Vehicles built from November,1993>

Refer to "DUAL AIR CONDITIONER" OF '94 PAJERO Workshop Manual Electrical Wiring (Pub No. PHJE 9026).

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NOTES

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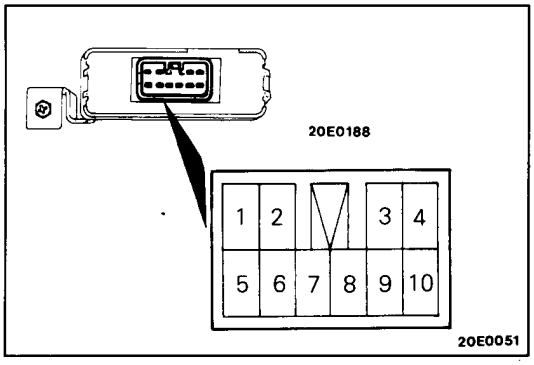

TROUBLESHOOTING HINTS

Inspection of Air Conditioner Control Unit

Disconnect the amplifier and inspect the connector on the wire harness side as shown in the chart below.

Test Conditions:

(1) Ignition switch: ON
(2) Air conditioner switch: ON
(3) Temperature control lever: MAX. COOL
(4) Blower switch: HI

Terminal No.	Signal	Conditions	Terminal voltage
1	Air conditioner output	When all conditions for switch-ON of the compressor are satisfied	System voltage
3	Air conditioner switch: A/C	Air conditioner switch A/C position	System voltage
4	Air-inlet sensor ⊕	Ignition switch, blower switch and air conditioner switch: ON	5.5 V
5	Air conditioner switch: ECONO or A/C	Air conditioner switch ECONO or A/C position	System voltage
6	Lever position switch	At all times	0 V
7	Air conditioner control unit ground	At all times	0 V
8	Air-thermo sensor ⊖	Between the terminals ⑧–⑩ [when the air temperature at the front evaporator outlet portion is 3°C (37°F)]	3.6 V
9	Air-inlet sensor ⊖	Between the terminals ④–⑨ [when the air temperature at the front evaporator inlet portion is 25°C (77°F)]	1.5 V
10	Air-thermo sensor ⊕	Ignition switch, blower switch and air conditioner switch: ON	5.5 V

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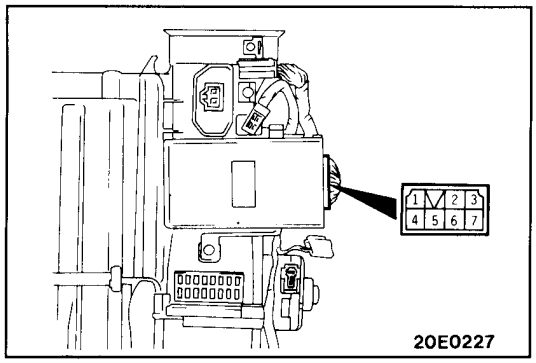

Inspection of rear cooler amp.
<Vehicles with dual air conditioner>

Disconnect the amplifier and inspect the connector on the wire harness side as shown in the chart below.

Test Conditions:

(1) Ignition switch: ON
(2) Air conditioner switch: ON
(3) Temperature control lever (front and rear): MAX. COOL
(4) Blower switch (front and rear): HI

Terminal No.	Signal	Conditions	Terminal voltage
1	Air-thermo sensor ⊕	At all times	5.5 V
2	Magnetic valve	Compressor: ON	0 V
3	Rear blower switch	Rear blower switch: ON	System voltage
4	Rear heater control assembly	Between the terminals ④–⑤ [when the air temperature at the rear evaporator outlet portion is 3°C (37°F)]	1.9 V
5	Air-thermo sensor ⊖	At all times	0 V
6	Front air conditioner switch	Front air conditioner switch: ON	System voltage
7	GND	At all times	0 V

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SAFETY PRECAUTIONS

E55XAAC

<Vehicles using R-12 refrigerant>

R-12 refrigerant is a chlorofluoro-carbon (CFC) that can contribute to the depletion of the ozone layer in the upper atmosphere.
Ozone filters out harmful radiation from the sun. To assist in protecting the ozone layer, Mitsubishi Motors Corporation recommends that a R-12 refrigerant recycling device that meets SAE standard J1991 be used.
Contact an automotive service equipment supplier for refrigerant recycling equipment that is available in your area.
The refrigerant used in all air conditioner is R-12. It is transparent and colourless in both liquid and vapour state. Since it has a boiling point of –29.8°C (–21.7°F), at atmospheric pressure, it will be a vapour at all normal temperatures and pressures. The vapour is heavier than air, nonflammable, and nonexplosive. It is nonpoisonous except when it is in direct contact with open flame. It is noncorrosive except when combined with water. The following precautions must be observed when handling R-12.

Caution
Wear safety goggles when servicing the refrigeration system.

R-12 evaporates so rapidly at normal atmospheric pressures and temperatures that it tends to freeze anything it contacts. For this reason, extreme care must be taken to prevent any liquid refrigerant from contacting the skin and especially the eyes. Always wear safety goggles when servicing the refrigeration part of the air conditioning system. Keep a bottle of sterile mineral oil handy when working on the refrigeration system. Should any liquid refrigerant get into the eyes, use a few drops of mineral oil to wash them out. R-12 is rapidly absorbed by the oil Next, splash the eyes with plenty of cool water. Call your doctor immediately even though irritation has ceased after treatment.

Caution
Do not heat R-12 above 40°C (104°F).

In most instances, moderate heat is required to bring the pressure of the refrigerant its container above the pressure of the system when charging or adding refrigerant. A bucket or large pan of hot water not over 40°C (104°F) is all the heat required for this purpose. Do not heat the refrigerant container with a blow torch or any other means that would raise temperature and pressure above this temperature. Do not weld or steam clean on or near the system components or refrigerant lines.

Caution
Keep R-12 containers upright when charging the system.

When adding R-12 into the refrigeration system, keep the supply tank or cans in an upright position. If the refrigerant container is on its side or upside down, liquid refrigerant will enter the system and damage the compressor.

Caution
Always work in a well-ventilated room.

Good ventilation is vital in the working area.
Although R-12 vapour is normally nonpoisonous, contact with an open flame can cause the vapour to become very poisonous.
A poisonous gas is produced when using the flame-type leak detector. Avoid inhaling the fumes from the leak detector.

Caution
Do not allow liquid refrigerant to touch bright metal.

Refrigerant will tarnish bright metal and chrome surfaces, and in combination with moisture can severely corrode all metal surfaces.

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<Vehicles using R-134a refrigerant>

Because R-134a refrigerant is a hydrofluorocarbon (HFC) which contains hydrogen atoms in place of chlorine atoms, it will not cause damage to the ozone layer.
Ozone filters out harmful radiation from the sun. To assist in protecting the ozone layer, Mitsubishi Motors Corporation recommends an R-134a refrigerant recycling device.
Refrigerant R-134a is transparent and colorless in both the liquid and vapor state. Since it has a boiling point of -29.8°C (-21.7°F), at atmospheric pressure, it will be a vapour at all normal temperatures and pressures. The vapor is heavier than air, non-flammable, and nonexplosive. The following precautions must be observed when handling R-134a.

Caution
Wear safety goggles when servicing the refrigeration system.

R-134a evaporates so rapidly at normal atmospheric pressures and temperatures that it tends to freeze anything it contacts. For this reason, extreme care must be taken to prevent any liquid refrigerant from contacting the skin and especially the eyes. Always wear safety goggles when servicing the refrigeration part of the A/C system. Keep a bottle of sterile mineral oil handy when working on the refrigeration system. Should any liquid refrigerant get into the eyes, use a few drops of mineral oil to wash them out. R-134a is rapidly absorbed by the oil. Next splash the eyes with plenty of cool water. Call your doctor immediately even though irritation has ceased after treatment.

Caution
Do not heat R-134a above 40°C (104°F).

In most instances, moderate heat is required to bring the pressure of the refrigerant in its container above the pressure of the system when charging or adding refrigerant.
A bucket or large pan of hot water not over 40°C (104°F) is all the heat required for this purpose. Do not heat the refrigerant container with a blow torch or any other means that would raise temperature and pressure above this temperature. Do not weld or steam clean on or near the system components or refrigerant lines.

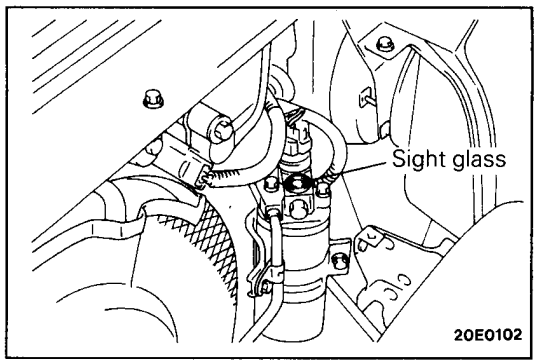
Caution
Keep R-134a containers upright when charging the system.

When adding R-134a into the refrigeration system keep the supply tank or cans in an upright position. If the refrigerant container is on its side or upside down, liquid refrigerant will enter the system and damage the compressor.

Caution
1. **A leak detector for designed R-134a should be used to check for refrigerant gas leaks.**
2. **Do not allow liquid refrigerant to touch bright metal.**

Refrigerant will tarnish bright metal and chrome surfaces, and in combination with moisture can severely corrode all metal surfaces.

NOTES



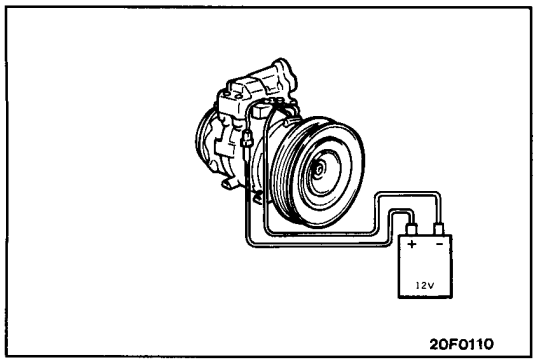
SERVICE ADJUSTMENT PROCEDURES

TEST PROCEDURES E55FABC

SIGHT GLASS REFRIGERANT LEVEL TEST

The sight glass is a refrigerant level indicator. To check the refrigerant level, clean the sight glass and start the vehicle engine. Push the air conditioner button to operate the compressor, place the blower switch to high and move the temperature control lever to max cool. After operating for a few minutes in this manner, check the sight glass.

(1) If the sight glass is clear, the magnetic clutch is engaged,the compressor discharge line is warm and the compressor inlet line is cool; the system has a full charge.
(2) If the sight glass is clear, the magnetic clutch is engaged and there is no significant temperature difference between compressor inlet and discharge lines; the system has lost most of it refrigerant charge.
(3) If the sight glass shows foam or bubbles, the system could be low on charge. The system has to be tested, leak checked then recharged with refrigerant.



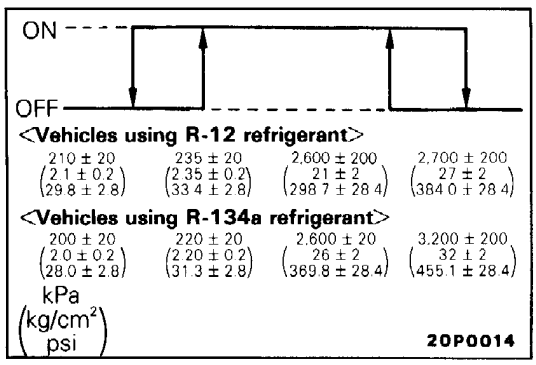
MAGNETIC CLUTCH

(1) Disconnect the wiring from the magnetic clutch.
(2) Connect battery (−) to compressor body.
(3) Connect battery (+) voltage directly to wiring for the magnetic clutch.
(4) If the magnetic clutch is normal, there will be a "click". If the pulley and armature do not make contact ("click"), there is a malfunction.

RECEIVER DRIER

To Test the Receiver Drier

(1) Operate the unit and check the piping temperature by touching the receiver drier outlet and inlet.
(2) If there is a difference in the temperatures, the receiver drier is restricted.
Replace the receiver drier.



DUAL PRESSURE SWITCH

Measure the pressure at the high pressure side. When the dual pressure switch is ON as in the figure at left, and if there is continuity between the dual pressure switch terminals, then the condition is normal; if there is no continuity, replace the switch.

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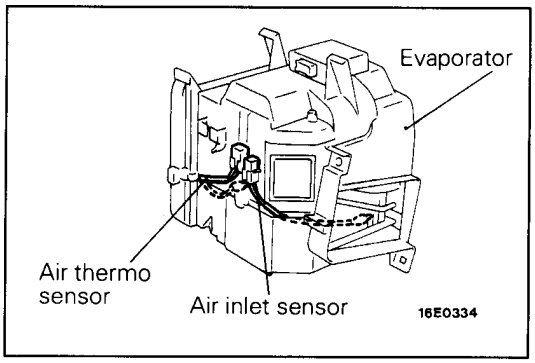
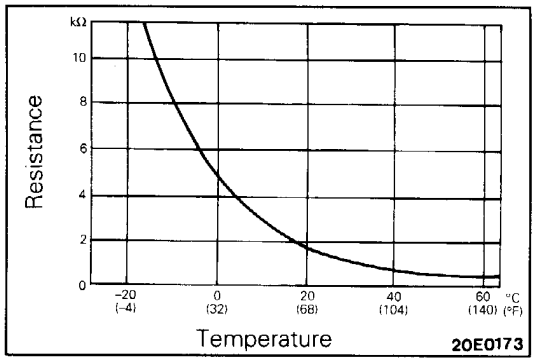
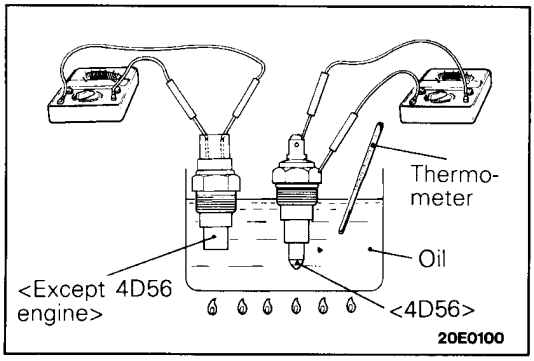


AIR-THERMO SENSOR AND AIR-INLET SENSOR

Disconnect the sensor's connector at the evaporator case and by using an ohmmeter, measure the resistance. If the resistance is within 10% of value of the characteristic curve, the sensor is functioning normally.



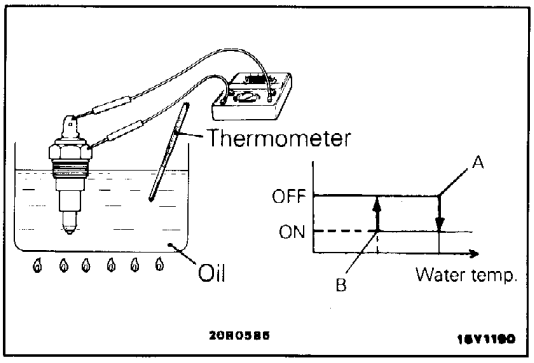


ENGINE COOLANT TEMPERATURE SWITCH

<For air conditioner switch off>

(1) Dip the engine coolant temperature switch in oil and heat the oil with a gas burner or similar item.
(2) When the oil temperature reaches the standard value, check that there is no continuity between the switch terminals.

Standard value: **<Except 4D56 engine>**
More than 112–118°C (234–244°F)
<4D56>
More than 114–118°C (237–244°F)



<For condenser fan>

(1) Dip the engine coolant temperature switch in oil as shown in the illustration.
(2) Check the continuity with a circuit tester as the temperature of the oil changes, and the condition is normal if the continuity is within the following ranges.

<4D56>

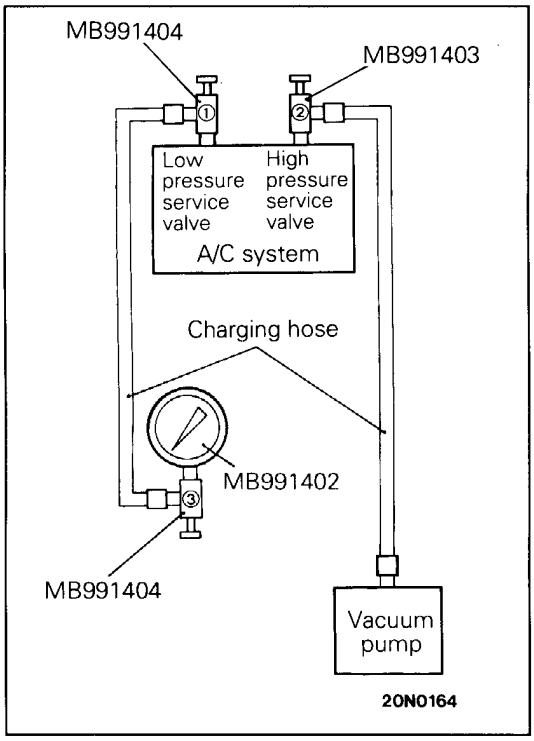
Item	Standard value
Continuity (temperature at point A)	More than 99–105°C (210–221°F)
No continuity (temperature at point B)	Less than 97°C (206°F)

<4M40>

Item	Standard value
Continuity (temperature at point A)	More than 101–105°C (214–221°F)
No continuity (temperature at point B)	Less than 98°C (208°F)

COMPRESSOR DRIVE BELT ADJUSTMENT E55FWAD

Refer to GROUP 11 – Engine Adjustment.



CHARGING <Vehicles using R-12 refrigerant> E55FUBB

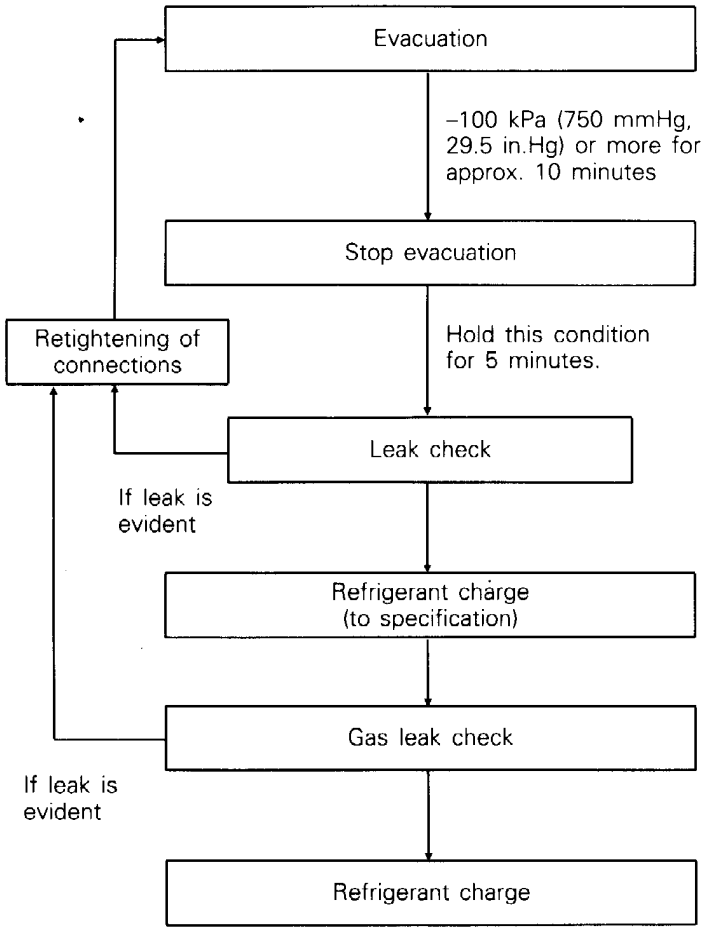
CHARGING THE SYSTEM

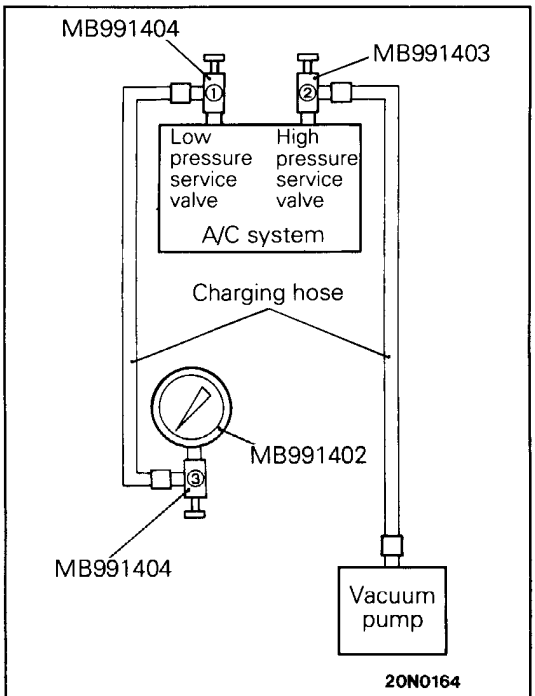
<In case the vacuum gauge is used>

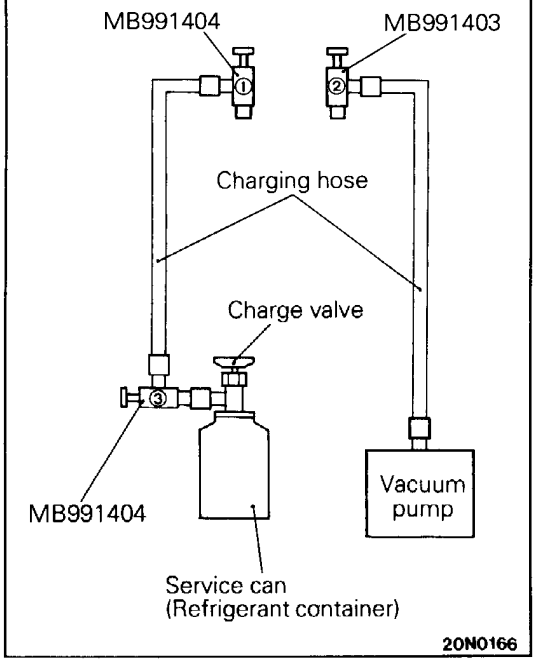
(1) With the handle of the special tools ① and ② turned back all the way (valve closed), install the special tools ① and ② to each high and low pressure service valve.

NOTE
The high and low pressure service valves are attached to the compressor.

(2) Tighten the handle of the special tools ① and ② (valve open).
(3) Connect the charging hose to the special tools ① and ②.
(4) With the handle of the special tool ③ tightened (valve open), install the special tool ③ to the low pressure charging hose.
(5) Install the vacuum gauge (MB991402) to the special tool ③.
(6) Install the vacuum pump to the high pressure charging hose.







(7) Start up the vacuum pump.
(8) Evacuate to a vacuum reading of -100 kPa (750 mmHg, 29.5 in.Hg) or higher (approx. 10 minutes).

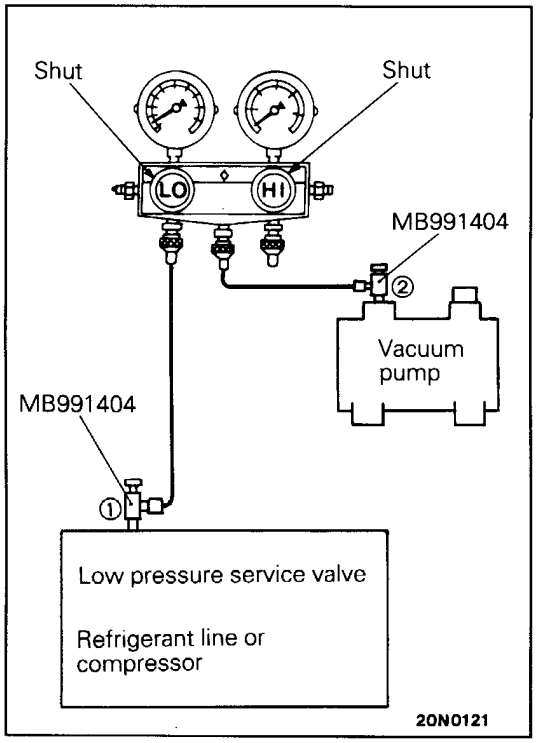
Caution
The vacuum reading should always be made with the vacuum gauge in an upright position, otherwise the reading will be erratic.

(9) Turn the handle of the special tool ② back all the way (valve closed).
(10) Stop the vacuum pump and allow to stand for 5 minutes.
(11) Check for leaks. (Good if the vacuum is held.)
(12) With the handle of the charge valve turned back all the way (valve open), install the charge valve.
(13) With the handle of the special tool ③ turned back all the way (valve closed), remove the vacuum gauge and install the service can.
(14) Tighten the handle of charge valve (valve closed) to puncture the service can.
(15) Turn the handle of charge valve back (valve open) and tighten the special tool ③ handle (valve open), to charge the system with refrigerant.
(16) If the refrigerant is not drawn in, turn the handle of the special tool ① back all the way (valve closed).
(17) Check for gas leaks using a leak detector.
(18) Start the engine.
(19) Operate the air conditioner and set at the lowest temperature. (MAX. COOL).
(20) Fix the engine speed at 1,500 r/min.
(21) Tighten the handle of the special tool ① fully (valve open) to charge the required volume of refrigerant.

Caution
If the service can is inverted, liquid refrigerant may be drawn into the compressor damaging it by liquid compression. Keep the service can upright to ensure that refrigerant is charged in gas state.

(22) After charging with refrigerant, turn the handle of the special tool ① back all the way (valve closed).
(23) Tighten the charge valve handle (valve closed).
(24) Remove the special tools ① and ② from the high and low pressure service valves.
(25) Remove the service can.

NOTE
If the service can is not emptied completely, keep the charge valve and special tools ① and ③ in closed condition for next charging.

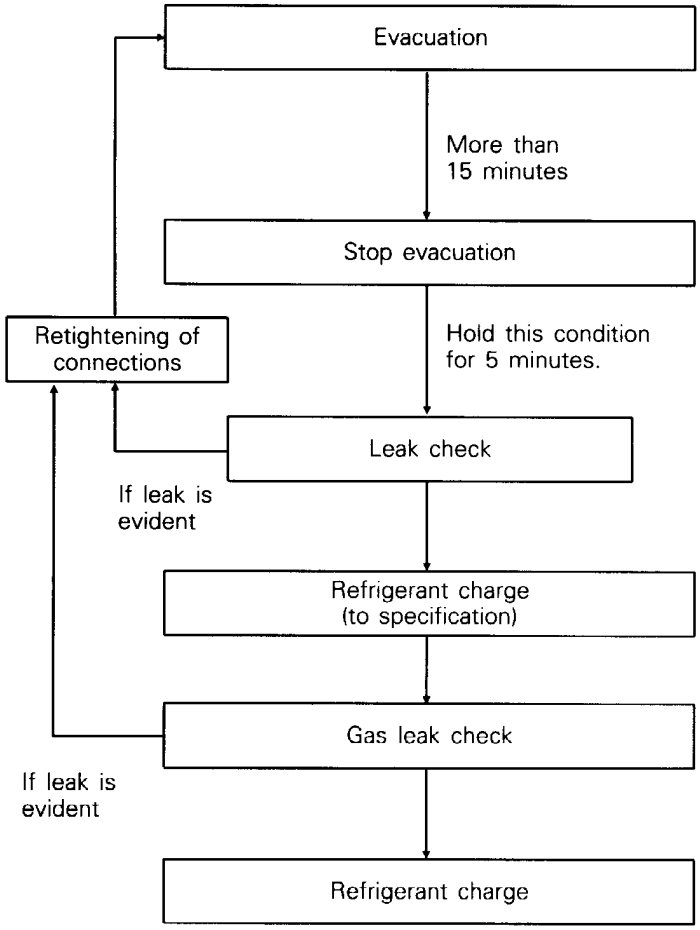


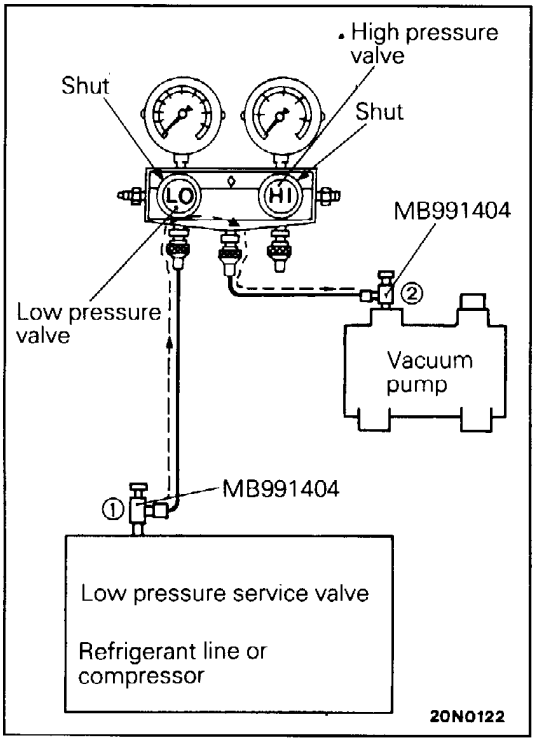
<In case the gauge manifold is used>

(1) Turn back the handle of the special tools ① and ② (valve closed) to install the special tools ① and ② the low pressure service valve and vacuum pump.

NOTE
The high and low pressure service valve are attached to the compressor.

(2) Close the high and low pressure valves of the gauge manifold.
(3) Connect the charging hose to the special tools ① and ② as illustrated.
(4) Tighten the handle of the special tools ① and ② (valve open).





(5) Start up the vacuum pump.

Caution
1. Do not use the compressor for evacuation.
2. Do not operate the compressor in the vacuum condition; damage may occur.

(6) Evacuate to a vacuum reading of -100 kPa (1.0 kg/cm², 14.2 psi) or higher (approx. 10 minutes).
(7) Turn back the handle of the adaptor valve ② (valve closed).
(8) Stop the vacuum pump and allow to stand for 5 minutes.
(9) Check for leaks. (Good if the vacuum is held.)

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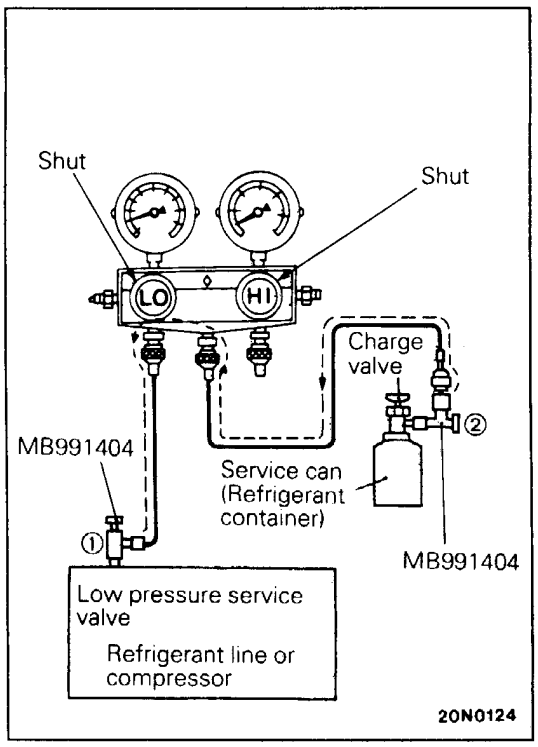

(10) Tighten the charge valve handle to puncture the service can.
(11) Turn back the handle of the charge valve tighten the handle of the adaptor valve ② (valve open).

(12) Open the low pressure valve of the gauge manifold to charge refrigerant.

Caution
If the service can is inverted, liquid refrigerant may be drawn into the compressor damaging it by liquid compression. Keep the service can upright to ensure that refrigerant is charged in gas state.

(13) When refrigerant is no longer drawn in, turn back the handle of the adaptor valve ① (valve closed).
(14) Check for gas leaks using a leaks detector.
(15) Start the engine.
(16) Operate the air conditioner and set it to the lowest temperature (MAX. COOL).
(17) Fix the engine at 1,500 r/min.
(18) Tighten the handle of the special tool ① (valve open) and charge refrigerant to the specified amount.

Caution
If the service can is inverted, liquid refrigerant may be drawn into the compressor damaging it by liquid compression. Keep the service can upright to ensure that refrigerant is charged in gas state.

(19) After finishing charging refrigerant, turn back the handle of the special tool ① (valve closed).
(20) Tighten the charge valve handle (valve closed).
(21) Remove the special tool ① from the low pressure service valve.
(22) Remove the service can.

NOTE
If the service can is not emptied completely, keep the charge valve and special tool ② in closed condition for next charging.

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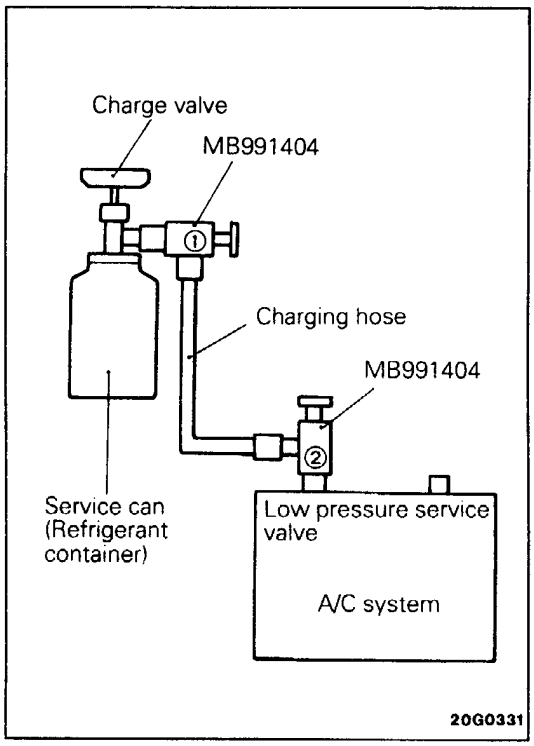


CORRECTING LOW REFRIGERANT LEVEL

In case the service can is used

(1) Install the charge valve to the service can with its handle turned back all the way (valve opened).
(2) Install to the charge valve with the special tool ① tightened (valve open).
(3) Install the charging hose to the special tool ①.
(4) Turn back the handle of the special tool ② all the way (valve closed) to install the charging hose.
(5) Tighten the handle of charge valve (valve closed) to puncture the service can.
(6) Turn back the handle of the charge valve all the way to open the valve (valve open), operate the handle of the special tool ② to vacuum the air.
(7) Install the special tool ② to the low pressure side service valve.

Caution
Never use the high pressure side as this may cause refrigerant to flow back, causing rupture of the service can and charging hose.

(8) Start the engine.
(9) Operate the air conditioner and set it to the lowest temperature (MAX. COOL).
(10) Fix the engine speed at 1,500 r/min.
(11) Tighten the handle of the special tool ② (valve open) and charge refrigerant checking level with the sight glass.
(12) After working, make certain that the handle of the special tool ② is turned back all the way (valve closed) and then remove the special tool ②.

NOTE
If the service can is not emptied completely, keep the charge valve and special tools ① and ② in closed condition for next charging.

In case the refrigerant recovery and recycling unit is used

Charge the refrigerant by using a refrigerant and recycling unit.

NOTE
Refer to the refrigerant recovery and recycling unit instruction manual for operation of the unit.

DISCHARGING SYSTEM

Use the refrigerant recovery unit to discharge refrigerant gas from the system.

NOTE
Refer to the refrigerant recovery and recycling unit instruction manual for operation of the unit.

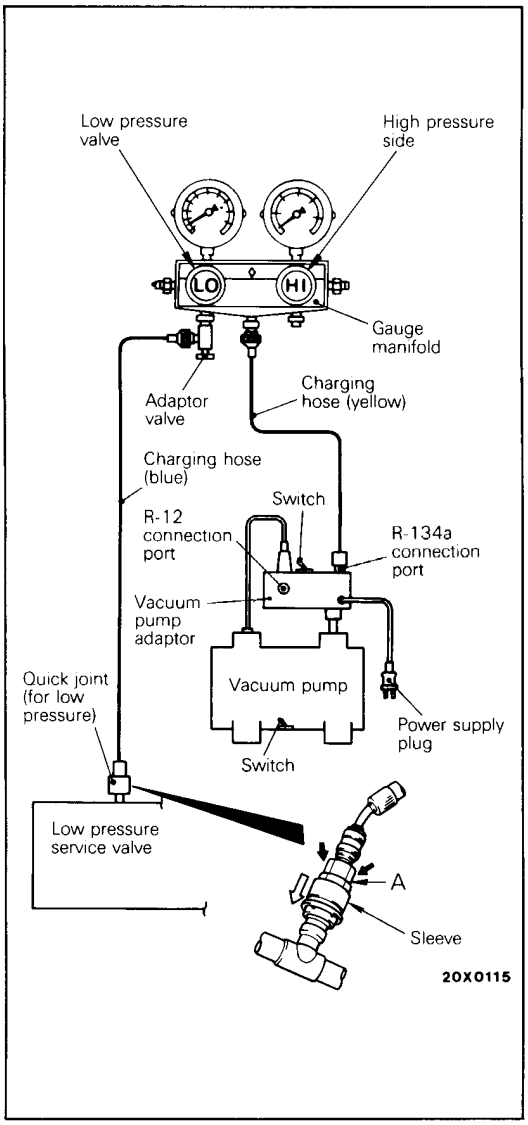
REFILLING OF OIL IN THE AIR-CONDITIONER SYSTEM

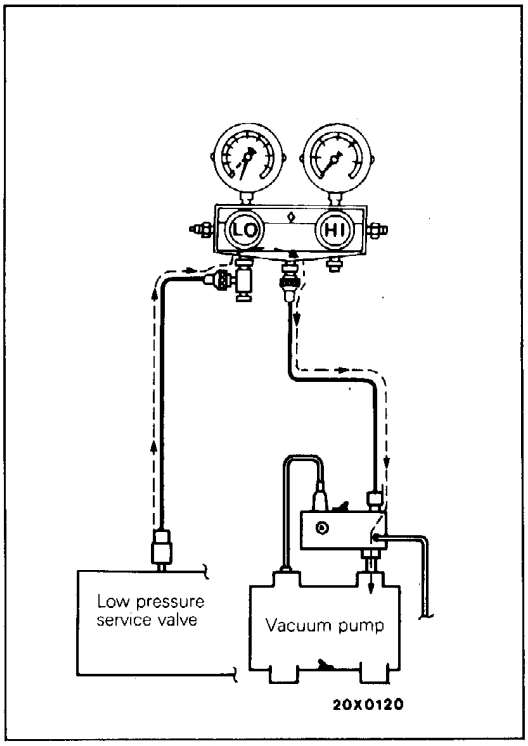
Too little oil will provide inadequate compressor lubrication and cause a compressor failure. Too much oil will increase discharge air temperature.
When a 10PA15 compressor is installed at the factory, it contains 80 cm^3 (4.9 cu.in.), *150 cm^3 (9.2 cu.in.) of refrigerant oil. While the air conditioning system is in operation, the oil is carried through the entire system by the refrigerant.
Some of this oil will be trapped and retained in various parts of the system.
When the following system components are charged, it is necessary to add oil to the system to replace the oil being removed with the component.

Compressor oil: DENSO oil 6
Quantity:

Evaporator:	**60 cm^3 (3.6 cu.in.)**
Condenser:	**30 cm^3 (1.8 cu.in.)**
Suction hose:	**10 cm^3 (0.6 cu.in.)**
Receiver:	**10 cm^3 (0.6 cu.in.)**

NOTE
* : Vehicles with dual air conditioner.





CHARGING <Vehicles using R-134a refrigerant>

E55AF05AA

1. With the handles turned back all the way (valve closed) install the adaptor valve to the low-pressure side of the gauge manifold.
2. Connect the charging hose (blue) to the adaptor valve.
3. Connect the quick joint (for low pressure) to the charging hose (blue).
4. Connect the quick joint (for low pressure) to the low pressure service valve.

   NOTE
   The low-pressure service valve should be connected to the compressor.

   Caution
   1. Use tools that are designed for R-134a.
   2. To install the quick joint, press section A firmly against the service valve until a click is heard. When connecting, run your hand along the hose while pressing to ensure that there are no bends in the hose.
5. Close the high and low pressure valves of the gauge manifold.
6. Install the vacuum pump adaptor to the vacuum pump.
7. Connect the vacuum pump plug to the vacuum pump adaptor.
8. Connect the charging hose (yellow) to the R-134a connection port of the vacuum pump adaptor.
9. Tighten the adaptor valve handle (valve open).
10. Open the low pressure valve of the gauge manifold.
11. Turn the power switch of the vacuum pump to the ON position.

    NOTE
    Even if the vacuum pump power switch is turned ON, the vacuum pump will not operate because of the power supply connection in step (7).
12. Turn the vacuum pump adaptor switch to the R-134a side to start the vacuum pump.

    Caution
    Do not operate the compressor during evacuation.
13. Evacuate to a vacuum reading of -100 kPa (1.0 kg/cm², 14.2 psi) or higher (takes approx. 10 minutes).
14. Turn the vacuum pump adaptor switch OFF and allow to stand it for 5 minutes.

    Caution
    Do not operate the compressor in the vacuum condition; damage may occur.
15. Carry out a leak test. (Good if the negative pressure does not drop.)

    Caution
    If the negative pressure (vacuum) is lost, check for loose connections. Then, repeat the evacuation procedure from step (12). If negative pressure (vacuum) is still lost, add 1 lb of refrigerant and check system using an R-134a compatible leak detector.

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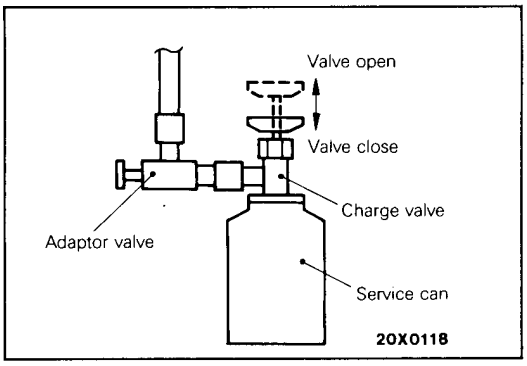
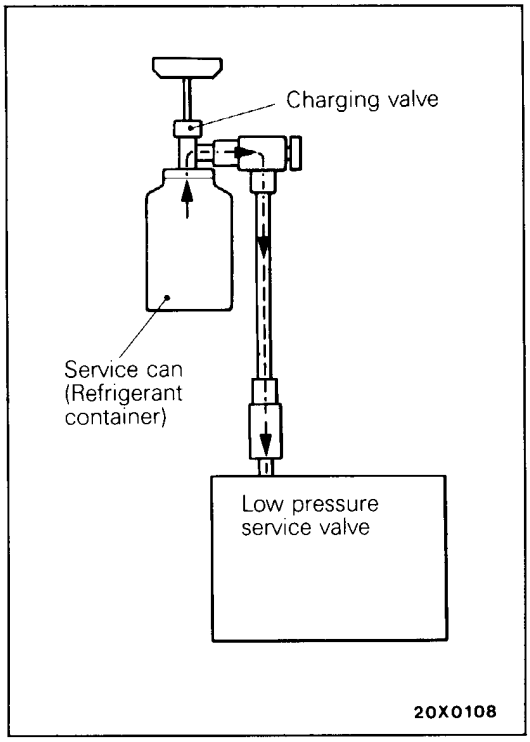


16. With the handle turned out all the way (valve open), install the charging valve to the service can.
17. Turn the handle of the adaptor valve back all the way (valve closed), remove it from the gauge manifold and install the service can.
18. Tighten the handle of the charging valve (valve closed) to puncture the service can.



19. Turn the handle of the charging valve back (valve open) and tighten the handle of the adaptor valve (valve open) to charge the system with refrigerant.

    Caution
    If the service can is inverted, liquid refrigerant may be drawn into the compressor damaging it by liquid compression. Keep the service can upright to ensure that refrigerant is charged in gas state.

20. If the refrigerant is not drawn in, turn the handle of the adaptor valve back all the way (valve closed).
21. Check for gas leaks using a leak detector.
    If a gas leak is detected, re-tighten the connections, and then repeat the charging procedure from evacuation in step (12).

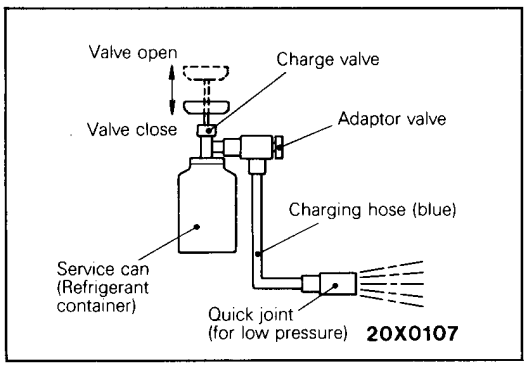
    Caution
    A leak detector designed for R-134a should be used.

22. Start the engine.
23. Operate the A/C and set to the lowest temperature (MAX. COOL).
24. Fix the engine speed at 1,500 r/min.
25. Tighten the handle of the adaptor valve (valve open) to charge the required volume of refrigerant.

    Caution
    If the service can is inverted, liquid refrigerant may be drawn into the compressor damaging it by liquid compression. Keep the service can upright to ensure that refrigerant is charged in gas state.

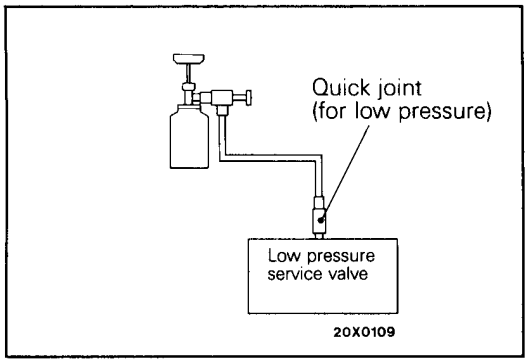
26. After charging with refrigerant, turn the handle of the adaptor valve back all the way (valve closed).
27. Tighten the charging valve handle (valve closed).
    Remove the quick joint (for low pressure) from the low-pressure service valve.

    NOTE
    If the service can is not emptied completely, keep the handles of the charging valve and adaptor valve closed for the next charging.



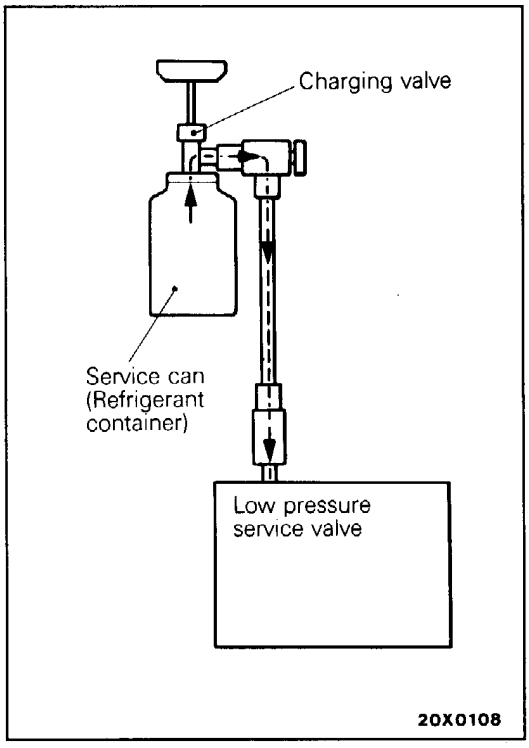
CORRECTING LOW REFRIGERANT LEVEL IN CASE THE SERVICE CAN IS USED

1. Install the charge valve with the handle turned all the way out (valve open) of the service can.
2. Install the adaptor valve with the handle turned all the way back (valve close) to the charging valve.
3. Connect the charging hose (blue) to the adaptor valve.
4. Connect the charging hose (blue) to the quick joint (for low pressure).
5. Tighten the handle of the charge valve (valve close), and pierce the service can.
6. Turn the handle of the adaptor valve to bleed the air.



7. Install the quick joint (for low pressure) to the low pressure service valve.

   NOTE
   The low-pressure service valve should be connected to the compressor.



8. Start the engine.
9. Operate the air conditioner and set at the lowest temperature (MAX. COOL).
10. Fix the engine speed at 1,500 r/min.
11. Tighten the handle of the adaptor valve (valve open), and replenish refrigerant checking the quantity through the sight glass.

    Caution
    If the service can is inverted, liquid refrigerant may be draw into the compressor damaging it by liquid compression. Keep the service can upright to ensure that refrigerant is charged in gas state.

12. After replenishing is completed, turn the handle of the adaptor valve all the way back (valve close), and remove the quick joint.

    NOTE
    If any refrigerant is remaining in the service can, close the adaptor valve and save the refrigerant for another vehicle. Do not release into the atmosphere.

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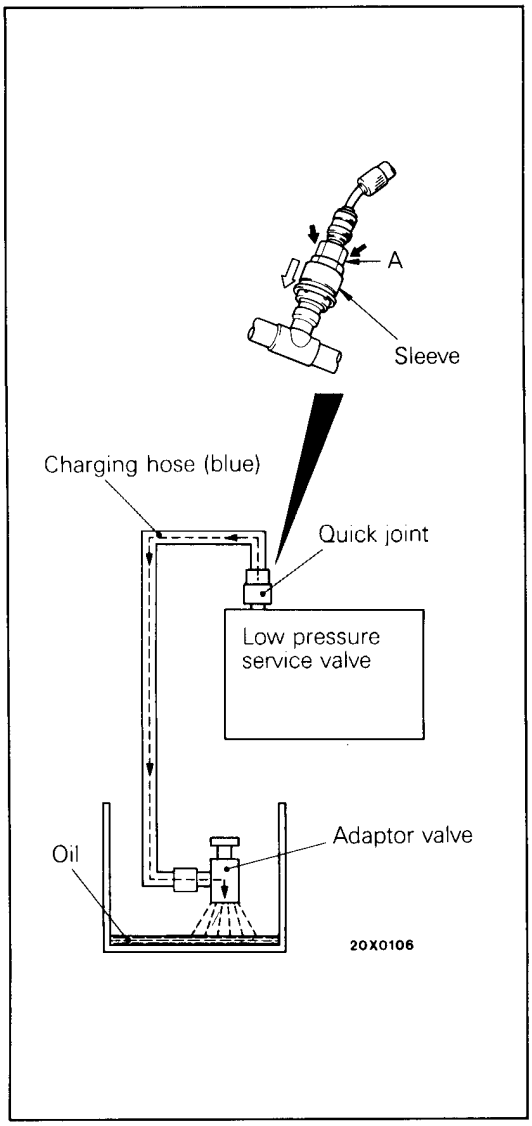

DISCHARGING SYSTEM

E55AF05CA

1. Turn the engine at an engine speed of 1200 – 1500 r/min for approximately 5 minutes with the A/C operating to return the oil.

   NOTE
   Returning the oil will be more effective if it is done while driving.
2. Stop the engine.
3. Connect the charging hose (blue) to the adaptor valve with its handle turned back all the way (valve closed).
4. Connect the quick joint to the charging hose (blue).
5. Install the quick joint to the low pressure service valve.

   NOTE
   The low-pressure service valve should be connected to the compressor.

   Caution
   To connect the quick joint, press section A firmly against the service valve until a click is heard.
   When connecting, run your hand along the hose while pressing to ensure that there are no bends in the hose.
6. Place the adaptor valve inside the container and discharge the refrigerant by opening the handle gradually so that oil does not gush out.

   NOTE
   Any oil remaining in the container should be returned to the A/C system.

REFILLING OF OIL IN THE AIR-CONDITIONER SYSTEM

Too little oil will provide inadequate compressor lubrication and cause a compressor failure. Too much oil will increase discharge air temperature.
When a 10PA15 compressor is installed at the factory, it contains 80 cm³ (4.9 cu.in.), *150 cm³ (9.2 cu.in.) of refrigerant oil.

NOTE
* : for dual A/C

While the air conditioning system is in operation, the oil is carried through the entire system by the refrigerant.
Some of this oil will be trapped and retained in various parts of the system.
When the following system components are charged, it is necessary to add oil to the system to replace the oil being removed with the component.

Compressor oil: ND – OIL 8
Quantity:

- **Vehicles with single A/C**

Evaporator:	**40 cm³ (2.4 cu.in.)**
Condenser:	**40 cm³ (2.4 cu.in.)**
Suction hose:	**10 cm³ (0.6 cu.in.)**
Receiver:	**10 cm³ (0.6 cu.in.)**

- **Vehicles with dual A/C**

Evaporator:	**60 cm³ (3.6 cu.in.)**
Condenser:	**30 cm³ (1.8 cu.in.)**
Suction hose:	**10 cm³ (0.6 cu.in.)**
Receiver:	**10 cm³ (0.6 cu.in.)**

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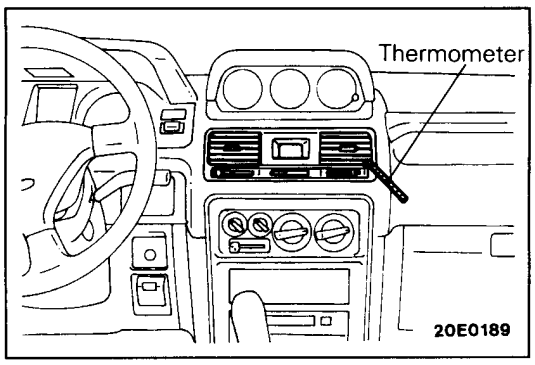


PERFORMANCE TEST E55FTAI

<Vehicles using R-12 refrigerant>

(1) The vehicle to be tested should be in a place that is not in direct sunlight.
(2) Connect a tachometer.
(3) Turn back the handle of the special tools (MB991403, MB991404) (valve closed) and install the special tools (MB991403, MB991404) to the high pressure and low pressure service valves.
(4) Connect the gauge manifold to the special tools (MB991403, MB991404).
(5) Tighten the handle of the special tools (MB991403, MB991404) (valve open).
(6) Start the engine.
(7) Set the A/C controls as follows:
Air conditioning switch: Air conditioner – ON position
Mode selection: Face position
Temperature control: Max. cooling position
Air selection: Recirculation position
Blower switch: HI (Fast) position
(8) Adjust engine speed to 1,000 r/min with air conditioner clutch engaged.
(9) Engine should be warmed up with doors, windows closed and bonnet opened.
(10) <Vehicles with single air conditioner>
Insert a thermometer in the left center air conditioner outlet and operate the engine for 20 minutes.
<Vehicles with dual air conditioner>
Insert a thermometer at the air conditioning outlet at the left center of the instrument panel and the one at the ceiling front left side, and then let engine run for 20 minutes.
(11) Note the discharge air temperature.

NOTE
If the clutch cycles, take the reading before the clutch disengages.

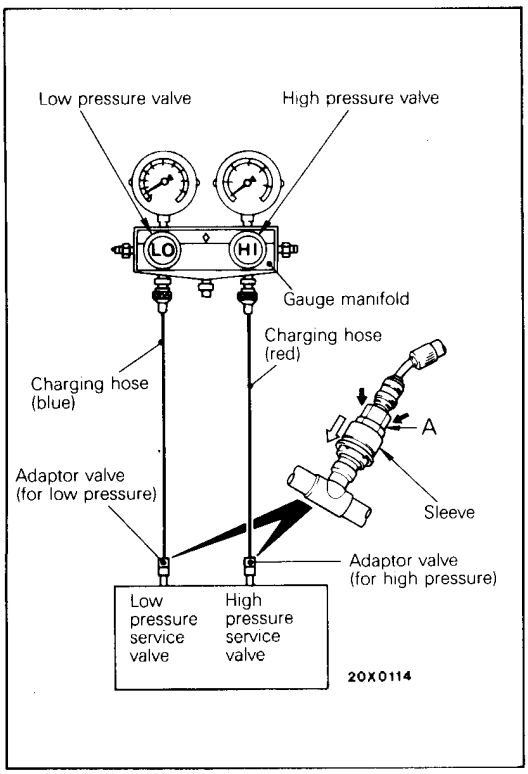
Performance Temperature Chart

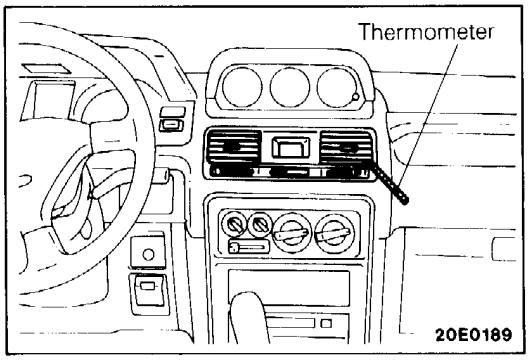
SINGLE AIR CONDITIONER

Garage ambient temperature °C (°F)	21 (70)	26.7 (80)	32.2 (90)	37.8 (100)	43.3 (110)
Discharge air temperature °C (°F)	3.0–6.0 (37.4–42.8)	3.0–7.0 (37.4–44.6)	3.5–7.5 (38.3–45.5)	4.0–8.0 (39.2–46.4)	4.5–8.5 (40.1–47.3)
Compressor discharge pressure kPa (kg/cm^2, psi)	980–1,230 (9.8–12.3, 139.4–174.9)	1,050–1,300 (10.5–13.0, 149.3–184.9)	1,130–1,380 (11.3–13.8, 160.7–196.3)	1,270–1,580 (12.7–15.8, 180.6–224.7)	1,330–1,740 (13.3–17.4, 189.2–247.5)
Compressor suction pressure kPa (kg/cm^2, psi)	120–220 (1.2–2.2, 17.1–31.3)	120–230 (1.2–2.3, 17.1–32.7)	130–240 (1.3–2.4, 18.5–34.1)	150–270 (1.5–2.7, 21.3–38.4)	170–280 (1.7–2.8, 24.2–39.8)

DUAL AIR CONDITIONER

Garage ambient temperature °C (°F)		21 (70)	26.7 (80)	32.2 (90)	37.8 (100)	43.3 (110)
Discharge air temperature °C (°F)	Front	2–8 (35–46)	3–9 (37–48)	4–10 (39–50)	7–14 (45–57)	12–18 (54–64)
	Rear	2–8 (35–46)	3–9 (37–48)	4–10 (39–50)	7–14 (45–57)	12–18 (54–64)
Compressor discharge pressure kPa (kg/cm², psi)		981–1,373 (9.81–13.73, 142–199)	981–1,373 (9.81–13.73, 142–199)	1,079–1,472 (10.79–14.72, 156–213)	1,373–1,766 (13.73–17.66, 199–256)	1,668–2,060 (16.68–20.06, 242–299)
Compressor suction pressure kPa (kg/cm², psi)		108–206 (1.08–2.06, 16–30)	108–206 (1.08–2.06, 16–30)	128–226 (1.28–2.26, 18–33)	206–304 (2.06–3.04, 30–44)	226–324 (2.26–3.24, 33–47)





<Vehicles using R-134a refrigerant>

(1) The vehicles to be tested should be in a place that is not in direct sunlight.
(2) Close the high and low pressure valve of the gauge manifold.
(3) Connect the charging hose (blue) to the low pressure valve and connect the charging hose (red) to the high pressure valve of the gauge manifold.
(4) Install the quick joint (for low pressure) to the charging hose (blue), and connect the quick joint (for high pressure) to the charging hose (red).
(5) Connect the quick joint (for low pressure) to the low-pressure service valve and connect the quick joint (for high pressure) to the high-pressure service valve.

NOTE
The high-pressure service valve is on high-pressure pipe B, and the low-pressure service valve is on the low-pressure hose.

Caution
To connect the quick joint, press section A firmly against the service valve until a click is heard.
When connecting, run your hand along the hose while pressing to ensure that there are no bends in the hose.

(6) Start the engine.
(7) Set the A/C controls as follows:
A/C switch: A/C – ON position
Mode selection: Face position
Temperature control: Max. cooling position
Air selection: Recirculation position
Blower switch: HI (Fast) position
(8) Adjust engine speed to 1,000 r/min with A/C clutch engaged.
(9) Engine should be warmed up with doors and windows closed.
(10) Insert a thermometer in the left center A/C outlet and operate the engine for 20 minutes.
(11) Note the discharge air temperature.

NOTE
If the clutch cycles, take the reading before the clutch disengages.

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Performance Temperature Chart

Garage ambient temperature °C (°F)	21 (70)	26.7 (80)	32.2 (90)	37.8 (100)	43.3 (110)
Discharge air temperature °C (°F)	3.0–6.0 (37–43)	3.0–7.0 (37–45)	3.5–7.5 (38–46)	4.0–8.0 (39–46)	4.5–8.5 (40–47)
Compressor discharge pressure kPa (kg/cm², psi)	961–1402 (9.8–14.3, 139–203)	1029–1471 (10.5–15.0, 149–213)	1108–1549 (11.3–15.8, 151–225)	1215–1745 (12.7–17.8, 181–253)	1304–1902 (13.3–19.4, 189–276)
Compressor suction pressure kPa (kg/cm², psi)	98–216 (1.0–2.2, 14–31)	98–226 (1.0–2.3, 14–33)	108–235 (1.1–2.4, 16–34)	137–265 (1.4–2.7, 20–38)	157–275 (1.6–2.8, 23–40)

REFRIGERANT LEAK REPAIR PROCEDURE E55FUAE

Lost Charge

If the system has lost all charge due to a leak:

(1) Evacuate the system. (See procedure.)
(2) Charge the system with approximately one pound of refrigerant.
(3) Check, for leaks.
(4) Discharge the system.
(5) Repair leaks.
(6) Replace receiver drier.

Caution
Replacement filter-drier units must be sealed while in storage. The drier used in these units will saturate water quickly upon exposure to the atmosphere. When installing a drier, have all tools and supplies ready for quick reassembly to avoid keeping the system open any longer than necessary.

(7) Evacuate and charge the system.

Low Charge

If the system has not lost all of its refrigerant charge; locate and repair all leaks. If it is necessary to increase the system pressure to find the leak (because of an especially low charge), add refrigerant. If it is possible to repair the leak without discharging the refrigerant system, use the procedure for correcting low refrigerant level.

HANDLING TUBING AND FITTINGS E55FVAD

Kinks in the refrigerant tubing or sharp bends in the refrigerant hose lines will greatly reduce the capacity of the entire system. High pressures are produced in the system when it is operating. Extreme care must be exercised to make sure that all connections are pressure tight. Dirt and moisture can enter the system when it is opened for repair or replacement of lines or components. The following precautions must be observed. The system must be completely discharged before opening any fitting of connection in the refrigeration system. Open fittings with caution even after the system has been discharged. If any pressure is noticed as a fitting is loosened, allow trapped pressure to bleed off very slowly.

Never attempt to rebend formed lines to fit. Use the correct line for the installation you are servicing. A good rule for the flexible hose lines is keep the radius of all bends at least 10 times the diameter of the hose. Sharper bends will reduce the flow of refrigerant. The flexible hose lines should be routed so that they are at least 80 mm (3 in.) from the exhaust manifold. It is good practice to inspect all flexible hose lines at least once a year to make sure they are in good condition and properly routed. O-ring used on connections are not reusable.

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COMPRESSOR NOISE E55FXAA

When investigating an air conditioning related noise, you must first know the conditions when the noise occurs. These conditions are weather, vehicle speed, in gear or neutral, engine temperature or any other special conditions. Noises that develop during air conditioning operation can often be misleading. For example: what sounds like a failed front bearing or connecting rod, may be caused by loose bolts, nuts, mounting brackets, or a loose clutch assembly. Verify accessory drive belt tension (power steering, alternator or air pump). Improper accessory drive belt tension can cause a misleading noise when the compressor is engaged and little or no noise when the compressor is disengaged. Drive belts are speed sensitive. That is, at different engine speeds, and depending upon belt tension, belts can develop unusual noises that are often mistaken for mechanical problems within the compressor.

Adjustment Procedures

(1) Select a quiet area for testing. Duplicate conditions as much as possible. Switch compressor on and off several times to clearly identify compressor noise.

To duplicate high ambient conditions (high head pressure), restrict air-flow through condenser. Install manifold gauge set to make sure discharge pressure does not exceed 2,070 kPa (21.1 kg/cm², 300 psi): R-12, 2,550 kPa (26 kg/cm², 370 psi): R-134a.

(2) Tighten all compressor mounting bolts, clutch mounting bolt, and compressor drive belt. Check to assure clutch coil is tight (no rotation or wobble).
(3) Check refrigerant hoses for rubbing or interference that can cause unusual noises.
(4) Check refrigerant charge (See "Charging the System").
(5) Recheck compressor noise as in Step 1.
(6) If noise still exists, loosen compressor mounting bolts and retorque. Repeat Step 1.
(7) If noise continues, replace compressor and repeat Step 1.

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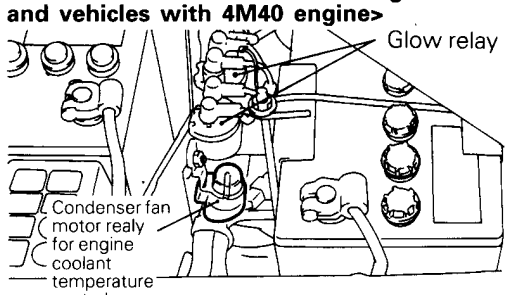
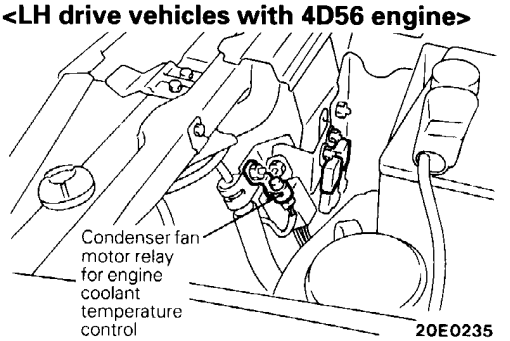
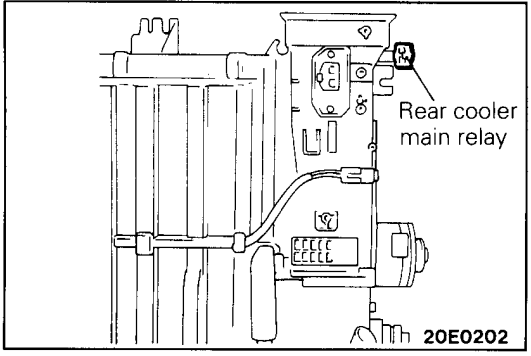
<RH drive vehicles with 4D56 engine and vehicles with 4M40 engine>



<LH drive vehicles with 4D56 engine>





POWER RELAY CHECK

(1) Remove each power relay.
  ① Remove the condenser fan motor relay and the compressor relay from the relay box in the engine compartment.
  ② Remove the condenser fan motor relay for engine coolant temperature control that is mounted on the side of the battery tray.
  ③ Remove the condenser fan motor relay for engine coolant temperature control which is co-tightened with the high pressure hose attaching clamp.
  ④ Remove the rear cooler main relay from the rear evaporator.
(2) Check the continuity between each terminal.

IDLE-UP OPERATION CHECK

(1) Before inspection, set the vehicle to the following condition:
- Engine coolant temperature: 80–90°C (176–194°F)
- Lights and all accessories: OFF
- Selector lever: "N" or "P" (A/T)
- Shift lever: Neutral (M/T)
- Steering wheel: Straight forward position

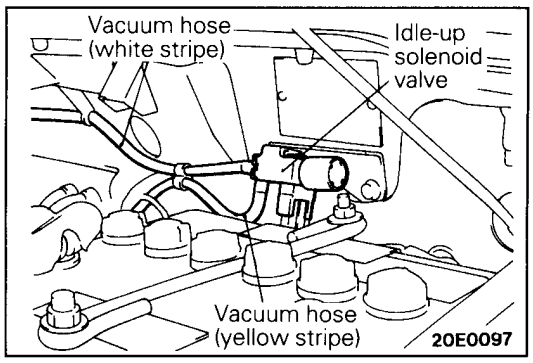
(2) Check that the idle speed is within the standard value.

Standard value: 700 ± 100 r/min <6G72, 6G74>
750 ± 100 r/min <4G64, 4D56>
800 ± 30 r/min <4M40>

(3) Turn the air conditioner switch to ON and check that the idle speed is at the standard value when the air conditioner is operating.

Standard value: 900 ± 100 r/min

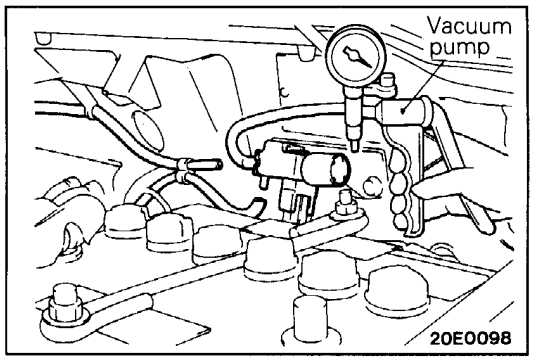
NOTE
If the idle speed is outside the standard value, refer to GROUP 11 – Engine Adjustment.



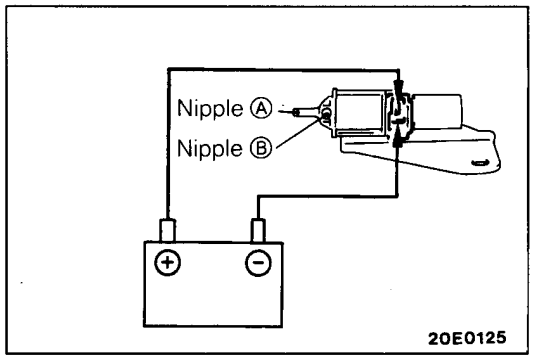
IDLE-UP SOLENOID VALVE CHECK <4D56, 4M40>

(1) Remove the vacuum hose from the idle-up solenoid valve.

NOTE
When installing the vacuum hose, be careful not to mistake the connection ends.



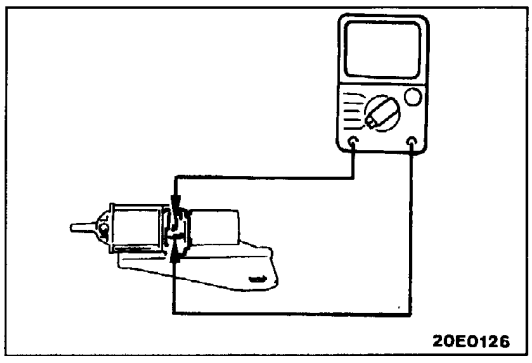
(2) Disconnect the idle-up solenoid valve connection.
(3) Connect the vacuum pump (Mighty Vac) to nipple Ⓐ.



(4) Check if air is pumped by the vacuum pump (Mighty Vac) when battery voltage is applied to the terminals of the idle-up solenoid valve, and when it is not applied.

Battery voltage	Nipple Ⓑ	Vacuum condition
Applied	Open	Vacuum leak at nipple Ⓑ
	Covered with a finger*1	Vacuum is maintained
Not applied	Open	Vacuum is maintained
	Covered with a finger*2	

NOTE
At *1, negative pressure can be felt by the finger, but at *2, it cannot be felt.



(5) Measure the resistance between the idle-up solenoid valve terminals.

Standard value: Approx. 40Ω

LEVER POSITION SWITCH CHECK <4D56, 4M40 — VEHICLES WITH A/T>

(1) When the air conditioner switch is turned to ON (air conditioner operation condition: magnetic clutch is ON), and the vehicle is at full acceleration (accelerator pedal depression amount is approximately 90% ± 7%), check that the magnetic clutch turns OFF for a period of approximately 7 seconds.

(2) If there is a malfunction, adjust the installation position of the lever position switch by the following procedure.

① Check that the idle speed is at the standard value, and adjust it if necessary.

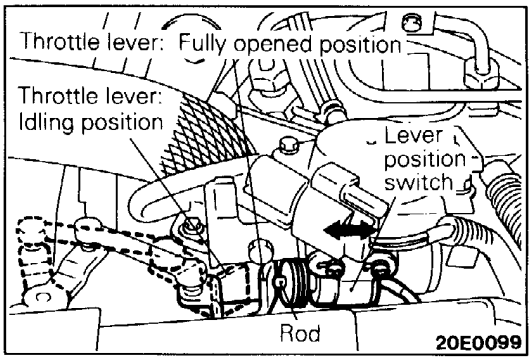
Standard value: 750 ± 100 r/min <4D56>
800 ± 30 r/min <4M40>

② Adjust the accelerator cable.

③ Depress the accelerator pedal fully to fully open the throttle lever of the fuel injection pump.

Caution
When fully opening the throttle lever of the fuel injection pump, always open it by the accelerator pedal, not from the injection pump side.

④ Adjust the stroke of the lever position switch rod by moving the lever position switch so that the rod is pushed down 4 ± 1 mm (0.16 ± 0.04 in.) from the free position.



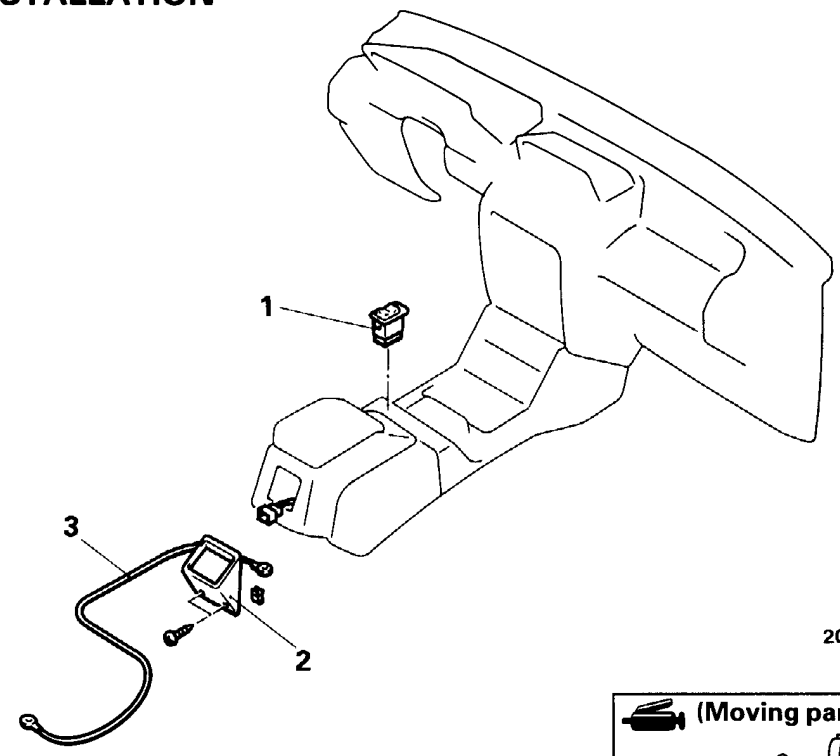
AIR CONDITIONER SWITCH E55QA--

Refer to the Heater Control Assembly for the removal, installation and inspection procedures of the air conditioner switch.

REAR BLOWER SWITCH

REMOVAL AND INSTALLATION

E55TA-D

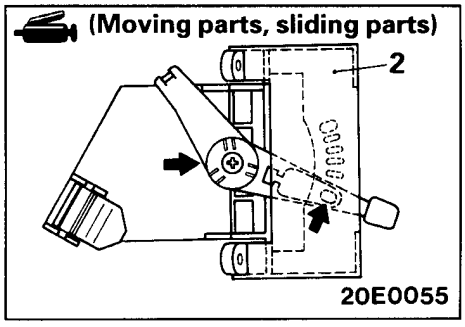


20E0228

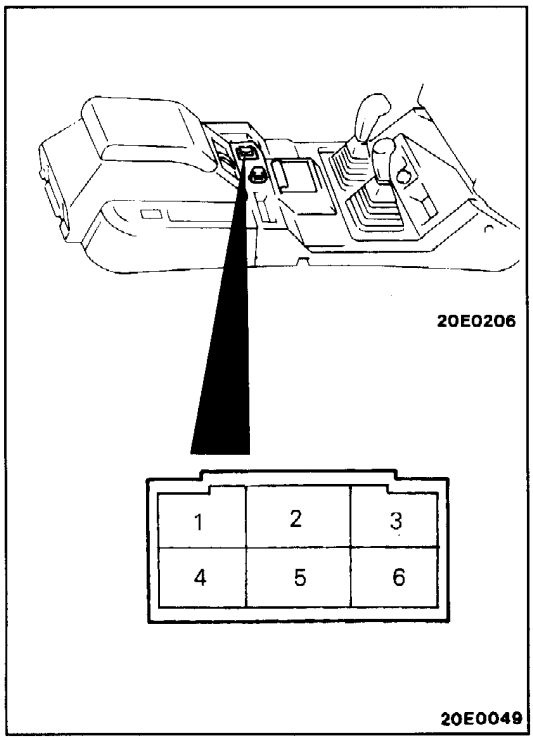
1. Rear blower main switch (Floor console side)

Rear heater control assembly removal steps

2. Rear heater control assembly
3. Connection for the rear heater temperature control wire (Rear heater control assembly side) <Vehicles without dual A/C>



20E0055



20E0049

INSPECTION

E55TCBC

REAR BLOWER MAIN SWITCH (BLOWER CONTROL SIDE)

Operate the main switch and use a circuit tester to check the continuity between the switch terminals.

Terminal No. / Switch position	1	2	5	6	3	4	Remark
✻	○	○		○	○	○	○—○ indicates that there is a continuity between the terminals
REAR		○	○		○	○	

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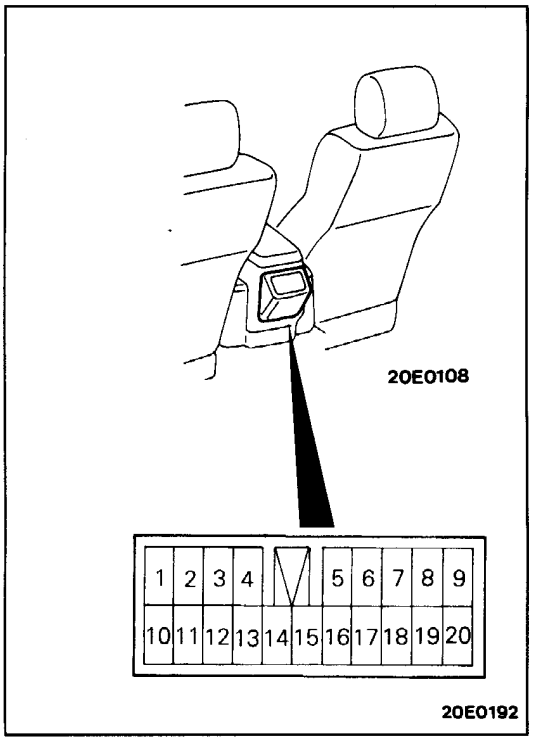

INSPECTION OF REAR BLOWER SWITCH, TEMPERATURE ADJUSTMENT SELECTOR AND REAR BLOWER MAIN SWITCH (REAR HEATER CONTROL ASSEMBLY SIDE)
<Vehicles with rear heater>

(1) Operate the rear blower main switch and rear blower switch and use a circuit tester to check the continuity between the terminals.

Terminal No. / Switch position	7	8	10	12	13	14	15	16	17	19	Remark
OFF		○	○								○—○ indicates that there is a continuity between the terminals.
■	○	○									
• (Lo)						○	○			○	
● (Me)					○			○		○	
● (Hi)				○					○	○	

(2) Operate the temperature adjustment selector and use a circuit tester to check the continuity between the terminals.

Switch position	
At MAX. COOL	No continuity between terminals 3–4
At MAX. HOT	No continuity between terminals 5–6

(3) Operate the temperature adjustment selector and use a circuit tester to check the continuity between the terminals.

Switch position	Standard value Ω
At MAX. COOL	Between terminals 3–4: 0–4
At MAX. HOT	Between terminals 5–6: 2400

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<Vehicles without rear heater>

(1) Operate the rear blower main switch and rear blower switch and use a circuit tester to check the continuity between the terminals.

Terminal No. / Switch position	7	8	10	12	13	14	19	Remark
▂	○—○							○—○ indicates that there is a continuity between the terminals.
▆		○—○						
• (Lo)						○—○		
● (Me)					○———○			
● (Hi)				○———————○				

(2) Operate the temperature adjustment selector and use a circuit tester to check the continuity between the terminals ④–⑤.

Switch position	Standard value Ω
At ●	3000
At MAX. COOL	0–4

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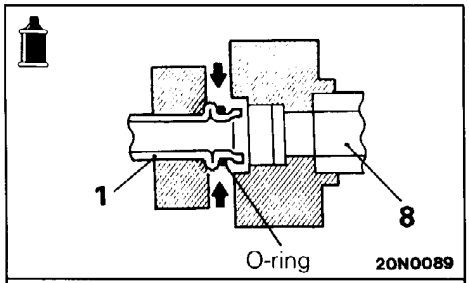
FRONT EVAPORATOR

REMOVAL AND INSTALLATION

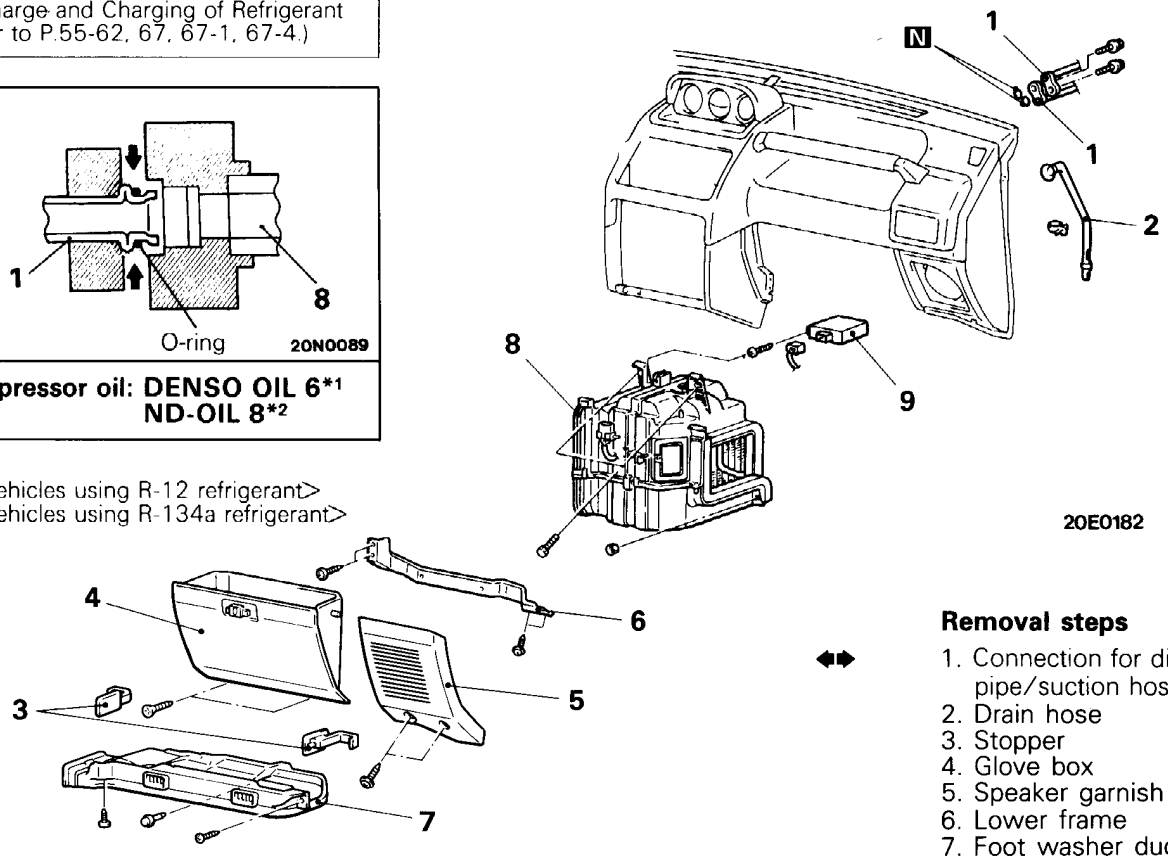
E55JA-1

Pre-removal and Post-installation Operation
- Discharge and Charging of Refrigerant (Refer to P.55-62, 67, 67-1, 67-4.)



Compressor oil: DENSO OIL 6*1
ND-OIL 8*2

NOTE
*1 : <Vehicles using R-12 refrigerant>
*2 : <Vehicles using R-134a refrigerant>



Removal steps
1. Connection for discharge pipe/suction hose
2. Drain hose
3. Stopper
4. Glove box
5. Speaker garnish
6. Lower frame
7. Foot washer duct (RH)
8. Front evaporator
9. A/C control unit

SERVICE POINTS OF REMOVAL

1. DISCONNECTION OF DISCHARGE PIPE AND SUCTION HOSE

If the hoses or pipes are disconnected, cap the hoses or pipes with a blank plug to prevent entry of dust, dirt, and water.

INSPECTION

E55JFAH

- Check for damage of the evaporator fin part.
- Check for damage or collapse of the drain hose.
- Check for peeling or cracking of the insulator.

SERVICE POINTS OF INSTALLATION

8. INSTALLATION OF FRONT EVAPORATOR

When replacing the evaporator, refill the evaporator with a specified amount of compressor oil.

<Vehicles using R-12 refrigerant>

Compressor oil:	**DENSO OIL 6**
Quantity:	**60 cm³ (3.6 cu.in.)**

<Vehicles using R-134a refrigerant>

Compressor oil:	**ND–OIL 8**
Quantity:	
Vehicles with single A/C:	**40 cm³ (2.4 cu.in.)**
Vehicles with dual A/C:	**60 cm³ (3.6 cu.in.)**

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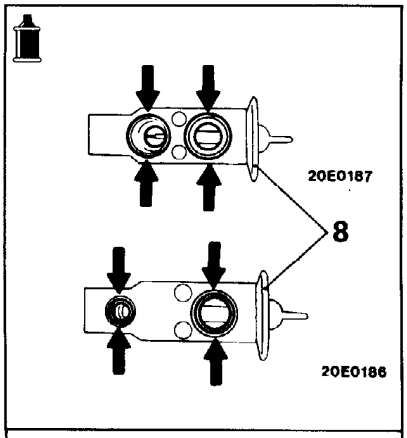
NOTES

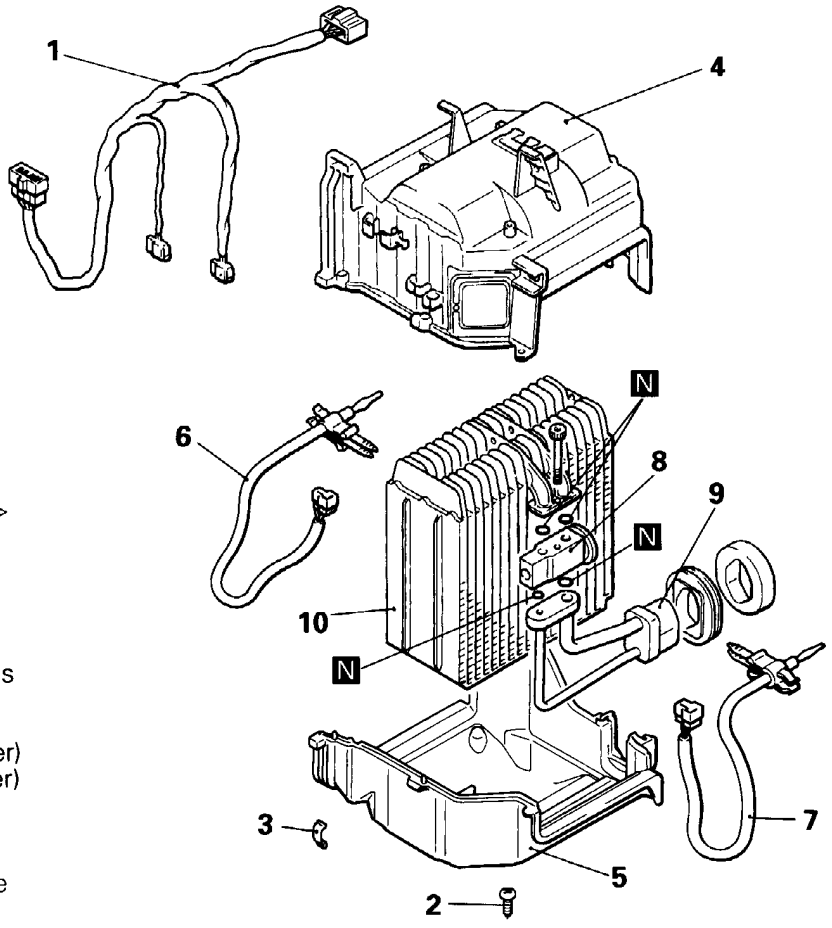
DISASSEMBLY AND REASSEMBLY

E55JC-1



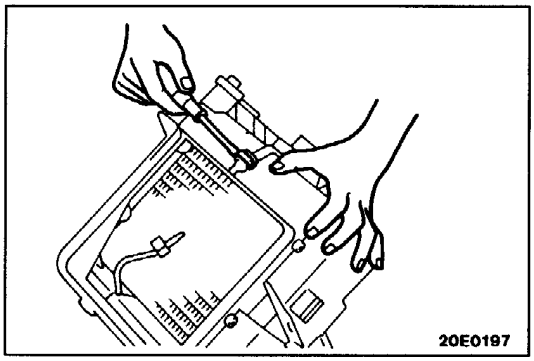
Compressor oil: DENSO OIL 6*1
ND-OIL 8*2

NOTE
*1 : <Vehicles using R-12 refrigerant>
*2 : <Vehicles using R-134a refrigerant>



Disassembly steps

1. Air conditioner harness
2. Screw
3. Clip
4. Evaporator case (upper)
5. Evaporator case (lower)
6. Air thermo sensor
7. Air inlet sensor
8. Expansion valve
9. Suction/discharge pipe
10. Evaporator

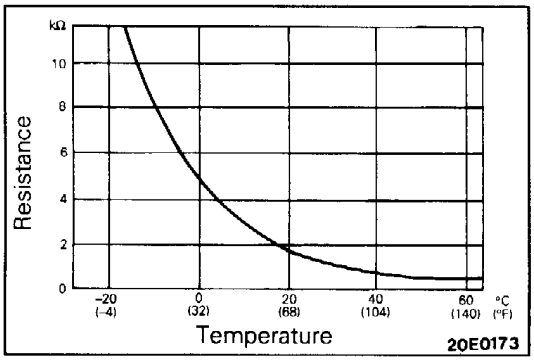


SERVICE POINT OF DISASSEMBLY

E55JDA1

3. REMOVAL OF CLIPS

Remove the clips with a screwdriver covered with a shop towel to prevent damage to case surfaces.



INSPECTION

E55JFAH

AIR THERMO SENSOR AND AIR INLET SENSOR CHECK

When the resistance value between the sensor terminals is measured under two or more temperature conditions, the resistance value should be close to the values shown in the graph.

NOTE
The temperature conditions when testing should not exceed the range of the characteristic curve in the graph.

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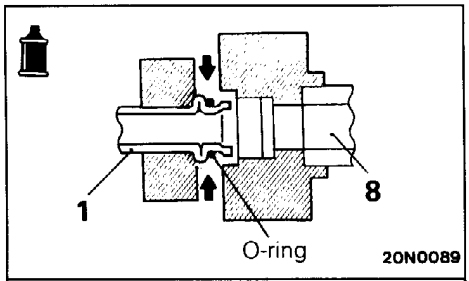
REAR EVAPORATOR, REAR COOLER AMPLIFIER AND RESISTOR

REMOVAL AND INSTALLATION

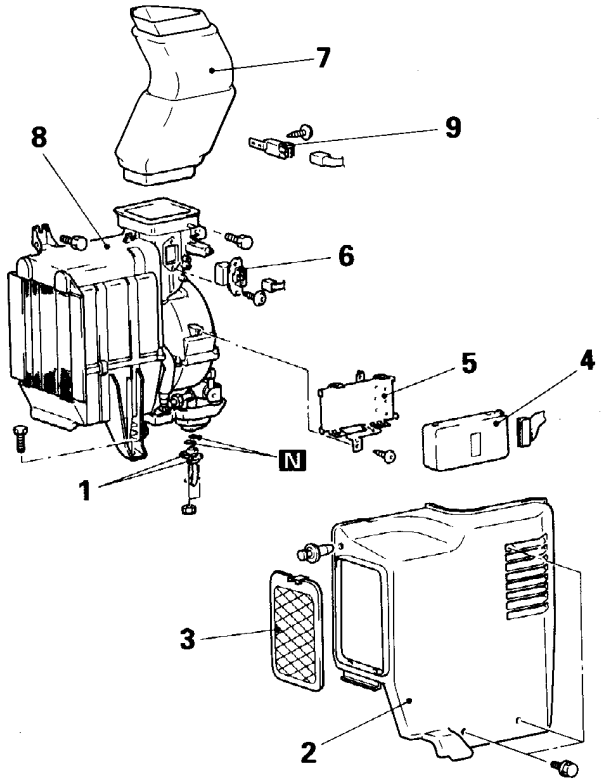
E55JA-2

Pre-removal and Post-installation Operation
- Removal and Installation of Rear Roof Rail Trim and Rear Pillar Trim (Refer to GROUP 52 – Trims.)



Compressor oil: DENSO OIL 6*1
ND-OIL 8*2

NOTE
*1 : <Vehicles using R-12 refrigerant>
*2 : <Vehicles using R-134a refrigerant>



Removal steps of rear evaporator
- Discharge and charging of refrigerant (Refer to P.55-62, 67.)

◆◆ 1. Connection of suction pipe and discharge pipe
2. Cover
3. Filter
4. Rear cooler amplifier
5. Rear cooler amplifier bracket
6. Resistor
7. Duct
◆◆ 8. Rear evaporator
9. Rear cooler main relay

Removal steps of rear cooler amplifier
2. Cover
4. Rear cooler amplifier

Removal steps of resistor
2. Cover
6. Resistor

SERVICE POINTS OF REMOVAL

1. DISCONNECTION OF SUCTION PIPE AND DISCHARGE PIPE

If the hoses or pipes are disconnected, cap the hoses or pipes with a blank plug to prevent entry of dust, dirt, and water.

INSPECTION

E55JFAI

- Check for damage of the evaporator fin part.
- Check for damage or collapse of the drain hose.
- Check for peeling or cracking of the insulator.

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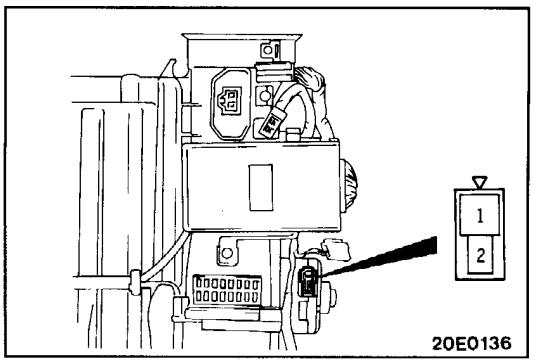
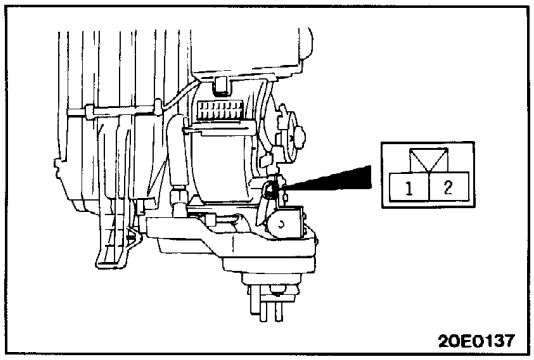


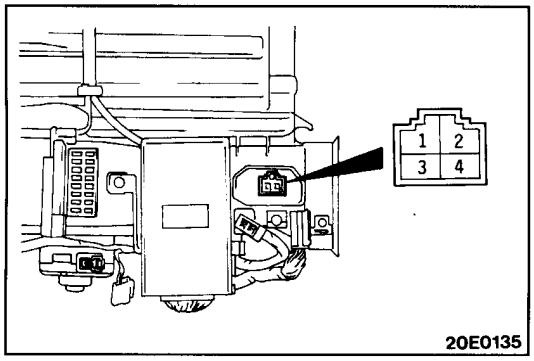
INSPECTION OF BLOWER MOTOR ASSEMBLY

When battery voltage is applied between the terminals, check that the motor turns without making any abnormal noise.



INSPECTION OF MAGNETIC VALVE

When battery voltage is applied to the magnetic valve terminal ① and terminal ② is earthed, the condition is normal if the magnetic valve operating sound can be heard.



INSPECTION OF RESISTOR

Use a circuit tester to measure the resistance between the terminals as shown below. The condition is normal if the measured values are within the standard values.

Measurement terminal	Standard value Ω
Between terminals ②–③	Approx. 0.8
Between terminals ③–④	Approx. 2.98
Between terminals ①–③	Approx. 4.57

SERVICE POINTS OF INSTALLATION

8. INSTALLATION OF REAR EVAPORATOR

When replacing the evaporator, refill the evaporator with a specified amount of compressor oil.

<Vehicles using R-12 refrigerant>

Compressor oil: DENSO OIL 6

Quantity: 60 cm³ (3.6 cu.in.)

<Vehicles using R-134a refrigerant>

Compressor oil: ND-OIL 8

Quantity:

Vehicles with single A/C: 40 cm³ (2.4 cu.in.)

Vehicles with dual A/C: 60 cm³ (2.4 cu.in.)

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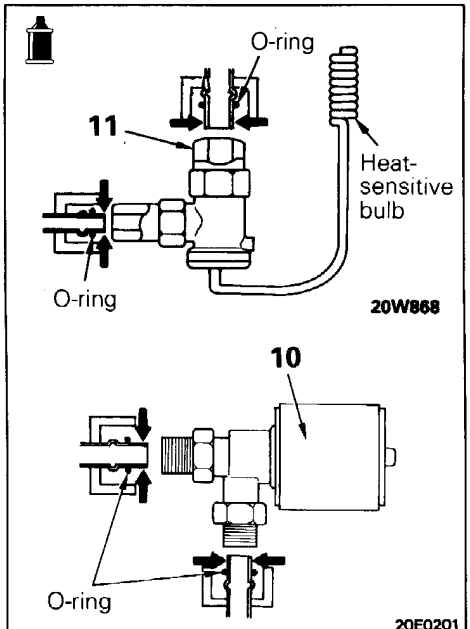
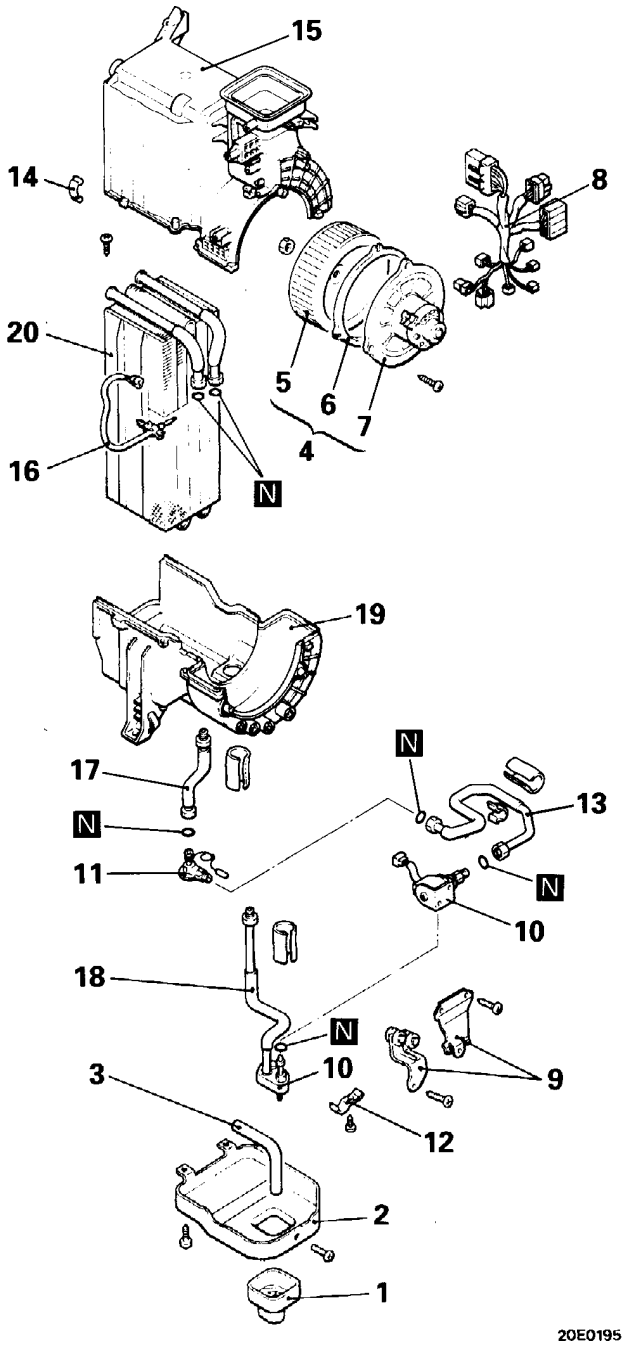
DISASSEMBLY AND REASSEMBLY

E55JC-2



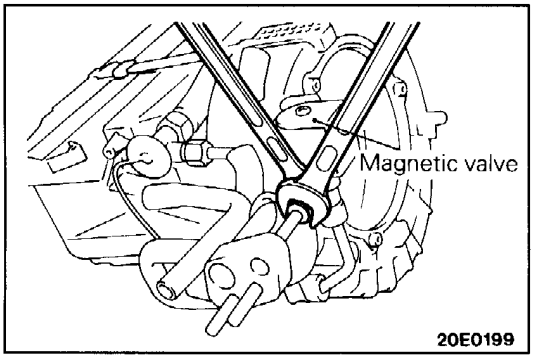
Compressor oil: DENSO OIL 6*1
ND-OIL 8*2

NOTE
*1 : <Vehicles using R-12 refrigerant>
*2 : <Vehicles using R-134a refrigerant>



Disassembly steps

1. Grommet
2. Tray
3. Drain hose
4. Blower motor assembly
5. Blower fan
6. Packing
7. Blower motor
8. A/C harness
9. Bracket
10. Magnetic valve
11. Expansion valve
12. Pipe bracket
13. Liquid pipe A
14. Clip
15. Case (upper)
16. Air thermo sensor
17. Liquid pipe B
18. Suction pipe
19. Case (lower)
20. Evaporator



SERVICE POINTS OF DISASSEMBLY

E55JDAG

10. REMOVAL OF MAGNETIC VALVE

Use two wrenches to loosen the flare nut on the pipe connection (for both the inlet and outlet).

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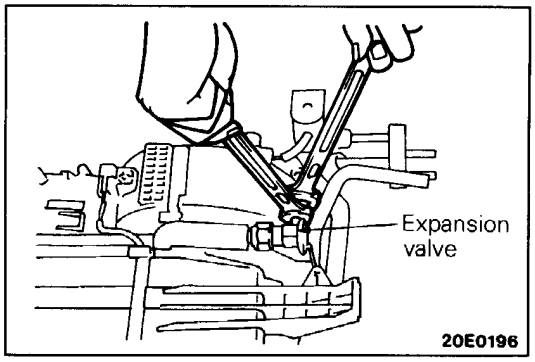
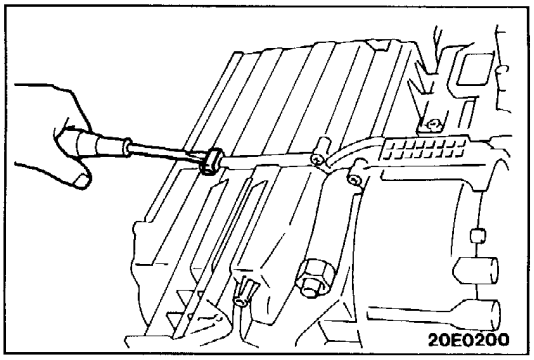


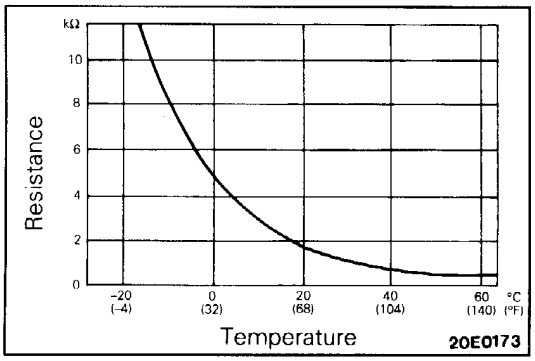
11. REMOVAL OF EXPANSION VALVE

Use two wrenches to loosen the flare nut on the pipe connection (for both the inlet and outlet).



14. REMOVAL OF CLIP

Remove the clips with a screwdriver covered with a shop towel to prevent damage to case surfaces.

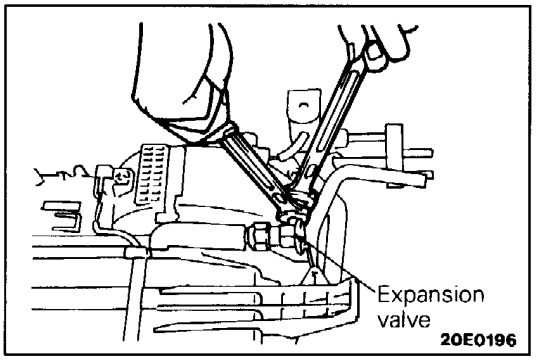


INSPECTION E55JFAI

AIR THERMO SENSOR INSPECTION

When the resistance value between the sensor terminals is measured under two or more temperature conditions, the resistance value should be close to the values shown in the graph.

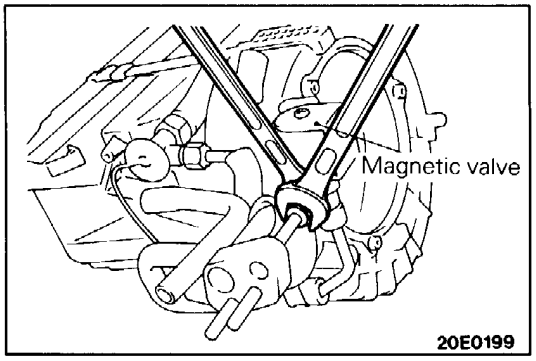
NOTE
The temperature conditions when testing should not exceed the range of the characteristic curve in the graph.



SERVICE POINTS OF REASSEMBLY E55JEAH

11. INSTALLATION OF EXPANSION VALVE

Use two wrenches to tighten the flare nut on the pipe connection (for both the inlet and outlet).



10. INSTALLATION OF MAGNETIC VALVE

Use two wrenches to tighten the flare nut on the pipe connection (for both the inlet and outlet).

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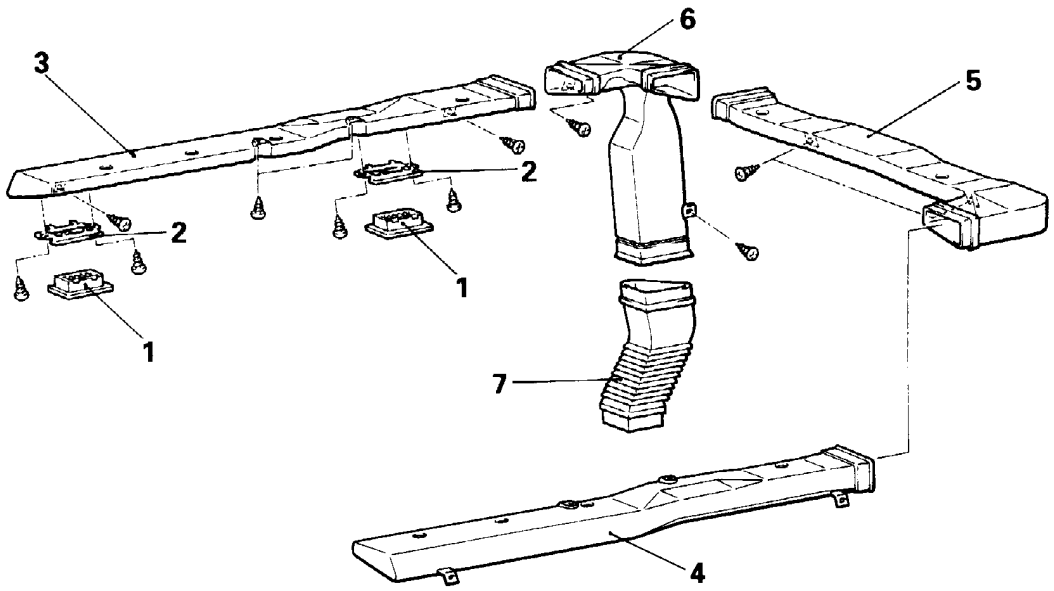
REAR VENTILATORS

REMOVAL AND INSTALLATION

E55MA-3



20E0111

Removal steps

1. Air outlet grille
2. Retainer B
- Rear headlining
  (Refer to GROUP 52 – Headlining.)
- Front headlining
  <Vehicles without sun roof>
  (Refer to GROUP 52 – Headlining.)
3. Roof duct assembly (RH)
4. Roof duct assembly (LH)
5. Rear roof duct assembly
6. Pillar duct
7. Duct

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ENGINE COOLANT TEMPERATURE SWITCH

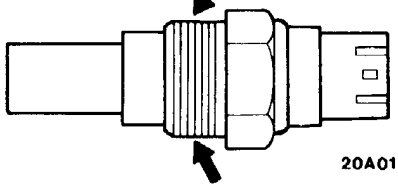
REMOVAL AND INSTALLATION

E55HA-1

Pre-removal and Post-installation Operation
(1) Draining and Supplying of Coolant
(2) Removal and Installation of Intercooler <4D56, 4M40> (Refer to GROUP 15–Intercooler.)

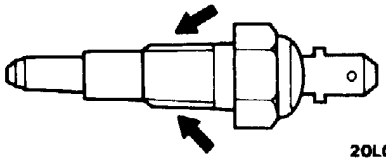
1. Engine coolant temperature switch (for air conditioner switch-off)
2. Engine coolant temperature switch (for condenser fan) <4D46, 4M40>

<for air conditioner switch-off>



20A0198

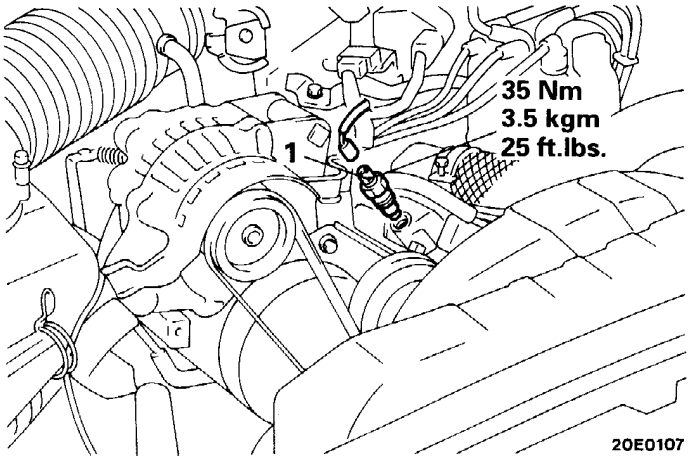
<for condenser fan>



20L0120

Sealant: 3M Nut Locking Part NO. 4171 or equivalent

<6G72>



20E0107

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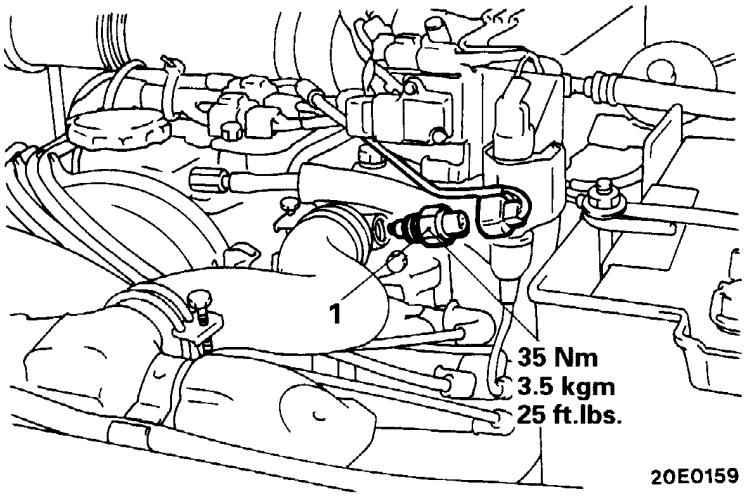
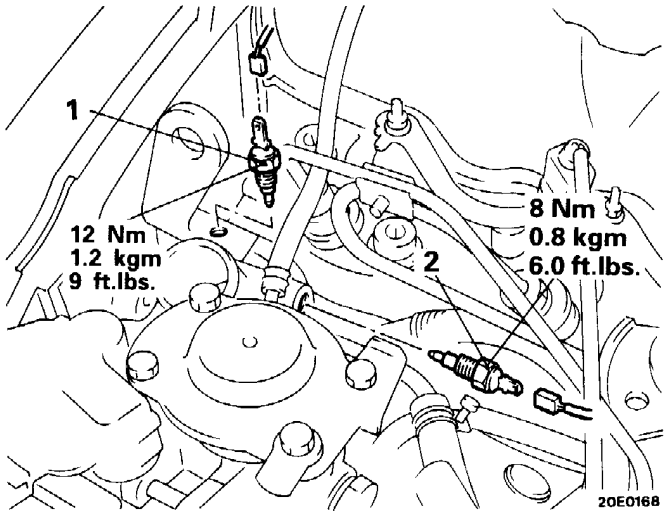
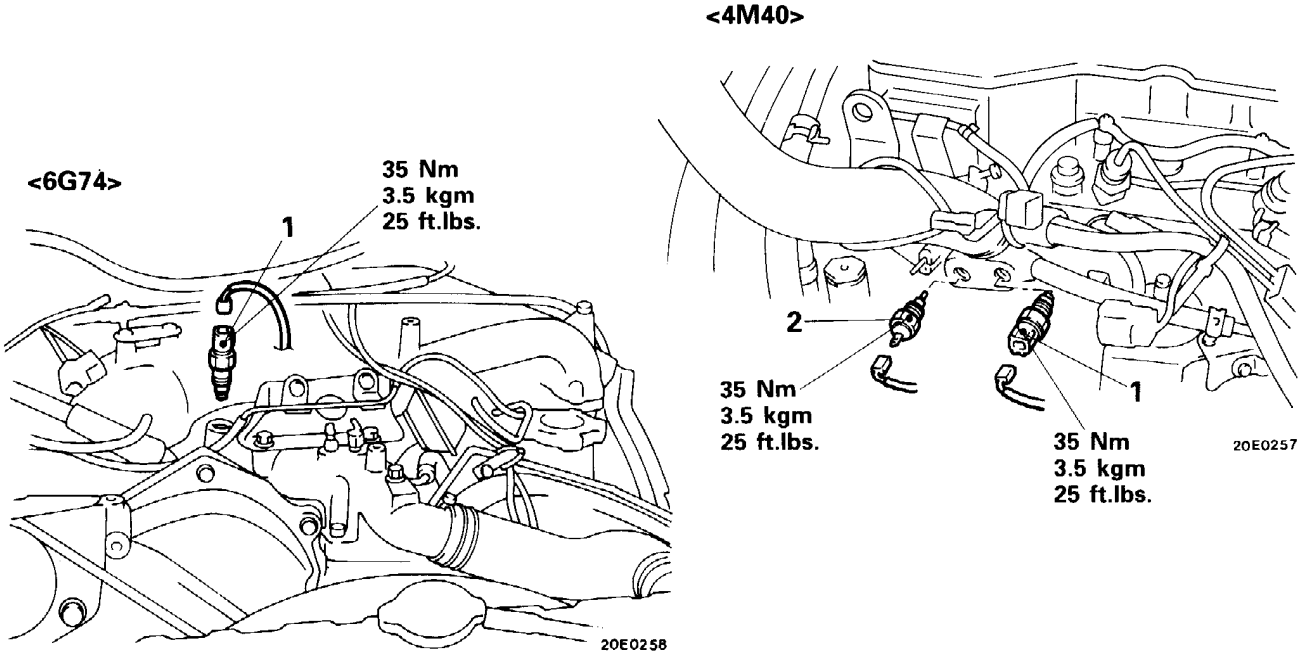


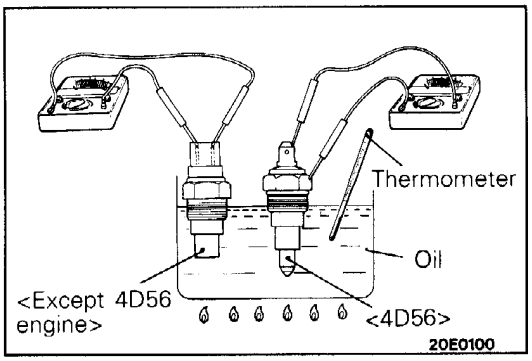
20E0159

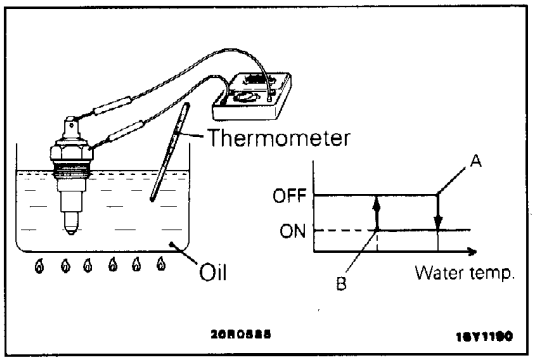
<4D56>



20E0168







INSPECTION E55HCAO

ENGINE COOLANT TEMPERATURE SWITCH CHECK

<For air conditioner Switch-off>

(1) Dip the engine coolant temperature switch in oil and heat the oil with a gas burner or similar item.
(2) When the oil temperature reaches the standard value, check that there is no continuity between the switch terminals.

Standard value: **<Except 4D56 engine>**
More than 112–118°C (234–244°F)
<4D56>
More than 114–118°C (237–244°F)

<For condenser fan>

(1) Dip the engine coolant temperature switch in oil as shown in the illustration.
(2) Check the continuity with a circuit tester as the temperature of the oil changes, and the condition is normal if the continuity is within the following ranges.

<4D56>

Item	Standard value
Continuity (temperature at point A)	More than 99–105°C (210–221°F)
No continuity (temperature at point B)	Less than 97°C (206°F)

<4M40>

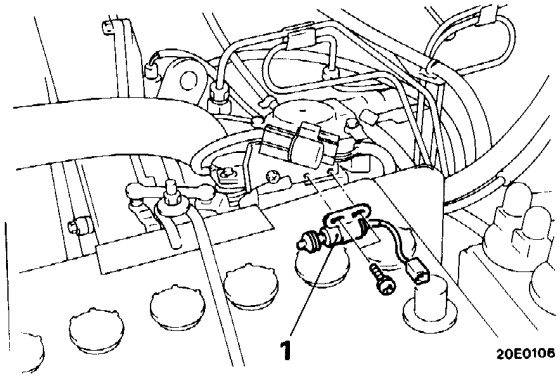
Item	Standard value
Continuity (temperature at point A)	More than 101–105°C (214–221°F)
No continuity (temperature at point B)	Less than 98°C (208°F)

LEVER POSITION SWITCH <4D56-A/T, 4M40-A/T>

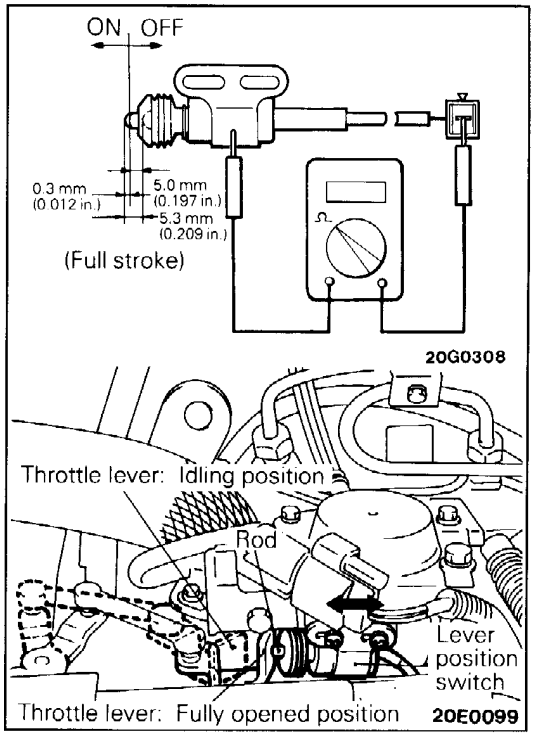
REMOVAL AND INSTALLATION

E55HA-2

Pre-removal and Post-installation Operation
- Removal and Installation of Intercooler (Refer to GROUP 15 – Intercooler.)



◆◆ 1. Lever position switch



INSPECTION

E55HCAP

INSPECTION OF LEVER POSITION SWITCH

(1) Connect a circuit tester as shown in the diagram, and check that there is continuity in the section 0.3 mm (0.012 in.) from the full length (full stroke), and that there is no continuity for the remainder of the stroke (5.0 mm [0.197 in.]).
(2) If there is a defect, replace the component.

SERVICE POINT OF INSTALLATION

E55HDAF

INSTALLATION OF LEVER POSITION SWITCH

① Check that the idle speed is at the standard value, and adjust it if necessary.

Standard value: 750 ± 100 r/min

② Adjust the accelerator cable.
③ Depress the accelerator pedal fully to fully open the throttle lever of the fuel injection pump.

Caution
When fully opening the throttle lever of the fuel injection pump, always open it by the accelerator pedal, not from the injection pump side.

④ Adjust the stroke of the lever position switch rod by moving the lever position switch so that the rod is pushed down 4 ± 1 mm (0.16 ± 0.04 in.) from the free position.

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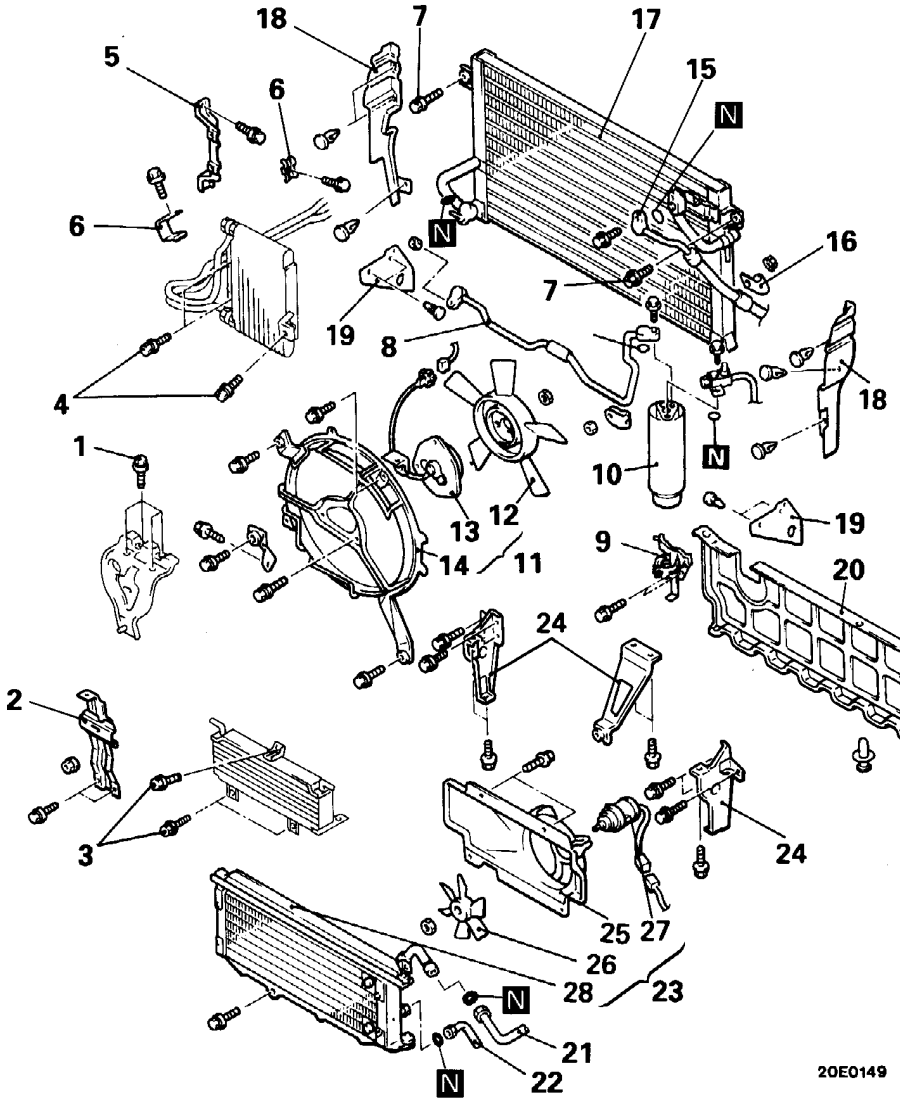
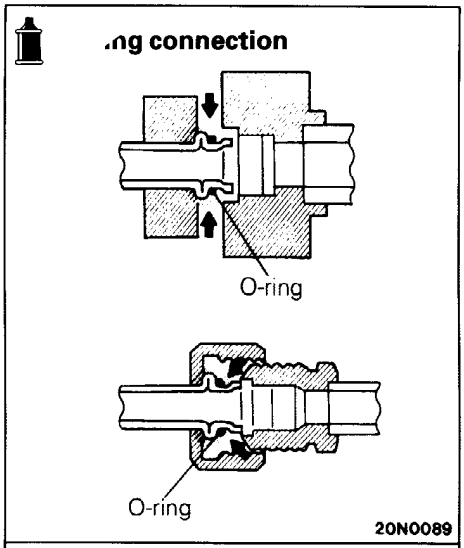
CONDENSER AND CONDENSER FAN

REMOVAL AND INSTALLATION

E55NA-1





Compressor oil: DENSO OIL 6*1
ND-OIL 8*2

NOTE
*1 : <Vehicles using R-12 refrigerant>
*2 : <Vehicles using R-134a refrigerant>

Removal steps of condenser and condenser fan

1. Hood latch bracket assembly mounting bolt
2. Hood latch stay
3. A/T oil cooler mounting bolt <A/T>
4. Engine oil cooler mounting bolt
5. Engine oil cooler bracket
6. Bracket
7. Condenser mounting bolt
8. Discharge pipe A
9. Receiver bracket
10. Receiver
11. Condenser fan motor assembly
12. Fan
13. Motor
14. Shroud
15. Connection for discharge hose
16. Discharge hose bracket
17. Condenser
18. Headlamp side seal
19. Frame side seal
20. Under seal

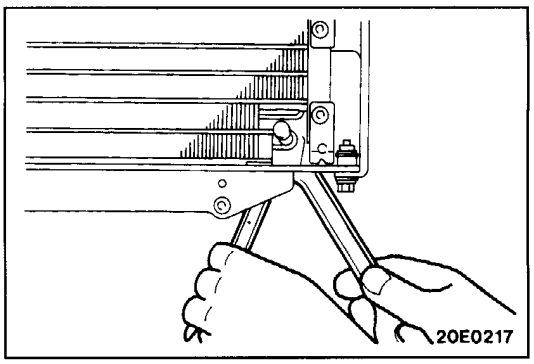
<Vehicles with condenser fan>

Pre-removal and Post-installation Operation
(1) Discharge and Charging of Refrigerant (Refer to P.55-62, 67, 67-1, 67-4.)
(2) Removal and Installation of Radiator Grille

Removal steps of sub-condenser fan <Vehicles with sub-condenser fan>

- Removal and installation of skid plate

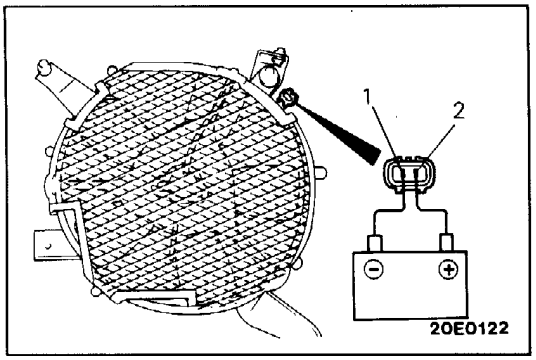
21. Discharge pipe D connection
22. Discharge pipe E connection
23. Sub-condenser assembly
24. Sub-condenser bracket
25. Sub condenser shroud
26. Sub condenser fan
27. Sub condenser motor
28. Sub-condenser



SERVICE POINTS OF REMOVAL E55NBAN

21. CONNECTION OF DISCHARGE PIPE D/22. CONNECTION OF DISCHARGE PIPE E

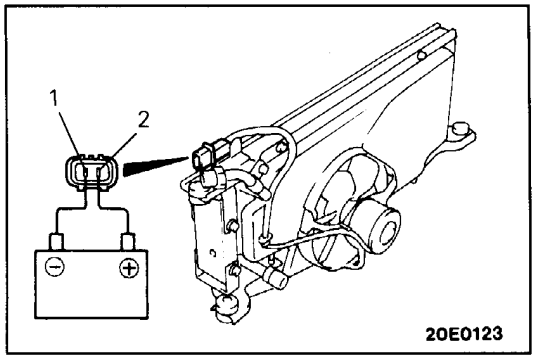
Caution
Remove the discharge pipes D and E with connected portions fixed by using spanners, etc. so that excessive force will not be applied to the discharge pipe for the sub-condenser connected portion.

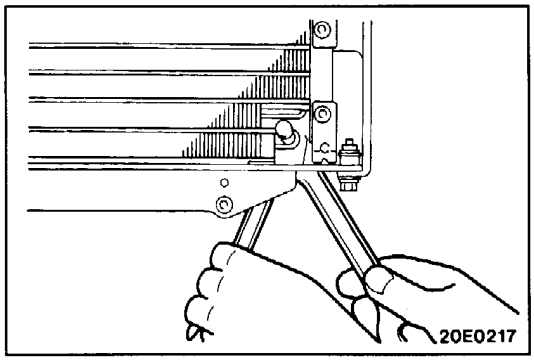


INSPECTION E55NEAC

INSPECTION OF CONDENSER FAN MOTOR AND SUB CONDENSER FAN MOTOR

When battery voltage is applied to the terminal (2) and terminal (1) is earthed, check that the condenser fan motor turns.





SERVICE POINTS OF INSTALLATION E55NDAH

22. CONNECTION OF DISCHARGE PIPE E/21. CONNECTION OF DISCHARGE PIPE D

Caution
Remove the discharge pipes D and E with connected portions fixed by using spanners, etc. so that excessive force will not be applied to the discharge pipe for the sub-condenser connected portion.

17. INSTALLATION OF CONDENSER

When replacing the condenser, refill the condenser with a specified amount of compressor oil.

<Vehicles using R-12 refrigerant>
Compressor oil: DENSO OIL 6
Quantity: 30 cm³ (1.8 cu.in.)

<Vehicles using R-134a refrigerant>
Compressor oil: ND–OIL 8
Quantity:
Vehicles with single A/C: 40 cm³ (2.4 cu.in.)
Vehicles with dual A/C: 30 cm³ (1.8 cu.in.)

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REFRIGERANT LINE

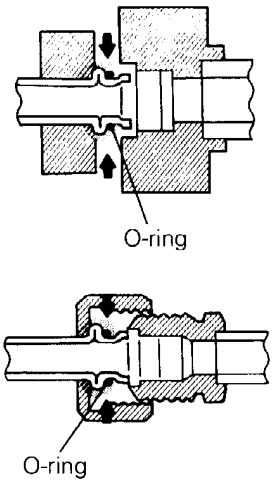
REMOVAL AND INSTALLATION

E55NA-2

Pre-removal and Post-installation Operation
- Discharge and Charging of Refrigerant (Refer to P.55-62, 67, 67-1, 67-4.)

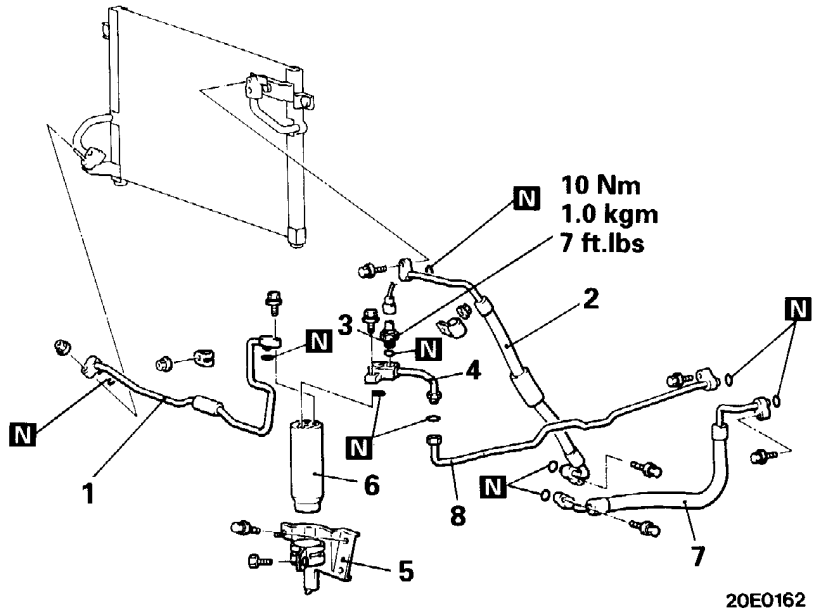
Single air conditioner <R.H. drive vehicles>

Piping connection



Compressor oil:
DENSO OIL 6*1
ND-OIL 8*2

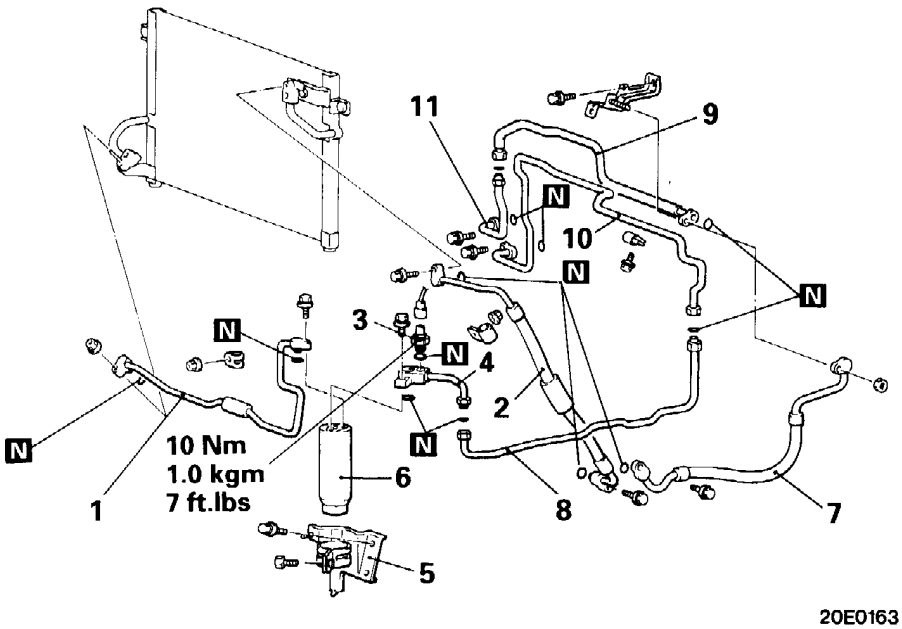
NOTE
*1 : <Vehicles using R-12 refrigerant>
*2 : <Vehicles using R-134a refrigerant>



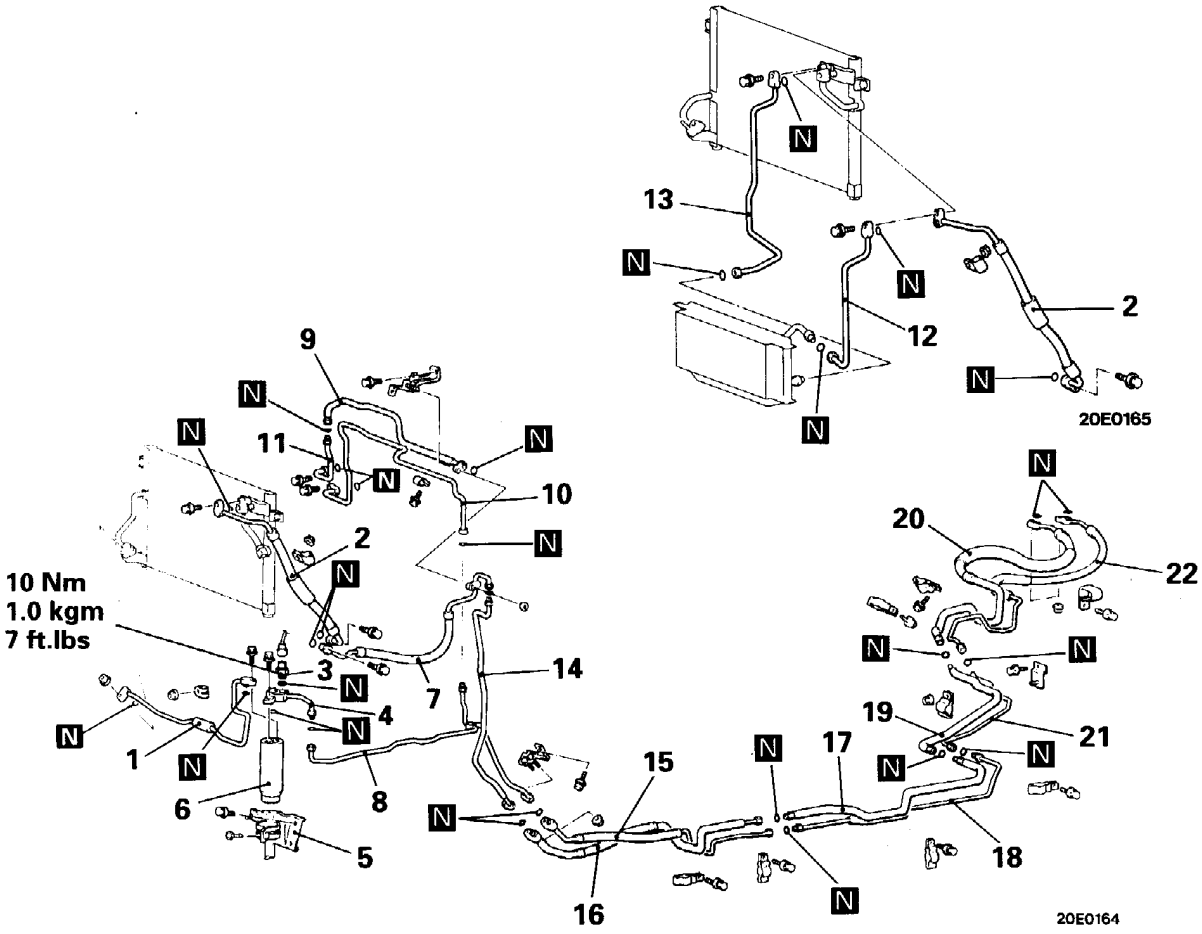
Removal steps
1. Discharge pipe A
2. Discharge hose
3. Dual pressure switch
4. Discharge pipe B
5. Receiver bracket
6. Receiver
7. Suction hose
8. Discharge pipe C
- Link bracket (Refer to GROUP 13 – Auto-cruise.) <L.H. drive vehicles with automatic cruise control>

9. Suction pipe A
10. Discharge pipe D
11. Suction pipe B

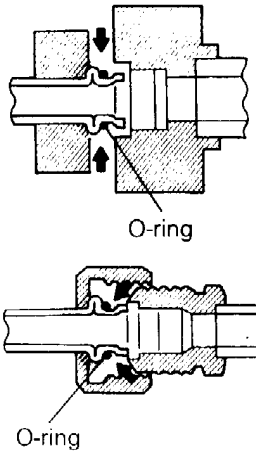
<L.H. drive vehicles>



Dual air conditioner
<L.H. drive vehicles>



Piping connection



Compressor oil: DENSO OIL 6*1
ND – OIL 8*2

NOTE
*1 : <Vehicles using R-12 refrigerant>
*2 : <Vehicles using R-134a refrigerant>

Removal steps

1. Discharge pipe A
2. Discharge hose
3. Dual pressure switch
4. Discharge pipe B
5. Receiver bracket
6. Receiver
7. Suction hose
8. Discharge pipe C
   ● Link bracket
   (Refer to GROUP 13 – Auto-cruise.)
   <Vehicles with Auto-cruise>
9. Suction pipe A
10. Discharge pipe D
11. Suction pipe B
12. Discharge pipe E <4D56>
13. Discharge pipe F <4D56>
14. Suction pipe C
15. Discharge pipe G
16. Suction pipe D
17. Suction pipe E
18. Discharge pipe H
19. Suction pipe F
20. Suction hose A
21. Discharge hose I
22. Discharge hose A

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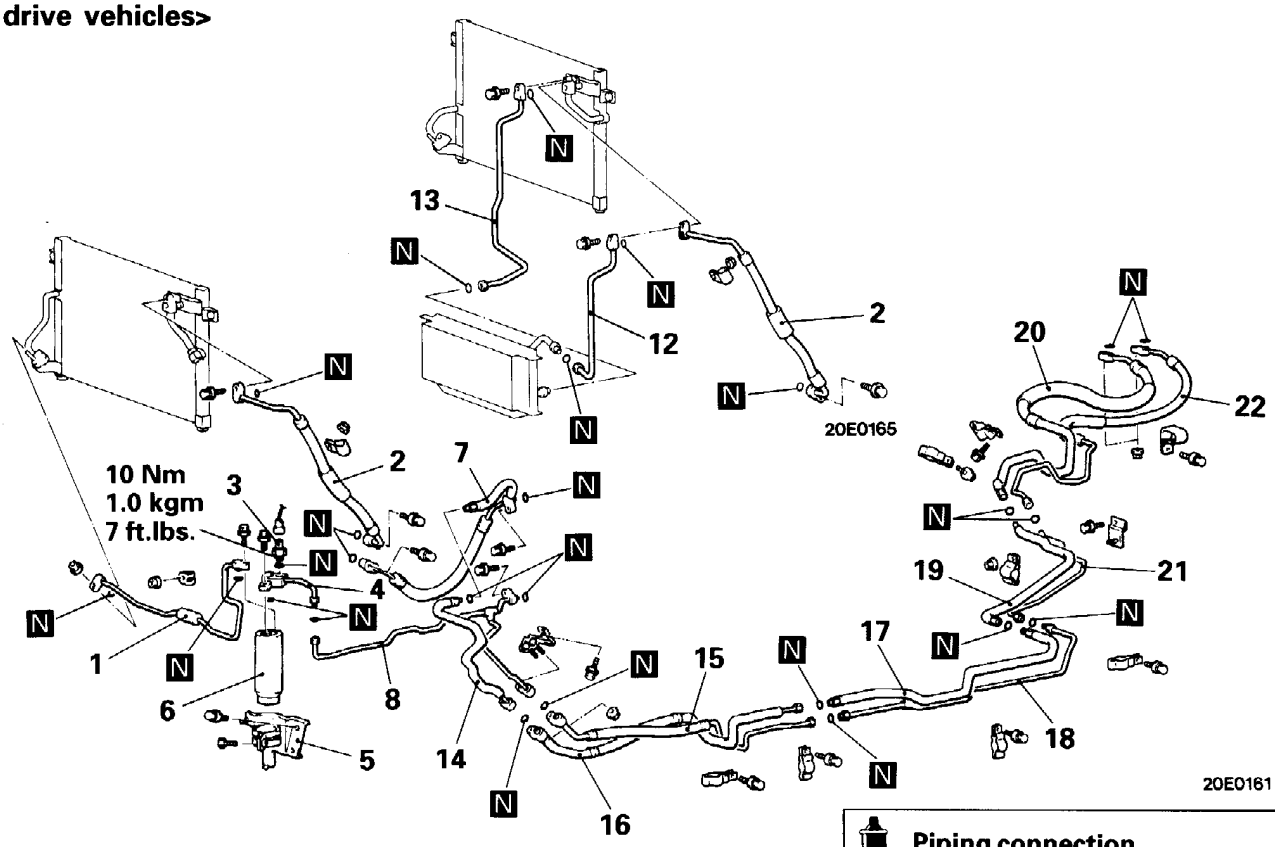
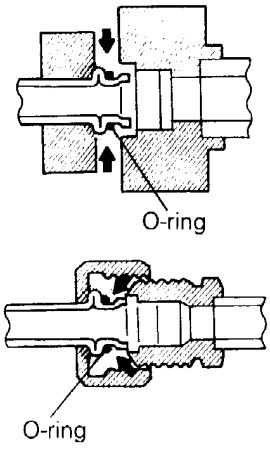
<R.H. drive vehicles>



Removal steps

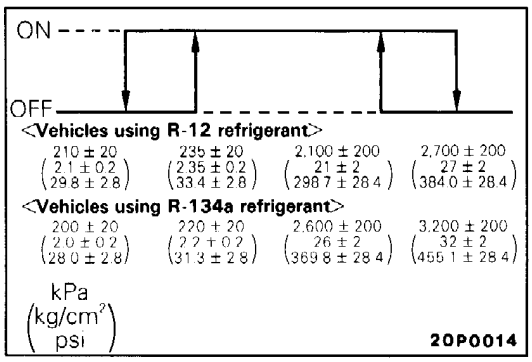
1. Discharge pipe A
2. Discharge hose
3. Dual pressure switch
4. Discharge pipe B
5. Receiver bracket
6. Receiver
7. Suction hose
8. Discharge pipe C
12. Discharge pipe E <4D56>
13. Discharge pipe F <4D56>
14. Suction pipe C
15. Discharge pipe G
16. Suction pipe D
17. Suction pipe E
18. Discharge pipe H
19. Suction pipe F
20. Suction hose A
21. Discharge pipe I
22. Discharge pipe A

Piping connection



Compressor oil: DENSO OIL 6*1
ND–OIL 8*2

NOTE
*1 : <Vehicles using R-12 refrigerant>
*2 : <Vehicles using R-134a refrigerant>



INSPECTION E55NEAB

DUAL PRESSURE SWITCH CHECK

Measure the pressure at the high pressure side. When the dual pressure switch is ON as in the figure at left, and if there is continuity between the dual pressure switch terminals, then the condition is normal; if there is no continuity, replace the switch.

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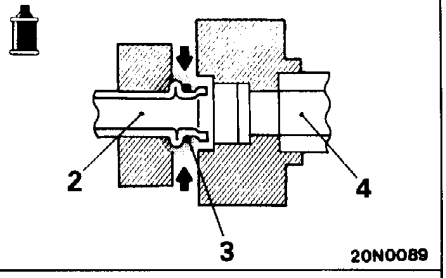
COMPRESSOR AND TENSION PULLEY

REMOVAL AND INSTALLATION

E55LA--

Pre-removal Operation
- Removal of Battery and Battery Tray
- Removal of Radiator Shroud Cover <6G72, 6G74, 4D56, 4M40> (Refer to GROUP 14–Radiator)
- Removal of Steering Shaft Joint Assembly <4M40–L.H. drive vehicles> (Refer to GROUP 37–Steering Column and Shaft)

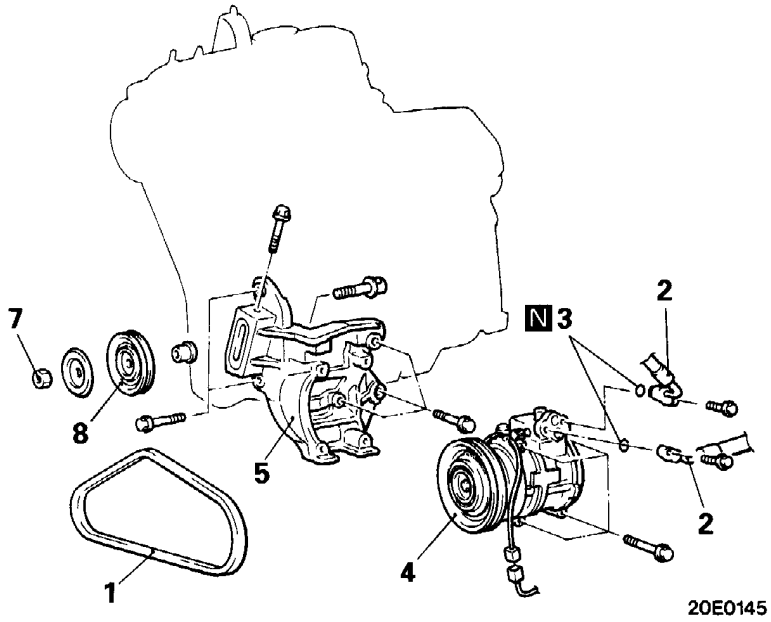
Post-installation Operation
- Adjustment of the Compressor Drive Belt (Refer to P.55-62.)
- Installation of the Radiator Shroud Cover <6G72, 6G74, 4D56, 4M40> (Refer to GROUP 14–Radiator)
- Installation of the Battery and Battery Tray
- Installation of Steering Shaft Joint Assembly <4M40–L.H. drive vehicles> (Refer to GROUP 37–Steering Column and Shaft)



Compressor oil: DENSO OIL 6*1
ND–OIL 8*2

NOTE
*1 : <Vehicles using R-12 refrigerant>
*2 : <Vehicles using R-134a refrigerant>

<6G72, 6G74>



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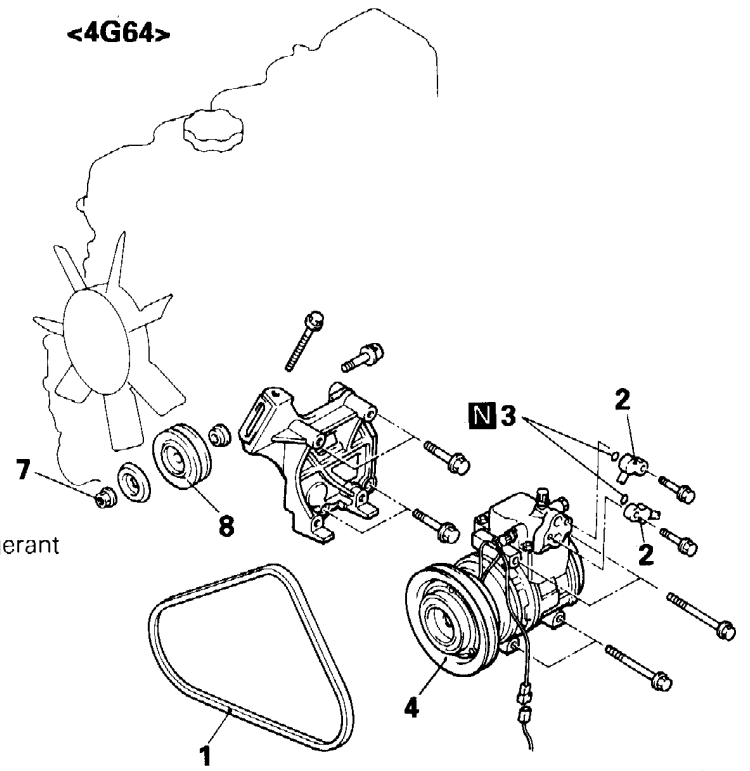

Removal steps of compressor
- Discharging and Charging of Refrigerant (Refer to P.55-62, 67, 67-1, 67-4.)

1. V-belt for A/C
2. Connection for discharge hose and suction hose
3. O-ring
4. Compressor
5. Compressor bracket

Removal steps of tension pulley

1. V-belt for A/C
7. Tension pulley mounting nut
8. Tension pulley

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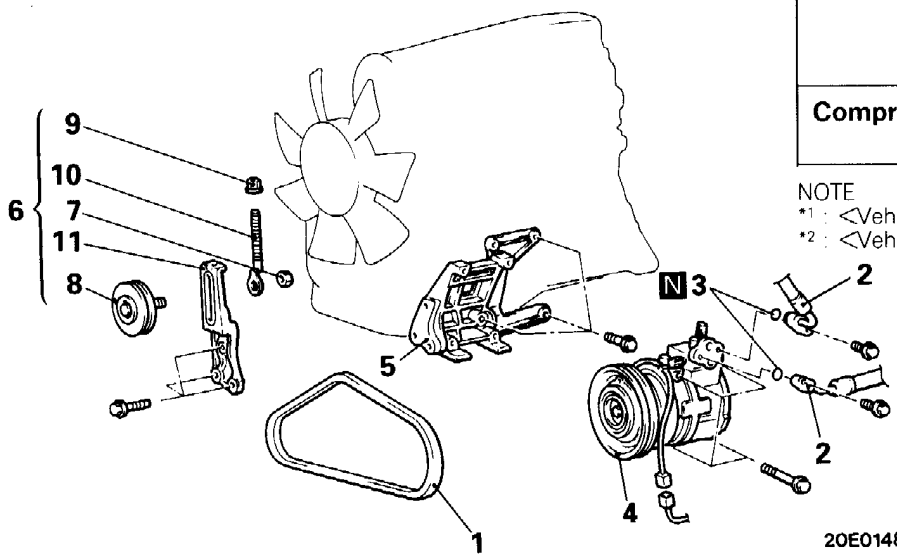
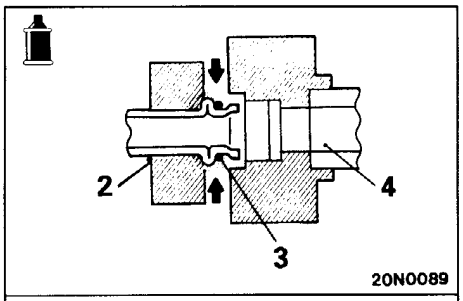
<4D56, 4M40>



20E0148



20N0089

Compressor oil: DENSO OIL 6*1
ND–OIL 8*2

NOTE
*1 : <Vehicles using R-12 refrigerant>
*2 : <Vehicles using R-134a refrigerant>

Removal steps of compressor

Discharging and Charging of Refrigerant (Refer to P.55-62, 67, 67-1, 67-4.)
1. V-belt for A/C
2. Connection for discharge hose and suction hose
3. O-ring
4. Compressor
5. Compressor bracket

Removal steps of compressor pulley

1. V-belt for A/C
6. Tension pulley bracket assembly
7. Tension pulley mounting nut
8. Tension pulley
9. Adjusting bolt
10. Adjusting bolt
11. Tension pulley bracket

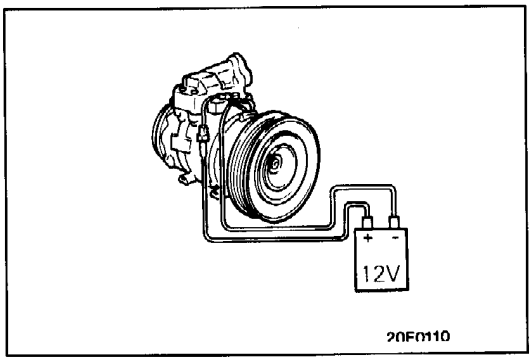
SERVICE POINTS OF REMOVAL

2. DISCONNECTION OF DISCHARGE HOSE AND SUCTION HOSE

If the hoses are disconnected, cap the hoses with a blank plug to prevent entry of dust, dirt, and water.

4. REMOVAL OF COMPRESSOR <4M40>

(1) Remove the power steering oil pump with the hose still connected, and place it somewhere where it will not be in the way while working.
(Refer to GROUP 37–Power Steering Oil Pump)
(2) Affix insulation tape to the brake pipe under the battery tray to protect the brake pipe.



20E0110

INSPECTION E55LGAF

COMPRESSOR MAGNETIC CLUTCH OPERATION INSPECTION

Connect the battery (+) terminal to the compressor side terminal, and earth the battery (–) terminal to the body of the compressor. The condition is normal if the sound of the magnetic clutch (click) can be heard.

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SERVICE POINTS OF INSTALLATION

4. INSTALLATION OF COMPRESSOR

If a new compressor is installed, first adjust the amount of oil according to the procedures described below, and then install the compressor.

(1) Measure the amount [X cm^3 (X cu.in.)] of oil within the removed compressor.

(2) Wipe away (from the new compressor) the amount of oil calculated according to the following formula, and then install the new compressor.

Amount of oil in new compressor:

80 cm^3 (4.9 cu.in.)*1
150 cm^3 (9.2 cu.in.)*2
} – X cm^3 (X cu.in.) = Y cm^3 (Y cu.in.)

NOTE

(1) *1 : Compressor for single A/C

(2) *2 : Compressor for dual A/C

(3) Y cm^3 (Y cu.in.) indicates the amount of oil in the refrigerant line, the condenser, the cooling unit, etc.

(4) If replacing any of the following parts at the same time as the compressor, subtract the specified amount of oil for each of the parts from Y cm^3 (Y cu.in.), and then remove this amount of oil from the new compressor.

Quantity:

<Vehicles using R-12 refrigerant>

Evaporator	**60 cm^3 (3.6 cu.in.)**
Condensor	**30 cm^3 (1.8 cu.in.)**
Suction hose	**10 cm^3 (0.6 cu.in.)**
Receiver	**10 cm^3 (0.6 cu.in.)**

<Vehicles using R-134a refrigerant>

- **Compressor for single A/C**

Evaporator	**40 cm^3 (2.4 cu.in.)**
Condenser	**40 cm^3 (2.4 cu.in.)**
Suction hose	**10 cm^3 (0.6 cu.in.)**
Receiver	**10 cm^3 (0.6 cu.in.)**

- **Compressor for dual A/C**

Evaporator	**60 cm^3 (3.6 cu.in.)**
Condenser	**30 cm^3 (1.8 cu.in.)**
Suction hose	**10 cm^3 (0.6 cu.in.)**
Receiver	**10 cm^3 (0.6 cu.in.)**

(5) Install the compressor with the compressor mounting bolts attached to the compressor <4D56, 4M40>

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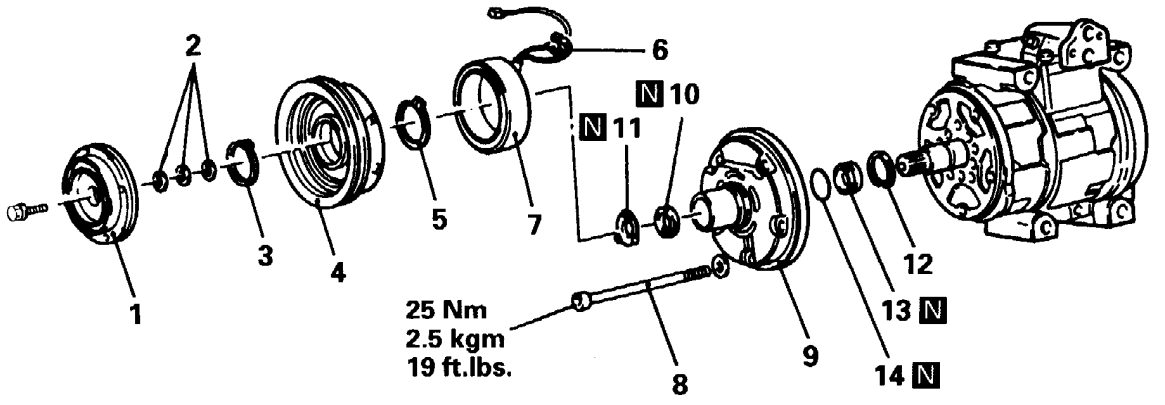
NOTES

DISASSEMBLY AND REASSEMBLY

E55LB--



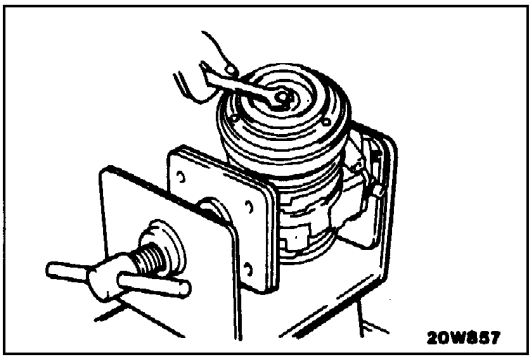
20W856

Magnetic clutch disassembly steps

- ◆◆ • Adjustment of clutch clearance
- ◆◆ 1. Clutch hub
- 2. Shims
- 3. Snap ring
- ◆◆ 4. Rotor assembly
- 5. Snap ring
- 6. Ground terminal
- ◆◆ 7. Clutch coil

Compressor front housing and shaft seal disassembly steps

- ◆◆ 8. Through bolt
- ◆◆ 9. Front housing
- ◆◆ 10. Felt
- 11. Felt holder
- 12. Snap ring
- ◆◆ ◆◆ 13. Shaft seal
- 14. O-ring



SERVICE POINTS OF DISASSEMBLY

E55LCAG

1. REMOVAL OF CLUTCH HUB

(1) Secure the compressor in a vise.
(2) If the clutch hub cannot be pulled off by hand, screw in an 8 mm (0.315 in.) completely threaded bolt so as to raise the clutch hub so it can be removed.

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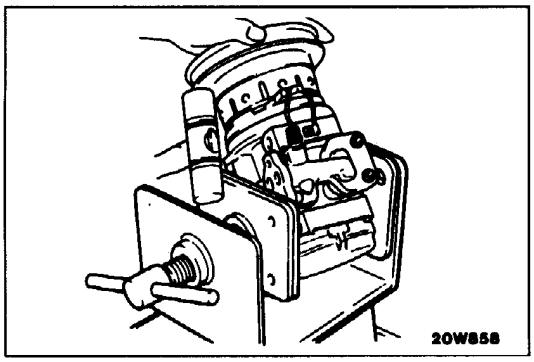


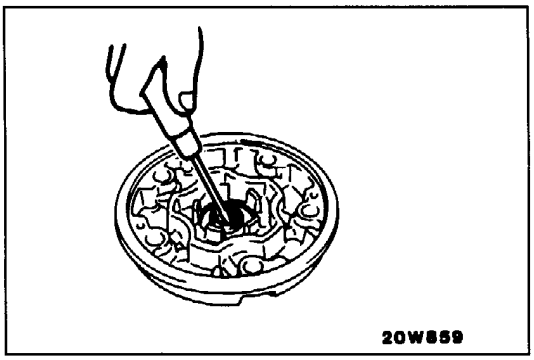
4. REMOVAL OF ROTOR ASSEMBLY

Using a plastic hammer, lightly tap the rotor off the shaft.

8. REMOVAL OF THROUGH BOLT

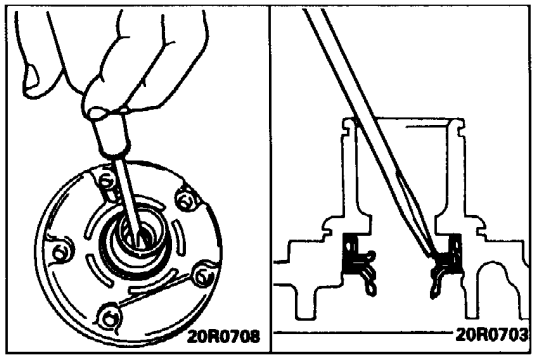
Remove the through bolt after first securing the rear housing of the compressor by placing it in a vise.

Caution
If the through bolt is removed without first doing so, the rear housing will become uncoupled and compressor oil will escape.



10. REMOVAL OF FELT

Using a screwdriver, remove the felt from the front housing.



13. REMOVAL OF SHAFT SEAL

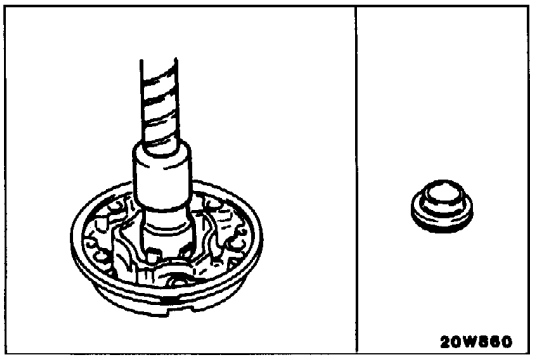
Using a screwdriver, remove the shaft seal from the front housing.

INSPECTION E55LDAE

- Check the surface of the clutch hub for scoring or bluing.
- Check the surface of the rotor for scoring or bluing.
- Check the sealing surfaces for cracks, scratches and deformation.
- Check the front housing for cracks or scoring on the sealing surfaces.
- Check the compressor shaft for scoring.

SERVICE POINTS OF REASSEMBLY E55LEAJ

13. INSTALLATION OF SHAFT SEAL



(1) Lubricate the shaft seal with specified compressor oil.

Specified compressor oil:
<Vehicles using R-12 refrigerant>
DENSO OIL 6
<Vehicles using R-134a refrigerant>
ND-OIL 8

(2) Set the shaft seal to the front housing so that the projection side of the center ring is at the shaft seal side.
(3) Using a 21 mm (0.83 in.) socket, install the shaft seal.

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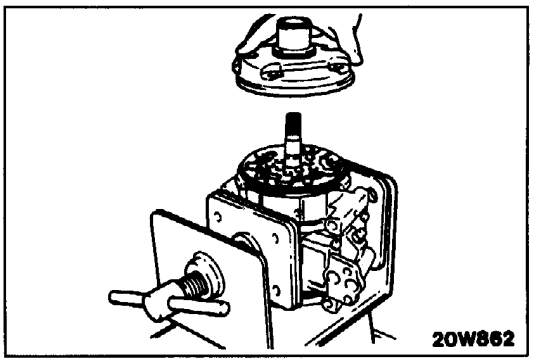
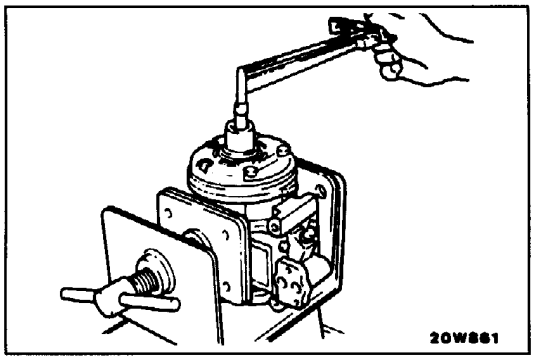


9. INSTALLATION OF FRONT HOUSING

(1) Apply the specified compressor oil on the shaft.

Specified compressor oil:
<Vehicles using R-12 refrigerant>
DENSO OIL 6
<Vehicles using R-134a refrigerant>
ND–OIL 8

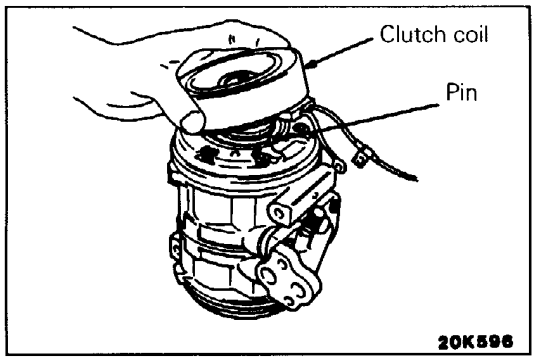
(2) Install the front housing, taking care not to damage the lip part of the shaft seal.



(3) Mount the bolt on the shaft, and then measure the shaft starting torque.

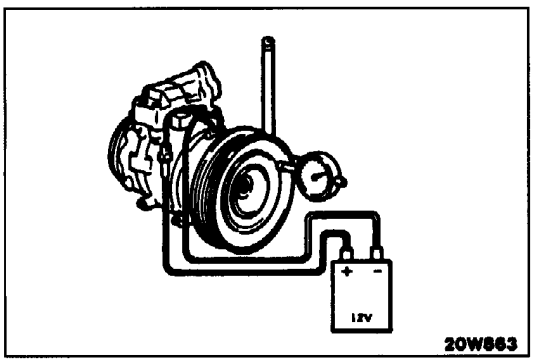
Standard value: 5.0 Nm (0.5 kgm, 3.6 ft.lbs.) or less

(4) Remove the bolt from the shaft.



7. INSTALLATION OF CLUTCH COIL

The clutch coil must be aligned with the pin in the compression housing.



• ADJUSTMENT OF CLUTCH CLEARANCE

(1) Connect the magnetic clutch to the battery.
(2) The clutch hub will be attracted to and fit closely to the rotor.
(3) Use a shim(s) to adjust so that the amount of movement of the clutch hub is as described below.

Standard value: 0.35–0.65 mm (0.0138–0.0256 in.)

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