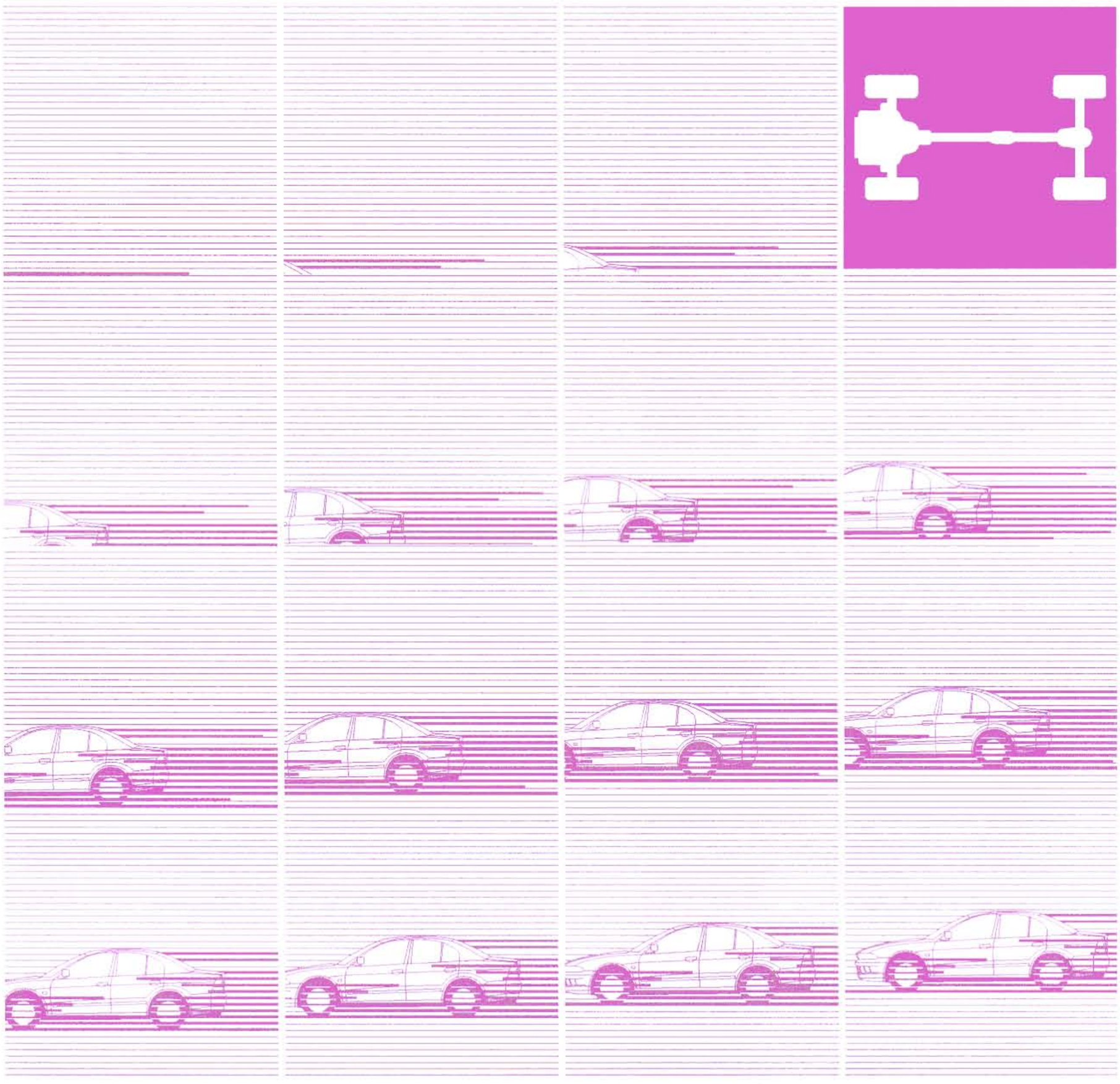
MITSUBISHI MOTORS

Workshop Manual

chassis

GALANT 1999



GALANT

WORKSHOP MANUAL SUPPLEMENT

FOREWORD

This manual outlines changes in servicing procedures related to the chassis including vehicle inspections, adjustments and improvements in the newly equipped models. Use the following manuals in combination with this manual required.

TECHNICAL INFORMATION MANUAL	
	PYDE9604 (Basic)
	PYDE9604-A (Supplement)
WORKSHOP MANUAL	
CHASSIS GROUP	PWDE9611 (Basic)
ENGINE GROUP	PWEE□□□□ (Looseleaf edition)
ELECTRICAL WIRING	PHDE9608
	PHDE9608-A
	PHDE9608-B
BODY REPAIR MANUAL	PBDE9609
PARTS CATALOGUE	
Sedan	B608S109A□
Wagon	B608T509A□

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

"GDI" is a trade mark of Mitsubishi Motors Corporation.

 Nov. 1998

GENERAL

CONTENTS

HOW TO USE THIS MANUAL

MODEL INDICATIONS

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

2000: Indicates models equipped with the 2,000 mL <4G63> petrol engine.
2400: Indicates models equipped with the 2,400 mL <4G64> petrol engine.
2500: Indicates models equipped with the 2,500 mL <6A13> petrol engine.
2000D: Indicates models equipped with the 2,000 mL <4D68> diesel engine.
MPI: Indicates the multipoint injection, or engine equipped with the multipoint injection.
GDI: Indicates the gasoline direct injection, or engine equipped with the gasoline direct injection.
SOHC: Indicates an engine with the single overhead camshaft, or models equipped with such an engine.
DOHC: Indicates an engine with the double overhead camshaft, or a model equipped with such an engine
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.

VEHICLE IDENTIFICATION

MODELS

<SEDAN>

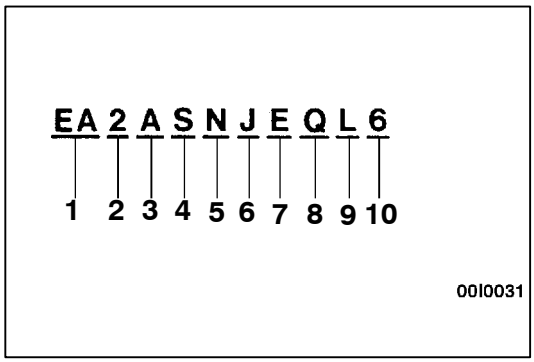
Model code		Engine model	Transmission model	Fuel supply system
EA2A	SNHEQL6	4G63-SOHC (1,997 mL)	F5M42 (2WD-5M/T)	MPI
	SRHEQL6		F4A42 (2WD-Sports Mode 4A/T)	
	SNJEQL6		F5M42 (2WD-5M/T)	
EA3A	SNHCQL6	4G64-DOHC-GDI (2,350 mL)	F5M42 (2WD-5M/T)	GDI
	SRHCQL6		F4A42 (2WD-Sports Mode 4A/T)	
EA5A	SNGEQL6	6A13-SOHC (2,498 mL)	F5M42 (2WD-5M/T)	MPI
	SRGEQL6		F4A42 (2WD-Sports Mode 4A/T)	
EA6A	SNHFQL6	4D68-SOHC (1,998 mL)	F5M42 (2WD-5M/T)	Electronically controlled injection pump
EA2A	SNHEQL6C	4G63-SOHC (1,997 mL)	F5M42 (2WD-5M/T)	MPI
	SRHEQL6C		F4A42 (2WD-Sports Mode 4A/T)	
	SNJEQL6C		F5M42 (2WD-5M/T)	
EA3A	SNHCQL6C	4G64-DOHC-GDI (2,350 mL)	F5M42 (2WD-5M/T)	GDI
	SRHCQL6C		F4A42 (2WD-Sports Mode 4A/T)	
EA5A	SNGEQL6C	6A13-SOHC (2,498 mL)	F5M42 (2WD-5M/T)	MPI
	SRGEQL6C		F4A42 (2WD-Sports Mode 4A/T)	
EA6A	SNHFQL6C	4D68-SOHC (1,998 mL)	F5M42 (2WD-5M/T)	Electronically controlled injection pump
EA2A	SNHEDL6C	4G63-SOHC (1,997 mL)	F5M42 (2WD-5M/T)	MPI
	SRHEDL6C		F4A42 (2WD-Sports Mode 4A/T)	
	SNJEDL6C		F5M42 (2WD-5M/T)	
EA3A	SNHCDL6C	4G64-DOHC-GDI (2,350 mL)	F5M42 (2WD-5M/T)	GDI
	SRHCDL6C		F4A42 (2WD-Sports Mode 4A/T)	
EA5A	SNGEDL6C	6A13-SOHC (2,498 mL)	F5M42 (2WD-5M/T)	MPI
	SRGEDL6C		F4A42 (2WD-Sports Mode 4A/T)	

Model code		Engine model	Transmission model	Fuel supply system
EA2A	SNHEQR6	4G63-SOHC (1,997 mL)	F5M42 (2WD-5M/T)	MPI
	SRHEQR6		F4A42 (2WD-Sports Mode 4A/T)	
EA3A	SNHCQR6	4G64-DOHC-GDI (2,350 mL)	F5M42 (2WD-5M/T)	GDI
	SRHCQR6		F4A42 (2WD-Sports Mode 4A/T)	
EA5A	SNGEQR6	6A13-SOHC (2,498 mL)	F5M42 (2WD-5M/T)	MPI
	SRGEQR6		F4A42 (2WD-Sports Mode 4A/T)	
EA6A	SNHFQR6	4D68-SOHC (1,998 mL)	F5M42 (2WD-5M/T)	Electronically controlled injection pump

<WAGON>

Model code		Engine model	Transmission model	Fuel supply system
EA2W	LNHEQL6	4G63-SOHC (1,997 mL)	F5M42 (2WD-5M/T)	MPI
	LRHEQL6		F4A42 (2WD-Sports Mode 4A/T)	
	LNJEQL6		F5M42 (2WD-5M/T)	
EA3W	LNHCQL6	4G64-DOHC-GDI (2,350 mL)	F5M42 (2WD-5M/T)	GDI
	LRHCQL6		F4A42 (2WD-Sports Mode 4A/T)	
EA5W	LNGEQL6	6A13-SOHC (2,498 mL)	F5M42 (2WD-5M/T)	MPI
	LRGEQL6		F4A42 (2WD-Sports Mode 4A/T)	
EA6W	LNHFQL6	4D68-SOHC (1,998 mL)	F5M42 (2WD-5M/T)	Electronically controlled injection pump
EA2W	LNHEQL6C	4G63-SOHC (1,997 mL)	F5M42 (2WD-5M/T)	MPI
	LRHEQL6C		F4A42 (2WD-Sports Mode 4A/T)	
	LNJEQL6C		F5M42 (2WD-5M/T)	
EA3W	LNHCQL6C	4G64-DOHC-GDI (2,350 mL)	F5M42 (2WD-5M/T)	GDI
	LRHCQL6C		F4A42 (2WD-Sports Mode 4A/T)	
EA5W	LNGEQL6C	6A13-SOHC (2,498 mL)	F5M42 (2WD-5M/T)	MPI
	LRGEQL6C		F4A42 (2WD-Sports Mode 4A/T)	

Model code		Engine model	Transmission model	Fuel supply system
EA6W	LNHFQL6C	4D68-SOHC (1,998 mL)	F5M42 (2WD-5M/T)	Electronically controlled injection pump
EA2W	LNHEDL6C	4G63-SOHC (1,997 mL)	F5M42 (2WD-5M/T)	MPI
	LRHEDL6C		F4A42 (2WD-Sports Mode 4A/T)	
	LNJEDL6C		F5M42 (2WD-5M/T)	
EA3W	LNHCDL6C	4G64-DOHC-GDI (2,350 mL)	F5M42 (2WD-5M/T)	GDI
	LRHCDL6C		F4A42 (2WD-Sports Mode 4A/T)	
EA5W	LNGEDL6C	6A13-SOHC (2,498 mL)	F5M42 (2WD-5M/T)	MPI
	LRGEDL6C		F4A42 (2WD-Sports Mode 4A/T)	
EA2W	LNHEQR6	4G63-SOHC (1,997 mL)	F5M42 (2WD-5M/T)	MPI
	LRHEQR6		F4A42 (2WD-Sports Mode 4A/T)	
EA3W	LNHCQR6	4G64-DOHC-GDI (2,350 mL)	F5M42 (2WD-5M/T)	GDI
	LRHCQR6		F4A42 (2WD-Sports Mode 4A/T)	
EA5W	LNGEQR6	6A13-SOHC (2,498 mL)	F5M42 (2WD-5M/T)	MPI
	LRGEQR6		F4A42 (2WD-Sports Mode 4A/T)	
EA6W	LNHFQR6	4D68-SOHC (1,998 mL)	F5M42 (2WD-5M/T)	Electronically controlled injection pump

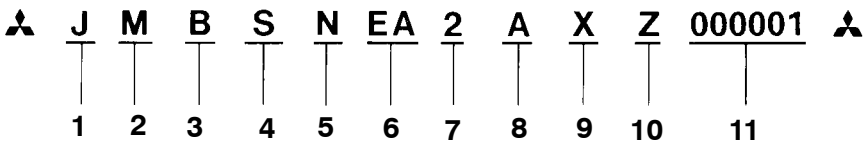


MODEL CODE

No.	Items	Contents
1	Development	EA: MITSUBISHI GALANT
2	Engine type	2: 2,000 mL petrol engine 3: 2,400 mL petrol engine 5: 2,500 mL petrol engine 6: 2,000 mL diesel engine
3	Sort	A: Passenger car W: Wagon
4	Body style	S: 4-door sedan L: 4-door station wagon
5	Transmission type	N: 5-speed manual transmission R: 4-speed automatic transmission
6	Trim level	J: GLX H: GLS G: V6-24
7	Specification engine feature	E: MPI-SOHC C: GDI-DOHC F: Turbocharger with intercooler
8	Exhaust system specification	Q, D*: With catalytic converter None: Without catalytic converter
9	Steering wheel location	L: Left hand R: Right hand
10	Destination	6: For Europe 6C: For Central Europe*

NOTE
*: Vehicles for Ausia, Czech, Germany, Hungary, Slovakia, Slovenia and Switzerland

CHASSIS NUMBER



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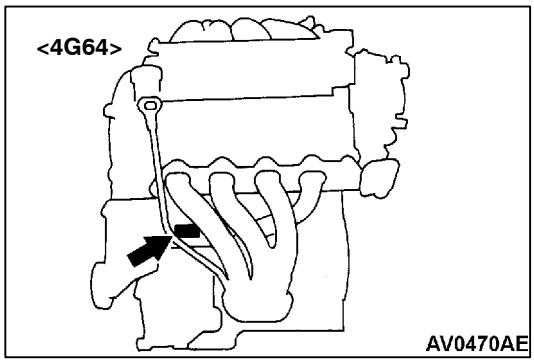
No.	Items		Contents
1	Fixed figure	J	Asia
2	Distribution channel	M	Japan channel
3	Destination	A	For Europe, right hand drive
		B	For Europe, left hand drive
4	Body style	S	4-door sedan
		L	4-door station wagon
5	Transmission type	N	5-speed manual transmission
		R	4-speed automatic transmission
6	Development order	EA	GALANT
7	Engine	2	4G63: 1,997 mL petrol engine
		3	4G64: 2,350 mL petrol engine
		5	6A13: 2,498 mL petrol engine
		6	4D68: 1,998 mL diesel engine
8	Sort	A	Passenger car
9	Model year	X	1999
10	Plant	Z	Okazaki Motor Vehicle Works
11	Serial number	–	–



ENGINE MODEL NUMBER <4G64>

1. The engine model number is stamped at the cylinder block as shown in the following.

Engine model	Engine displacement mL
4G64	2,350 mL

2. The engine serial number is stamped near the engine model number.

Engine serial number	AA0201 to YY9999

NEW VEHICLES

New vehicles has been added as shown below.
New vehicle has been developed from the respective basic vehicle. Specification show only a particular part of the new vehicle. For the remaining par, refer to specifications for basic vehicle.

New vehicle	Basic vehicle
EA3ASNHCQL6	EA2ASNHEQL6
EA3ASRHCQL6	EA2ASRHEQL6
EA3ASNHCQL6C	EA2ASNHEQL6C
EA3ASRHCQL6C	EA2ASRHEQL6C
EA3ASNHCDL6C	EA2ASNHEDL6C
EA3ASRHCDL6C	EA2ASRHEDL6C
EA3ASNHCQR6	EA2ASNHEQR6
EA3ASRHCQR6	EA2ASRHEQR6
EA3WLNHCQL6	EA2WLNHEQL6
EA3WLRHCQL6	EA2WLRHEQL6
EA3WLNHCQL6C	EA2WLNHEQL6C
EA3WLRHCQL6C	EA2WLRHEQL6C
EA3WLNHCDL6C	EA2WLNHEDL6C
EA3WLRHCDL6C	EA2WLRHEDL6C
EA3WLNHCQR6	EA2WLNHEQR6
EA3WLRHCQR6	EA2WLRHEQR6

MAJOR SPECIFICATIONS

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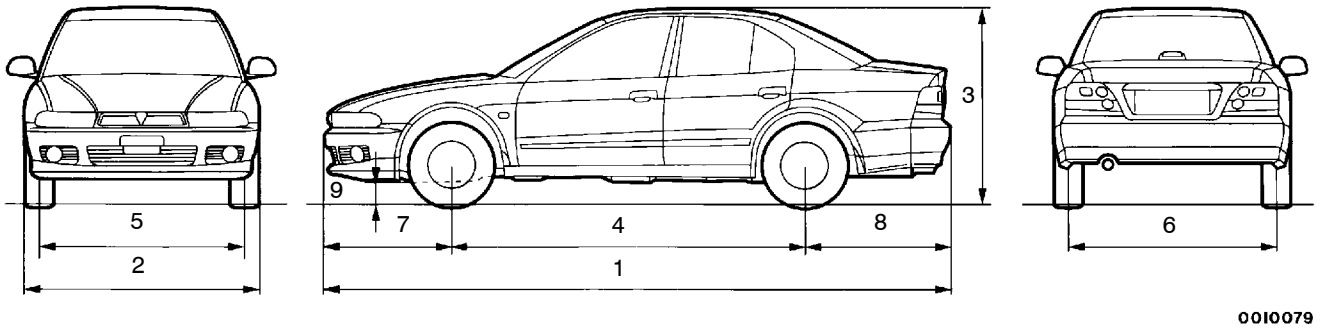
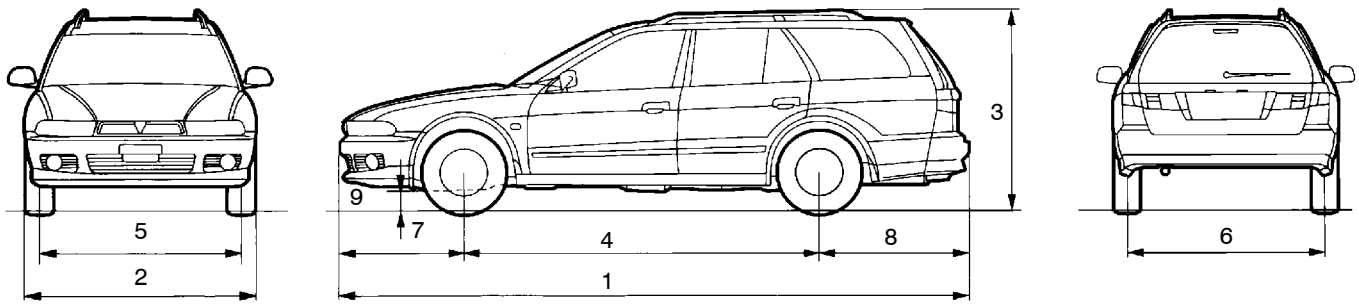


Items			EA2A SNJEQL6, SNJEQL6C, SNJEDL6C	EA2A SNHEQL6, SNHEQL6C, SNHEDL6C, SNHEQR6	EA2A SRHEQL6, SRHEQL6C, SRHEDL6C, SRHEQR6	EA3A SNHCQL6, SNHCQL6C, SNHCDL6C, SNHCQR6	EA3A SRHCQL6, SRHCQL6C, SRHCDL6C, SRHCQR6
Vehicle dimensions mm	Overall length	1	4,630	4,630	4,630	4,630	4,630
	Overall width	2	1,740	1,740	1,740	1,740	1,740
	Overall height (unladen)	3	1,415	1,415	1,415	1,415	1,415
	Wheelbase	4	2,635	2,635	2,635	2,635	2,635
	Track-front	5	1,510	1,510	1,510	1,510	1,510
	Track-rear	6	1,505	1,505	1,505	1,505	1,505
	Overhang-front	7	930	930	930	930	930
	Overhang-rear	8	1,065	1,065	1,065	1,065	1,065
	Ground clearance (unladen)	9	150	150	150	150	150
Vehicle weight kg	Kerb weight		1,260		1,280	1,320	1,340
	Max. gross vehicle weight		1,775			1,835	
	Max. axle weight rating-front		925			985	
	Max. axle weight rating-rear		850			850	
Seating capacity			5				
Engine	Model No.		4G63			4G64	
	Total displacement mL		1,997			2,350	
Transmission	Model No.		F5M42		F4A42	F5M42	F4A42
	Type		5-speed manual		Sports Mode 4-speed automatic	5-speed manual	Sports Mode 4-speed automatic
Fuel system	Fuel supply system		Electronically controlled multipoint injection			Gasoline Direct Injection	

Items			EA5A SNGEQL6, SNGEQL6C, SNGEDL6C, SNGEQR6	EA5A SRGEQL6, SRGEQL6C, SRGEDL6C, SRGEQR6	EA6A SNHFQL6, SNHFQL6C, SNHFQR6
Vehicle dimensions mm	Overall length	1	4,630	4,630	4,630
	Overall width	2	1,740	1,740	1,740
	Overall height (unladen)	3	1,415	1,415	1,415
	Wheelbase	4	2,635	2,635	2,635
	Track-front	5	1,510	1,510	1,510
	Track-rear	6	1,505	1,505	1,505
	Overhang-front	7	930	930	930
	Overhang-rear	8	1,065	1,065	1,065
	Ground clearance (unladen)	9	150	150	150
Vehicle weight kg	Kerb weight		1,290	1,310	1,300
	Max. gross vehicle weight		1,805		1,795
	Max. axle weight rating-front		955		955
	Max. axle weight rating-rear		850		840
Seating capacity			5		
Engine	Model No.		6A13		4D68
	Total displacement mL		2,498		1,998
Transmission	Model No.		F5M42	F4A42	F5M42
	Type		5-speed manual	Sports Mode 4-speed automatic	5-speed manual
Fuel system	Fuel supply system		Electronically controlled multipoint injection		Electronically controlled fuel injection

<Wagon>



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Items			EA2W LNJEQL6, LNJEQL6C, LNJEDL6C	EA2W LNHEQL6, LNHEQL6C, LNHEDL6C, LNHEQR6	EA2W LRHEQL6, LRHEQL6C, LRHEDL6C, LRHEQR6	E3AW LNHCQL6, LNHCQL6C, LNHCDL6C, LNHCQR6	EA3W LRHCQL6, LRHCQL6C, LRHCDL6C, LRHCQR6
Vehicle dimensions mm	Overall length	1	4,680	4,680	4,680	4,680	4,680
	Overall width	2	1,740	1,740	1,740	1,740	1,740
	Overall height (unladen)	3	1,445, 1,495*	1,445, 1,495*	1,445, 1,495*	1,445, 1,495*	1,445 1,495*
	Wheelbase	4	2,635	2,635	2,635	2,635	2,635
	Track-front	5	1,510	1,510	1,510	1,510	1,510
	Track-rear	6	1,505	1,505	1,505	1,505	1,505
	Overhang-front	7	930	930	930	930	930
	Overhang-rear	8	1,115	1,115	1,115	1,115	1,115
	Ground clearance (unladen)	9	150	150	150	150	150
Vehicle weight kg	Kerb weight		1,310	1,310	1,330	1,370	1,390
	Max. gross vehicle weight		1,830			1,890	
	Max. axle weight rating-front		920			980	
	Max. axle weight rating-rear		910			910	
Seating capacity			5				
Engine	Model No.		4G63			4G64	
	Total displacement mL		1,997			2,350	
Transmission	Model No.		F5M42		F4A42	F5M42	F4A42
	Type		5-speed manual		Sports Mode 4-speed automatic	5-speed manual	Sprorts Mode 4-speed automatic
Fuel system			Electronically controlled multipoint injection			Gasoline Direct Injection	

NOTE
*: With roof rails

Items			EA5W LNGEQL6, LNGEQL6C, LNGED6C, LNGEQR6	EA5W LRGEQL6, LRGEQL6C, LRGEDL6C, LRGEQR6	EA6W LNHFQL6, LNHFQL6C, LNHFQR6
Vehicle dimensions mm	Overall length	1	4,680	4,680	4,680
	Overall width	2	1,740	1,740	1,740
	Overall height (unladen)	3	1,445 1,495*	1,445 1,495*	1,445 1,495*
	Wheelbase	4	2,635	2,635	2,635
	Track-front	5	1,510	1,510	1,510
	Track-rear	6	1,505	1,505	1,505
	Overhang-front	7	930	930	930
	Overhang-rear	8	1,115	1,115	1,115
	Ground clearance (unladen)	9	150	150	150
Vehicle weight kg	Kerb weight		1,340	1,360	1,350
	Max. gross vehicle weight		1,860		1,850
	Max. axle weight rating-front		950		
	Max. axle weight rating-rear		910		900
Seating capacity			5		
Engine	Model No.		6A13		4D68
	Total displacement mL		2,498		1,998
Transmission	Model No.		F5M42	F4A42	F5M42
	Type		5-speed manual	Sports Mode 4-speed automatic	5-speed manual
Fuel system	Fuel supply system		Electronically controlled multipoint injection		Electronically controlled fuel injection

NOTE
*: With roof rails

ENGINE
<4G6-GDI>

CONTENTS

GENERAL

OUTLINE OF CHANGE

The following service procedures have been added to correspond to the addition of the 4G64-GDI engine.

GENERAL INFORMATION

Items			4G64-GDI
Total displacement mL			2,350
Bore × Stroke mm			86.5 × 100.0
Compression ratio			11.5
Combustion chamber			Pentroof + ball-in-piston
Camshaft arrangement			DOHC
Number of valve	Intake		8
	Exhaust		8
Valve timing	Intake	Opening	BTDC 16°
		Closing	ABDC 60°
	Exhaust	Opening	BBDC 56°
		Closing	ATDC 16°
Fuel system			Electronically controlled multipoint fuel injection
Rocker arm			Roller type
Auto-lash adjuster			Equipped

SERVICE SPECIFICATIONS

Items			Standard value	Limit
Alternator drive belt tension	Vibration frequency Hz	When checked	189 – 232	–
		When a used belt is installed	201 – 222	–
		When a new belt is installed	241 – 276	–
	Tension N	When checked	392 – 588	–
		When a used belt is installed	441 – 539	–
		When a new belt is installed	637 – 833	–
	Deflection (Reference value) mm	When checked	6.7 – 9.0	–
		When a used belt is installed	7.2 – 8.4	–
		When a new belt is installed	5.0 – 6.4	–

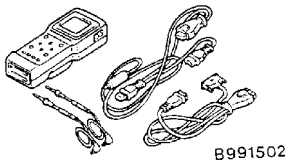
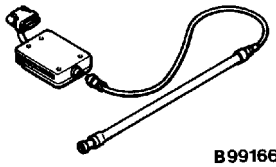
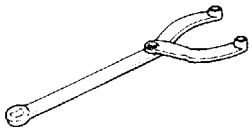
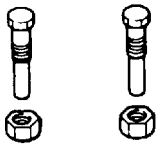
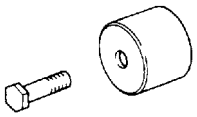
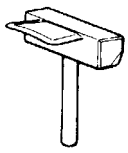
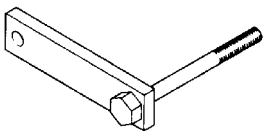
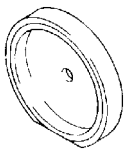
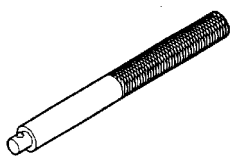
Items			Standard value	Limit
Power steering oil pump and A/C compressor drive belt tension	Vibration frequency Hz	When checked	108 – 132	–
		When a used belt is installed	114 – 126	–
		When a new belt is installed	137 – 157	–
	Tension N	When checked	392 – 588	–
		When a used belt is installed	441 – 539	–
		When a new belt is installed	637 – 834	–
	Deflection (Reference value) mm	When checked	11.7 – 15.3	–
		When a used belt is installed	12.5 – 14.3	–
		When a new belt is installed	8.8 – 11.0	–
Basic ignition timing			5° BTDC ± 3°	–
Ignition timing			Approx. 20°BTDC*1	–
Idle speed r/min	M/T		600 ± 100*2	–
	A/T		650 ± 100	–
CO contents %			0.5 or less	–
HC contents ppm			100 or less	–
Compression pressure kPa – r/min			1,570 – 300	1,210 – 300
Compression pressure difference of all cylinder kPa			–	Max. 100
Intake manifold vacuum kPa			–	Min. 56*3
Cylinder head bolt shank length mm			–	99.4
Timing belt B tension mm			5 – 7	–
Auto-tensioner push rod movement mm			Within 1	–
Timing belt tension torque Nm (Reference value)			3.5	–
Auto-tensioner rod protrusion amount mm			3.8 – 4.5	–

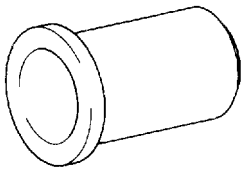
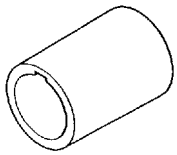
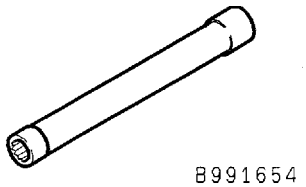
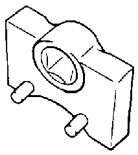
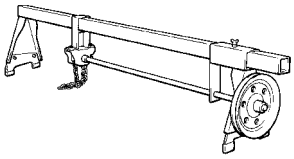
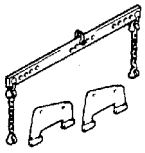
NOTE
*1: Indicates the value measured within 4 minutes since the engine was started.
*2: Varies depending on the transmission oil temperature. For details, refer to P.11D-10.
*3: Indicates the value when more than 4 minutes have passed since the engine was started.

SEALANTS

Items	Specified sealants	Remarks
Beam camshaft cap Cylinder head	3M ATD Part No.8660 or equivalent	–
Cam position sensor support Oil pan	MITSUBISHI GENUINE PART MD970389 or equivalent	Semi-drying sealant
Flywheel or drive plate bolt	3M Stud Locking 4170 or equivalent	–

SPECIAL TOOLS

Tool	Number	Name	Use
	MB991502	MUT-II sub assembly	• Measuring the drive belt tension • Checking the ignition timing • Checking the idle speed • Erasing diagnosis code
	MB991668	Belt tension meter set	Measuring the drive belt tension (used together with the MUT-II)
	MB990767	End yoke holder	• Holding the camshaft sprocket • Holding the crankshaft sprocket
	MD998719 or MD998754	Crankshaft pulley holder pin	• Holding the camshaft sprocket • Holding the crankshaft sprocket
	MD998713	Camshaft oil seal installer	Press-in of the camshaft oil seal
	MD998727	Oil pan remover	Removal of oil pan
	MD998781	Flywheel stopper	Securing the flywheel
	MD998776	Crankshaft rear oil seal installer	Press-in of the crankshaft rear oil seal
	MB990938	Handle	Press-in of the crankshaft rear oil seal

Tool	Number	Name	Use
	MD998382	Crankshaft front oil seal installer	Installation of crankshaft front oil seal
	MD998285	Crankshaft front oil seal guide	
 B991654	MB991654	Cylinder head bolt wrench	Cylinder head bolt removal and installation
	MD998767	Tension pulley socket wrench	Timing belt tension adjustment
	GENERAL SERVICE TOOL MZ203827	Engine lifter	Supporting the engine assembly during removal and installation of the transmission
 B991453	MB991453	Engine hanger assembly	

ON-VEHICLE SERVICE

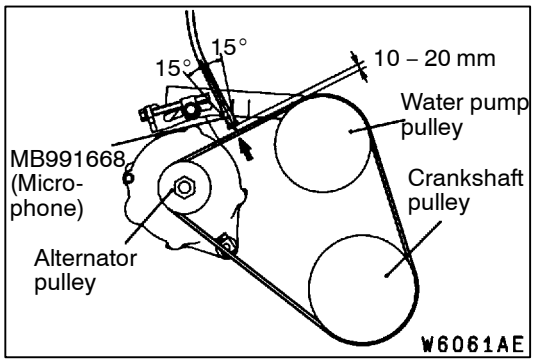
DRIVE BELT TENSION CHECK AND ADJUSTMENT

ALTERNATOR DRIVE BELT TENSION CHECK

Check the drive belt tension in the following procedure.

Standard value:

Vibration frequency Hz	189 – 232
Tension N	392 – 588
Deflection (Reference value) mm	6.7 – 9.0

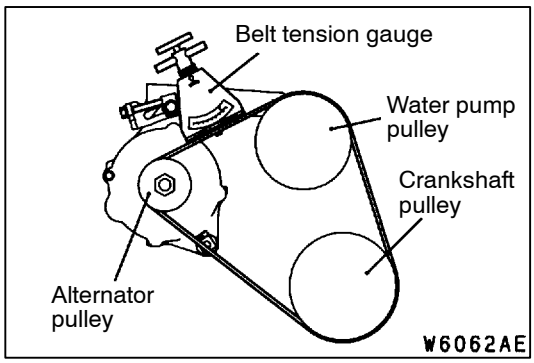


<When using the MUT-II>

1. Connect the special tool (belt tension meter set) to the MUT-II.
2. Connect the MUT-II to the diagnosis connector.
3. Turn the ignition switch to ON and select "Belt Tension Measurement" from the menu screen.
4. Hold the microphone to the middle of the drive belt between the pulleys (at the place indicated by the arrow), about 10 – 20 mm away from the rear surface of the belt and so that it is perpendicular to the belt (within an angle of ± 15°).
5. Gently tap the middle of the belt between the pulleys (the place indicated by the arrow) with your finger as shown in the illustration, and check that the vibration frequency of the belt is within the standard value.

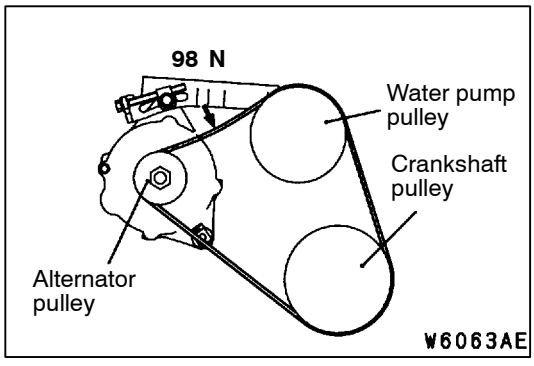
Caution

(1) The temperature of the surface of the belt should be as close as possible to normal temperature.
(2) Do not let any contaminants such as water or oil get onto the microphone.
(3) If strong gusts of wind blow against the microphone or if there are any loud sources of noise nearby, the values measured by the microphone may not correspond to actual values.
(4) If the microphone is touching the belt while the measurement is being made, the values measured by the microphone may not correspond to actual values.
(5) Do not take the measurement while the vehicle's engine is running.



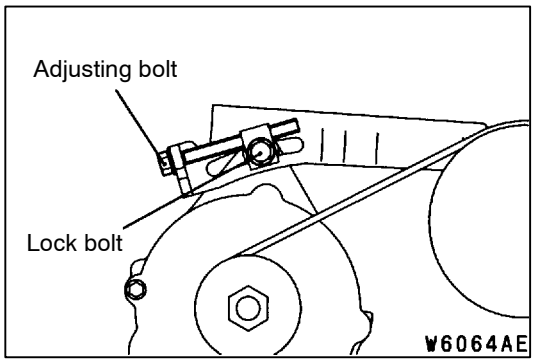
<When using a tension gauge>

Use a belt tension gauge to check that the belt tension is within the standard value.



<Belt deflection check>

Apply 98 N of force to the middle of the drive belt between the pulleys (at the place indicated by the arrow) and check that the amount of deflection is within the standard value.



ALTERNATOR DRIVE BELT TENSION ADJUSTMENT

1. Loosen the nut of the alternator pivot bolt.
2. Loosen the lock bolt.
3. Use the adjusting bolt to adjust the belt tension and belt deflection to the standard values.

   Standard value:

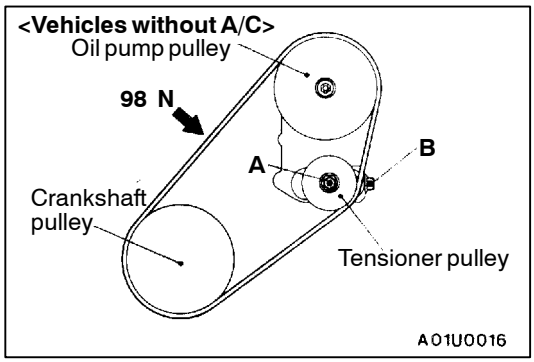
Items	When a used belt is installed	When a new belt is installed
Vibration frequency Hz	201 – 222	241 – 276
Tension N	441 – 539	637 – 833
Deflection (Reference value) mm	7.2 – 8.4	5.0 – 6.4

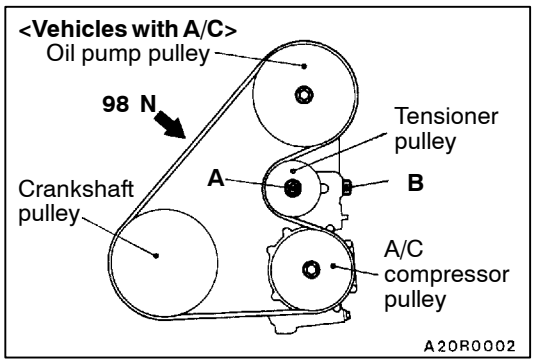
4. Tighten the nut of the alternator pivot bolt.

   Tightening torque: 49 Nm
5. Tighten the lock bolt.

   Tightening torque: 22 Nm
6. Tighten the adjusting bolt.

   Tightening torque: 5 Nm





POWER STEERING OIL PUMP AND AIR CONDITIONER COMPRESSOR DRIVE BELT TENSION CHECK AND ADJUSTMENT

1. Check if the belt tension is within the standard value using one of the methods below.

   Standard value:

Items	When checked	When a used belt is installed	When a new belt is installed
Vibration frequency Hz	108 – 132	114 – 126	137 – 157
Tension N	392 – 588	441 – 539	637 – 834
Deflection (Reference value) mm	11.7 – 15.3	12.5 – 14.3	8.8 – 11.0

   <When measuring the vibration frequency>

   With your finger tip lightly tap the centre of the belt between the pulleys in the location shown by the arrow in the illustration and then measure the belt vibration frequency.

   NOTE
   Refer to P.11D-6 for information regarding the vibration frequency measurement method using MUT-II.

   <When measuring the tension>

   Use a belt tension gauge to measure the belt tension.

   <When measuring the deflection>

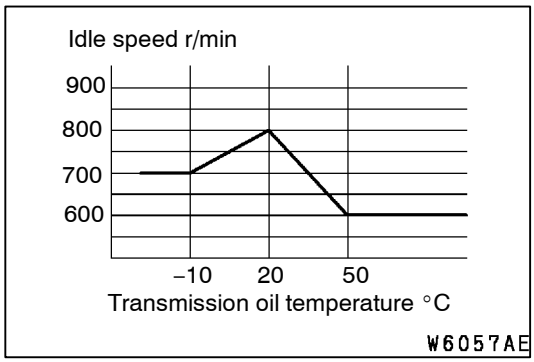
   Apply 98 N of pressure against the location between the pulleys shown by the arrow in the illustration and then measure the deflection.

2. If the tension or deflection is outside the standard value, adjust by the following procedure.
   (1) Loosen tensioner pulley fixing nut A.
   (2) Adjust the amount of belt deflection using adjusting bolt B.
   (3) Tighten fixing nut A.

   Tightening torque: 25 Nm

   (4) Check the belt deflection amount and tension, and readjust if necessary.

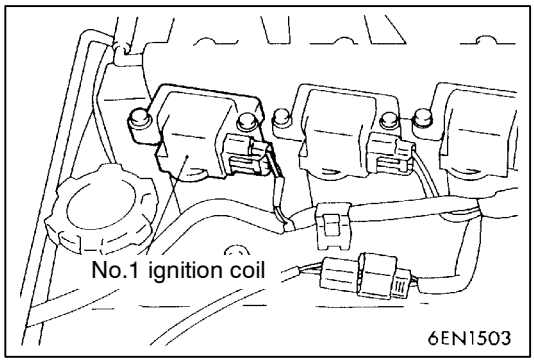
   Caution
   Check after turning the crankshaft once or more clockwise (right turn).



IGNITION TIMING CHECK

1. Before inspection, set the vehicle to the pre-inspection condition.
   For vehicles with manual transmission, drive the vehicle for 15 minutes or more to warm the engine, and then carry out the checking while the transmission oil temperature is more than 50°C.

   NOTE
   The idle speed in vehicles with manual transmission varies as shown in the illustration in accordance with the transmission oil temperature.
2. Turn off the ignition switch and then connect the MUT-II to the diagnosis connector.



3. Set the timing light to the power supply line (terminal No.1) of the ignition coil No.1.

   NOTE
   The power supply line is looped and also longer than the other ones.
4. Start the engine and let it run at idle.
5. Use the MUT-II to measure engine idle speed and check that it is within the standard value.

   Standard value:

Items	Idle speed r/min
M/T	600 ± 100 (700 ± 100)*
A/T	650 ± 100 (700 ± 100)*

   NOTE
   *: Indicates the values when more than 4 minutes have passed since the idling condition was started.
6. Select No.17 of the MUT-II Actuator test.

   NOTE
   At this time, the engine speed will become approximately 700 r/min.
7. Check that basic ignition timing is within the standard value.

   Standard value: 5° BTDC ± 3°
8. If the basic ignition timing is outside the standard value, inspect the GDI system while referring to GROUP 13I – Troubleshooting.

9. Press the MUT-II clear key (Select a forced driving cancel mode) to release the Actuator test.

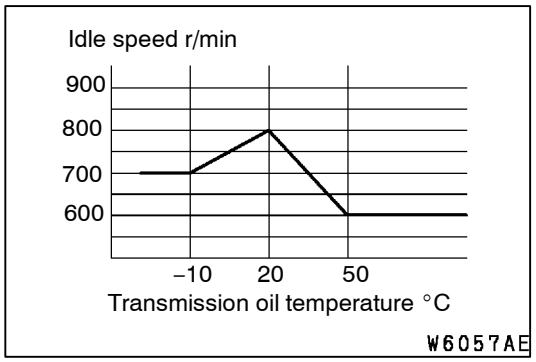
   Caution
   If the test is not cancelled, a forced driving will continue for 27 minutes. Driving under this condition may damage the engine.

10. Check that ignition timing is at the standard value.

    Standard value: approx. 20°BTDC

    NOTE
    (1) The ignition timing will become approximately 5°BTDC after more than 4 minutes have passed since the basic ignition timing set mode was released.
    (2) The ignition timing may fluctuate within ±7°BTDC. This is normal.
    (3) In higher altitude, the ignition timing is more advanced than the standard value by approximately 5 degree.

11. Remove the timing light.
12. Turn off the ignition switch and then remove the MUT-II.



IDLE SPEED CHECK

1. Before inspection, set the vehicle to the pre-inspection condition.
   For vehicles with manual transmission, drive the vehicle for 15 minutes or more to warm the engine, and then carry out the checking while the transmission oil temperature is more than 50°C.

   NOTE
   The idle speed in vehicles with manual transmission varies as shown in the illustration in accordance with the transmission oil temperature.

2. Turn off the ignition switch and then connect the MUT-II to the diagnosis connector.
3. Check the basic ignition timing.

   NOTE
   Refer to P.11D-9 concerning the check procedure of the basic ignition timing.

   Standard value: 5° BTDC ± 3°

4. Run the engine at idle for 2 minutes.

5. Check the idle speed. Select item No. 22 and take a reading of the idle speed.

   Standard value:

Items	Idle speed r/min
M/T	600 ± 100 (700 ± 100)*
A/T	650 ± 100 (700 ± 100)*

   NOTE
   (1) *: Indicates the values when more than 4 minutes have passed since the idling condition was started.
   (2) The idle speed is controlled automatically by the idle speed control system.

6. If the idle speed is outside the standard value, inspect the GDI components by referring to GROUP 13I – Troubleshooting.

IDLE MIXTURE CHECK

1. Before inspection, set the vehicle to the pre-inspection condition.
2. Connect the MUT-II to the diagnosis connector.
3. Check that the basic ignition timing is within the standard value.

   NOTE
   Refer to P.11D-10 concerning the check procedure of the basic ignition timing.

   Standard value: 5° BTDC ± 3°

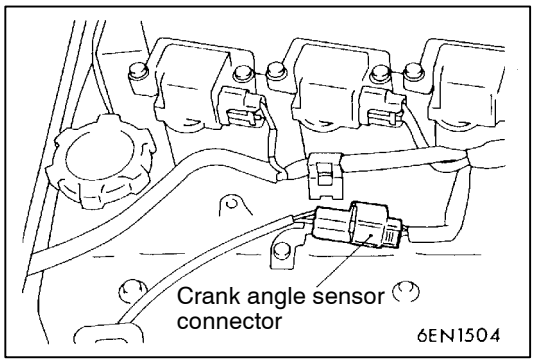
4. Run the engine at 2,500 r/min for 2 minutes.
5. Set the CO, HC tester.
6. Check the CO contents and the HC contents at idle.

   NOTE
   This measurement should be performed in less than approximately 4 minutes since the engine speed become the idle speed.

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

7. If there is a deviation from the standard value, check the following items:
   - Diagnosis output
   - Fuel pressure
   - Injector
   - Ignition coil, spark plug
   - EGR control system
   - Evaporative emission control system
   - Compression pressure

   NOTE
   Replace the three way catalyst when the CO and HC contents are not within the standard value, even though the result of the inspection is normal on all items.

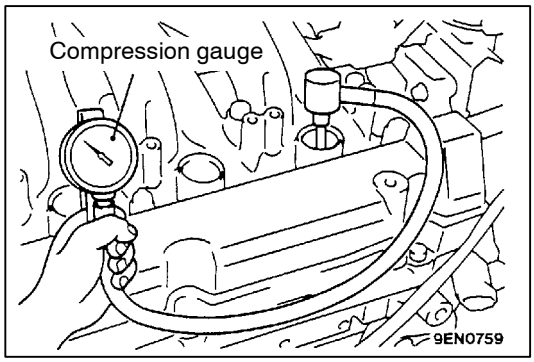


COMPRESSION PRESSURE CHECK

1. Before inspection, check that the engine oil, starter and battery are normal. In addition, set the vehicle to the pre-inspection condition.
2. Remove all of the ignition coils and spark plugs.
3. Disconnect the crank angle sensor connector.

   NOTE
   Doing this will prevent the engine-ECU from carrying out ignition and fuel injection.
4. Cover the spark plug hole with a shop towel etc., and after the engine has been cranked, check that no foreign material is adhering to the shop towel.

   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.



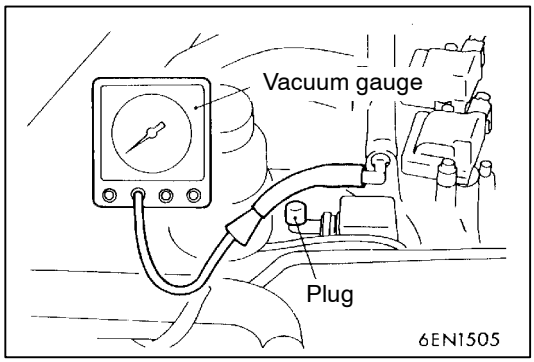
5. Set compression gauge to one of the spark plug holes.
6. Crank the engine with the throttle valve fully open and measure the compression pressure.

   Standard value (at engine speed of 300 r/min): 1,570 kPa

   Limit (at engine speed of 300 r/min): Min. 1,210 kPa
7. Measure the compression pressure for all the cylinders, and check that the pressure differences of the cylinders are below the limit.

   Limit: Max. 100 kPa
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 crank angle sensor connector.
10. Install the spark plugs and ignition coils.
11. Use the MUT-II to erase the diagnosis codes.

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



MANIFOLD VACUUM CHECK

1. Before inspection, set the vehicle to the pre-inspection condition.
2. Disconnect the ventilation hose from the positive crankcase ventilation (PCV) valve, and then connect a vacuum gauge to the ventilation hose.
3. Check the intake manifold vacuum while the engine is idling.

   Limit: Min. 56 kPa

LASH ADJUSTER CHECK

If an abnormal noise (knocking) that seems to be coming from the lash adjuster is heard after starting the engine and does not stop, carry out the following check.

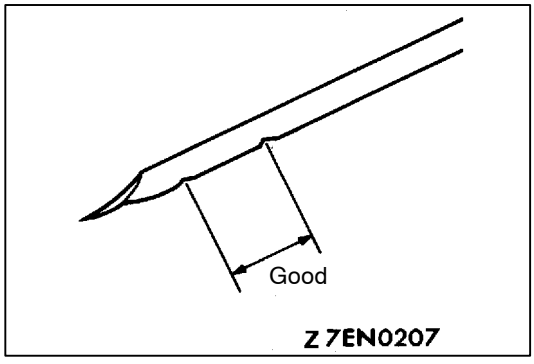
NOTE
(1) The abnormal noise which is caused by a problem with the lash adjusters is generated after the engine is started, and will vary according to the engine speed. However, this noise is not related to the actual engine load.
Because of this, if the noise does not occur immediately after the engine is started, if it does not change in accordance with the engine speed, or if it changes in accordance with the engine load, the source of the noise is not the lash adjusters.
(2) If there is a problem with the lash adjusters, the noise will almost never disappear, even if the engine has been run at idle to let it warm up.
The only case where the noise might disappear is if the oil in the engine has not been looked after properly and oil sludge has caused the lash adjusters to stick.

1. Start the engine.
2. Check that the noise occurs immediately after the engine is started, and that the noise changes in accordance with changes in the engine speed.
   If the noise does not occur immediately after the engine is started, or if it does not change in accordance with the engine speed, the problem is not being caused by the lash adjusters, so check for some other cause of the problem. Moreover, if the noise does not change in accordance with the engine speed, the cause of the problem is probably not with the engine. (In these cases, the lash adjusters are normal.)
3. While the engine is idling, check that the noise level does not change when the engine load is varied (for example, by shifting from N → D).
   If the noise level changes, the cause of the noise is probably parts striking because of worn crankshaft bearings or connecting rod bearings. (In such cases, the lash adjusters are normal.)

4. After the engine has warmed up, run it at idle and check if any noise can be heard.
   If the noise has become smaller or disappeared, oil sludge could make the lash adjusters stick. Clean the lash adjusters. (Refer to the Engine Workshop Manual.) If not improved, go to step 5.
5. Bleed air from the lash adjusters.
6. If the noise has not disappeared even after the air bleeding, clean the lash adjusters. (Refer to the Engine Workshop Manual.)

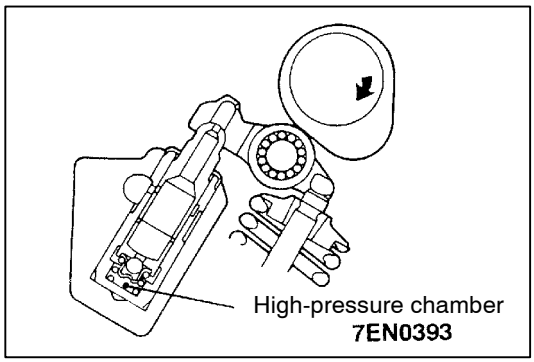
<LASH ADJUSTER AIR BLEEDING>

NOTE
(1) If the vehicle is parked on a slope for a long period of time, the amount of oil inside the lash adjuster will decrease, and air may get into the high pressure chamber when starting the engine.
(2) After parking the vehicle for long periods, the oil drains out of the oil passage, and it takes time for the oil to be supplied to the lash adjuster, so air can get into the high pressure chamber.
(3) If either of the above situations occur, the abnormal noise can be eliminated by bleeding the air from inside the lash adjusters.

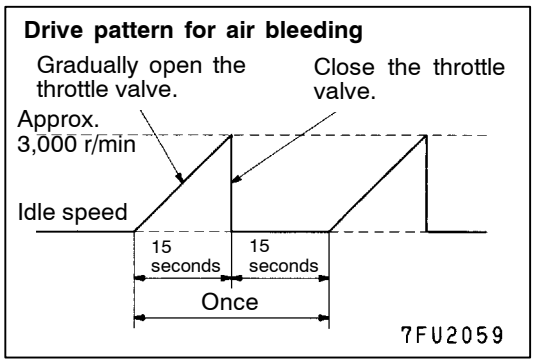


1. Check the engine oil and replenish or replace the oil if necessary.

   NOTE
   (1) If there is a only small amount of oil, air will be drawn in through the oil screen and will get into the oil passage.
   (2) If the amount of oil is greater than normal, then the oil will being mixed by the crankshaft and a large amount of air may get mixed into the oil.
   (3) If the oil is degenerated, air and oil will not separate easily in oil, and the amount of air mixed into the oil will increase.



(4) If the air which has been mixed in with the oil due to any of the above reasons gets into the high pressure chamber of the lash adjuster, the air inside the high pressure chamber will be compressed when the valve is open and the lash adjuster will over-compress, resulting in abnormal noise when the valve closes. This is the same effect as if the valve clearance is adjusted to be too large by mistake. If the air inside the lash adjusters is then released, the operation of the lash adjusters will return to normal.



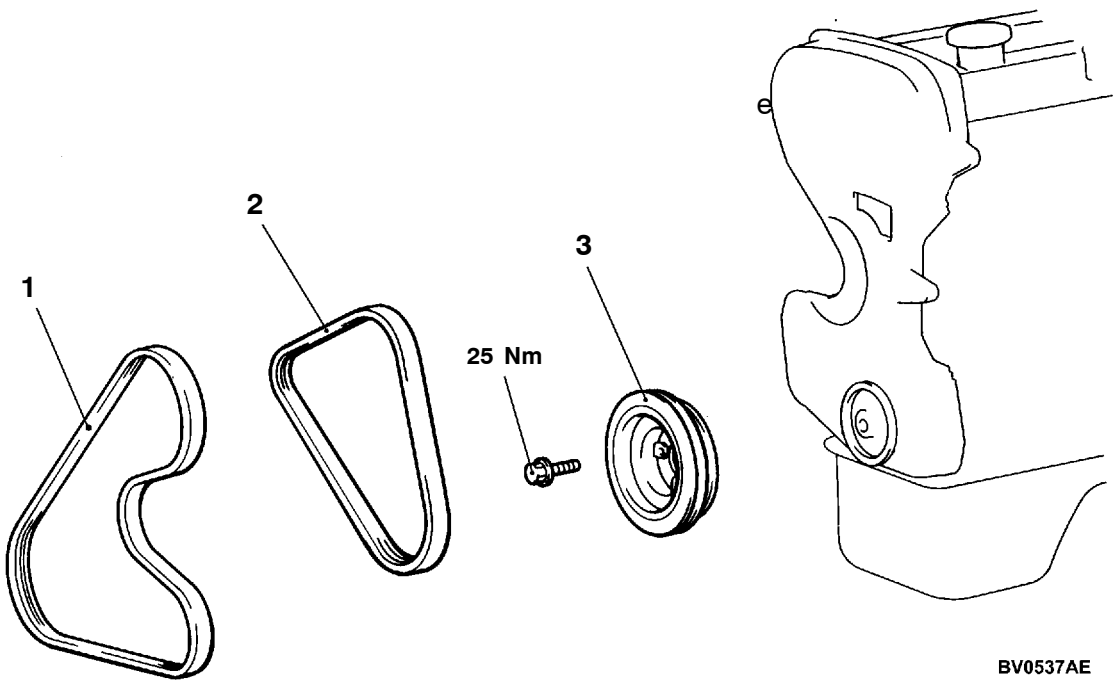
2. Run the engine at idle for 1 – 3 minutes to let it warm up.
3. With no load on the engine, repeat the drive pattern shown in the illustration at left and check if the abnormal noise disappears. (The noise should normally disappear after 10 – 30 repetitions, but if there is no change in the noise level after 30 repetitions or more, the problem is probably not due to air inside the lash adjusters.)
4. After the noise has disappeared, repeat the drive pattern shown in the illustration at left a further 5 times.
5. Run the engine at idle for 1 – 3 minutes and check that the noise has disappeared.

CRANKSHAFT PULLEY

REMOVAL AND INSTALLATION

Pre-removal Operation
Under Cover Removal

Post-installation Operation
- Drive Belt Tension Adjustment (Refer to P.11D-5.)
- Under Cover Installation



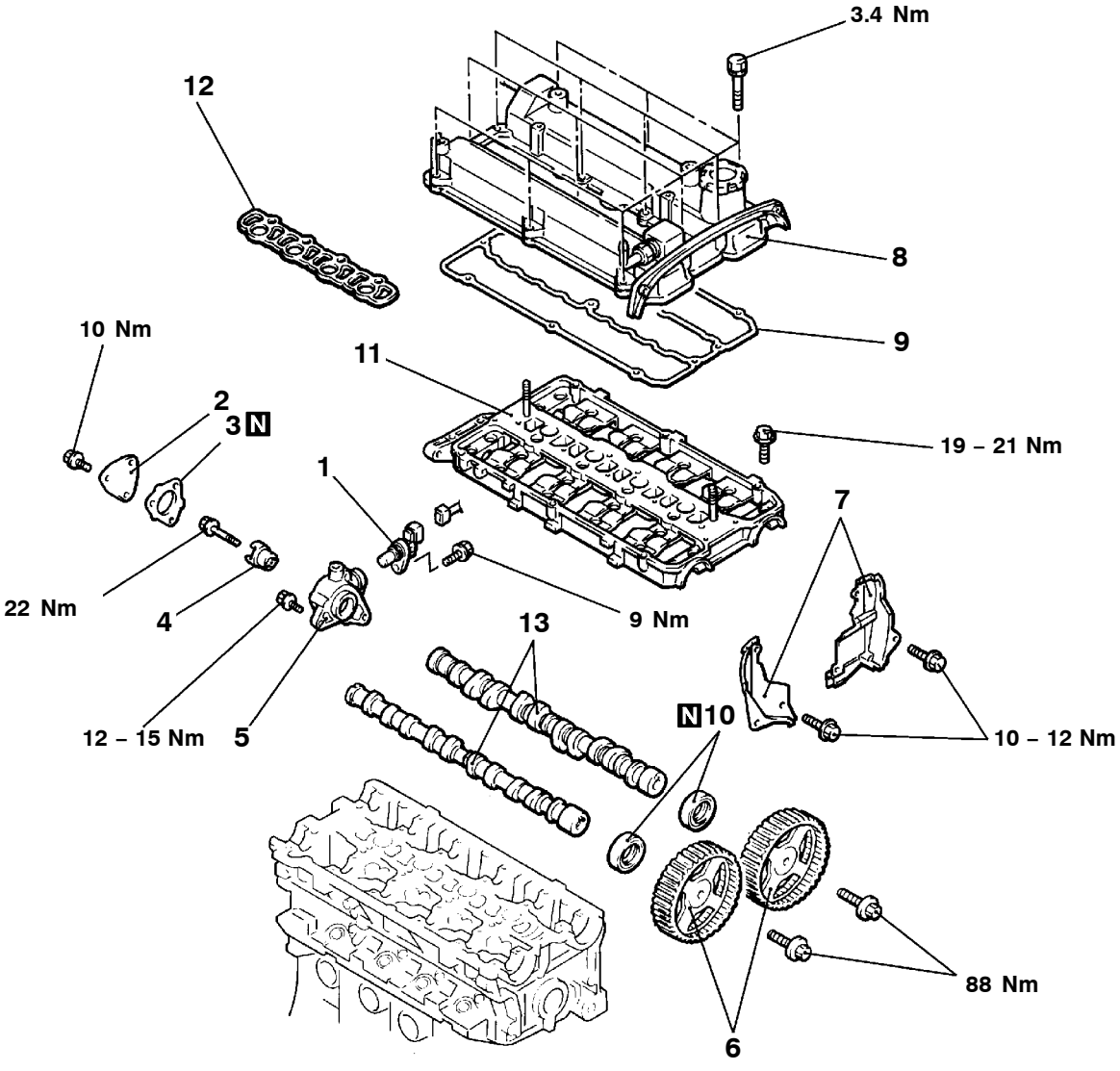
Removal steps
1. Drive belt (Power steering and A/C)
2. Drive belt (Alternator)
3. Crankshaft pulley

CAMSHAFT AND CAMSHAFT OIL SEAL

REMOVAL AND INSTALLATION

Pre-removal Operation
- Air Intake Hose Assembly Removal
- Timing Belt Removal (Refer to P.11D-29.)
- Engine Coolant Draining
- Intake Manifold Removal (Refer to GROUP 15.)
- Fuel Pump (High Pressure) Removal (Refer to GROUP 13I.)

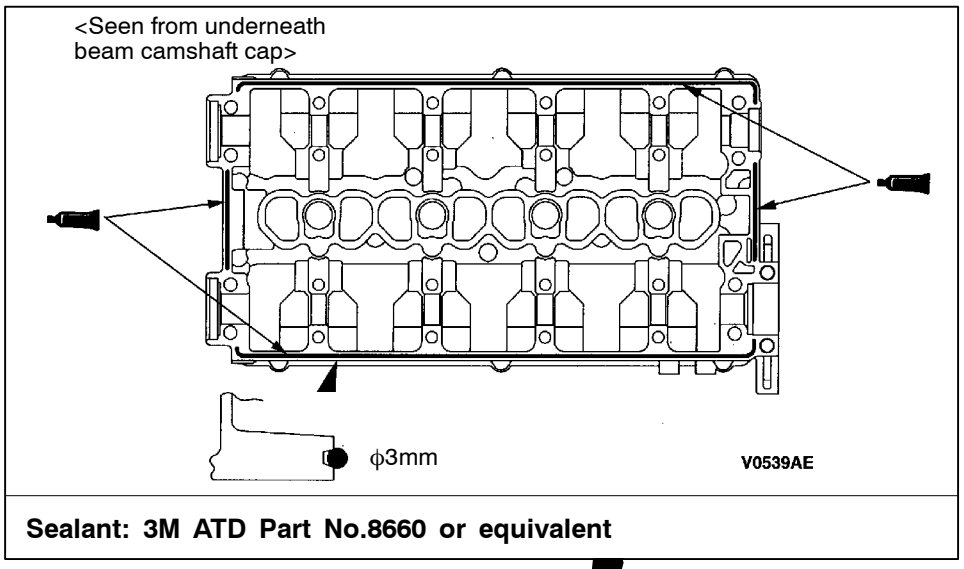
Post-installation Operation
- Fuel Pump (High Pressure) Installation (Refer to GROUP 13I.)
- Intake Manifold Installation (Refer to GROUP 15.)
- Timing Belt Installation (Refer to P.11D-29.)
- Air Intake Hose Assembly Installation
- Engine Coolant Supplying
- Drive Belt Tension Adjustment (Refer to P.11D-6.)



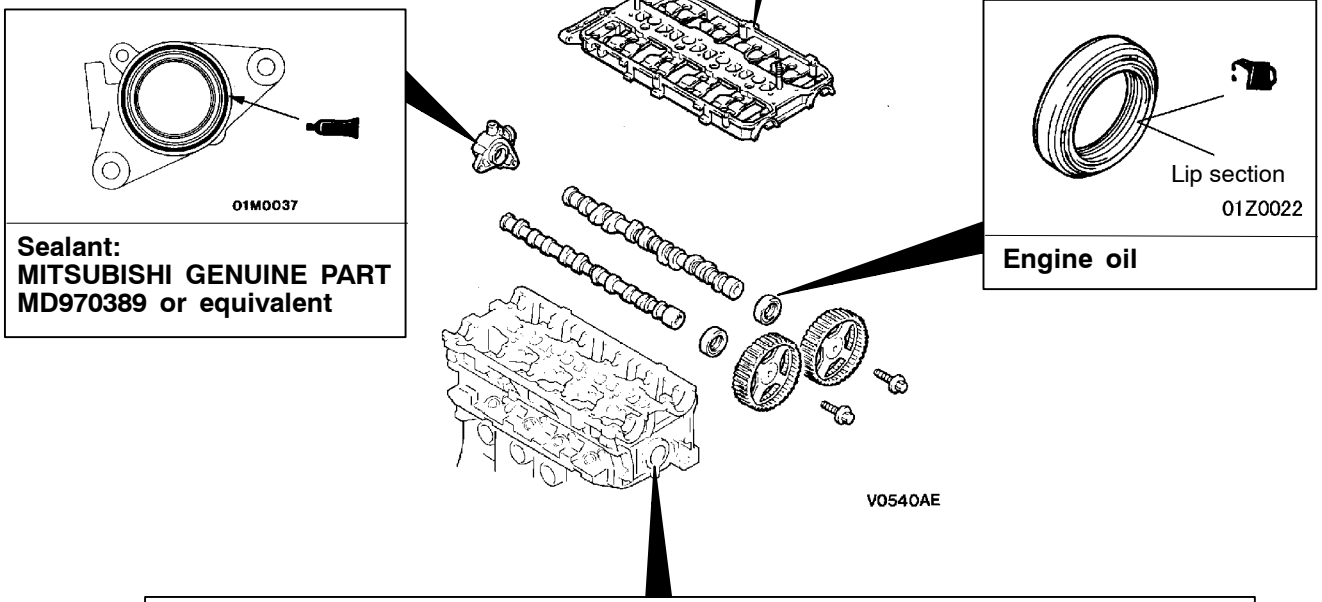
Removal steps

1. Cam position sensor
2. Cover
3. Gasket
▶E◀ 4. Camshaft position sensing cylinder
5. Camshaft position sensor support
◀A▶ ▶D◀ 6. Camshaft sprocket
7. Timing belt rear cover
8. Rocker cover
9. Rocker cover gasket
▶C◀ 10. Camshaft oil seal
▶B◀ 11. Beam camshaft cap
12. Beam camshaft cap gasket
▶A◀ 13. Camshaft

Lubrication points

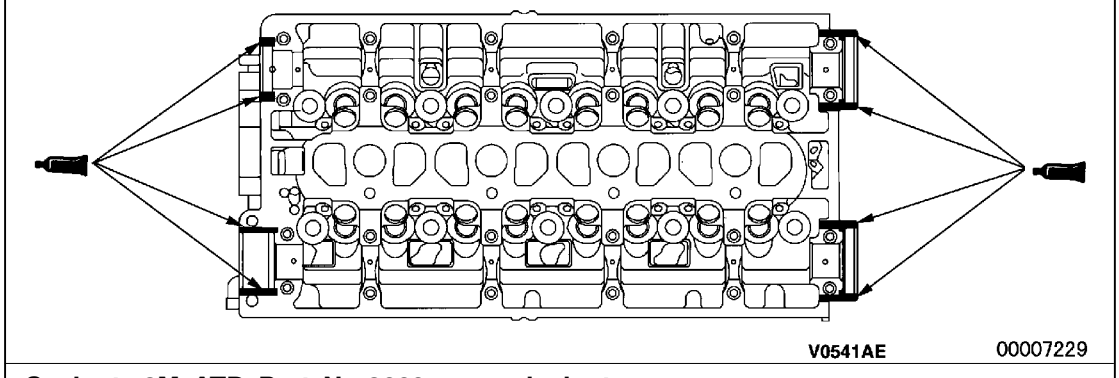


Sealant: 3M ATD Part No.8660 or equivalent

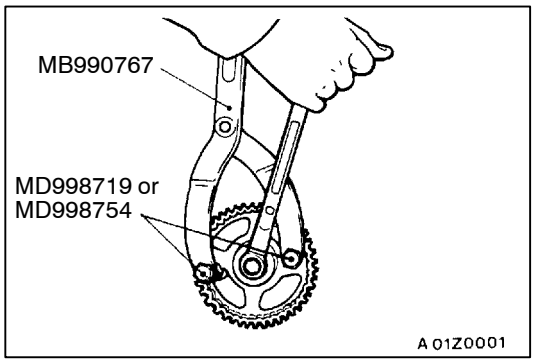


Sealant:
MITSUBISHI GENUINE PART
MD970389 or equivalent

Engine oil

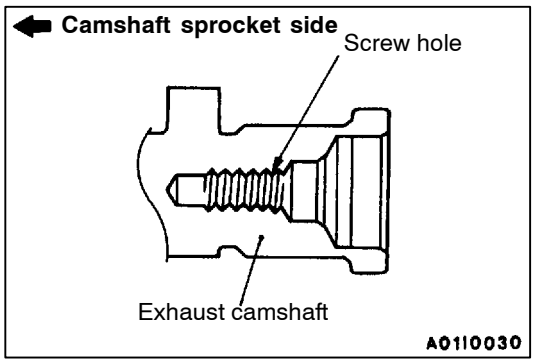


Sealant: 3M ATD Part No.8660 or equivalent



REMOVAL SERVICE POINTS

◀A▶ CAMSHAFT SPROCKET REMOVAL

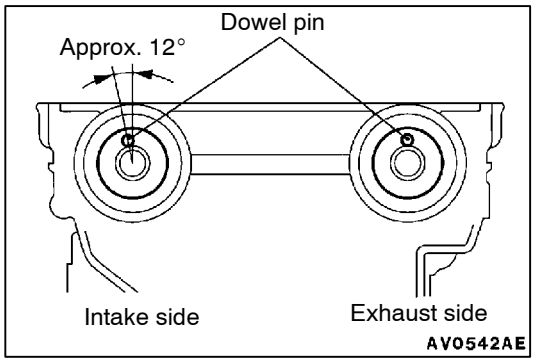


INSTALLATION SERVICE POINTS

▶A◀ CAMSHAFT INSTALLATION

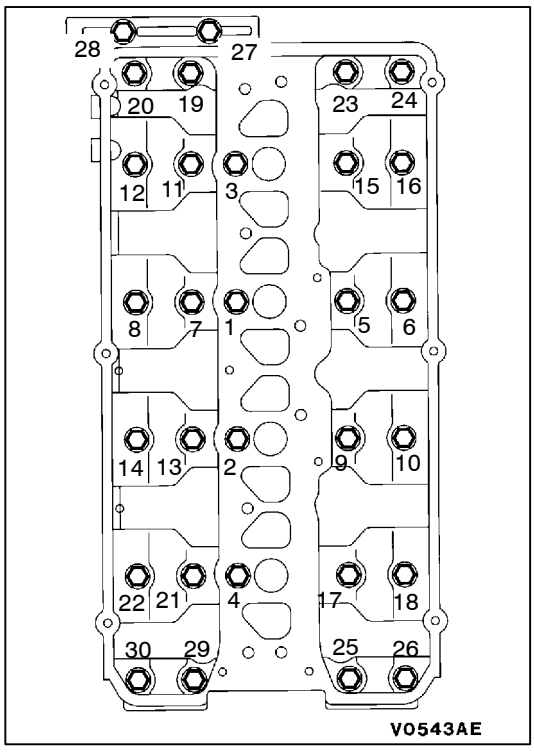
1. Apply engine oil to journals and cams of the camshafts.
2. Install the camshafts on the cylinder head.

Caution
Be careful not to confuse the intake camshaft with the exhaust one. There is a screw hole for the cam position sensing cylinder mounting bolt on the exhaust-side camshaft.



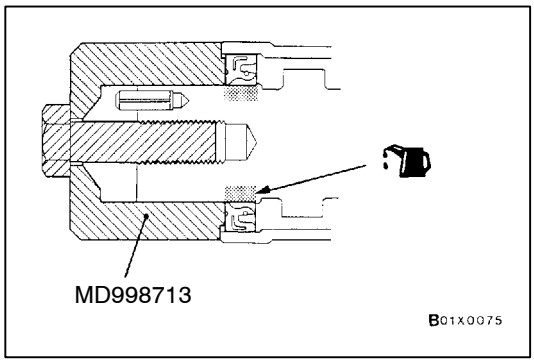
▶B◀ BEAM CAMSHAFT CAP INSTALLATION

1. Place the camshaft dowel pin as shown in the illustration.



2. Tighten the beam camshaft cap mounting bolts to the specified torque in the order shown in the illustration.

Tightening torque: 19 – 21 Nm



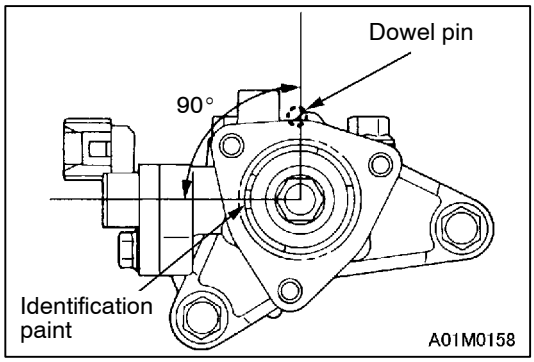
▶C◀ CAMSHAFT OIL SEAL INSTALLATION

1. Apply engine oil to the entire circumference of the oil seal lip.
2. Press-fit the oil seal as shown in the illustration.

▶D◀ CAMSHAFT SPROCKET INSTALLATION

Use the special tool to secure the camshaft sprocket in the same way as during removal, and then tighten the bolt to the specified torque.

Tightening torque: 88 Nm



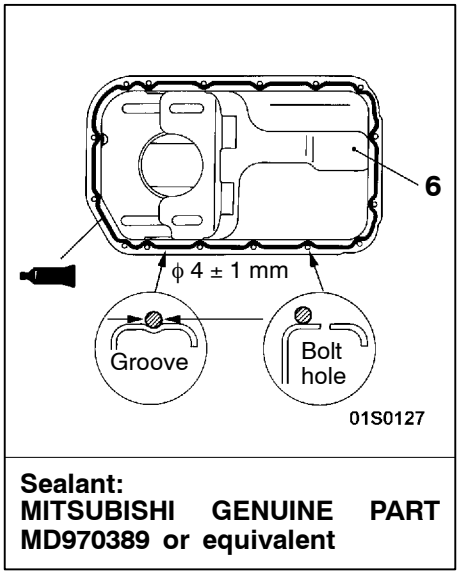
▶E◀ CAM POSITION SENSING CYLINDER INSTALLATION

Position the identification paint of cam position sensing cylinder as shown in the illustration.

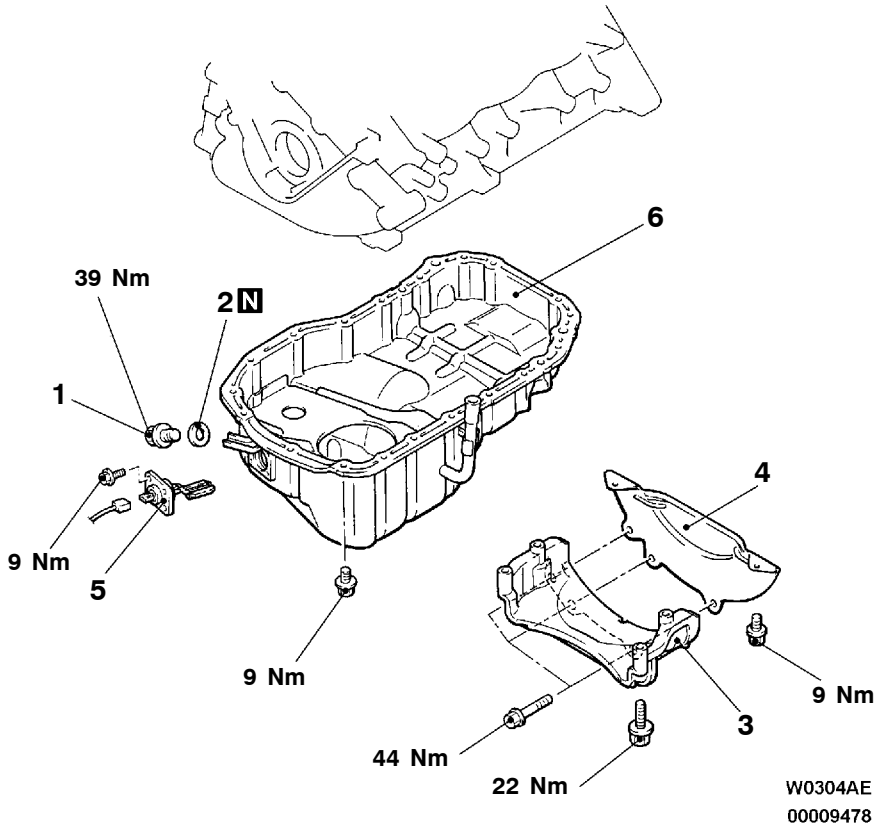
OIL PAN

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Under Cover Removal and Installation
- Engine Oil Draining and Supplying (Refer to GROUP 12 – On-vehicle Service.)
- Oil Level Gauge Removal and Installation
- Front Exhaust Pipe Removal and Installation

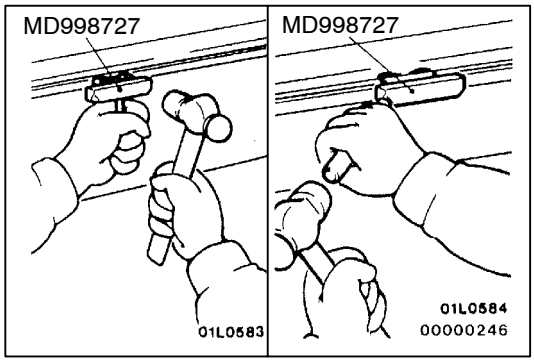


Sealant:
MITSUBISHI GENUINE PART MD970389 or equivalent



Removal steps

1. Drain plug
▶A◀ 2. Drain plug gasket
3. Transmission stay
4. Bell housing cover
5. Oil level sensor
◀A▶ 6. Oil pan

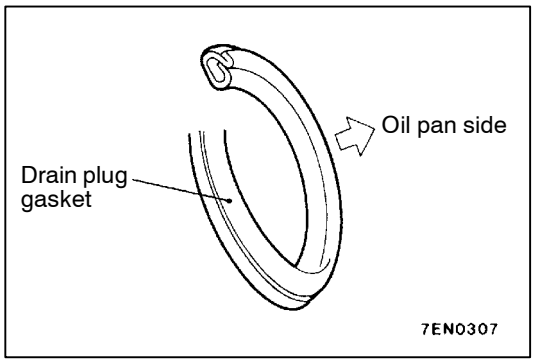


REMOVAL SERVICE POINT

◀A▶ OIL PAN REMOVAL

After removing the oil pan mounting bolts, remove the oil pan with the special tool and a brass bar.

Caution
Perform this slowly to avoid deformation of the oil pan flange.



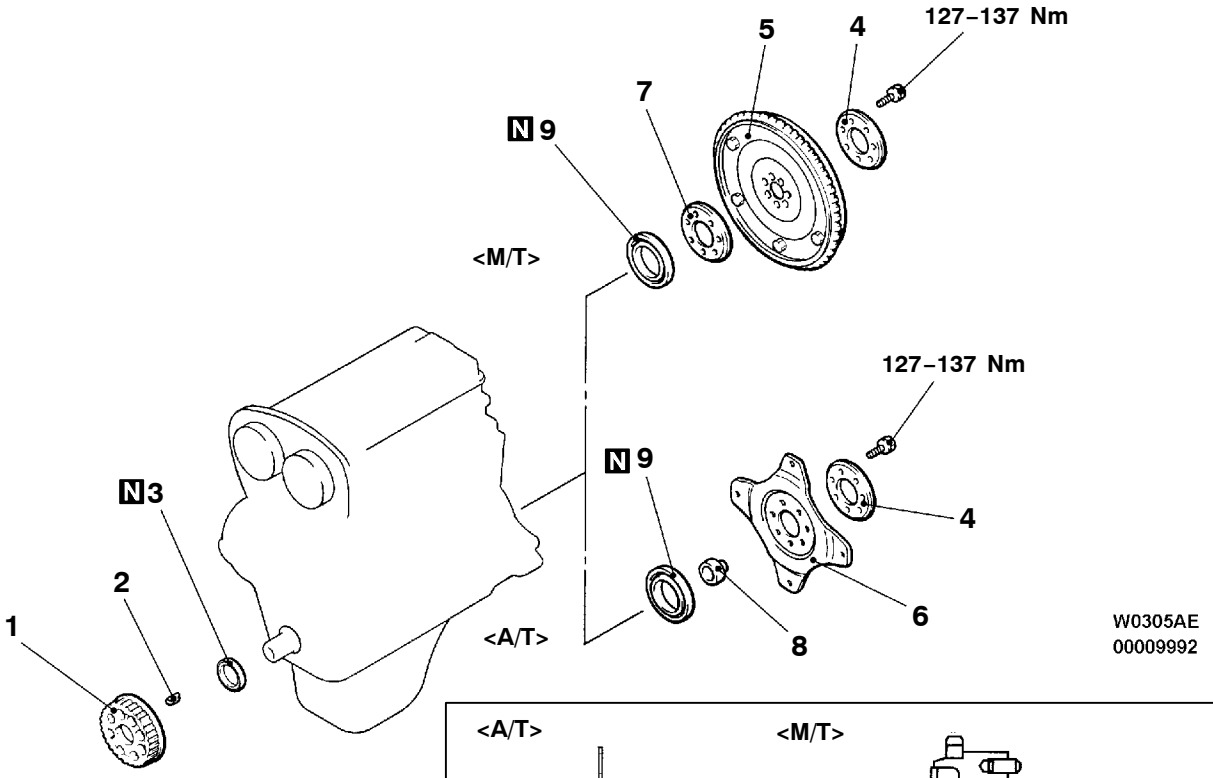
INSTALLATION SERVICE POINT

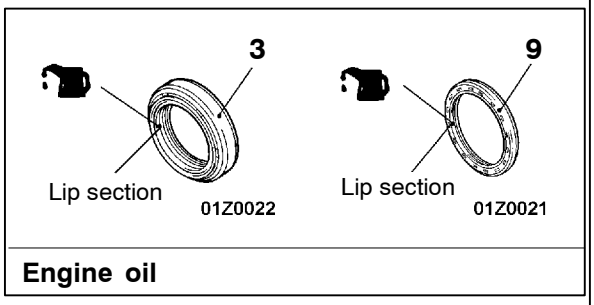
▶A◀ DRAIN PLUG GASKET INSTALLATION

Install the drain plug gasket in the direction so that it faces as shown in the illustration.

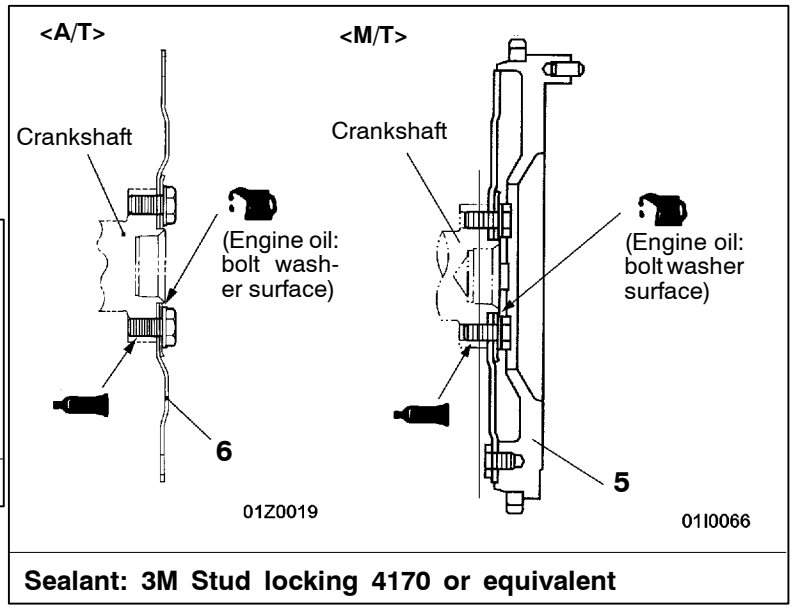
CRANKSHAFT OIL SEAL

REMOVAL AND INSTALLATION





Engine oil



Sealant: 3M Stud locking 4170 or equivalent

Crankshaft front oil seal removal steps

- Timing belt (Refer to P.11D-29.)

1. Crankshaft sprocket B
2. Key

▶C◀ 3. Crankshaft front oil seal

Crankshaft rear oil seal removal steps

◀A▶
- Transmission assembly
- Clutch cover and disc <M/T>

◀B▶ ▶B◀ 4. Adapter plate

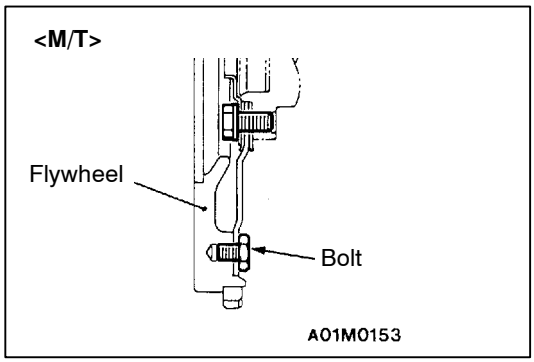
◀B▶ ▶B◀ 5. Flywheel <M/T>

◀B▶ ▶B◀ 6. Drive plate <A/T>

◀B▶ ▶B◀ 7. Adapter plate <M/T>

8 Crankshaft bushing <A/T>

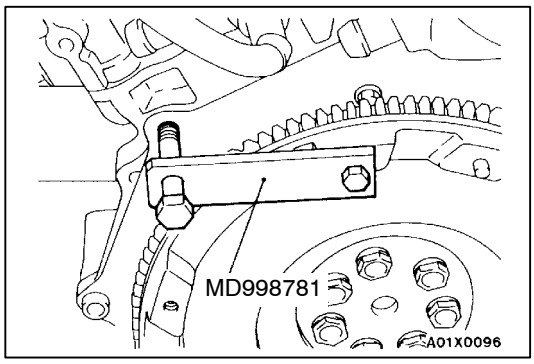
▶A◀ 9. Crankshaft rear oil seal



REMOVAL SERVICE POINTS

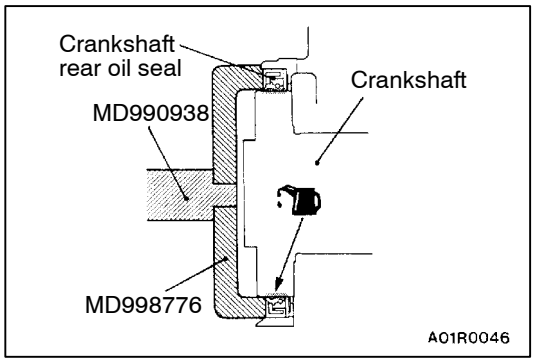
◀A▶ TRANSMISSION ASSEMBLY REMOVAL

Caution
For vehicles with manual transmission, do not remove the flywheel mounting bolt shown by the arrow. If this bolt Is removed, the flywheel will become out of balance and damaged.



◀B▶ ADAPTER PLATE/FLYWHEEL <M/T>/DRIVE PLATE <A/T> REMOVAL

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



INSTALLATION SERVICE POINTS

▶A◀ CRANKSHAFT REAR OIL SEAL INSTALLATION

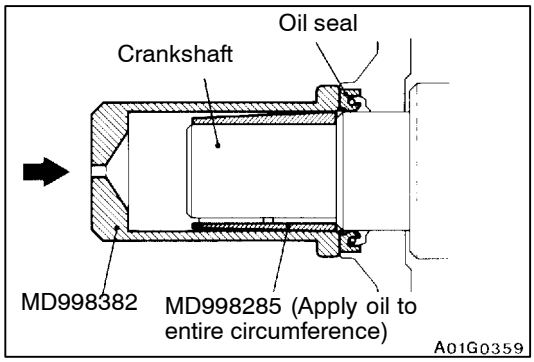
1. Apply a small mount of engine oil to the entire circumference of the oil seal lip.
2. Install the oil seal by tapping it as far as the chamfered position of the oil seal case as shown in the illustration.

▶B◀ DRIVE PLATE <A/T>/FLYWHEEL <M/T>/ADAPTER PLATE INSTALLATION

1. Clean off all sealant, oil and other substances which are adhering to the threaded bolts, crankshaft thread holes and the flywheel or drive plate.
2. Apply oil to the bearing surface of the flywheel or drive plate bolts.
3. Apply oil to the crankshaft thread holes.
4. Apply sealant to the threaded mounting holes.

   Specified sealant: 3M Stud locking 4170 or equivalent

5. Use the special tool to hold the flywheel or drive plate in the same manner as removal, and install the bolt.



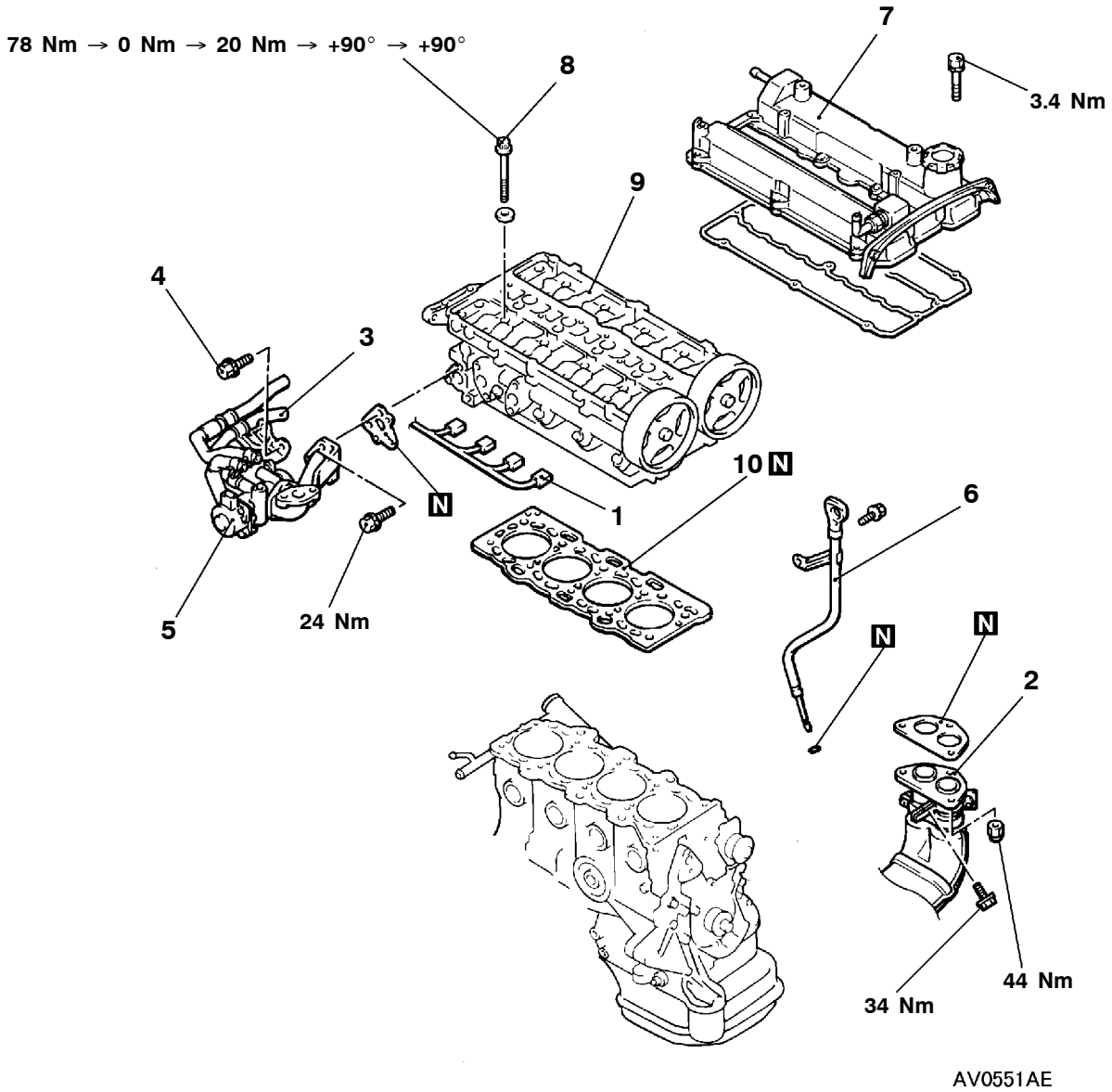
▶C◀ CRANKSHAFT FRONT OIL SEAL INSTALLATION

1. Apply a small amount of engine oil to the entire circumference of the oil seal lip.
2. Use the special tool to press-fit the oil seal unit it is flush with the oil seal case.

CYLINDER HEAD GASKET

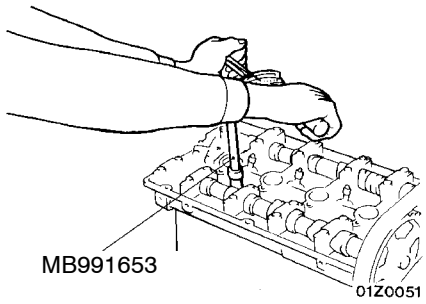
REMOVAL AND INSTALLATION

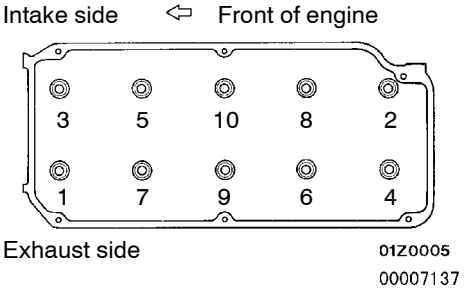
Pre-removal and Post-installation Operation
- Fuel Discharge Prevention (Refer to GROUP 13I – On-vehicle Service.) <Pre-removal only>
- Engine Coolant Draining and Supplying (Refer to GROUP 14 – On-vehicle Service.)
- Engine Oil Draining and Supplying (Refer to GROUP 12 – On-vehicle Service.)
- Intake Manifold Removal and Installation (Refer to GROUP 15.)
- Fuel Pressure Regulator (High Pressure) and Fuel Pump (High Pressure) Removal and Installation (Refer to GROUP 13I.)
- Thermostat Case Assembly Removal and Installation (Refer to GROUP 14 – Water Hose and Pipe.)
- Timing Belt Removal and Installation (Refer to P.11D-29.)



Removal steps

1. Injector harness connector
2. Front exhaust pipe connection
3. Water hose connection
4. Water pipe assembly mounting bolt
5. EGR valve and stay assembly
6. Engine oil level gauge
7. Rocker cover
◀A▶ ▶B◀ 8. Cylinder head bolt
9. Cylinder head assembly
▶A◀ 10. Cylinder head gasket





REMOVAL SERVICE POINT

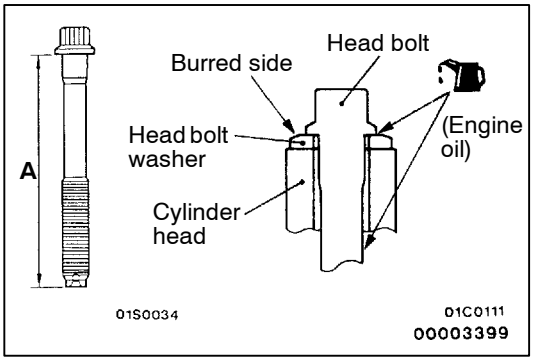
◀A▶ CYLINDER HEAD BOLT REMOVAL

Use the special tool to loosen the bolts in two or three steps in the order of the numbers shown in the illustration, and then remove the bolts.
If the washer is caught on valve spring and the bolt is not removed, pull up the bolt slightly and remove the bolt while tilting the washer by using a magnet, etc.

INSTALLATION SERVICE POINTS

▶A◀ CYLINDER HEAD GASKET INSTALLATION

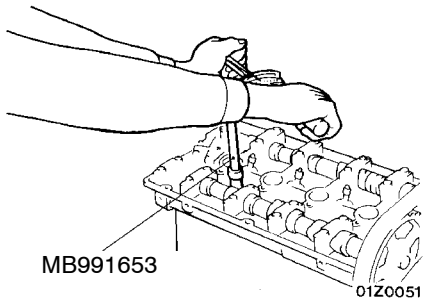
1. Wipe off all oil and grease from the gasket mounting surface.
2. Install so that the shapes of the cylinder head holes match the shapes of the respective cylinder head gasket holes.

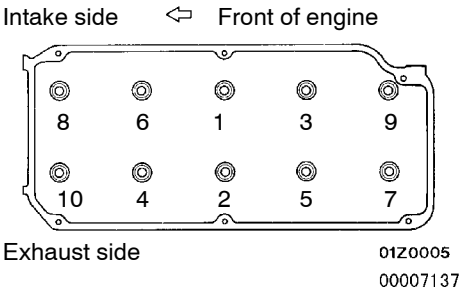


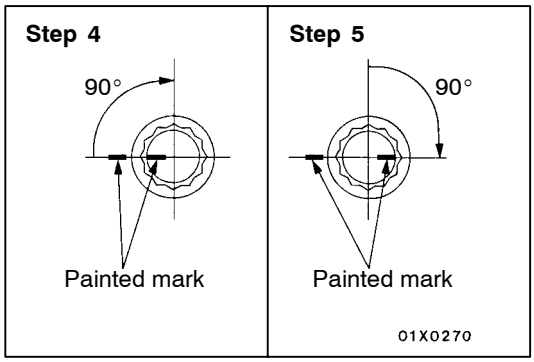
▶B◀ CYLINDER HEAD BOLT INSTALLATION

1. When installing the cylinder head bolts, the length below the head of the bolts should be within the limit.
   If it is outside the limit, replace the bolts.

   Limit (A): 99.4 mm
2. The head bolt washer should be installed with the burred side caused by tapping out facing upwards.
3. Apply a small amount of engine oil to the thread section and the washer of the cylinder head bolt.







4. Tighten the bolts by the following procedure.

Step	Operation	Remarks
1	Tighten to 78 Nm.	Carry out in the order shown in the illustration.
2	Fully loosen.	Carry out in the reverse order of that shown in the illustration.
3	Tighten to 20 Nm.	Carry out 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.

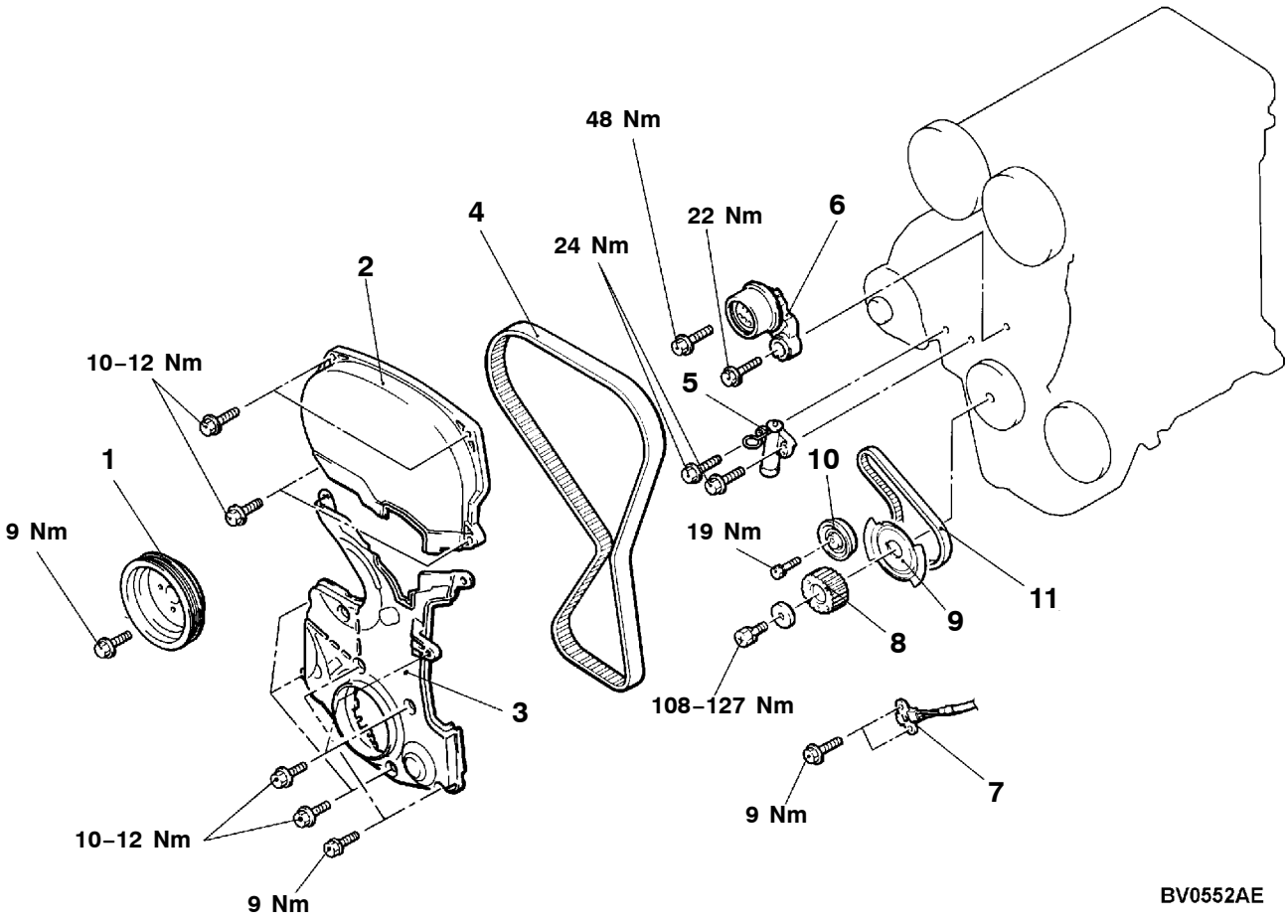
Caution

1. **Always make a tightening angle just 90°. If it is less than 90°, the head bolt will be loosened.**
2. **If it is more than 90°, remove the head bolt and repeat the procedure from step 1.**

TIMING BELT AND TIMING BELT B

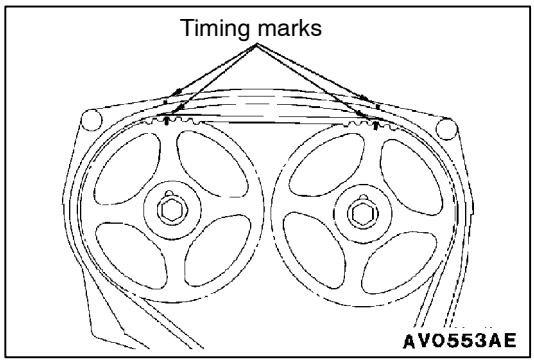
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Engine Cover Removal and Installation
- Under Cover Removal and Installation
- Crankshaft Pulley Removal and Installation (Refer to P.11D-16.)
- Engine Mount Bracket Removal and Installation



Removal steps

1. Water pump pulley
2. Timing belt front upper cover
3. Timing belt front lower cover
- ▶F◀ ● Timing belt tension adjustment
- ◀A▶ ▶E◀ 4. Timing belt
- ▶D◀ 5. Auto tensioner
6. Tensioner pulley assembly
7. Crankshaft position sensor
- ◀B▶ ▶C◀ 8. Crankshaft sprocket
- ▶B◀ 9. Crankshaft sensing blade
- ▶A◀ 10. Timing belt B tensioner
- ◀C▶ ▶A◀ 11. Timing belt B

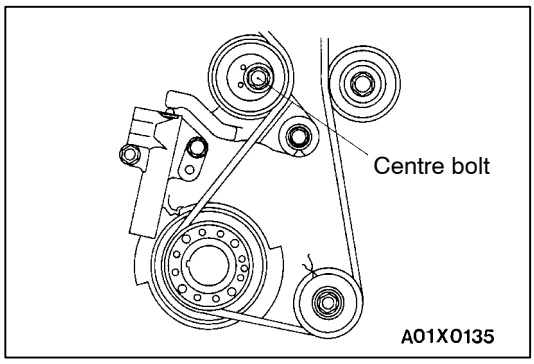


REMOVAL SERVICE POINT

◀A▶ TIMING BELT REMOVAL

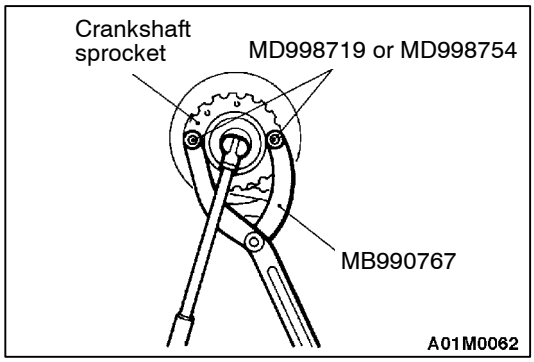
1. Turn the crankshaft clockwise (right turn) to align each timing mark and to set the No. 1 cylinder at compression top dead centre.

Caution
The crankshaft should always be turned only clockwise.



2. Loosen the tension pulley centre bolt.
3. Move the tension pulley to the water pump side, and then remove the timing belt.

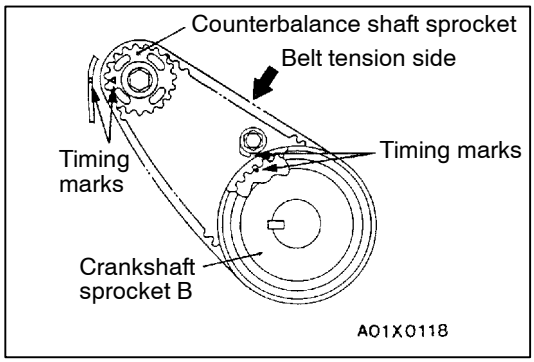
Caution
If the timing belt is to be re-used, use chalk to mark (on its flat side) an arrow indicating the clockwise direction.



◀B▶ CRANKSHAFT SPROCKET REMOVAL

◀C▶ TIMING BELT B REMOVAL

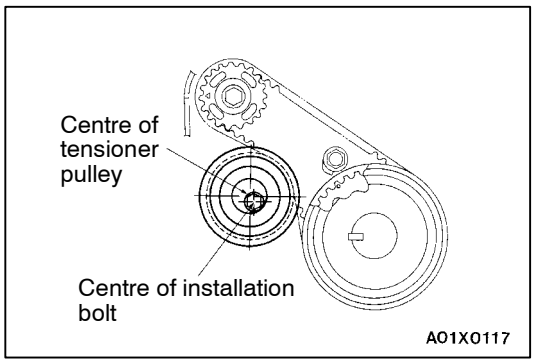
Caution
If timing belt B is to be re-used, use chalk to mark it with an arrow on its flat side indicating the turning direction (to the right).



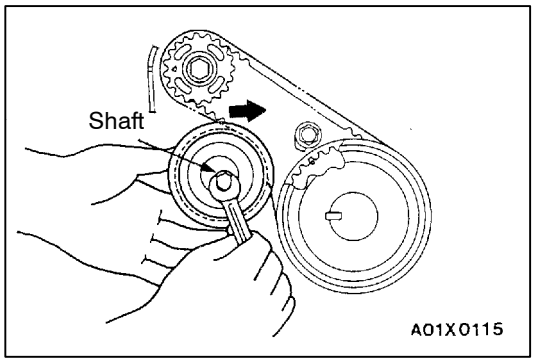
INSTALLATION SERVICE POINTS

▶A◀ TIMING BELT B/TIMING BELT B TENSIONER INSTALLATION

1. Install timing belt B by the following procedure.
   (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.

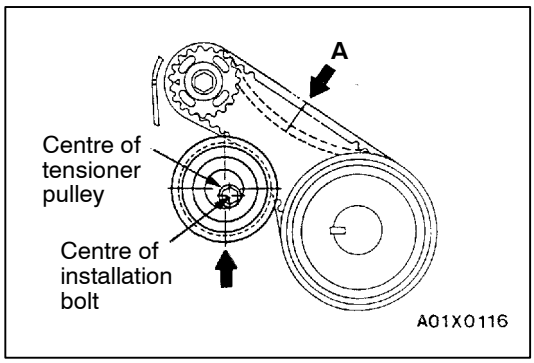


2. Adjust the tension of timing belt B by the following procedure.
   (1) Temporarily fix the timing belt B tensioner such that the centre of the tensioner pulley is to the left and above the centre of the installation bolt, and temporarily attach the tensioner pulley so that the flange is toward the front of the engine.



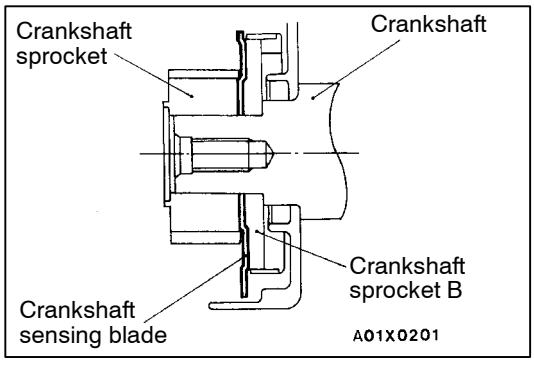
   (2) Holding the timing belt B tensioner up with your finger in the direction of the arrow, place pressure on the timing belt so that the tension side of the belt is taut. Now tighten the bolt to fix the tensioner.

   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.



3. To ensure that the tension is correct, depress the belt (point A) with a finger. If not, adjust.

   Standard value: 5 – 7 mm



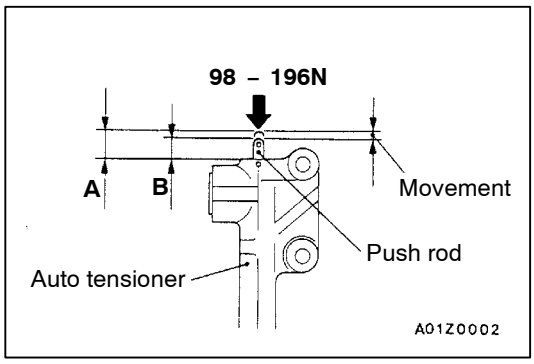
▶B◀ CRANKSHAFT SENSING BLADE INSTALLATION

Confirm the installation direction of crankshaft sensing blade and install it as shown in the illustration.

▶C◀ CRANKSHAFT SPROCKET INSTALLATION

1. Apply the minimum amount of engine oil to the seat surface and thread of the crankshaft bolt.
2. Hold the crankshaft sprocket as same as for removal, and then tighten the bolt to the specified torque.

   Tightening torque: 108 – 127 Nm

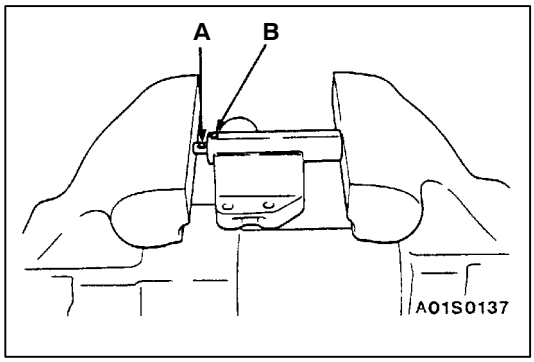


▶D◀ AUTO TENSIONER INSTALLATION

1. Apply 98 – 196 N force to the auto tensioner by pressing it against a metal (cylinder block, etc.), and measure the movement of the push rod.

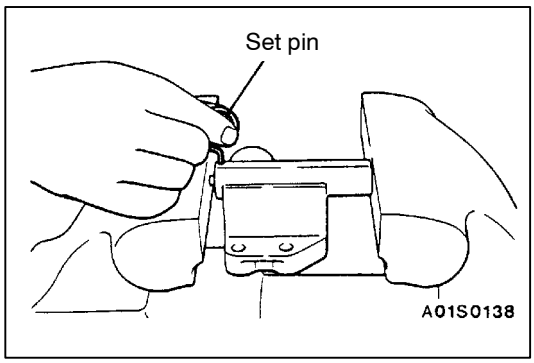
   Standard value: Within 1 mm
   A: Length when it is free (not pressed)
   B: Length when it is pressed
   A – B: Movement

2. If it is out of the standard value, replace the auto tensioner.



3. Use a press or vice to gently compress the auto tensioner push rod until pin hole A of the push rod and pin hole B of the tensioner cylinder are aligned.

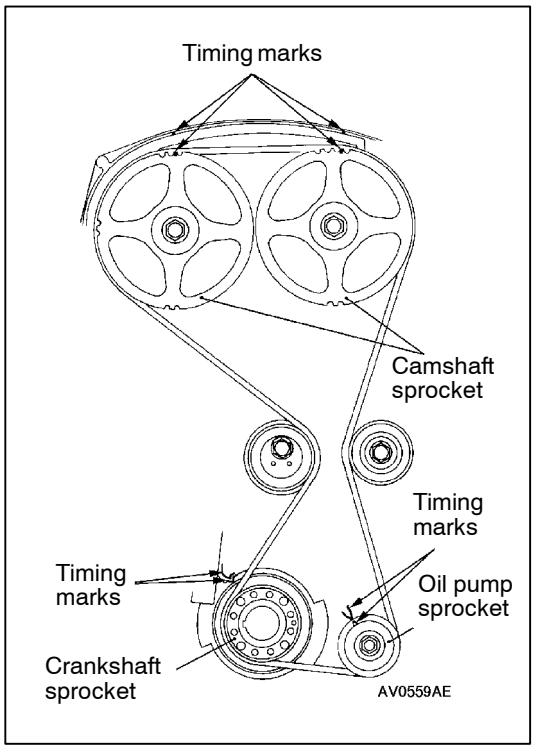
   Caution
   If the compression speed is too fast, the rod may become damaged, so be sure to carry out this operation slowly.



4. Once the holes are aligned, insert the set pin.

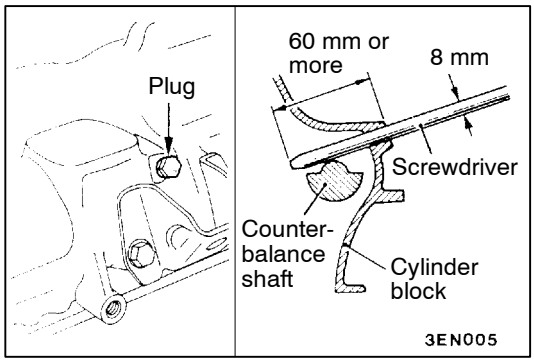
   NOTE
   When replacing the auto tensioner with a new part, the pin will be in the auto tensioner.

5. Install the auto tensioner to the engine.

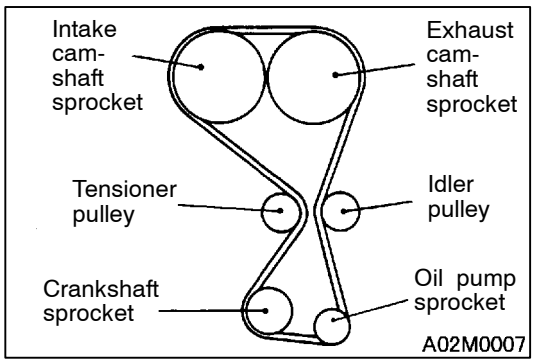


▶E◀ TIMING BELT INSTALLATION

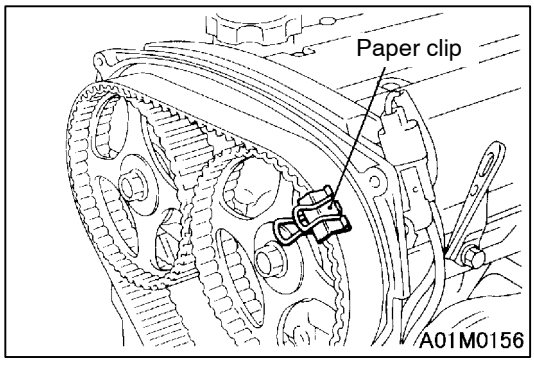
1. Align the timing marks on the camshaft sprocket, crankshaft sprocket and oil pump sprocket.



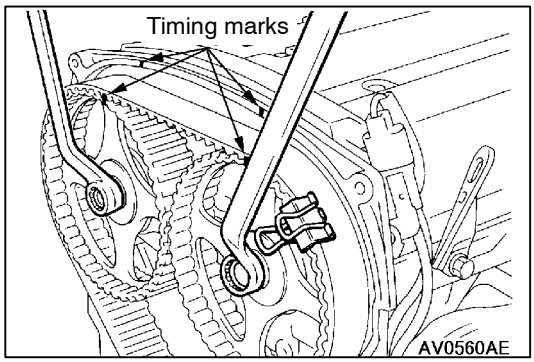
2. After aligning the timing mark on the oil pump sprocket, remove the cylinder block plug and insert a Phillips screwdriver with a diameter of 8 mm, and check to be sure that the screwdriver goes in 60 mm or more. If the screwdriver will only go in 20 – 25 mm before striking the counterbalance shaft, turn the sprocket once, realign the timing mark and check that the screwdriver goes in 60 mm or more. The screwdriver should not be taken out until the timing belt is installed.



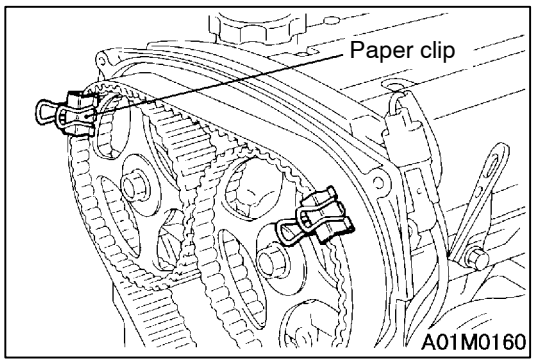
3. Install the timing belt by the following procedure. Take care not to slacken the belt at the tension side.
   (1) Install the timing belt to the crankshaft sprocket, oil pump sprocket and idler pulley in that order.,



   (2) Place the timing belt on the exhaust-side camshaft sprocket, and hold it in the position shown in the illustration with a paper clip.



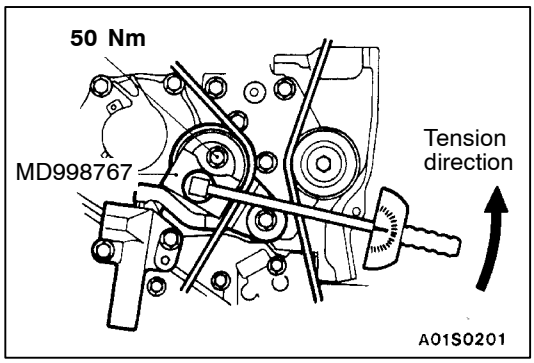
(3) Place the timing belt on the intake-side sprocket while using two wrenches to align the timing marks.



(4) Hold the belt in the position shown in the illustration with another paper clip.
(5) Place the timing belt on the tensioner pulley.
(6) Remove the two paper clips.

Caution
After installing the timing belt, apply force to turn the camshaft sprocket in the reverse direction, and recheck to be sure that the belt is fully tensioned and that each timing mark is in the proper position.

4. Set the tension pulley so that the pin holes of centre bolt are at the bottom, press the tension pulley lightly against the timing belt, and then provisionally tighten the centre bolt.
5. Check to be sure that all timing marks are aligned.
6. Adjust the timing belt tension.

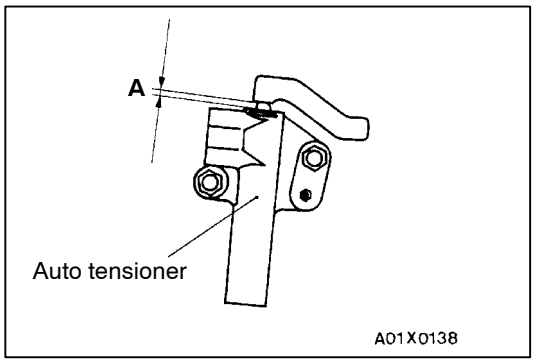


▶F◀ TIMING BELT TENSION ADJUSTMENT

1. After turning the crankshaft 1/4 of a revolution in the anticlockwise direction, turn it in the clockwise direction until the timing marks are aligned.
2. Loosen the tension pulley fixing bolt, and then use the special tool and a torque wrench to tighten the fixing bolt to the specified torque while applying tension to the timing belt.

Standard value: 3.5 Nm <Timing belt tension torque>

Caution
When tightening the fixing bolt, make sure that the tension pulley does not turn with the bolt.



3. Turn the crankshaft two revolutions in the clockwise direction so that the timing marks are aligned. After leaving it for 15 minutes, measure the amount of protrusion of the auto tensioner.

   Standard value (A): 3.8 – 4.5 mm

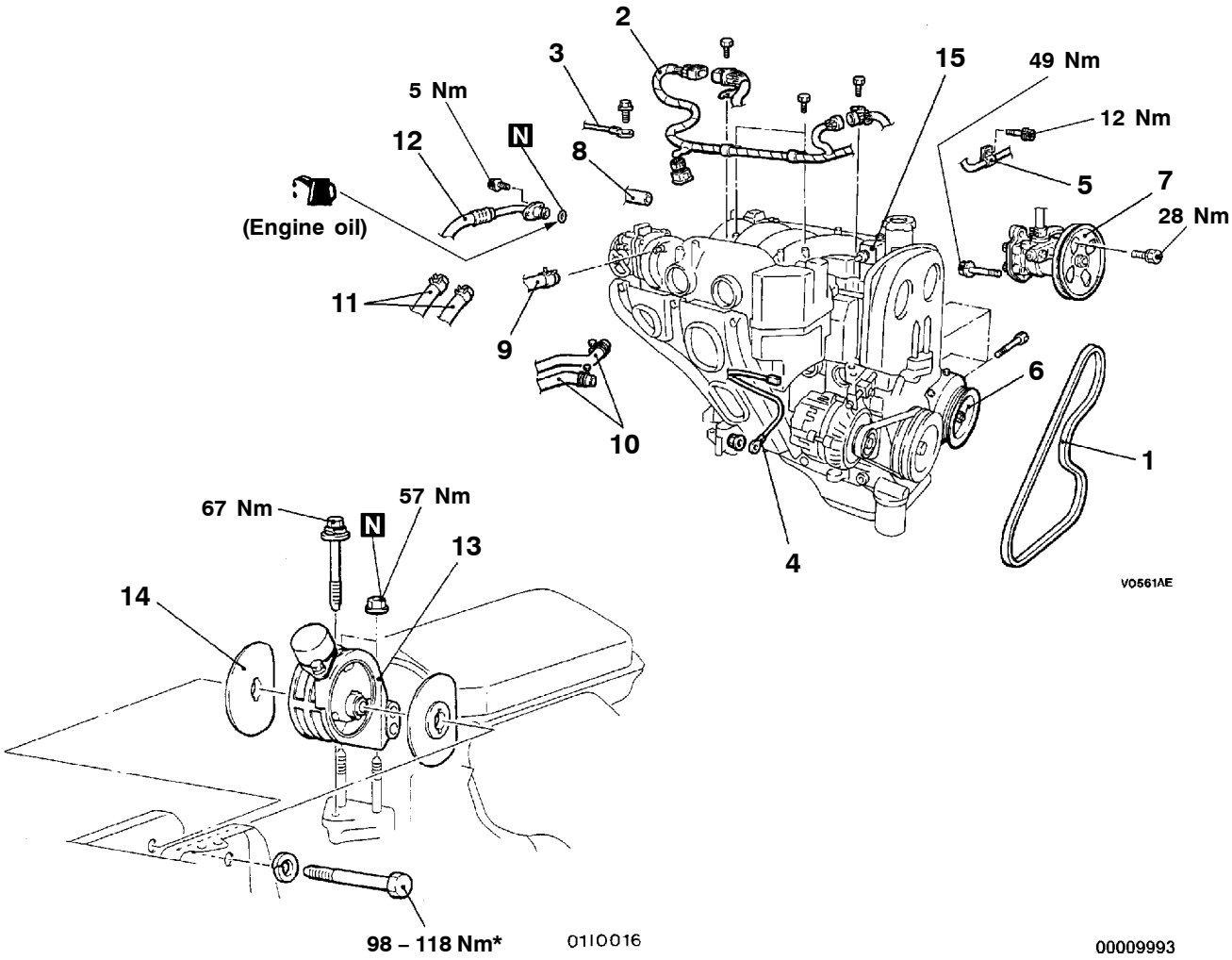
4. If the amount of protrusion is outside the standard value, repeat the operation in steps (1) to (3).
5. Check again to be sure that the timing marks of each sprocket are aligned.

ENGINE ASSEMBLY

REMOVAL AND INSTALLATION

Caution
Mounting locations marked by * should be provisionally tightened, and then fully tightened after placing the vehicle horizontally and loading the full weight of the engine on the vehicle body.

Pre-removal and Post-installation Operation
- Fuel Discharge Prevention (Refer to GROUP 13I – On-vehicle Service.) <Pre-removal only>
- Engine Cover Removal and Installation
- Under Cover Removal and Installation
- Engine Coolant Draining and Supplying (Refer to GROUP 14 – On-vehicle Service.)
- Hood Removal and Installation
- Transmission Assembly Removal and Installation
- Drive Belt Tension Adjustment (Refer to P.11D-6.) <Post-installation only>



Removal steps

1. Drive belt (Power steering and A/C)
2. Engine harness connector
3. Earth cable connection
4. Alternator connector
5. Power steering hose clamp
◀A▶ 6. A/C compressor
◀B▶ 7. Power steering oil pump
8. Vacuum hose connection
9. Brake booster vacuum hose connection
10. Heater hose connection
11. Fuel return hose connection
12. Fuel pressure hose connection
◀C▶ ▶C◀ 13. Engine mount bracket
▶B◀ 14. Engine mount stopper
◀D▶ ▶A◀ 15. Engine assembly

REMOVAL SERVICE POINTS

◀A▶ A/C COMPRESSOR REMOVAL

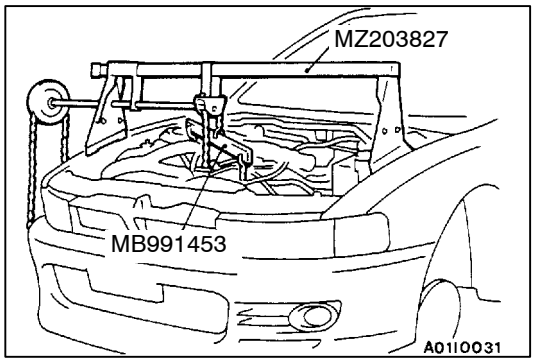
Disconnect the A/C compressor connector and remove the compressor from the compressor bracket with the hose still attached.

NOTE
Place the removed A/C compressor where it will not be a hindrance when removing and installing the engine assembly, and tie it with a cord.

◀B▶ POWER STEERING OIL PUMP REMOVAL

Remove the power steering oil pump and bracket assembly from the engine with the hose attached.

NOTE
Place the removed power steering oil pump in a place where it will not be a hindrance when removing and installing the engine assembly, and tie it with a cord.



◀C▶ ENGINE MOUNT BRACKET REMOVAL

1. Support the engine with a garage jack.
2. Remove the special tool which was attached when the transmission assembly was removed.
3. Hold the engine assembly with a chain block or similar tool.
4. Place a garage jack against the engine oil pan with a piece of wood in between, jack up the engine so that the weight of the engine is no longer being applied to the engine mount bracket, and then remove the engine mount bracket.

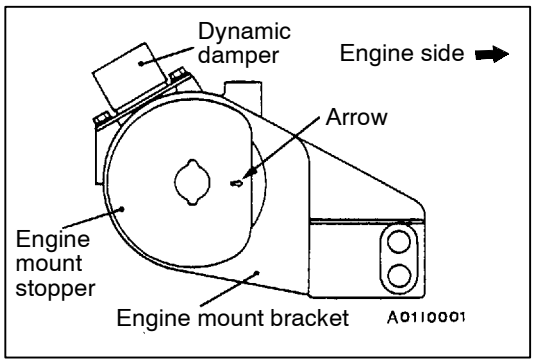
◀D▶ ENGINE ASSEMBLY REMOVAL

After checking that all cables, hoses and harness connectors, etc., are disconnected from the engine, lift the engine assembly away from the engine compartment.

INSTALLATION SERVICE POINTS

▶A◀ ENGINE ASSEMBLY INSTALLATION

Install the engine assembly, checking that the cables, hoses, and harness connectors are not clamped.



▶B◀ ENGINE MOUNT STOPPER INSTALLATION

Clamp the engine mount stopper so that the arrow points in the direction as shown in the diagram.

▶C◀ ENGINE MOUNT BRACKET INSTALLATION

1. Place a garage jack against the engine oil pan with a piece of wood in between, and install the engine mount bracket while adjusting the position of the engine.
2. Support the engine with the garage jack.
3. Remove the chain block and support the engine assembly with the special tool.

ENGINE LUBRICATION

CONTENTS

GENERAL

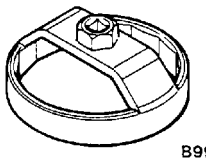
OUTLINE OF CHANGE

4G64-GDI engines have been introduced. Accordingly, service procedures have been added as follows.

LUBRICANTS

Items		4G64
Engine oil (API classification)		SG or higher
Engine oil quantity L	Oil filter	0.3
	Total	4.3

SPECIAL TOOL

Tool	Number	Name	Use
 B991610	MB991610	Oil filter wrench	Removal and installation of engine oil filter (When using the oil filter of MD136466 and MD356000)

ON-VEHICLE SERVICE <4G64>

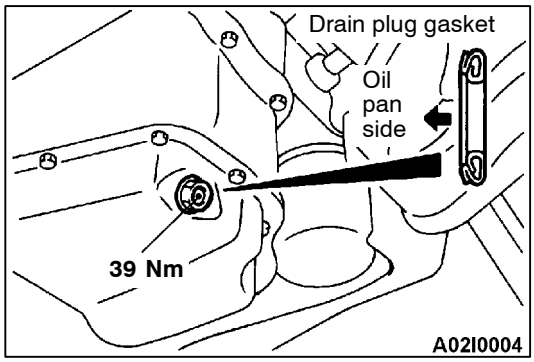
ENGINE OIL CHECK

1. Pull out the level gauge slowly and check that the oil level is in the illustrated range.
2. Check that the oil is not excessively dirty, that there is no coolant or gasoline mixed in, and that it has sufficient viscosity.

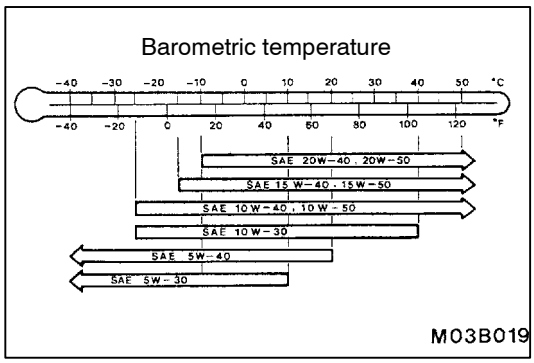
ENGINE OIL REPLACEMENT

1. Start the engine and warm it up until the coolant reaches 80 to 90°C.
2. Remove the engine oil filler cap.
3. Remove the drain plug to drain oil.

Caution
Use care as oil could be hot.



4. Install a new drain plug gasket so that it faces as shown, and then tighten the drain plug to the specified torque.

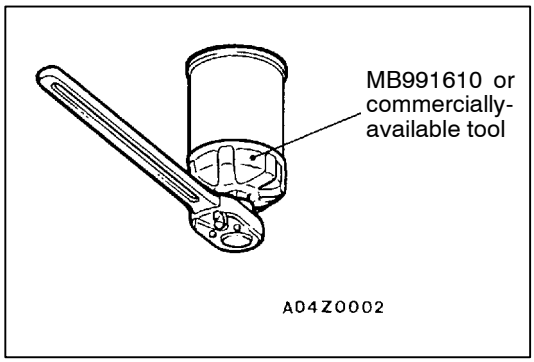


5. Refill with specified quantity of oil.

   Specified Engine Oil (API classification):
   SG or higher

   Total quantity (Includes volume inside oil filter):
   4.3 L

6. Install the engine oil filler cap.
7. Check oil level.

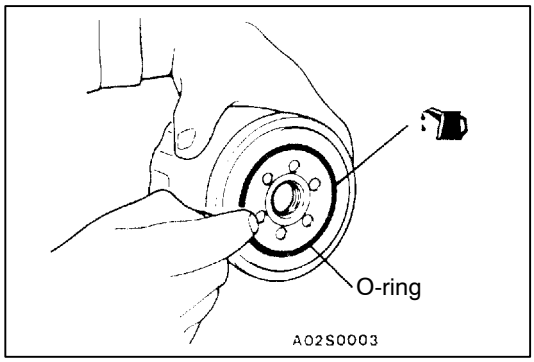


OIL FILTER REPLACEMENT

1. Start the engine and warm it up until the coolant reaches 80 to 90°C.
2. Remove the engine oil filler cap.
3. Remove the drain plug to drain oil.

   Caution
   Use care as oil could be hot.

4. Remove the under cover.
5. Use the respective tool in the following table to remove the engine oil filter.
6. Clean the filter bracket side mounting surface.



7. Apply a small amount of engine oil to the O-ring of the new oil filter.
8. Once the O-ring of the oil filter is touching the flange, use the respective tool in the following table to tighten to the specified torque.
9. Install the drain plug and refill engine oil. (Refer to Engine Oil Replacement on P.12-3.)
10. Race the engine 2 to 3 times, and check that no engine oil leaks from installation section of the oil filter.

Number	Tool	Tightening torque
MD136466	MB991610 or equivalent tool	Approx. 3/4 turn (17 Nm)
MD322508	Commercially-available tool	Approx. 3/4 turns (17 Nm)
MD356000	MB991610 or equivalent tool	Approx. 3/4 turn (14 Nm)

FUEL

CONTENTS

NOTE
THE GROUPS MARKED BY ARE NOT IN THIS MANUAL

MULTIPOINT FUEL INJECTION (MPI)

CONTENTS

MULTIPOINT FUEL INJECTION (MPI) <4G6>

GENERAL

OUTLINE OF CHANGES

Service procedures have been added for the following modifications:
- Modification of immobilizer system
- Modification of body harness

TROUBLESHOOTING

DIAGNOSIS TROUBLESHOOTING FLOW

NOTE
If the engine–ECU is replaced, the immobilizer–ECU and ignition key should be replaced together with it.

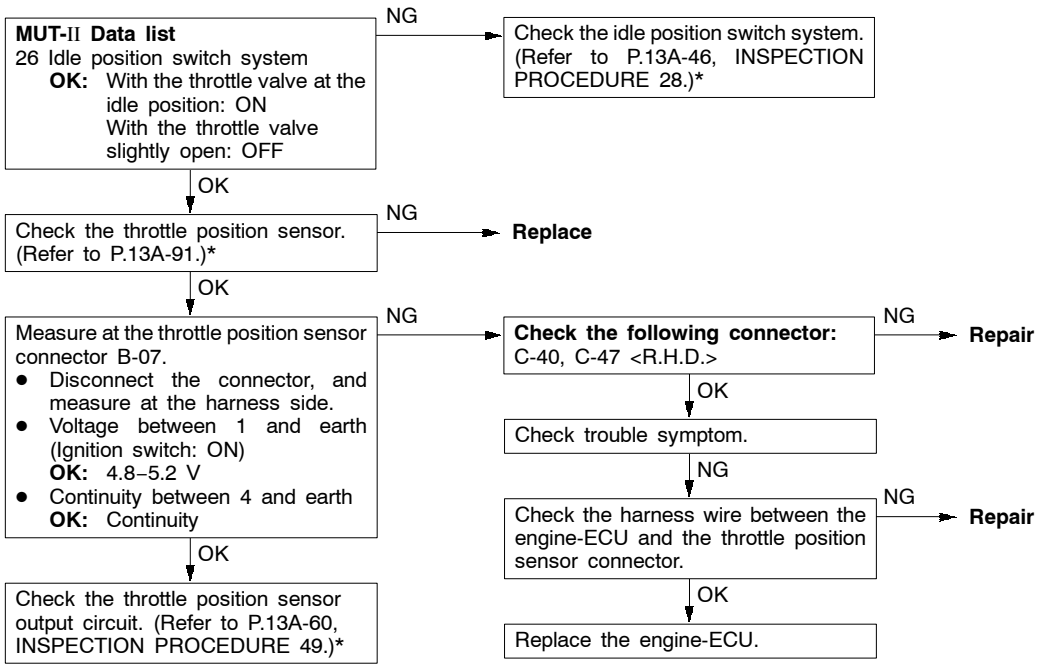
INSPECTION CHART FOR DIAGNOSIS CODES

The troubleshootings of code Nos.14, 22, 25 and 54 have been revised. The other items are the same as before.

Code No.	Diagnosis item	Reference page
14	Throttle position sensor system	13A-4
22	Crank angle sensor system	13A-5
25	Barometric pressure sensor system	13A-6
54	Immobilizer system	13A-7

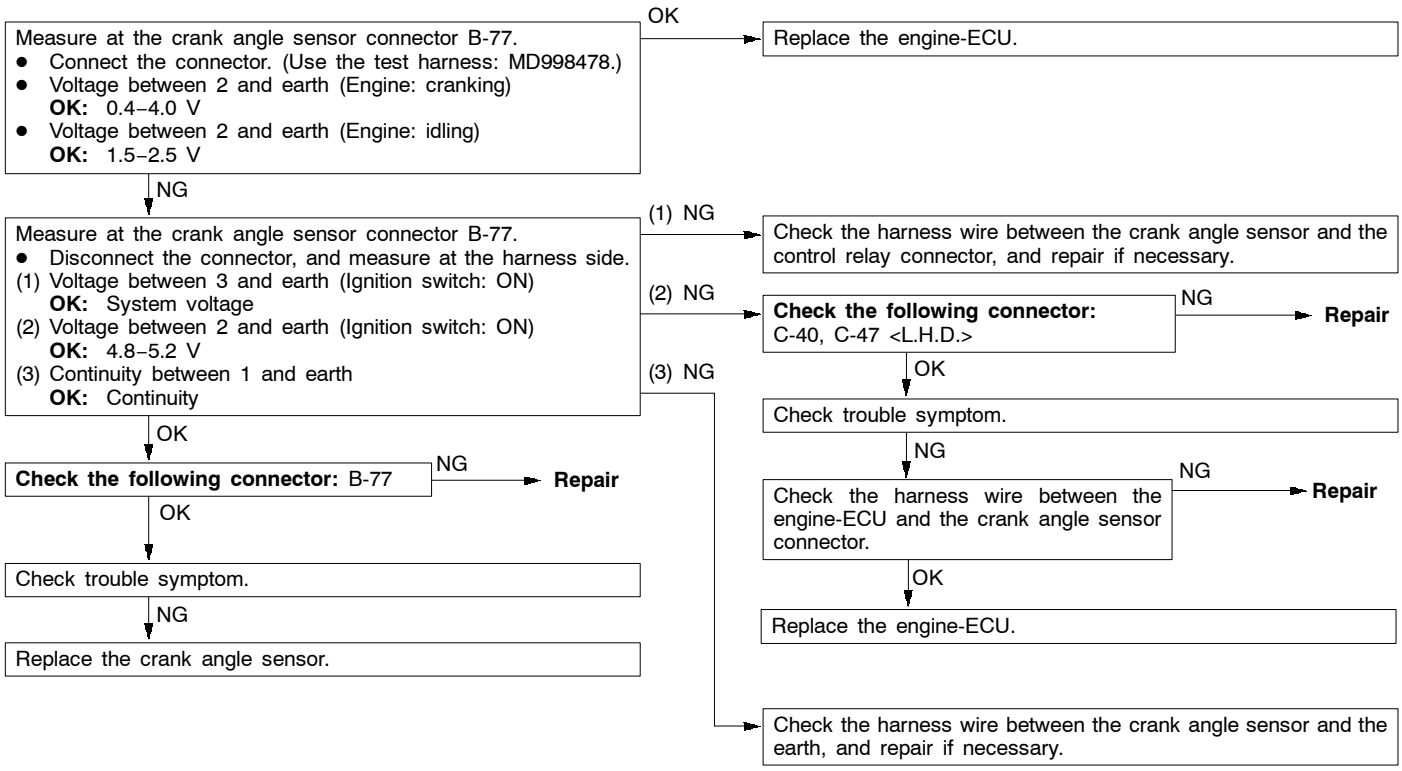
INSPECTION PROCEDURE FOR DIAGNOSIS CODES

Code No. 14 Throttle position sensor system	Probable cause
Range of Check ● Ignition switch: ON ● Excluding 60 seconds after the ignition switch is turned to ON or immediately after the engine starts. Set conditions ● When the idle position switch is ON, the sensor output voltage is 2 V or more for 4 seconds. or ● The sensor output voltage is 0.2 V or less for 4 seconds.	● Malfunction of the throttle position sensor or maladjustment ● Improper connector contact, open circuit or short-circuited harness wire of the throttle position sensor circuit ● Improper "ON" state of idle position switch ● Short circuit of the idle position switch signal line ● Malfunction of the engine-ECU

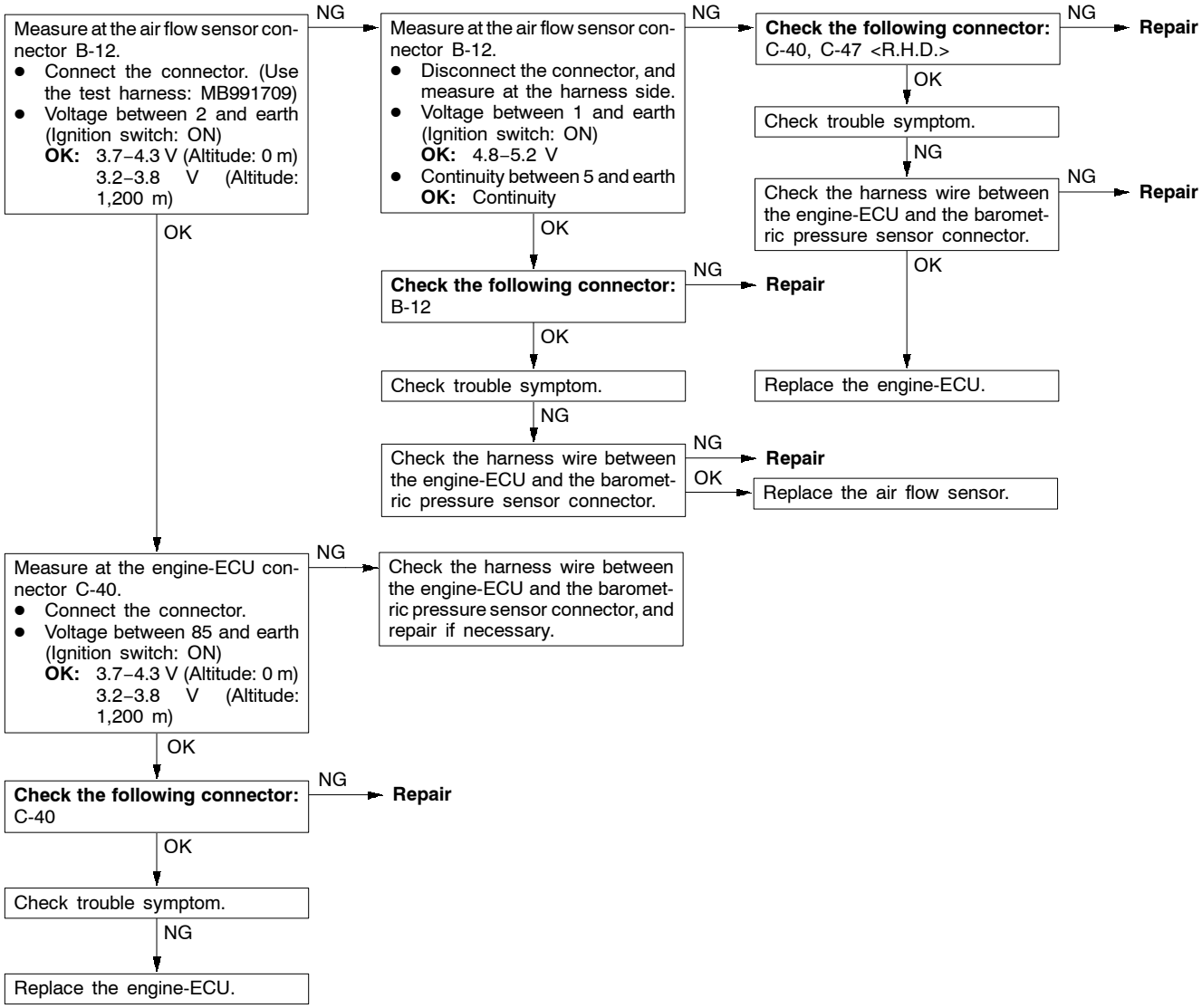


*: Refer to '97 GALANT Workshop Manual (Pub. No. PWDE9611)

Code No. 22 Crank angle sensor system	Probable cause
Range of Check ● Engine is cranking. Set conditions ● Sensor output voltage does not change for 4 seconds (no pulse signal input.)	● Malfunction of the crank angle sensor ● Improper connector contact, open circuit or short-circuited harness wire of the crank angle sensor ● Malfunction of the engine-ECU

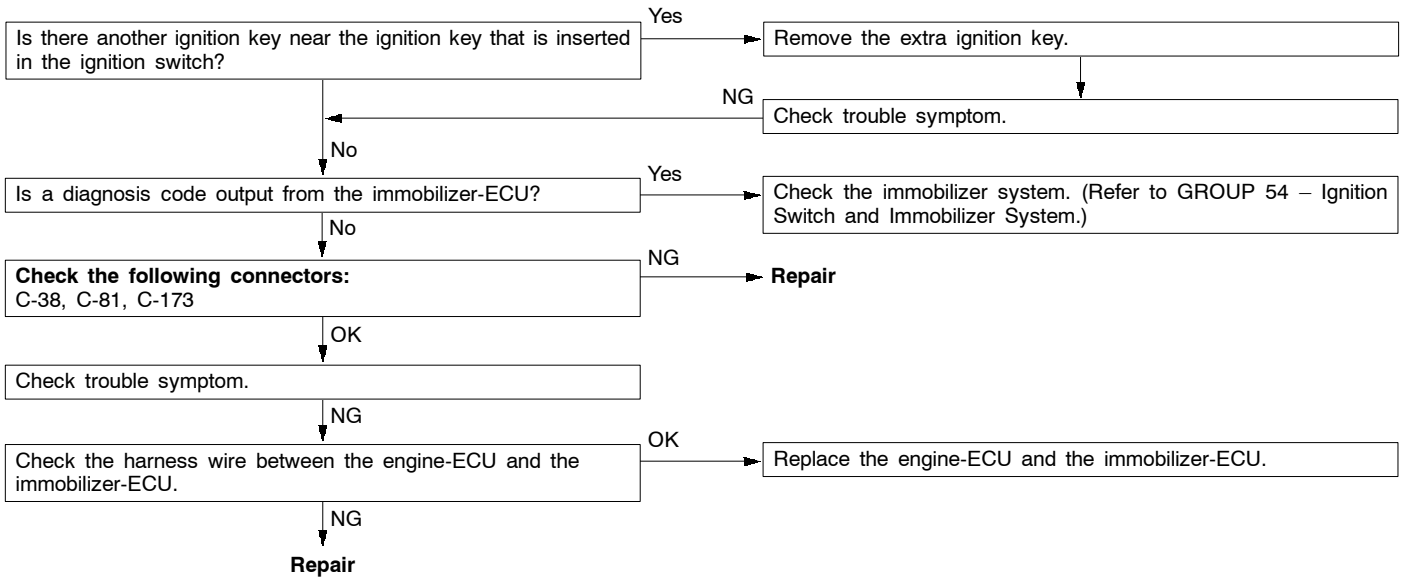


Code No. 25 Barometric pressure sensor system	Probable cause
Range of Check ● Ignition switch: ON ● Excluding 60 seconds after the ignition switch is turned to ON or immediately after the engine starts. ● Battery voltage is 8 V or more. Set conditions ● Sensor output voltage is 4.5 V or more (corresponding to a barometric pressure of 114 kPa or more) for 4 seconds. or ● Sensor output voltage is 0.2 V or less (corresponding to a barometric pressure of 5.33 kPa or less) for 4 seconds.	● Malfunction of the barometric pressure sensor ● Improper connector contact, open circuit or short-circuited harness wire of the barometric pressure sensor circuit ● Malfunction of the engine-ECU



Code No.54 Immobilizer system	Probable cause
Range of Check ● Ignition switch: ON Set Conditions ● Improper communication between the engine-ECU and immobilizer-ECU	● Radio interference of encrypted codes ● Incorrect encrypted code ● Malfunction of harness or connector ● Malfunction of immobilizer-ECU ● Malfunction of engine-ECU

NOTE
(1) If the ignition switches are close each other when starting the engine, radio interference may cause this code to be displayed.
(2) This code may be displayed when registering the key encrypted code.



INSPECTION CHART FOR TROUBLE SYMPTOMS

The troubleshootings of inspection procedures Nos. 2, 28, 34 and 45 have been revised. The other items are the same as before.

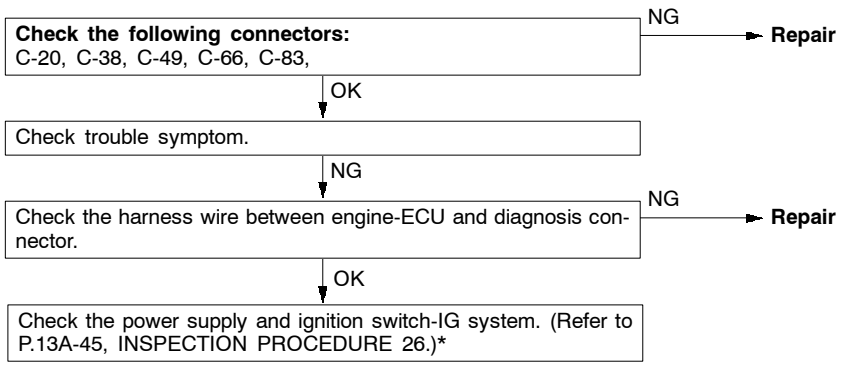
Trouble symptom		Inspection procedure No.	Reference page
Communication with MUT-II is impossible.	Communication with all systems is not possible.	1	13A-28*
	Communication with engine-ECU only is not possible.	2	13A-8

*: Refer to '97 GALANT Workshop Manual (Pub. No. PWDE9611).

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

INSPECTION PROCEDURE 2

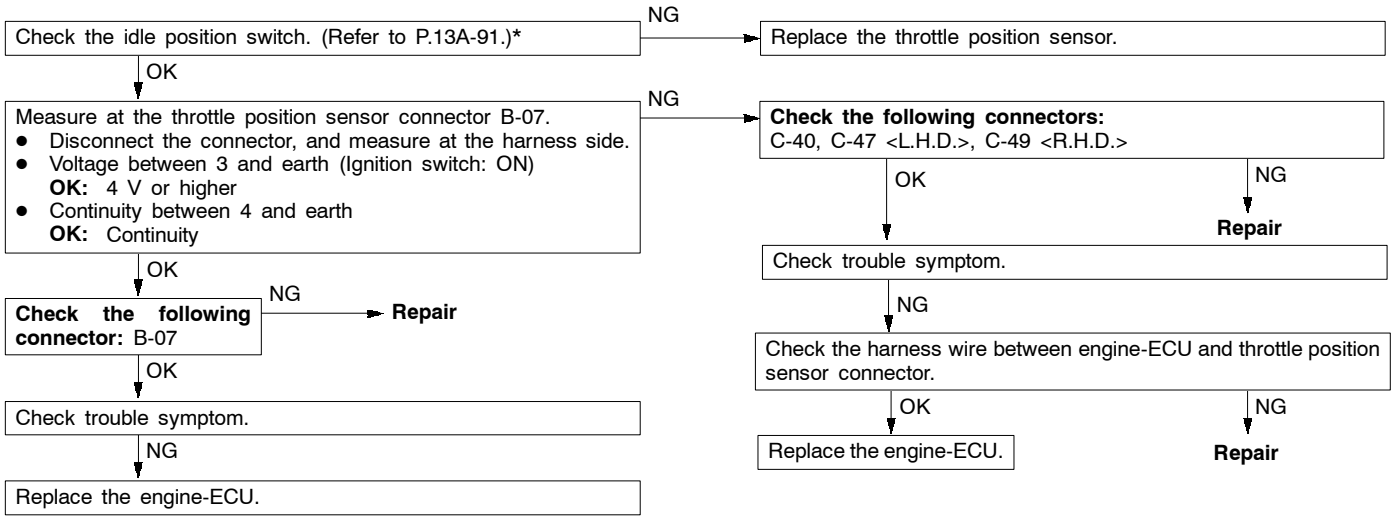
MUT-II communication with engine-ECU is impossible.	Probable cause
One of the following causes may be suspected. ● No power supply to engine-ECU. ● Defective earth circuit of engine-ECU. ● Defective engine-ECU. ● Improper communication line between engine-ECU and MUT-II	● Malfunction of engine-ECU power supply circuit ● Malfunction of engine-ECU ● Open circuit between engine-ECU and diagnosis connector



*: Refer to '97 GALANT Workshop Manual (Pub. No. PWDE9611).

INSPECTION PROCEDURE 28

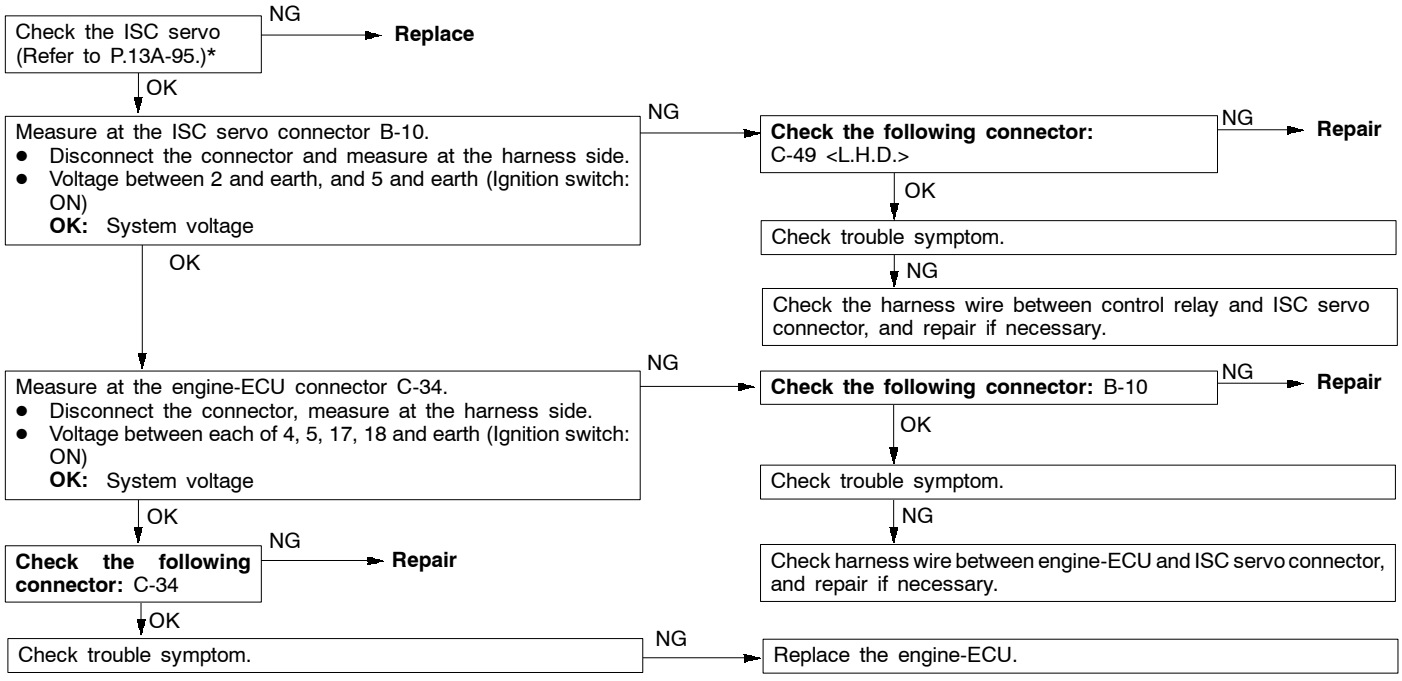
Idle position switch system	Probable cause
The idle position switch inputs the condition of the accelerator pedal, i.e. whether it is depressed or released (HIGH/LOW), to the engine-ECU. The engine-ECU controls the idle speed control servo based on this input.	• Maladjustment of the accelerator pedal • Maladjustment of the fixed SAS • Maladjustment of the idle position switch and throttle position sensor • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-ECU



*: Refer to '97 GALANT Workshop Manual (Pub. No. PWDE9611).

INSPECTION PROCEDURE 34

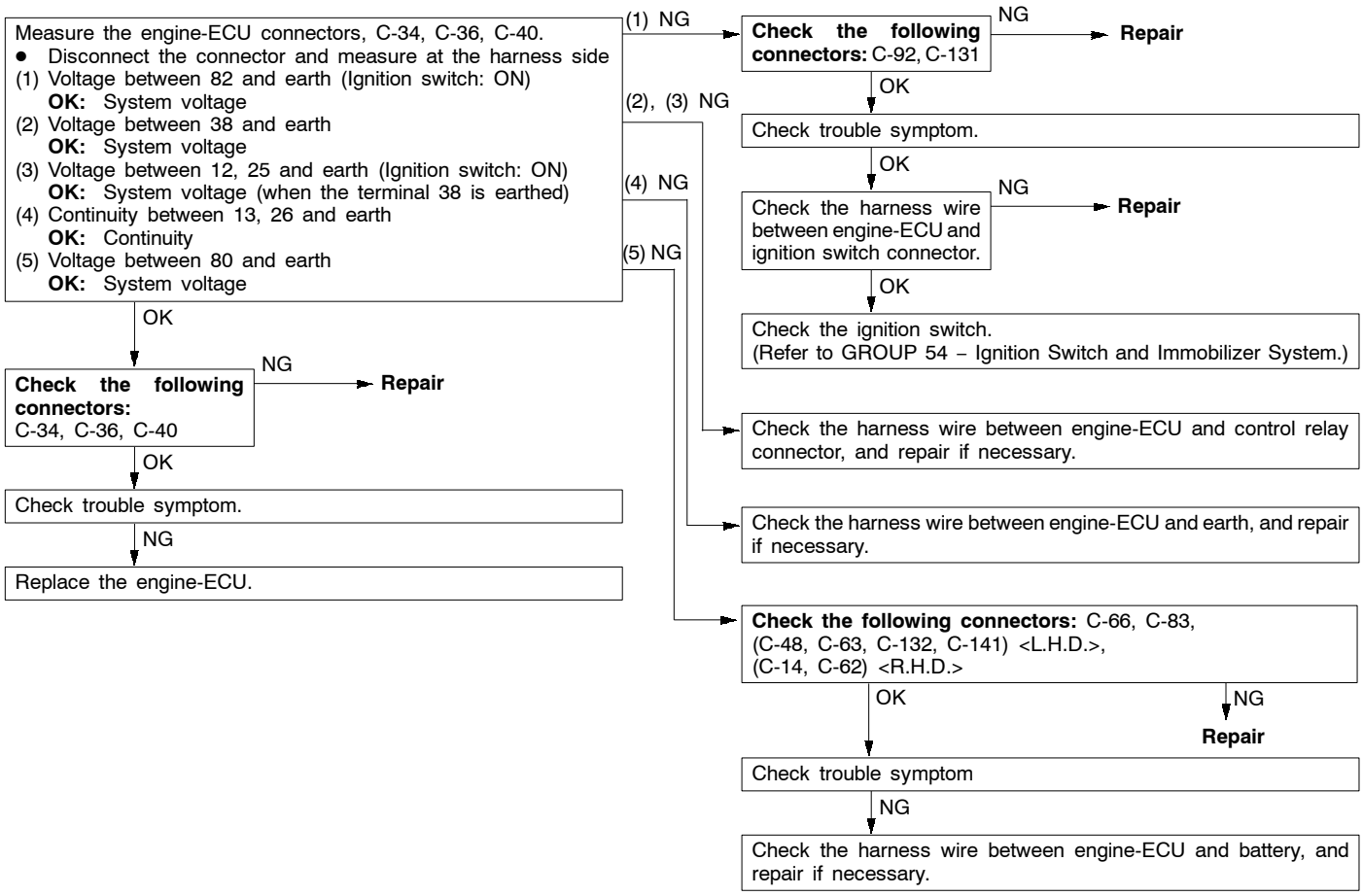
Idle speed control (ISC) servo (Stepper motor) system	Probable cause
The engine-ECU controls the intake air volume during idling by opening and closing the servo valve located in the bypass air passage.	• Malfunction of ISC servo • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-ECU



*: Refer to '97 GALANT Workshop Manual (Pub. No. PWDE9611).

INSPECTION PROCEDURE 45

Check the engine-ECU power supply and earth circuit.



MULTIPOINT FUEL INJECTION (MPI) <6A1>

GENERAL

OUTLINE OF CHANGES

Service procedures have been added for the following modifications:
- Modification of immobilizer
- Modification of body harness

TROUBLESHOOTING

DIAGNOSIS TROUBLESHOOTING FLOW

NOTE
If the engine-ECU is replaced, the immobilizer-ECU and ignition key should be replaced together with it.

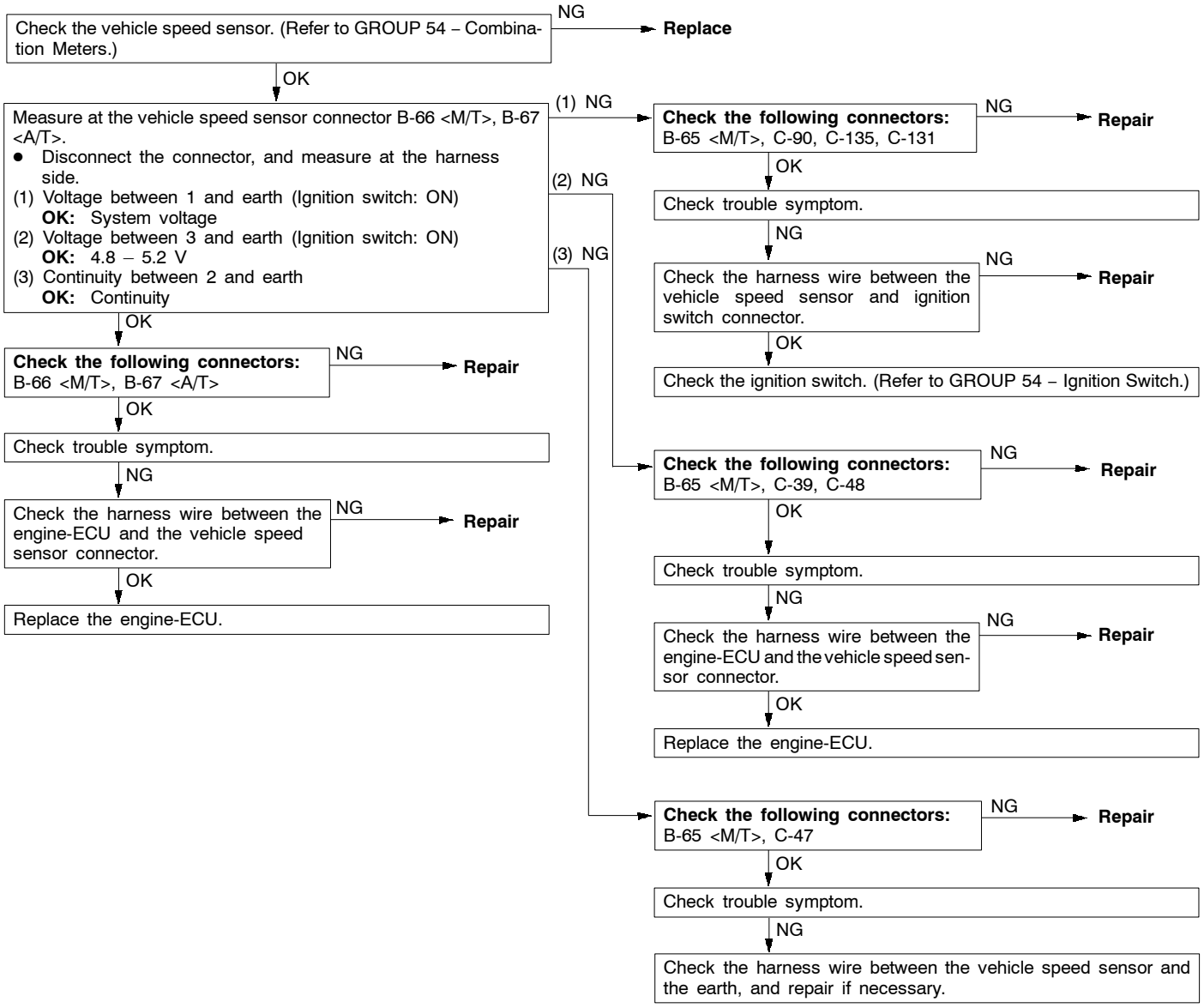
INSPECTION CHART FOR DIAGNOSIS CODES

The troubleshootings of code Nos.24, 54, 71 and 72 have been revised. The other items are the same as before.

Code No.	Diagnosis item	Reference page
24	Vehicle speed sensor system	13A-12
54	Immobilizer system	13A-13
71	Vacuum control solenoid valve system <Vehicles with TCL>	13A-14
72	Ventilation control solenoid valve system <Vehicles with TCL>	13A-15

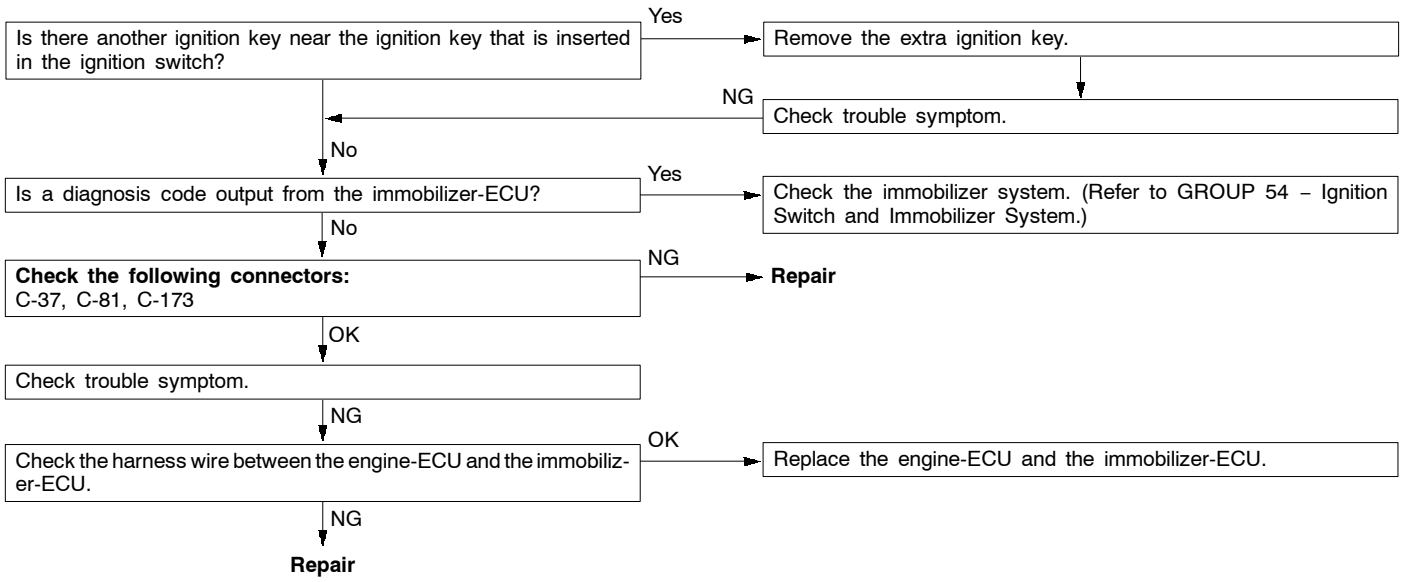
INSPECTION PROCEDURE FOR DIAGNOSIS CODES

Code No. 24 Vehicles speed sensor system	Probable cause
Range of check ● Ignition switch: ON ● Excluding 60 seconds after the ignition switch is turned to ON or immediately after the engine starts. ● Idle position switch: OFF ● Engine speed is 3,000 r/min or more. ● Driving under high engine load conditions. Set conditions ● Sensor output voltage does not change for 4 seconds (no pulse signal input).	● Malfunction of the vehicle speed sensor ● Improper connector contact, open circuit or short-circuited harness wire of the vehicle speed sensor circuit ● Malfunction of the engine-ECU

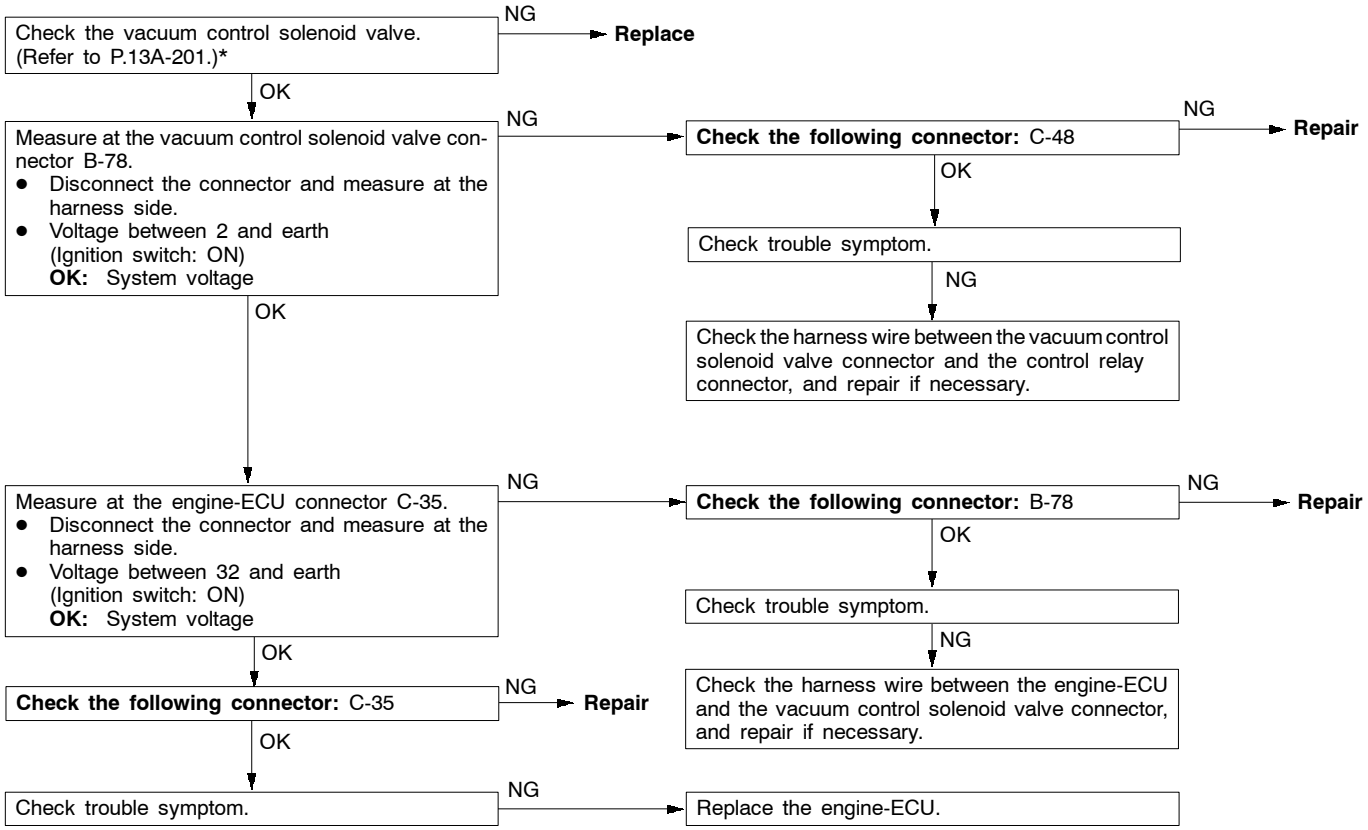


Code No.54 Immobilizer system	Probable cause
Range of Check ● Ignition switch: ON Set Conditions ● Improper communication between the engine-ECU and immobilizer-ECU	● Radio interference of encrypted codes ● Incorrect encrypted code ● Malfunction of harness or connector ● Malfunction of immobilizer-ECU ● Malfunction of engine-ECU

NOTE
(1) If the ignition switches are close each other when starting the engine, radio interference may cause this code to be displayed.
(2) This code may be displayed when registering the key encrypted code.

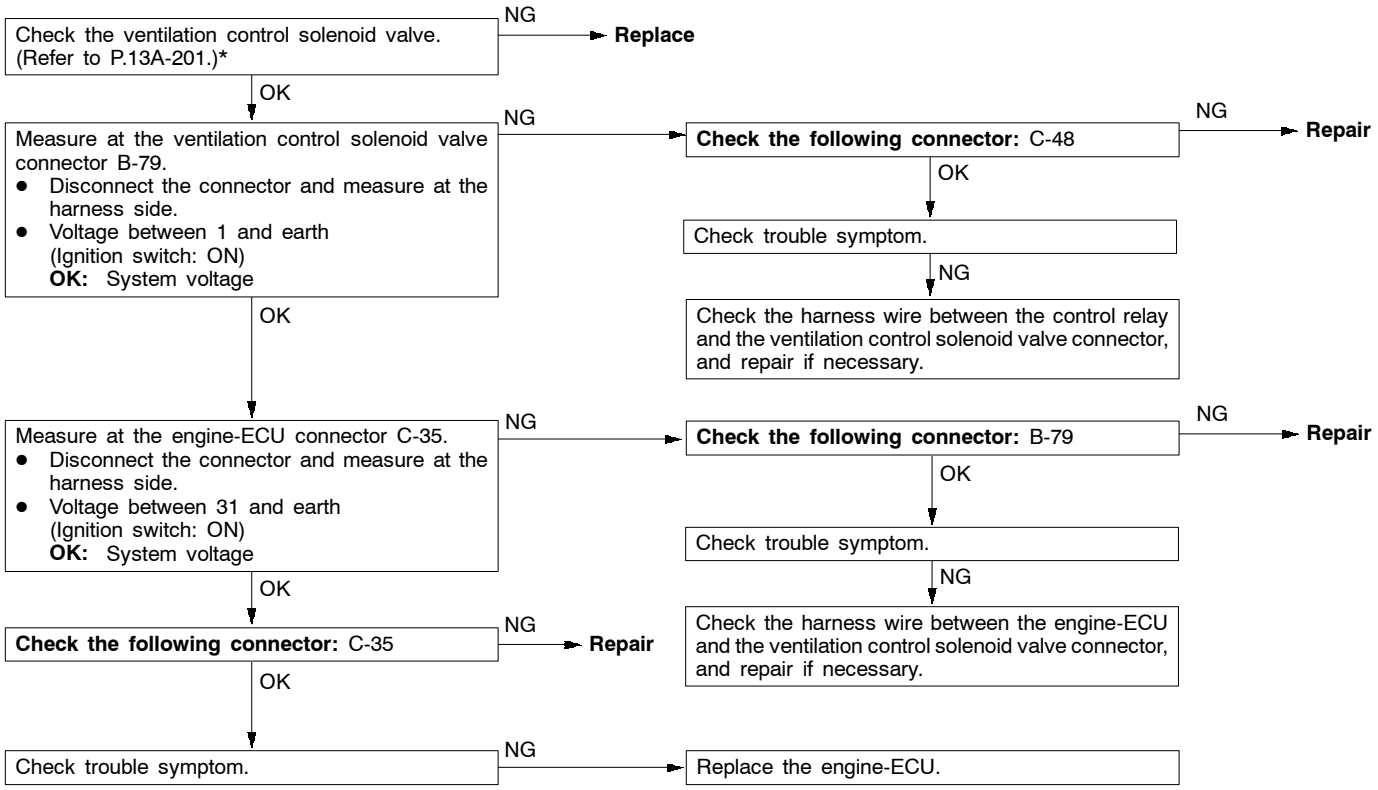


Code No. 71 Vacuum control solenoid valve system <Vehicles with TCL>	Probable cause
Range of Check ● Ignition switch: ON ● Excluding 60 seconds immediately after the engine starts. ● Battery voltage is 10 V or more. ● Forced actuation by means of MUT-II is not being carried out. Set condition Solenoid valve drive or non-drive instruction and energized condition of solenoid coil are different.	● Malfunction of the vacuum control solenoid valve ● Improper connector contact, open circuit or short-circuited harness wire of the vacuum control solenoid valve ● Malfunction of the engine-ECU



*: Refer to '97 GALANT Workshop Manual (Pub. No. PWDE9611).

Code No. 72 Ventilation control solenoid valve system <Vehicles with TCL>	Probable cause
Range of Check ● Ignition switch: ON ● Excluding 60 seconds immediately after the engine starts. ● Battery voltage is 10 V or more. ● Forced actuation by means of MUT-II is not being carried out. Set condition Solenoid valve drive or non-drive instruction and energized condition of solenoid coil are different.	● Malfunction of the ventilation control solenoid valve ● Improper connector contact, open circuit or short-circuited harness wire of the ventilation control solenoid valve ● Malfunction of the engine-ECU



*: Refer to '97 GALANT Workshop Manual (Pub. No. PWDE9611).

INSPECTION CHART FOR TROUBLE SYMPTOMS

The troubleshootings of inspection procedures Nos. 2, 31 and 48 have been revised. The other items are the same as before.

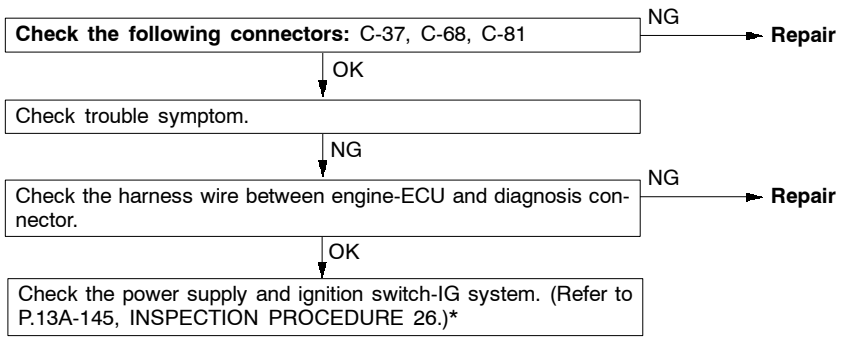
Trouble symptom		Inspection procedure No.	Reference page
Communication with MUT-II is impossible.	Communication with all systems is not possible.	1	13A-128*
	Communication with engine-ECU only is not possible.	2	13A-16

*: Refer to '97 GALANT Workshop Manual (Pub. No. PWDE9611).

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

INSPECTION PROCEDURE 2

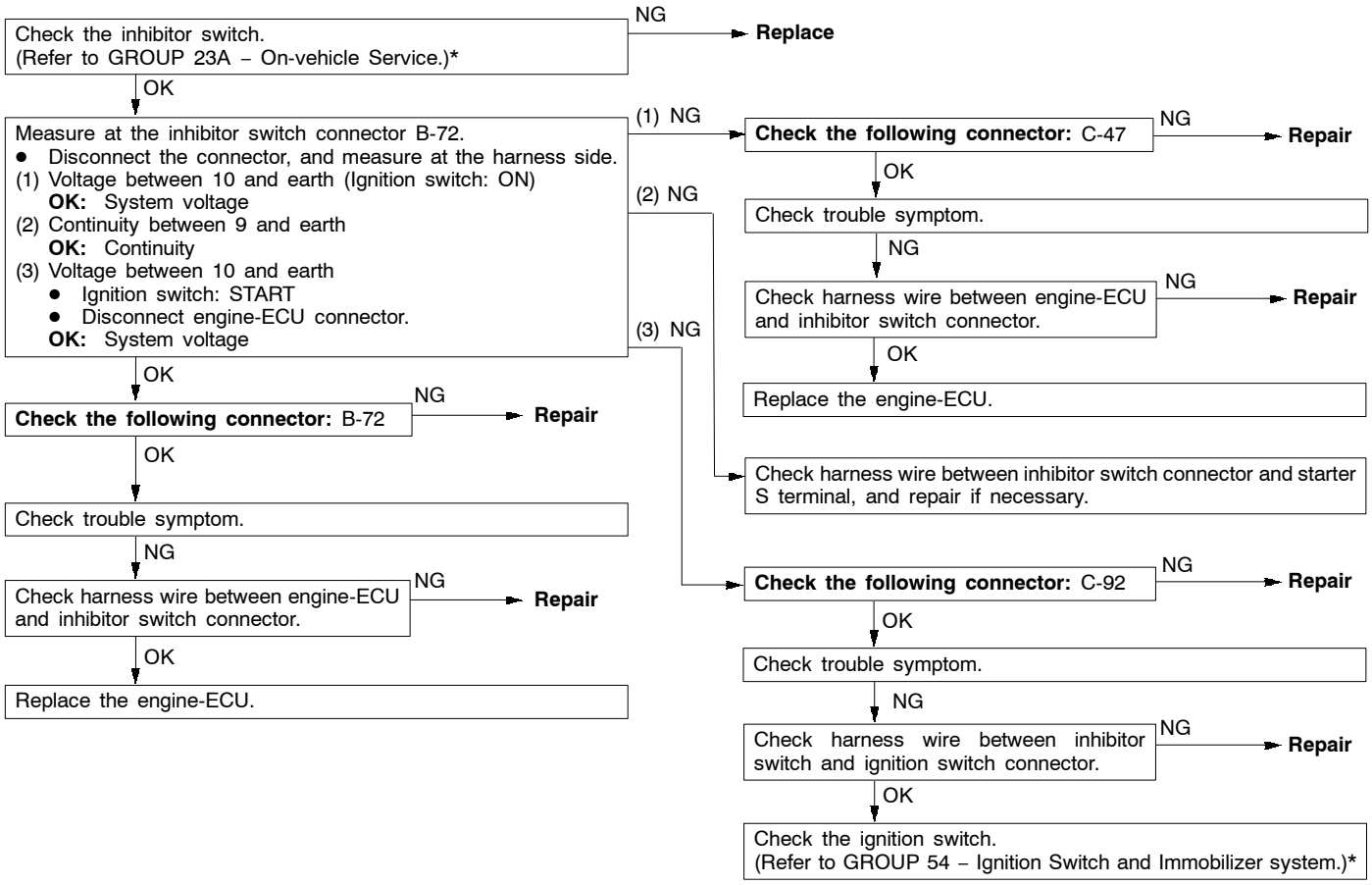
MUT-II communication with engine-ECU is impossible.	Probable cause
One of the following causes may be suspected. ● No power supply to engine-ECU. ● Defective earth circuit of engine-ECU. ● Defective engine-ECU. ● Improper communication line between engine-ECU and MUT-II	● Malfunction of engine-ECU power supply circuit ● Malfunction of engine-ECU ● Open circuit between engine-ECU and diagnosis connector



*: Refer to '97 GALANT Workshop Manual (Pub. No. PWDE9611).

INSPECTION PROCEDURE 31

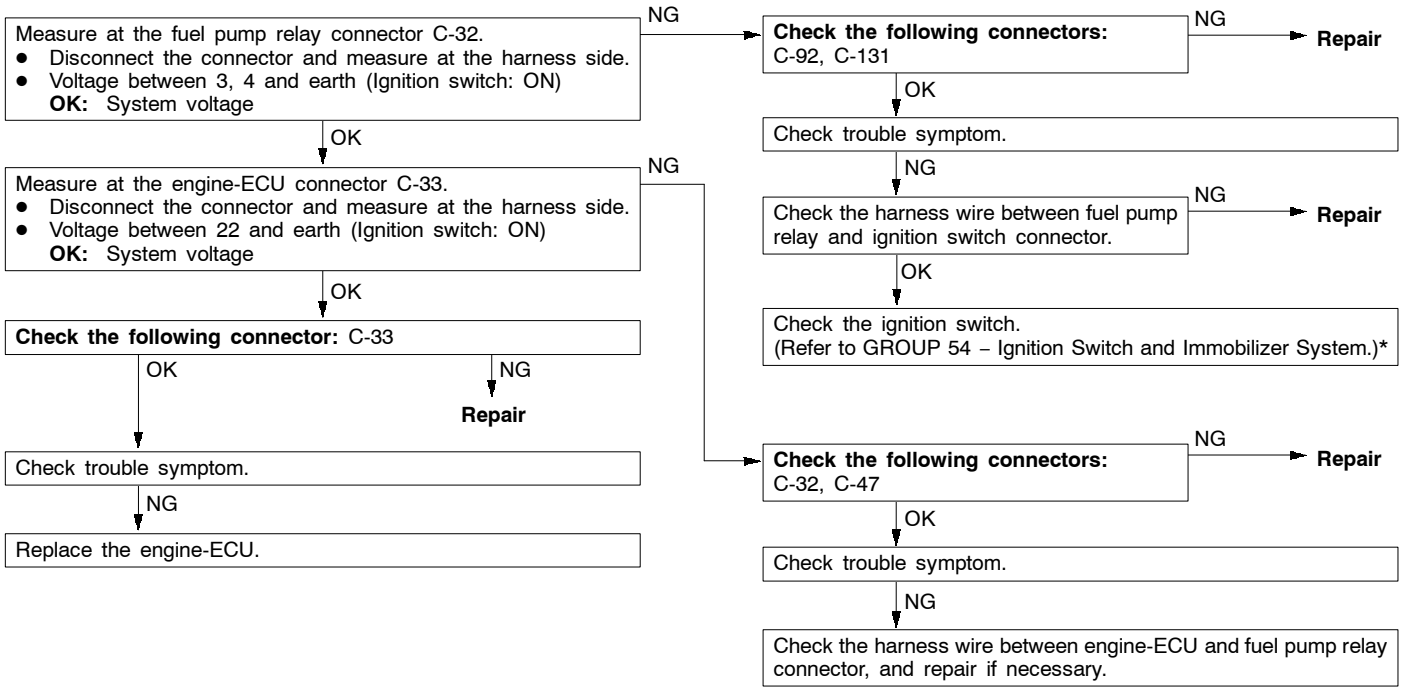
Ignition switch-ST and inhibitor switch system <A/T>	Probable cause
• The ignition switch-ST inputs a HIGH signal to the engine-ECU while the engine is cranking. The engine-ECU controls fuel injection, etc. during starting based on this input. • The inhibitor switch inputs the condition of the select lever, i.e. whether it is in P or N range or in some other range, to the engine-ECU. The engine-ECU controls the idle speed control (ISC) servo based on this input.	• Malfunction of ignition switch • Malfunction of inhibitor switch • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the engine-ECU.



*: Refer to '97 GALANT Workshop Manual (Pub. No. PWDE9611).

INSPECTION PROCEDURE 48

Check the fuel pump drive control circuit.



*: Refer to '97 GALANT Workshop Manual (Pub. No. PWDE9611).

GROUP 13E
DIESEL FUEL

GENERAL

OUTLINE OF CHANGE

- Troubleshooting regarding diagnosis code No.17 has been chenged to correspond to the change of the body wiring harness.

TROUBLESHOOTING

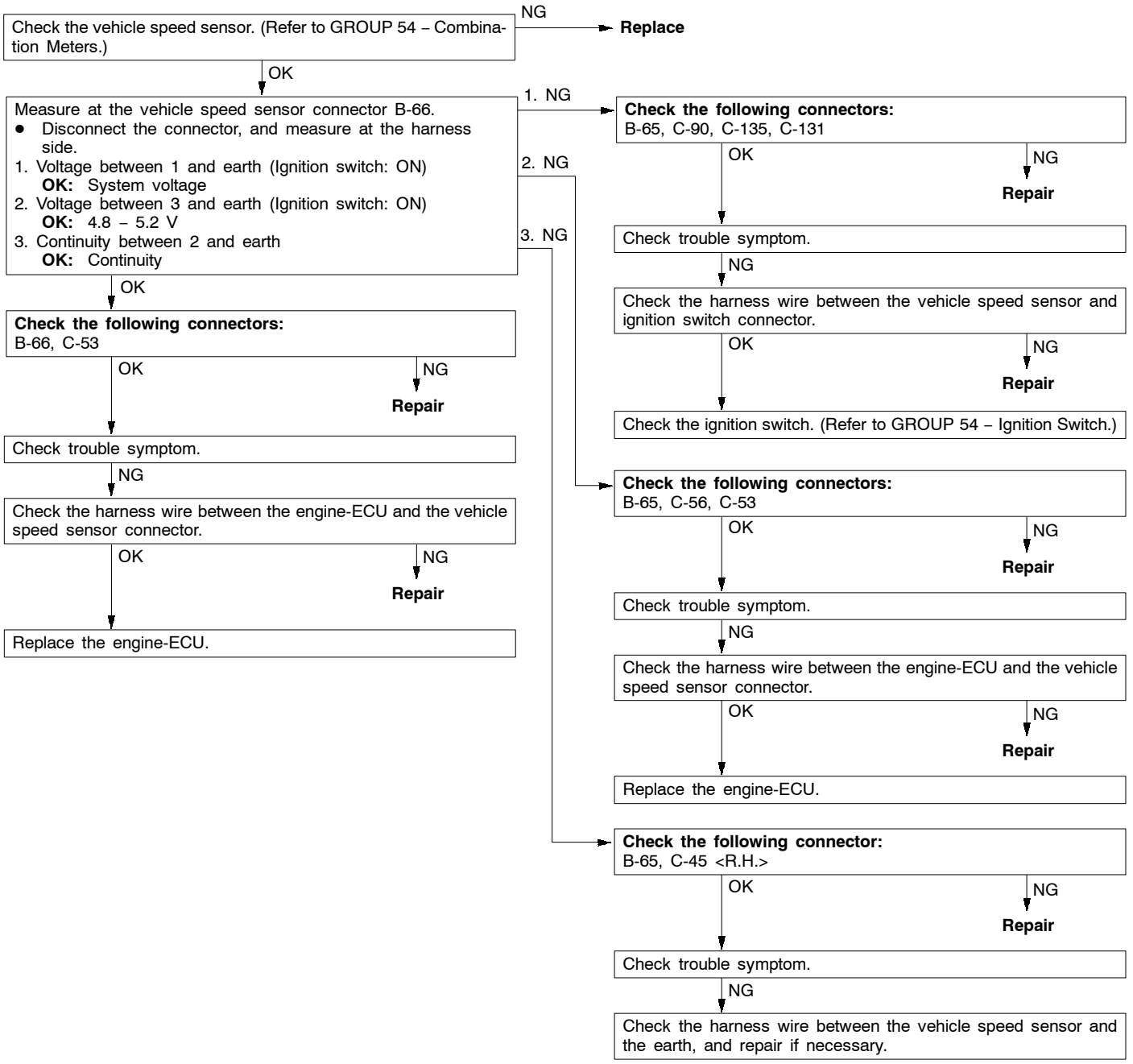
INSPECTION CHART FOR DIAGNOSIS CODES

Caution
Check that the engine-ECU earth circuit is normal before checking for the cause of the problem.

Code No.	Diagnosis item	Reference page
17	Vehicle speed sensor system	13E-2

INSPECTION PROCEDURE FOR DIAGNOSIS CODES

Code No.17 Vehicle speed sensor system	Probable cause
Range of Check ● Engine speed: 2,400 r/min or more ● Accelerator pedal opening amount: 50 % or more ● Engine coolant temperature: 60 °C or higher Set Conditions ● Vehicle speed signal is 0 km/h for 10 seconds or more.	● Malfunction of the vehicle speed sensor ● Open or short circuit in vehicle speed sensor circuit or poor connector contact ● Malfunction of the engine-ECU



GROUP 13H
TRACTION CONTROL SYSTEM (TCL)

GENERAL

OUTLINE OF CHANGE

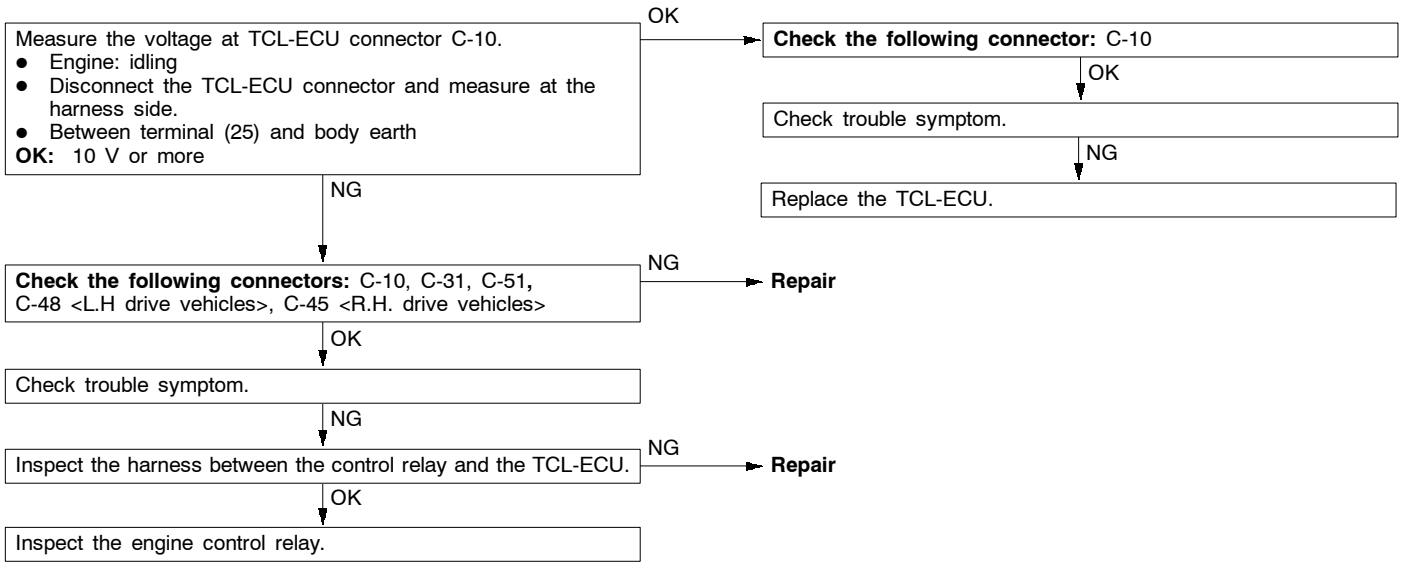
Troubleshootings have been revised for the modification of the traction control system (TCL) circuit.

TROUBLESHOOTING

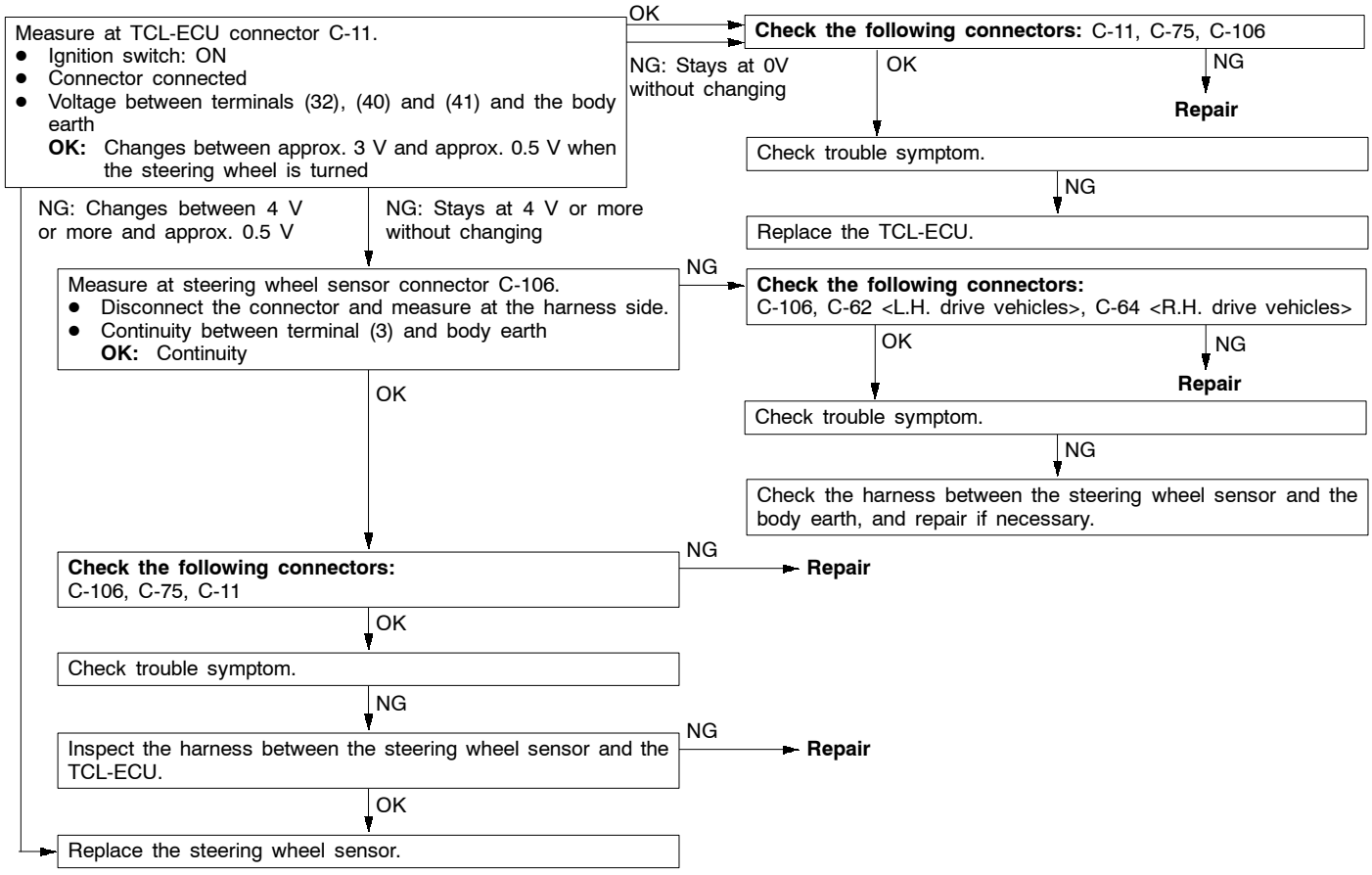
The other items than the following are the same as before.

INSPECTION PROCEDURE FOR DIAGNOSIS CODES

Code No. 27 TCL-ECU power supply voltage circuit (engine control relay circuit) system	Probable cause
This diagnosis code is output if the TCL-ECU power supply voltage (engine control relay supply voltage) is lower than the specified value. If the voltage returns to the specified value or greater, the diagnosis code is erased.	• Malfunction of control relay • Malfunction of harness or connector • Malfunction of TCL-ECU



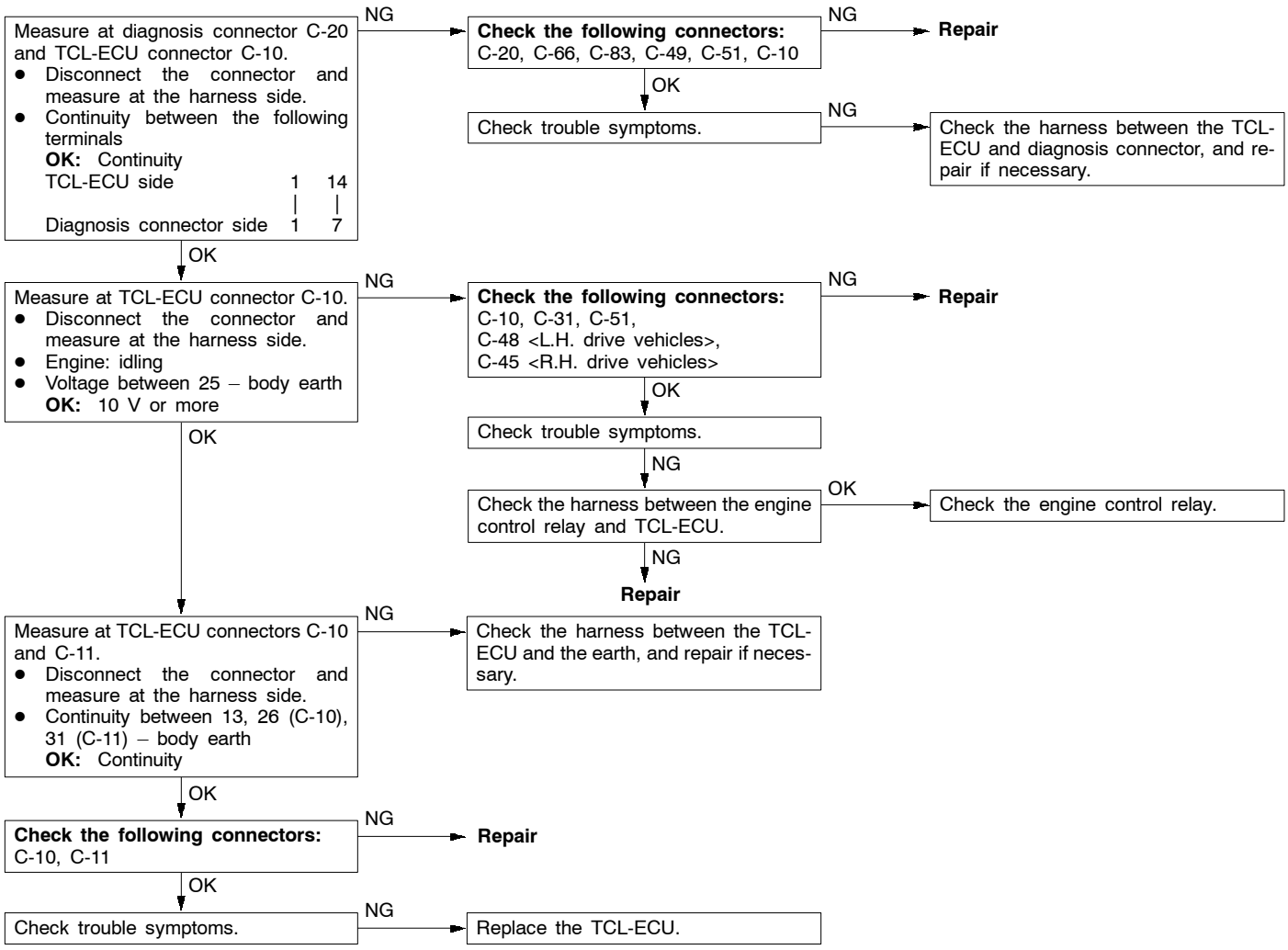
Code No. 41 Steering wheel sensor (ST-1) circuit system (open circuit) Code No. 42 Steering wheel sensor (ST-2) circuit system (open circuit) Code No. 43 Steering wheel sensor (ST-N) circuit system (open circuit)	Probable cause
These diagnosis codes are output if there is an open circuit in the output wire of the steering wheel sensor circuit.	• Malfunction of harness or connector • Malfunction of steering wheel sensor • Malfunction of TCL-ECU



INSPECTION PROCEDURE FOR TROUBLE SYMPTOM

Inspection Procedure 2

Communication with the MUT-II is not possible. (Communication with TCL-ECU only is not possible.)	Probable cause
If the MUT-II cannot communicate with the TCL-ECU only, the cause is probably an abnormality in the TCL diagnosis line or in the TCL-ECU power supply line or earth line.	• Malfunction of harness or connector • Malfunction of engine control relay • Malfunction of TCL-ECU



NOTES

GASOLINE DIRECT INJECTION (GDI) <4G6>

CONTENTS

GENERAL

OUTLINE OF CHANGE

- A 4G64-GDI engine has been added. To correspond to this, maintenance service procedures are given below:

GENERAL INFORMATION

The Gasoline Direct Injection System consists of sensors which detect the engine conditions, the engine-ECU which controls the system based on signals from these sensors, and actuators which operate under the control of the engine-ECU. The engine-ECU carries out activities such as fuel injection control, idle speed control and ignition timing control. In addition, the engine-ECU is equipped with several diagnosis modes which simplify troubleshooting when a problem develops.

FUEL INJECTION CONTROL

The injector drive times and injector timing are controlled so that the optimum air/fuel mixture is supplied to the engine to correspond to the continually-changing engine operation conditions.

A single injector for each cylinder is mounted at the cylinder head. The fuel is sent under pressure from the fuel tank to the fuel pressure regulator (low pressure) by the fuel pump (low pressure). The pressure is regulated by the fuel pressure regulator (low pressure) and the fuel regulated is then sent to the fuel pump (high pressure). The fuel under increased pressure generated by the fuel pump (high pressure) is then regulated by the fuel pressure regulator (high pressure) and is then distributed to each of the injectors via the delivery pipes.

Fuel injection is normally carried out once for each cylinder for every two rotations of the crankshaft. The firing order is 1-3-4-2. This is called sequential fuel injection.

When the engine is cold or under a severe load, the “open-loop” control keeps the air/fuel ratio at a richer than usual level to maintain driveability. When the engine is under low or medium loads, the air/fuel ratio becomes leaner to reduce fuel consumption. When the engine is running at medium or high loads after having warmed up, the “closed-loop” control uses the signal from the oxygen sensor to keep the air/fuel ratio at the optimum theoretical level.

THROTTLE VALVE OPENING ANGLE CONTROL

This system controls throttle valve opening angle electronically. The engine-ECU determines how deeply the accelerator pedal is depressed by means of the accelerator position sensor (APS). Then the engine-ECU sends a target value of the throttle valve opening angle to the throttle valve controller. The throttle valve control servo operates the throttle valve so that it reaches the target opening angle.

IDLE SPEED CONTROL

This system maintains engine idle speed at a predetermined condition by controlling the air flow that passes through the throttle valve according to engine idling condition and engine loads at idling.

The engine-ECU operates the throttle valve control servo so that engine speed is maintained within a map value. The map value is predetermined according to engine coolant temperature and air-conditioning load.

IGNITION TIMING CONTROL

The power transistor located in the ignition primary circuit turns ON and OFF to control the primary current flow to the ignition coil. This controls the ignition timing in order to provide the optimum ignition timing with respect to the engine operating conditions. The ignition timing is determined by the engine-ECU from the engine speed, intake air volume, engine coolant temperature, atmospheric pressure and injection timing (intake stroke or compression stroke).

SELF-DIAGNOSIS FUNCTION

- When an abnormality is detected in one of the sensors or actuators related to emission control, the engine warning lamp (check engine lamp) illuminates as a warning to the driver.
- When an abnormality is detected in one of the sensors or actuators, a diagnosis code corresponding to the abnormality is output.
- The RAM data inside the engine-ECU that is related to the sensors and actuators can be read by means of the MUT-II. In addition, the actuators can be force-driven under certain circumstances.

OTHER CONTROL FUNCTIONS

1. Fuel Pump Control
   Turns the fuel pump relay ON so that current is supplied to the fuel pump while the engine is cranking or running.
2. A/C Relay Control
   Turns the compressor clutch of the A/C ON and OFF.
3. Fan Motor Control
   The revolutions of the radiator fan and condenser fan are controlled in response to the engine coolant temperature and vehicle speed.
4. Purge Control Solenoid Valve Control
   Refer to GROUP 17.
5. EGR valve Control
   Refer to GROUP 17.

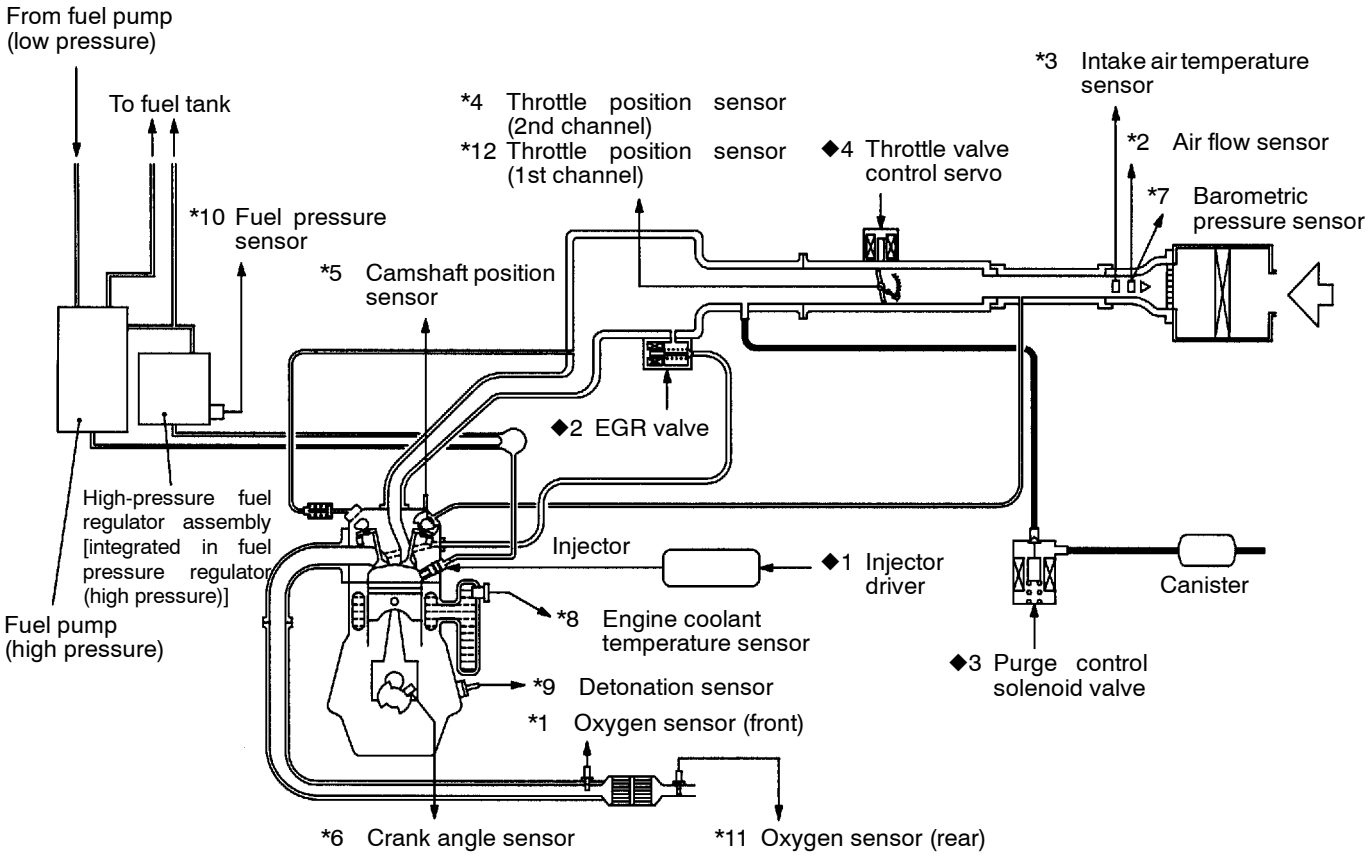
GENERAL SPECIFICATIONS

Items			Specifications
Throttle body	Throttle bore mm		65
	Throttle position sensor		Variable resistor type (Dual system type)
	Throttle valve control servo		Torque motor type
Engine-ECU	Identification model No.	Except vehicles for Germany	E2T72880
		Vehicles for Germany	E2T72881
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
	Accelerator pedal position sensor		Variable resistor type (Dual system type)
	Accelerator pedal position switch		Rotary contact type, within accelerator pedal position sensor
	Vehicle speed sensor		Magnetic resistive element type
	Inhibitor switch		Contact switch type
	Camshaft position sensor		Hall element type
	Crank angle sensor		Hall element type
	Detonation sensor		Piezoelectric type
	Fuel pressure sensor		Metallic membrane type
	Power steering fluid pressure switch		Contact switch type

Items		Specifications
Actuators	Engine control relay type	Contact switch type
	Fuel pump relay type	Contact switch type
	Injector driver relay	Contact switch type
	Injector type and number	Electromagnetic type, 4
	Injector identification mark	DIM 1100G
	Throttle valve control servo relay	Contact switch type
	EGR valve	Stepper motor type
	Purge control solenoid valve	Duty cycle type solenoid valve
Fuel pressure regulator (low pressure)	Regulator pressure kPa	324
Fuel pressure regulator (high pressure)	Regulator pressure MPa	5.5

GASOLINE DIRECT INJECTION SYSTEM DIAGRAM

*1 Oxygen sensor (front) *2 Air flow sensor *3 Intake air temperature senor *4 Throttle position sensor (2nd channel) *5 Camshaft position sensor *6 Crank angle sensor *7 Barometric pressure sensor *8 Engine coolant temperature sensor *9 Detonation sensor *10 Fuel pressure sensor *11 Oxygen Sensor (rear)	• Power supply • Ignition switch – IG • Ignition switch – ST • Accelerator pedal position sensor (1st channel) • Accelerator pedal position switch • Vehicle speed sensor • A/C switch • A/C pressure sensor • M/T oil temperature sensor • Inhibitor switch • Power steering fluid pressure switch • Alternator FR terminal • Stop lamp switch • Small lamp switch • Clutch switch • Brake vacuum sensor • Injector wire open circuit check signal • Throttle valve controller • A/T-ECU	⇨ Engine-ECU ⇨	◆1 Injector driver (Injector) ◆2 EGR valve (Stepper motor) ◆3 Purge control solenoid valve	• Engine control relay • Fuel pump relay • Injector driver relay • Throttle valve control servo relay • A/C relay • Ignition coil • Fan controller • Engine warning lamp • Diagnosis output • Alternator G terminal • Throttle valve controller • A/T-ECU • GDI ECO indication lamp
*12 Throttle position sensor (1st channel)	• Power supply • Ignition switch – IG • Accelerator pedal position sensor (2nd channel) • Engine-ECU	⇨ Throttle valve controller ⇨	◆4 Throttle valve control servo	• Engine-ECU



W6058AE

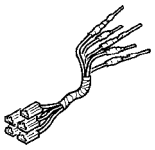
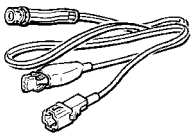
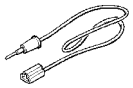
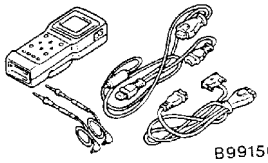
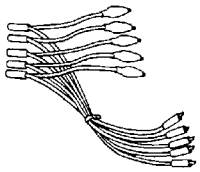
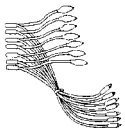
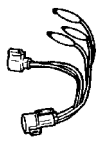
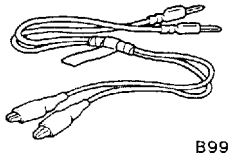
SERVICE SPECIFICATIONS

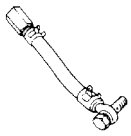
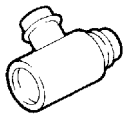
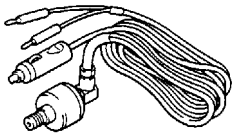
Item		Standard value
Adjustment voltage of throttle position sensor (1st channel) V		0.4 – 0.6
Adjustment voltage of throttle position sensor (2nd channel) V		4.2 – 4.8
Resistance of throttle position sensor (1st and 2nd channels) kΩ		1.7 – 3.3
Adjustment voltages of accelerator pedal position sensor (1st and 2nd channels) V		0.985 – 1.085
Resistance of accelerator pedal position sensor (1st and 2nd channels) kΩ		3.5 – 6.5
Intake air temperature sensor resistance kΩ	at 20°C	2.3 – 3.0
	at 80°C	0.30 – 0.42
Engine coolant temperature sensor resistance kΩ	at 20°C	2.1 – 2.7
	at 80°C	0.26 – 0.36
Fuel pressure	High-pressure side MPa	4 – 6.9
	Low-pressure side kPa	Approximately 324
Injector coil resistance Ω		0.9 – 1.1
Oxygen sensor output voltage V		0.6 – 1.0
Oxygen sensor heater resistance Ω		11 – 18
Throttle valve control servo resistance Ω		1.35 – 1.65

SEALANT

Item	Specified sealant	Remark
Engine coolant temperature sensor threaded portion	3M Nut Locking Part No. 4171 or equivalent	Drying sealant

SPECIAL TOOLS

Tool	Number	Name	Use
A  B  C  D  C991223	MB991223 A: MB991219 B: MB991220 C: MB991221 D: MB991222	Harness set A: Test harness B: LED harness C: LED harness adapter D: Probe	• Inspection of oxygen sensor A: Connector pin contact pressure inspection B: Power circuit inspection C: Power circuit inspection D: Commercial tester connection
 B991502	MB991502	MUT-II sub assembly	• Reading diagnosis code • GDI system inspection
	MB991348, MB991658	Test harness set	• Measurement of voltage during trouble-shooting • Inspection using an analyzer
 MB991709	MB991709	Test harness	
	MB991519	Alternator harness connector	Measurement of voltage during troubleshooting
	MD998478	Test harness (3-pin, triangle)	• Measurement of voltage during trouble-shooting • Inspection using an analyzer
 B991529	MB991529	Diagnosis code check harness	Reading diagnosis code

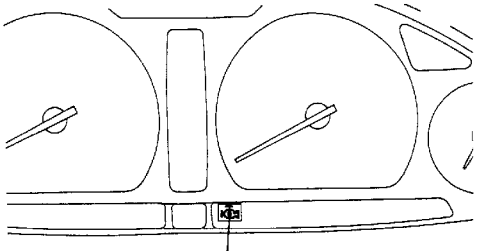
Tool	Number	Name	Use
	MD998709	Adaptor hose	Measurement of fuel pressure
	MD998742	Hose adaptor	
 B991637	MB991637	Fuel pressure gauge set	

TROUBLESHOOTING

DIAGNOSIS TROUBLESHOOTING FLOW

Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points.

NOTE
If the engine-ECU is replaced, the immobilizer-ECU and ignition key should be replaced together with it.



DIAGNOSIS FUNCTION

ENGINE WARNING LAMP (CHECK ENGINE LAMP)

If an abnormality occurs in any of the following items related to the Gasoline Direct Injection (GDI) system, the engine warning lamp will illuminate.
If the lamp remains illuminated or if the lamp illuminates while the engine is running, check the diagnosis code output.

Diagnosis items indicated by the engine warning lamp flashing

Engine-ECU
Oxygen sensor (front)
Oxygen sensor (rear)
Air flow sensor
Intake air temperature sensor
Throttle position sensor (1st channel)
Throttle position sensor (2nd channel)
Engine coolant temperature sensor
Crank angle sensor
Camshaft position sensor
Barometric pressure sensor
Detonation sensor
Injector
Abnormal combustion
Immobilizer system
Abnormal fuel pressure
Brake vacuum sensor
Fuel system malfunction
Accelerator pedal position sensor (1st channel)
Accelerator pedal position sensor (2nd channel)
Electronic-controlled throttle valve system
Throttle valve position feedback
Throttle valve control servo motor (Motor 1st phase malfunction)
Throttle valve control servo motor (Motor 2nd phase malfunction)
Communication line system with throttle valve controller

NOTE
The engine warning lamp flashes when the electronic-controlled throttle valve system is disabled.

METHOD OF READING AND ERASING DIAGNOSIS CODES

Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points.

INSPECTION USING MUT-II DATA LIST AND ACTUATOR TESTING

1. Carry out inspection by means of the data list and the actuator test function.
   If there is an abnormality, check and repair the chassis harnesses and components.
2. After repairing, re-check using the MUT-II and check that the abnormal input and output have returned to normal as a result of the repairs.
3. Erase the diagnosis code memory.
4. Remove the MUT-II.
5. Start the engine again and carry out a road test to confirm that the problem has disappeared.

FAIL-SAFE FUNCTION REFERENCE TABLE

If the diagnosis system detects any sensor malfunction, the vehicle can be driven safely by using a default control logic instead of the faulty sensors.

Defective part or function	What to do when a sensor is defective
Air flow sensor	(1) Disables lean-mixture combustion. (2) Determines injector basic operating time and basic ignition timing according to map value, which has been predetermined by throttle position sensor and crank angle sensor signals.
Intake air temperature sensor	Controls as the intake air temperature is 25°C.
Throttle position sensor (1st channel)	(1) Disables lean-mixture combustion. (2) Controls throttle valve opening angle by closed loop control by using the throttle position sensor (2nd channel) signal. (3) Disables the throttle valve opening angle control when the throttle position sensor (2nd channel) signal is also defective.
Throttle position sensor (2nd channel)	(1) Disables lean-mixture combustion. (2) Controls throttle valve opening angle by closed loop control by using the throttle position sensor (1st channel) signal. (3) Disables the throttle valve opening angle control when the throttle position sensor (1st channel) signal is also defective.
Engine coolant temperature sensor	Controls as if the engine coolant temperature is 80°C. (Note that this control will continue until the ignition switch is turned off even if the sensor signal return to normal.)

Defective part or function	What to do when a sensor is defective
Camshaft position sensor	Controls according to the conditions before a failure is detected.
Vehicle speed sensor	(1) Disables lean-mixture combustion. However, if a predetermined time elapses at an engine speed of 1,500 r/min or more, the lean-mixture combustion will return to normal. (2) Disables lean-mixture combustion during engine idling.
Barometric pressure sensor	Controls as if the barometric pressure is 101 kPa.
Detonation sensor	Holds the ignition timing at that for regular gasoline.
Injector	(1) Disables lean-mixture combustion. (2) Shuts down exhaust gas recirculation.
Abnormal combustion	Disables lean-mixture combustion.
Communication line with A/T-ECU	Disables ignition timing retard control (engine and transmission total control) during shift change.
Alternator FR terminal	Disables inhibition control of the alternator output according to electrical load (treats the alternator as if it is conventional one).
Oxygen sensor (front)	Air/fuel ratio closed loop control is not performed.
Oxygen sensor (rear)	Performs the closed loop control of the air/fuel ratio by using only the signal of oxygen sensor (front).
Fuel pressure sensor	(1) Controls as if the fuel pressure is 5.5 MPa (if there is open or short circuit). (2) Turns off the fuel pump relay (if the fuel pressure is excessively high). (3) Shuts off the fuel injection (If an excessively low pressure is detected or the engine speed exceeds 3,000 r/min).
Accelerator pedal position sensor (1st channel)	(1) Disables lean-mixture combustion. (2) Controls the throttle valve position by using the accelerator pedal position sensor (2nd channel) signal. (3) Disables the electronic-controlled throttle valve system if the accelerator pedal position sensor (2nd channel) signal is also defective, and holds the throttle valve at a predetermined angle where the vehicle can be driven safely although its performance is reduced.

Defective part or function	What to do when a sensor is defective
Accelerator pedal position sensor (2nd channel)	(1) Disables lean-mixture combustion. (2) Controls the throttle valve position by using the accelerator pedal position sensor (1st channel) signal. (3) Disables the electronic-controlled throttle valve system if the accelerator pedal position sensor (1st channel) signal is also defective.
Electronic-controlled throttle valve system	(1) Disables the electronic-controlled throttle valve system. (2) Disables lean-mixture combustion. (3) Disables idle engine speed feedback control.
Throttle valve position feedback	(1) Disables the electronic-controlled throttle valve system. (2) Disables lean-mixture combustion. (3) Disables idle engine speed feedback control.
Throttle valve control servo motor (Motor 1st phase malfunction)	Disables lean-mixture combustion.
Throttle valve control servo motor (Motor 2nd phase malfunction)	(1) Disables the electronic-controlled throttle valve system. (2) Disables lean-mixture combustion. (3) Disables idle engine speed feedback control.
Communication line with the throttle valve controller	(1) Error in communication from the throttle valve controller to the engine-ECU ● Disables lean-mixture combustion. ● Shuts off fuel supply when engine speed exceeds 3,000 r/min. (2) Error in communication from the engine-ECU to the throttle valve controller ● Disables lean-mixture combustion. ● Shuts off fuel supply when engine speed exceeds 3,000 r/min. ● The throttle valve controller controls the throttle valve opening angle by using the accelerator pedal position sensor (2nd channel) signal.

NOTE
The engine warning lamp illuminates when the electronic-controlled throttle valve system is disabled.

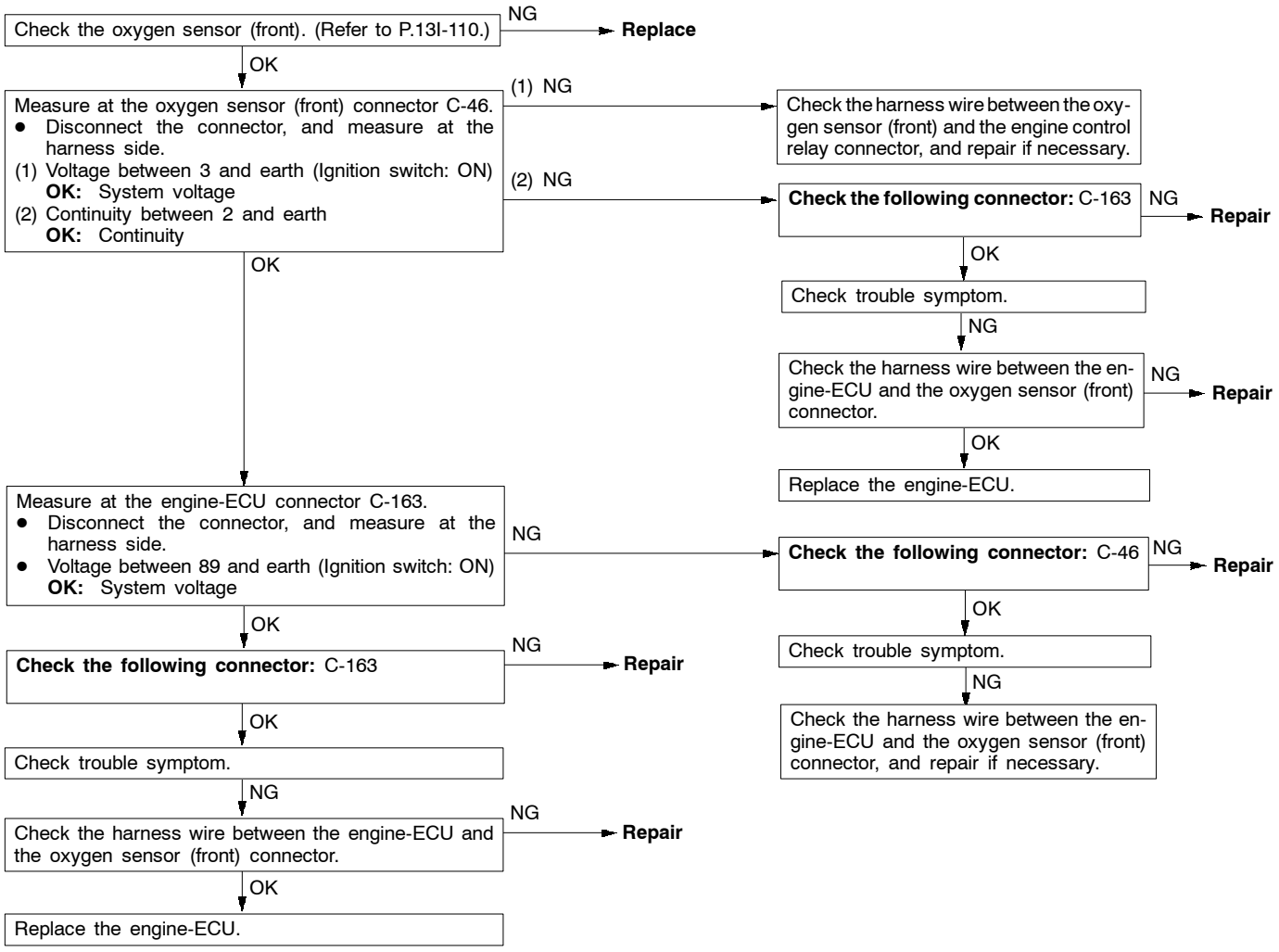
INSPECTION CHART FOR DIAGNOSIS CODES

Code No.	Diagnosis item	Reference page
11	Oxygen sensor (front) system	13I-14
12	Air flow sensor system	13I-15
13	Intake air temperature sensor system	13I-16
14	Throttle position sensor (2nd channel) system	13I-17
21	Engine coolant temperature sensor system	13I-18
22	Crank angle sensor system	13I-19
23	Camshaft position sensor system	13I-20
24	Vehicle speed sensor system	13I-21
25	Barometric pressure sensor system	13I-22
31	Detonation sensor system	13I-23
41	Injector system	13I-24
44	Abnormal combustion	13I-26
54	Immobilizer system	13I-27
56	Abnormal fuel pressure system	13I-28
59	Oxygen sensor (rear) system	13I-30
61	Communication line with A/T-ECU system	13I-31
64	Alternator FR terminal system	13I-31
66	Brake vacuum sensor system	13I-32
77	Accelerator pedal position sensor (2nd channel) system	13I-33
78	Accelerator pedal position sensor (1st channel) system	13I-34
79	Throttle position sensor (1st channel) system	13I-35
89	Abnormality in fuel pressure system	13I-36
91	Electronic-controlled throttle valve system	13I-36
92	Throttle valve position feedback system	13I-37
94	Communication line system with throttle valve controller	13I-37
95	Throttle valve control servo motor (Motor 1st phase malfunction) system	13I-38
99	Throttle valve control servo motor (Motor 2nd phase malfunction) system	13I-38

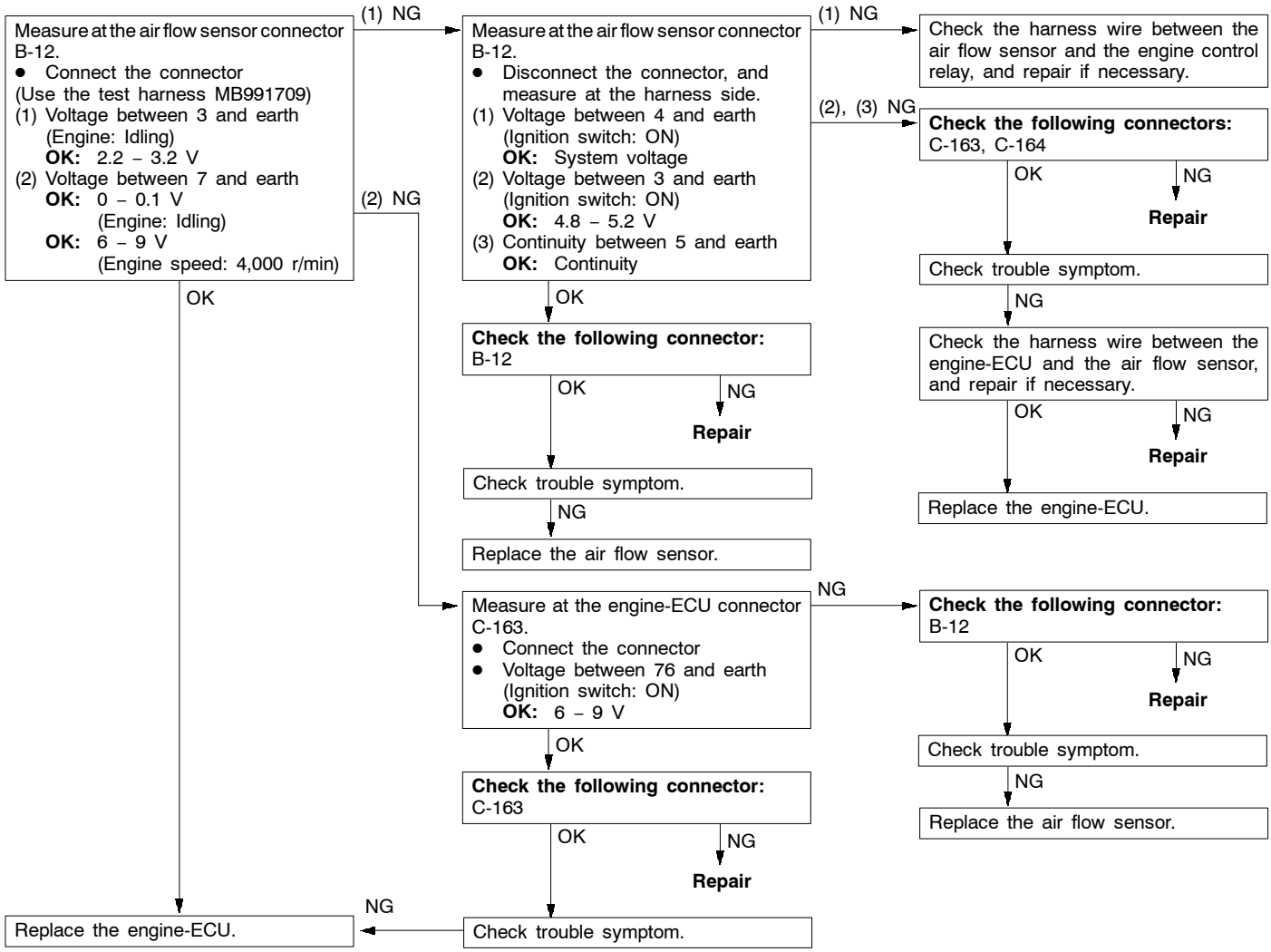
NOTE
Code No. 56 may be also output when air is sucked in high-pressure fuel line due to no fuel supply.

INSPECTION PROCEDURE FOR DIAGNOSIS CODES

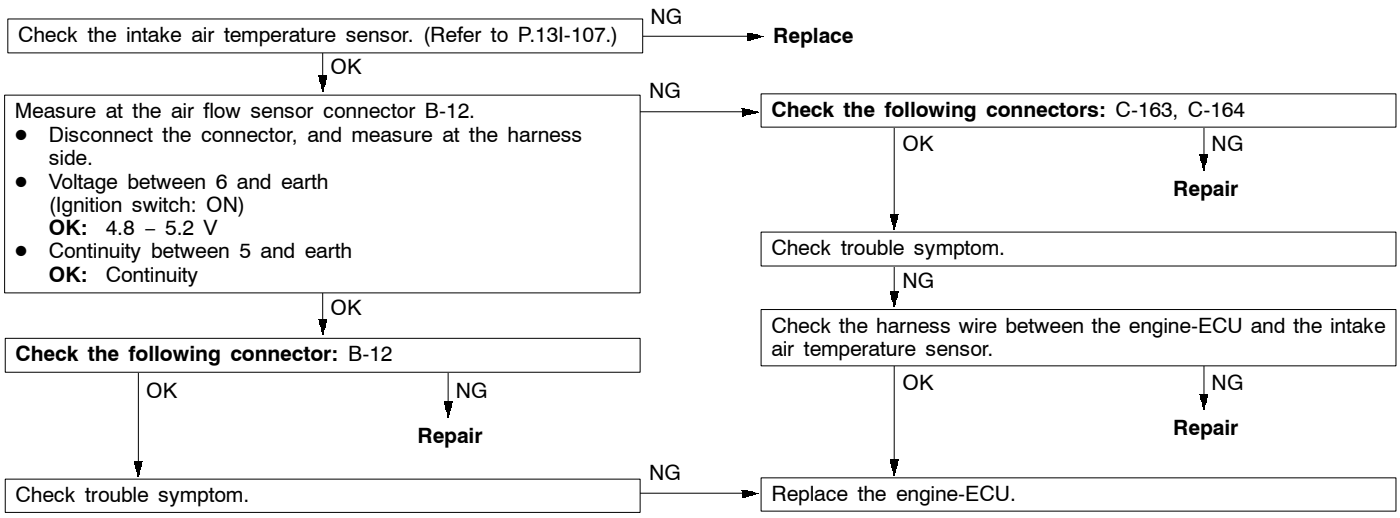
Code No. 11 Oxygen sensor (front) system	Probable cause
Range of check ● 3 minutes have passed after engine was started. ● Engine coolant temperature is approx. 80°C or more. ● Intake air temperature is 20–50°C. ● Engine speed is approx. 2,000–3,000 r/min ● Vehicle is moving at constant speed on a flat, level road surface Set conditions ● The oxygen sensor output voltage is around 0.6 V for 30 seconds (does not cross 0.6 V for 30 seconds). ● When the range of check operations given above which accompany starting of the engine are carried out four time in succession, a problem is detected after each operation.	● Malfunction of the oxygen sensor (front) ● Improper connector contact, open circuit or short-circuited harness wire ● Malfunction of the engine-ECU



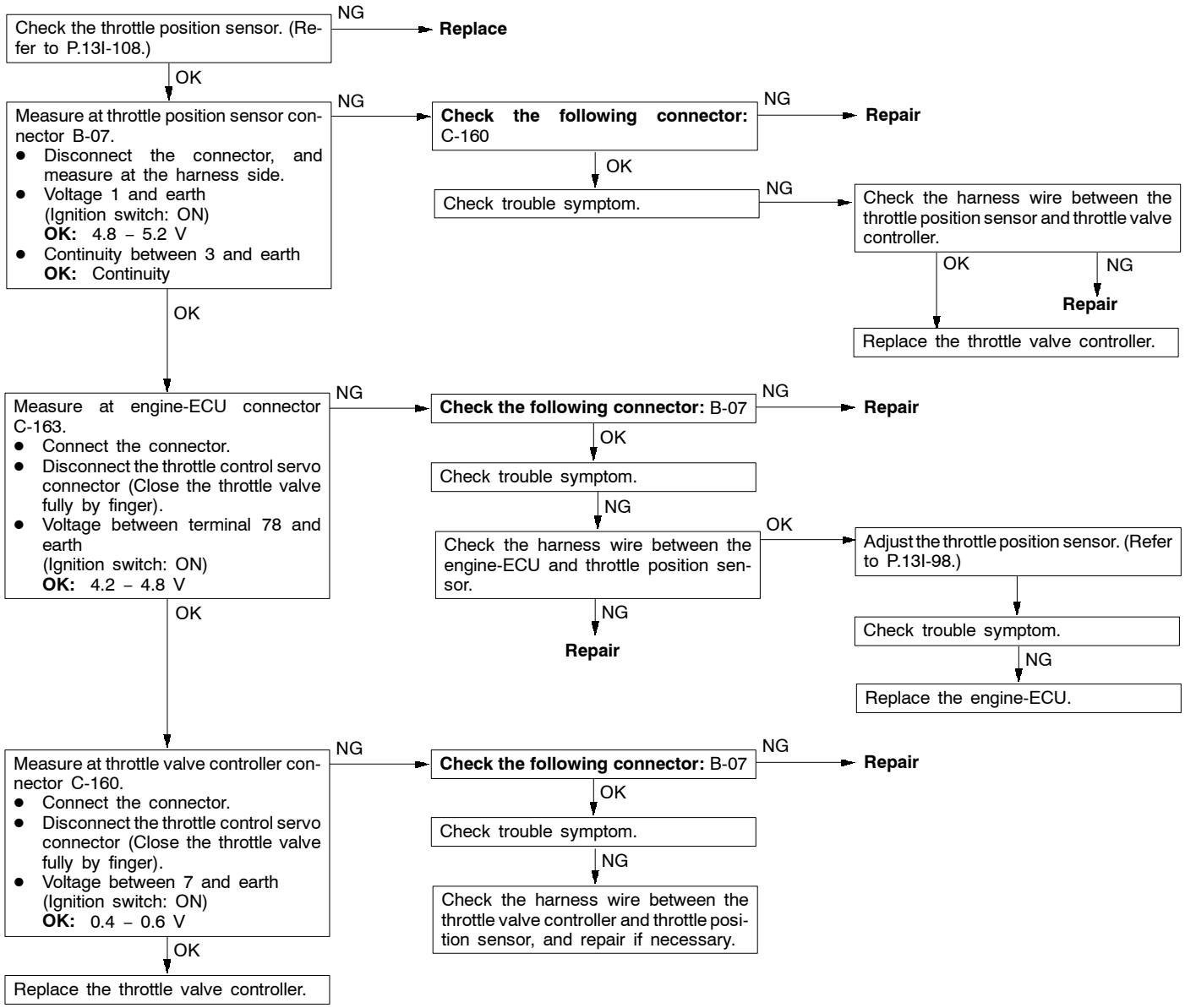
Code No.12 Air flow sensor system	Probable cause
Range of check ● Engine speed is 500 r/min or more. Set conditions ● Sensor output frequency is 3.3 Hz or less for 4 seconds.	● Malfunction of the air flow sensor ● Open circuit or short-circuited harness wire of air flow sensor circuit ● Malfunction of the engine-ECU



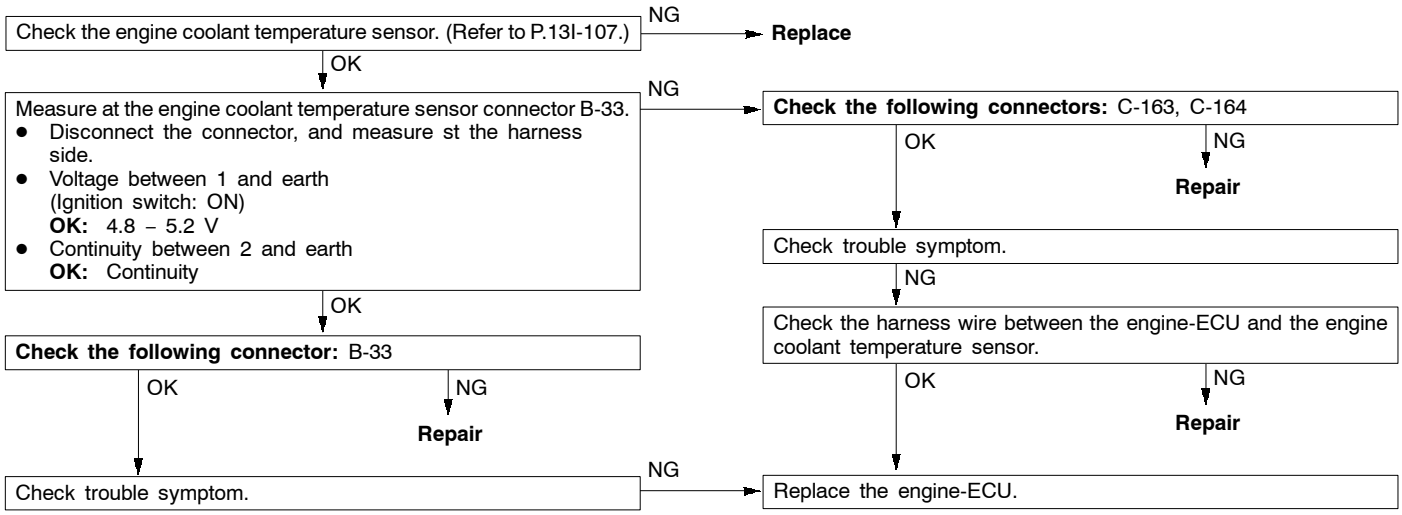
Code No.13 Intake air temperature sensor system	Probable cause
Range of check ● After 60 seconds have passed since the engine have started Set conditions ● Sensor resistance is 0.14 kΩ or less for 4 seconds. or ● Sensor resistance is 50 kΩ or more for 4 seconds.	● Malfunction of the intake air temperature sensor ● Open circuit or short-circuited harness wire of the intake air temperature sensor circuit ● Malfunction of the engine-ECU



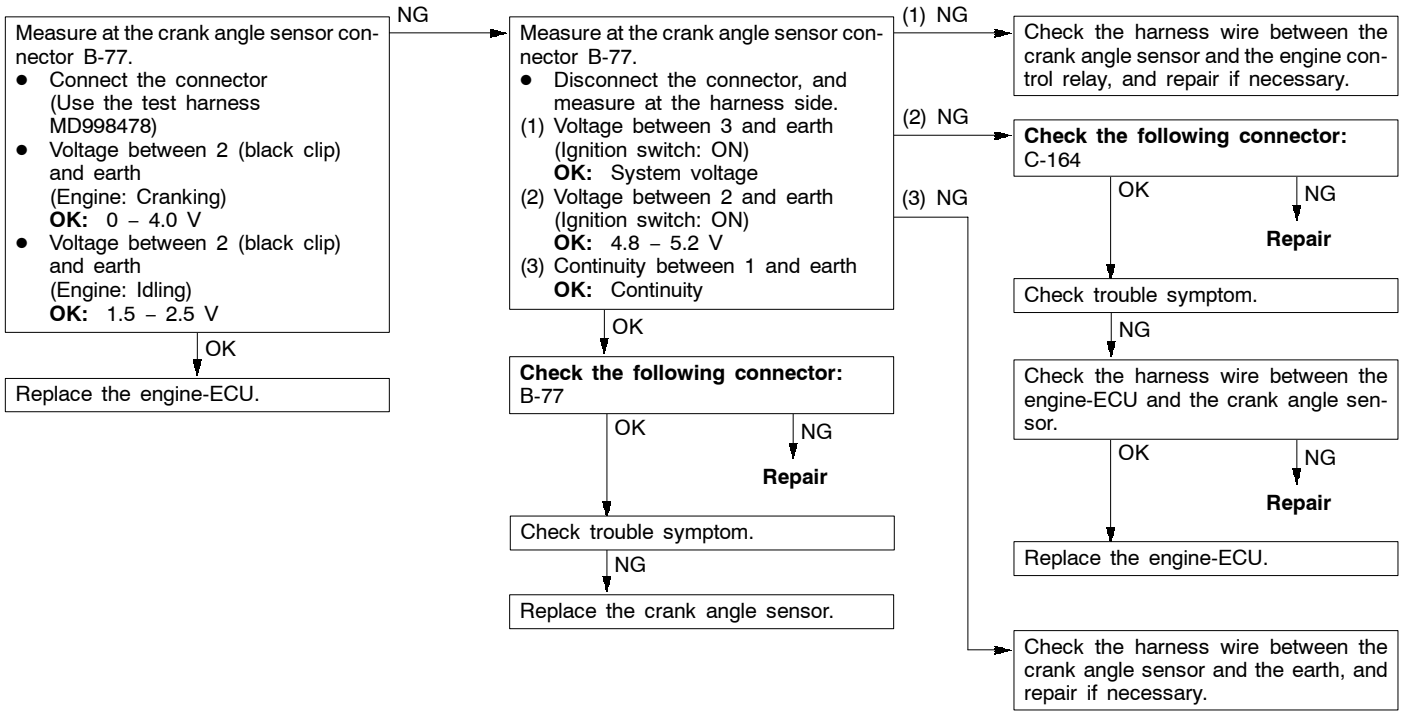
Code No.14 Throttle position sensor system (2nd channel)	Probable cause
The throttle valve controller determines whether a failure is present or not, and sends a signal indicating its result to the engine-ECU. Range of check ● Ignition switch: ON ● Throttle position sensor (1st channel) is normal Set conditions ● The throttle position sensor (1st channel) output voltage is 1.24 V or more, and the (2nd channel) output voltage is 4.6 V or more for one second. or ● The throttle position sensor (1st channel) output voltage is 3.53 V or less, and the (2nd channel) output voltage is 0.2 V or less for one second. or ● Throttle position sensor (1st and 2nd channels) output voltages are outside 4 to 6 V.	● Malfunction of throttle position sensor (2nd channel) ● Open circuit or short-circuited harness wire in throttle position sensor (2nd channel) or poor connector contact ● Faulty throttle valve controller ● Malfunction of the engine-ECU



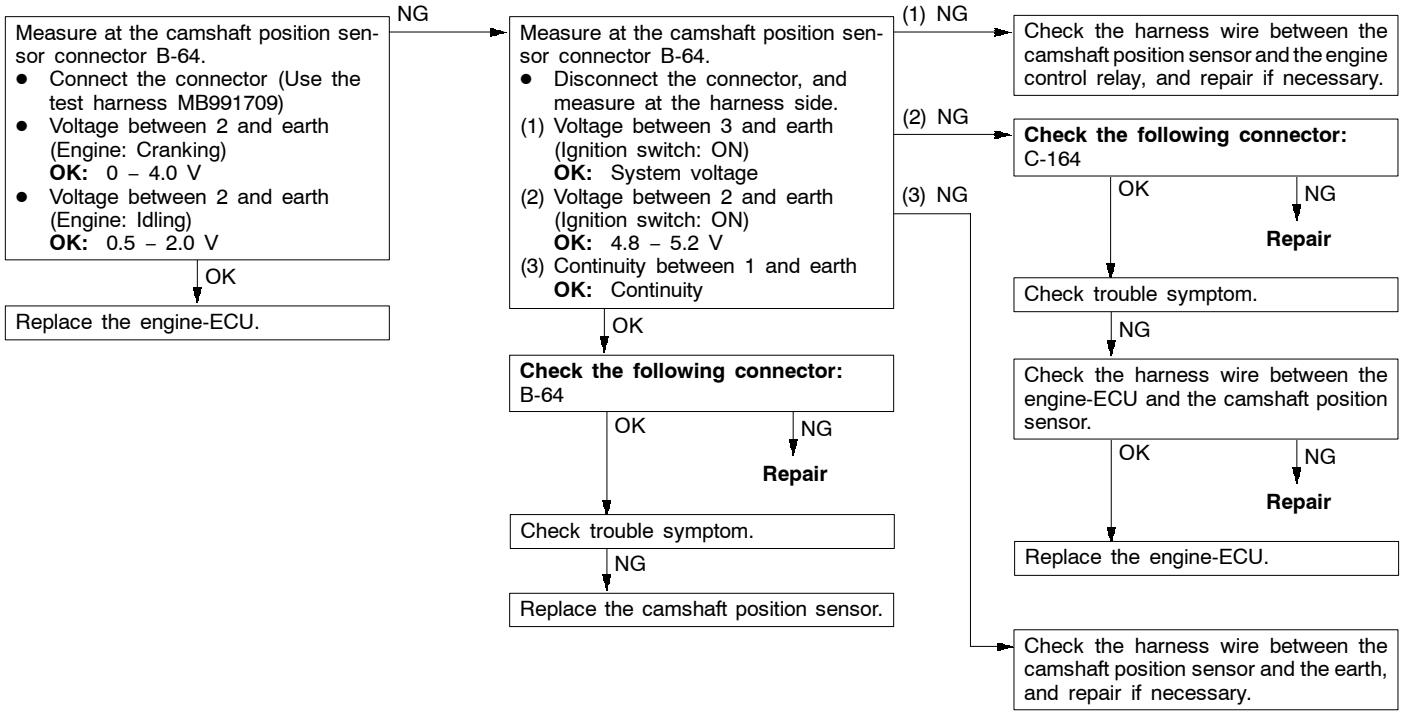
Code No.21 Engine coolant temperature sensor system	Probable cause
Range of check ● After 60 seconds have passed since the engine have started Set conditions ● Sensor resistance is 50 Ω or less for 4 seconds. or ● Sensor resistance is 72 kΩ or more for 4 seconds.	● Malfunction of the engine coolant temperature sensor ● Open circuit or short-circuited harness wire of the engine coolant temperature sensor circuit ● Malfunction of the engine-ECU
Range of check ● After engine starts Set conditions ● After 5 minutes or more have passed since the engine coolant temperature after filtering has dropped from 40°C or more to less than this temperature	



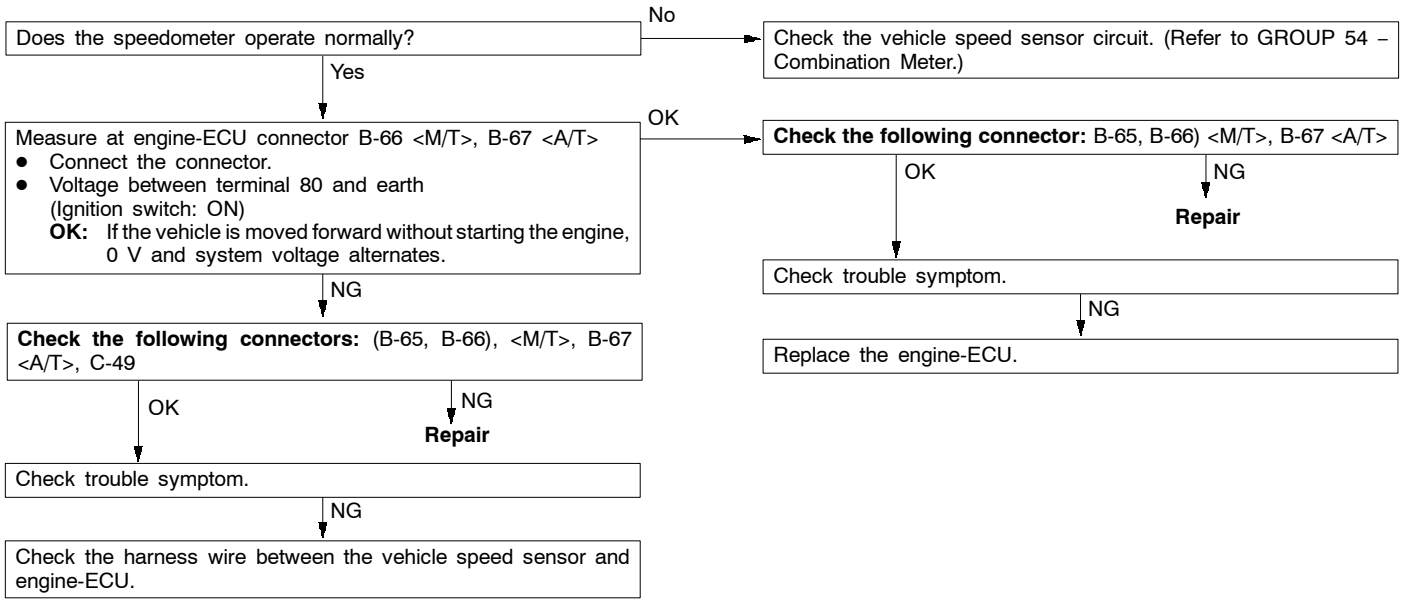
Code No.22 Crank angle sensor system	Probable cause
Range of check ● Engine: During cranking Set conditions ● Sensor output voltage does not change for 4 seconds (no pulse signal is being input).	● Malfunction of the crank angle sensor ● Open circuit or short-circuited harness wire of the crank angle sensor circuit ● Malfunction of the engine-ECU



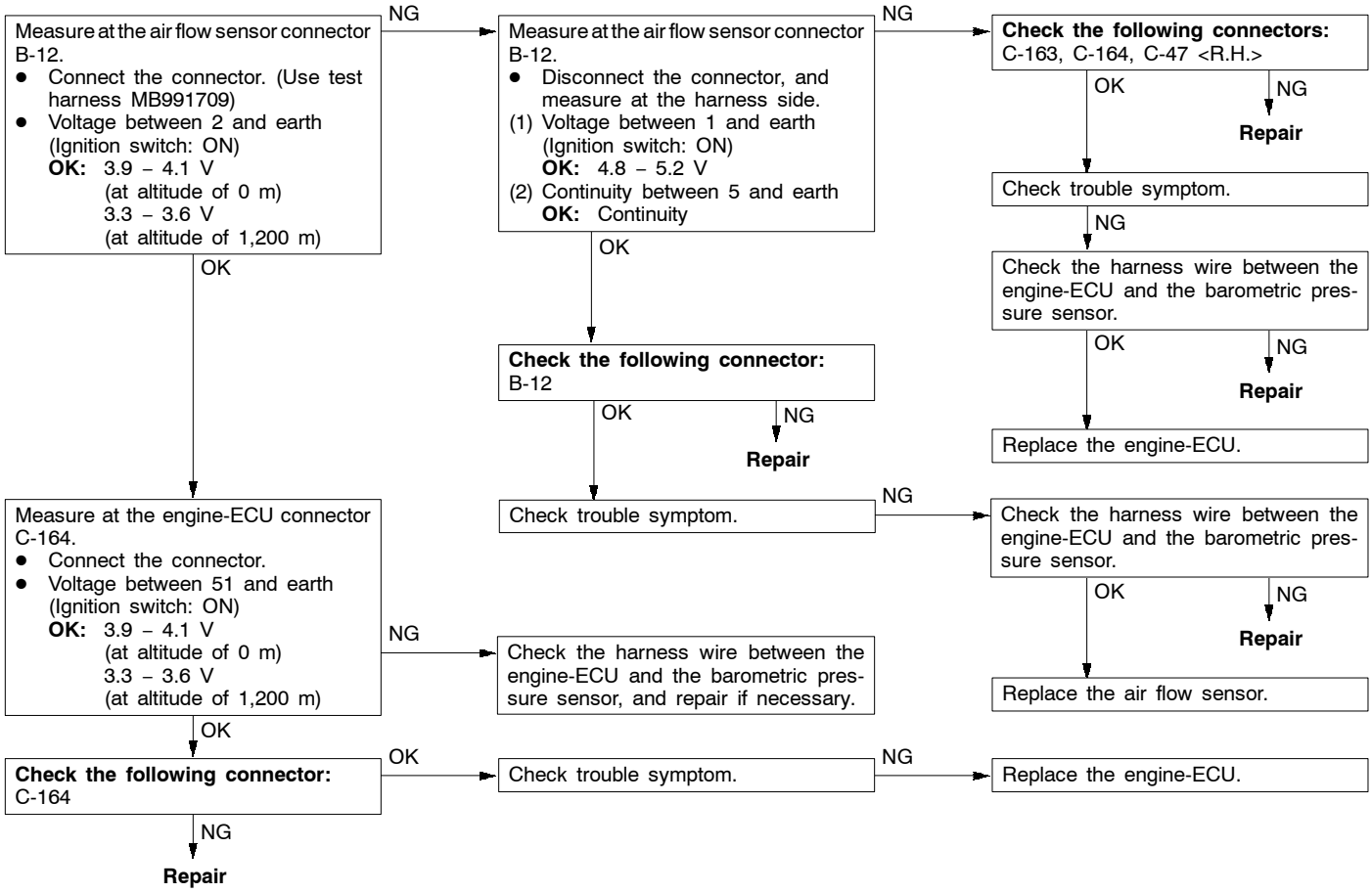
Code No.23 Camshaft position sensor system	Probable cause
Range of check ● While engine is cranking or running Set conditions ● Sensor output voltage does not change for 4 seconds (no pulse signal is being input). or ● Abnormal pulse signal pattern is output.	● Malfunction of the camshaft position sensor ● Open circuit or short-circuited harness wire of the camshaft position sensor ● Malfunction of the engine-ECU



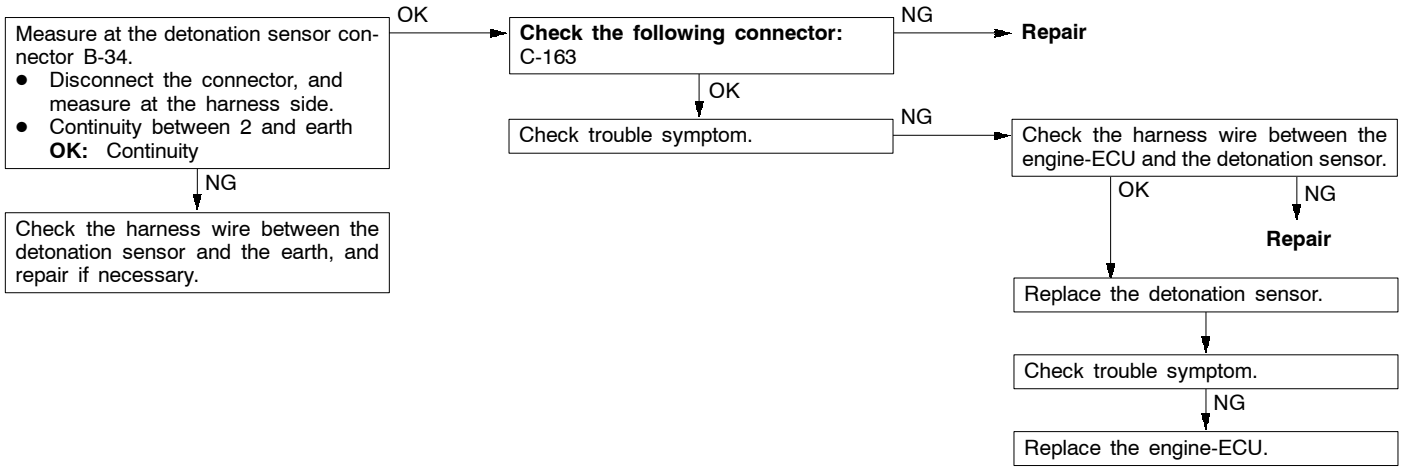
Code No. 24 Vehicles speed sensor system	Probable cause
Range of check ● Ignition switch: ON ● Excluding 60 seconds after the ignition switch is turned to ON or immediately after the engine starts. ● Engine speed is 3,000 r/min or more. ● Driving under high engine load conditions. Set conditions ● Sensor output voltage does not change for 4 seconds (no pulse signal input).	● Malfunction of the vehicle speed sensor ● Improper connector contact, open circuit or short-circuited harness wire of the vehicle speed sensor circuit ● Malfunction of the engine-ECU



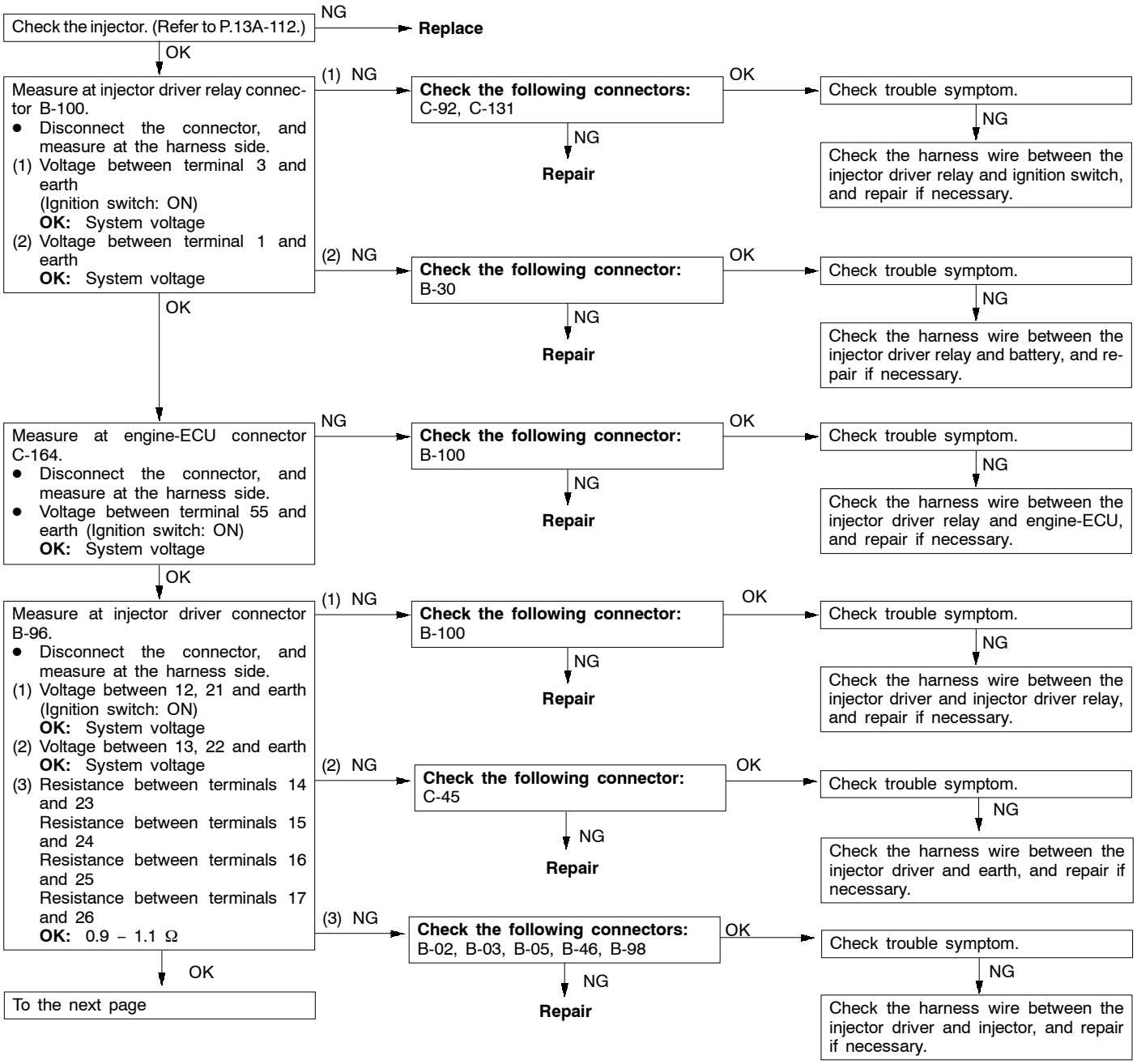
Code No.25 Barometric pressure sensor system	Probable cause
Range of check ● After 60 seconds have passed since the engine have started ● Battery voltage is 8 V or more. Set conditions ● Sensor output voltage is 0.2 V or less for 4 seconds. or ● Sensor output voltage is 4.5 V or more for 4 seconds.	● Malfunction of the barometric pressure sensor ● Open circuit or short-circuited harness wire of the barometric pressure sensor ● Malfunction of the engine-ECU

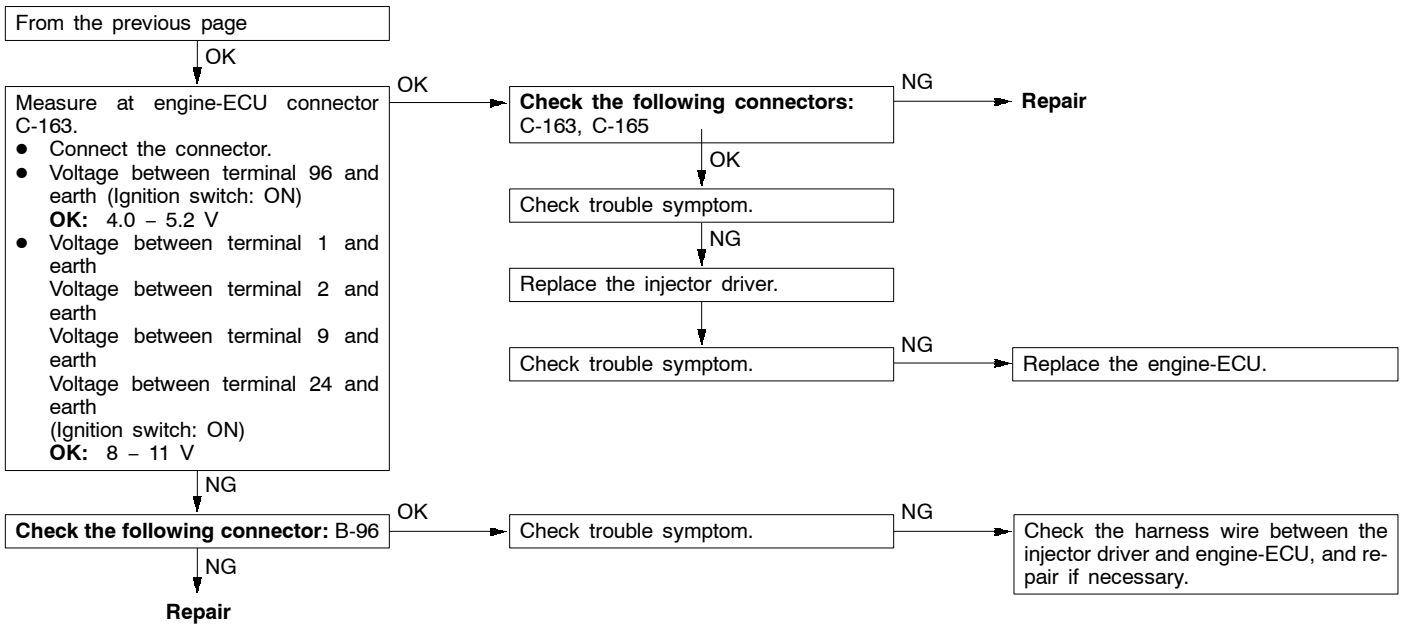


Code No.31 Detonation sensor system	Probable cause
Range of check ● After 60 seconds have passed since the engine have started Set conditions ● Amount of change in the sensor output voltage (detonation sensor peak voltage for each half rotation of the crankshaft) is 0.06 V or less for 200 continuous times.	● Malfunction of the detonation sensor ● Open circuit or short-circuited harness wire of the detonation sensor ● Malfunction of the engine-ECU

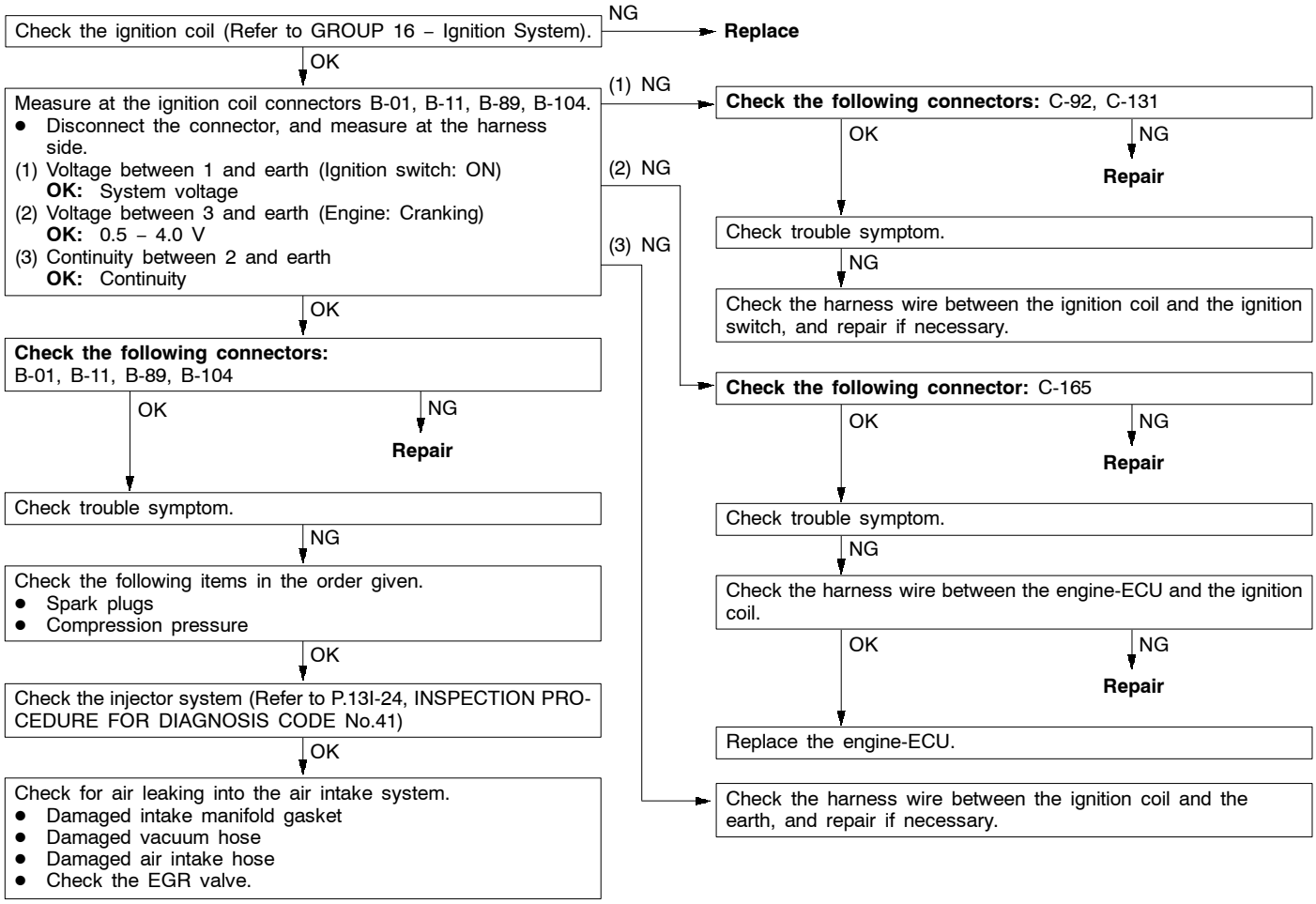


Code No.41 Injector system	Probable cause
Range of check ● Engine: while cranking, or running ● Engine speed: 4,000 r/min or less ● System voltage: 10 V or more ● Fuel shut off, or while forcible activating of injector (actuator test) is in operation. Set conditions ● Injector open circuit check signal is not output from the injector predetermined time(s).	● Malfunction of the injector ● Faulty injector driver relay ● Faulty injector driver ● Open circuit or short-circuited harness wire in the injector drive circuit, or poor connector contact ● Malfunction of the engine-ECU



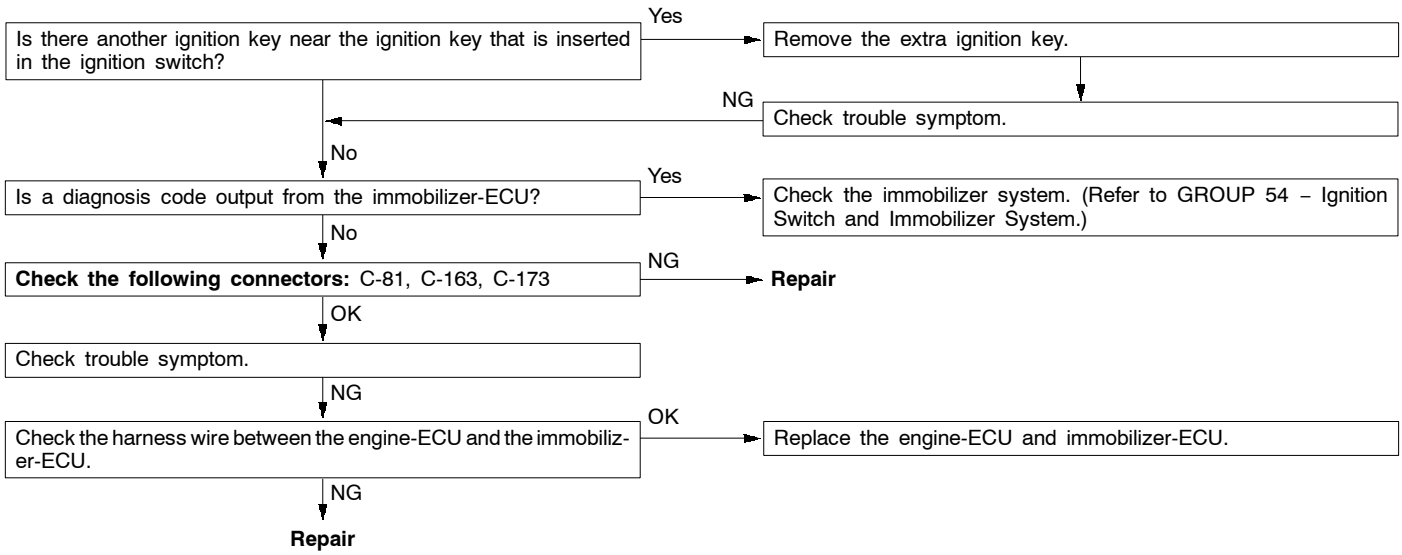

From the previous page
OK
Measure at engine-ECU connector C-163.
● Connect the connector.
● Voltage between terminal 96 and earth (Ignition switch: ON)
OK: 4.0 – 5.2 V
● Voltage between terminal 1 and earth
Voltage between terminal 2 and earth
Voltage between terminal 9 and earth
Voltage between terminal 24 and earth
(Ignition switch: ON)
OK: 8 – 11 V
OK
Check the following connectors: C-163, C-165
NG
Repair
OK
Check trouble symptom.
NG
Replace the injector driver.
Check trouble symptom.
NG
Replace the engine-ECU.
NG
Check the following connector: B-96
OK
Check trouble symptom.
NG
Check the harness wire between the injector driver and engine-ECU, and repair if necessary.
NG
Repair

Code No.44 Abnormal combustion	Probable cause
Range of check ● While engine is running during lean fuel combustion Set conditions ● Abnormal engine speed due to mis-firing is detected by the crank angle sensor	● Malfunction of the ignition coil ● Malfunction of the spark plug ● Malfunction of the EGR valve ● Open circuit or short-circuit in ignition primary circuit ● Malfunction of the injector system ● Malfunction of the engine-ECU

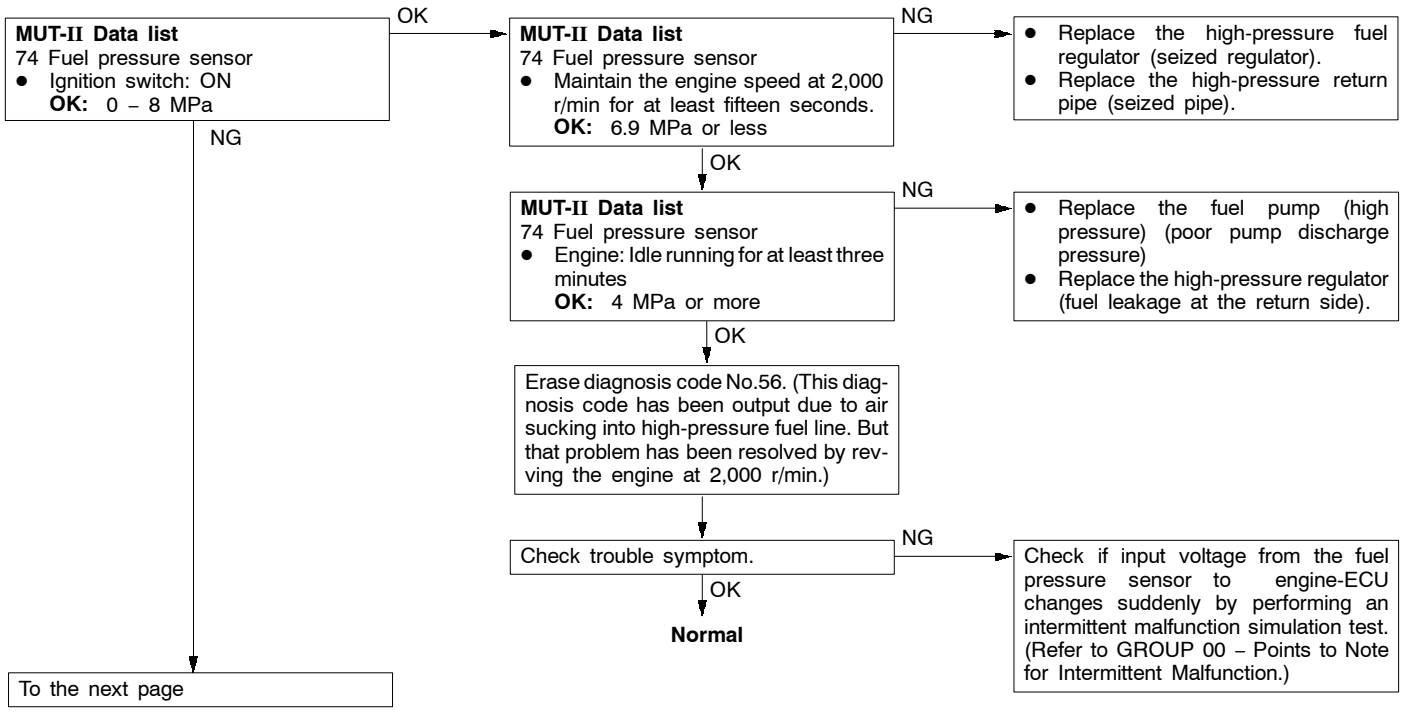


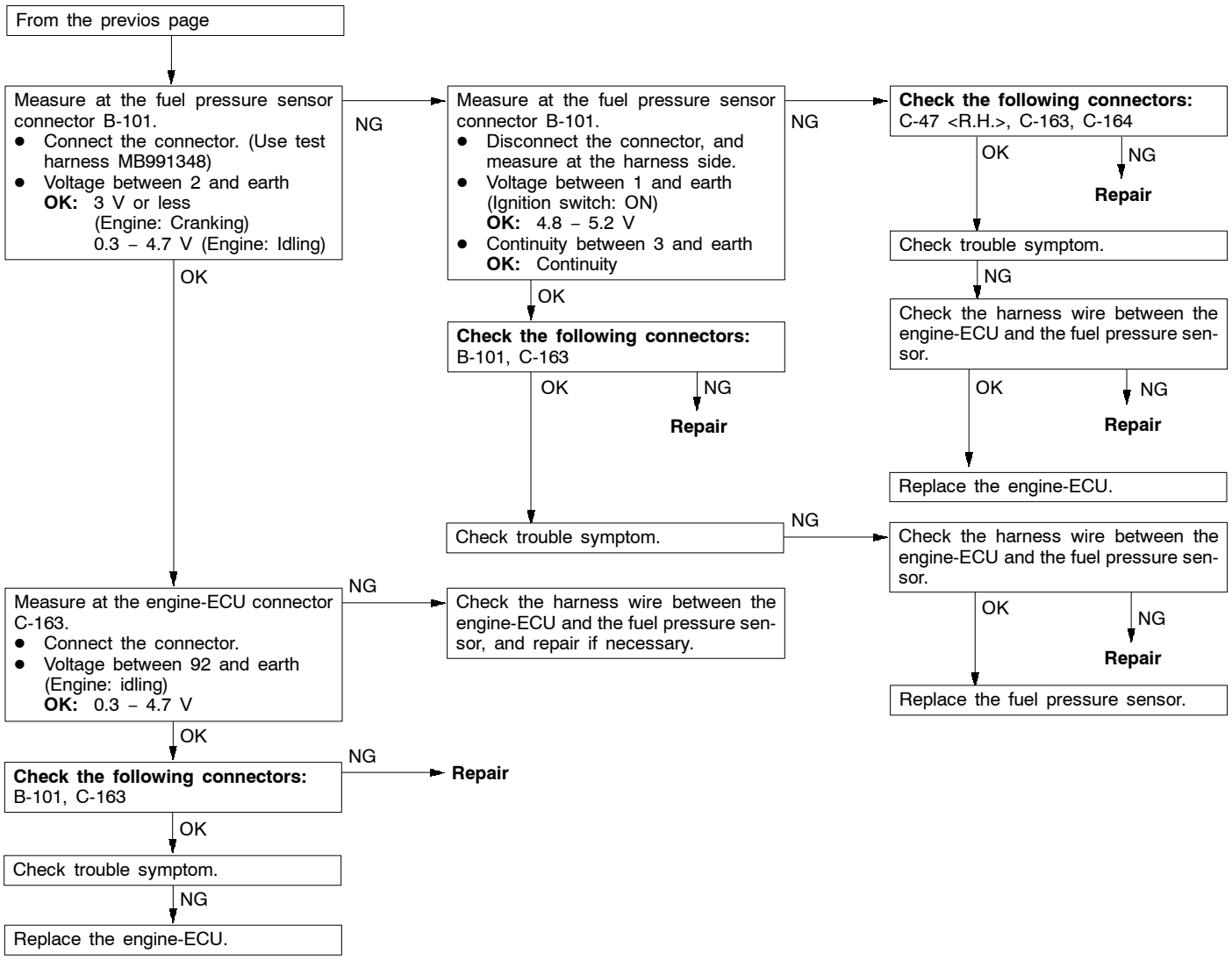
Code No.54 Immobilizer system	Probable cause
Range of Check ● Ignition switch: ON Set Conditions ● Improper communication between the engine-ECU and immobilizer-ECU	● Radio interference of encrypted codes ● Incorrect encrypted code ● Malfunction of harness or connector ● Malfunction of immobilizer-ECU ● Malfunction of engine-ECU

NOTE
(1) If the ignition switches are close each other when starting the engine, radio interference may cause this code to be displayed.
(2) This code may be displayed when registering the key encrypted code.

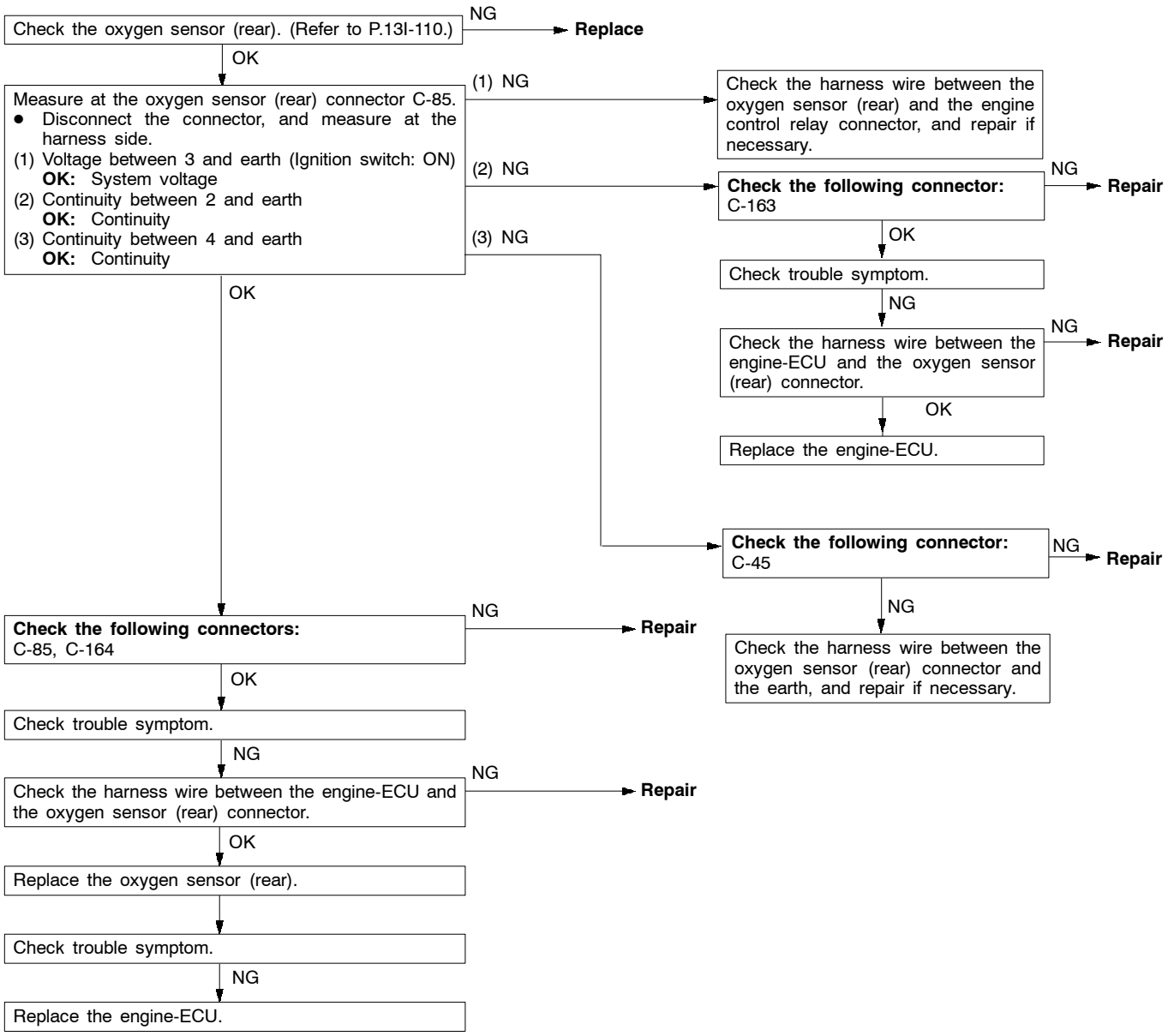


Code No.56 Abnormal fuel pressure	Probable cause
Range of check ● Ignition switch: ON Set conditions ● Sensor output voltage is 4.8 V or more for four seconds. or ● Sensor output voltage is 0.2 V or less for four seconds. Range of check ● After the engine is started, the following condition has been detected: (1) Engine speed: 1,000 r/min or more (2) Fuel pressure: 2 MPa or more ● While engine is running Set conditions ● Fuel pressure is 6.9 MPa or more for four seconds. or ● Fuel pressure is 2 MPa or less for four seconds.	● Malfunction of the fuel pressure sensor ● Open circuit or short-circuited harness wire of the fuel pressure sensor ● Malfunction of the engine-ECU ● Malfunction of the fuel pump (high pressure) ● Malfunction of the fuel pressure regulator (high pressure) ● Clogged high-pressure fuel line
This diagnosis code is also output when air is sucked in high-pressure fuel line due to no fuel supply. In this case, air can be bled by letting the engine run at 2,000 r/min for at least fifteen seconds. After the air bleeding, the diagnosis code must be erased by the MUT-II.	● Air sucking due to no fuel supply

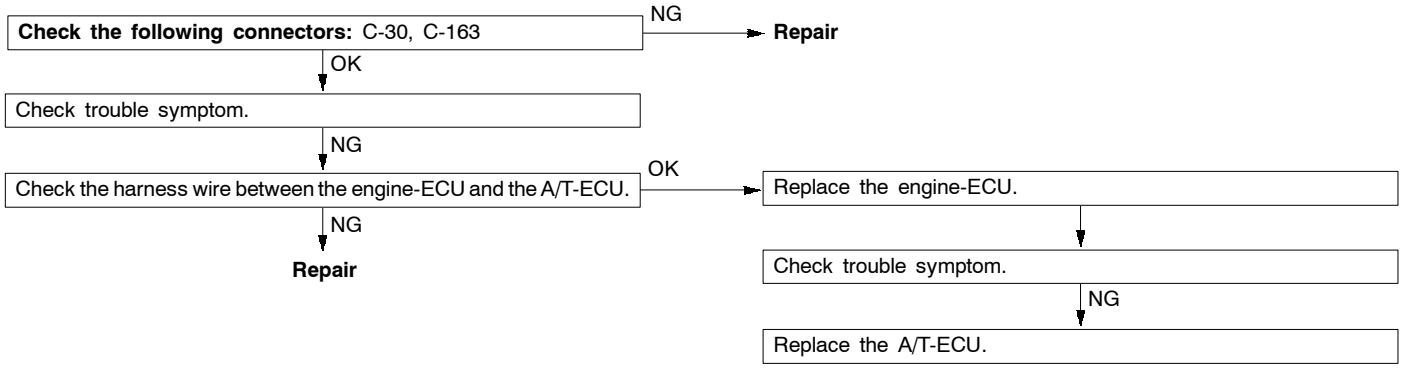



From the previos page
Measure at the fuel pressure sensor connector B-101.
• Connect the connector. (Use test harness MB991348)
• Voltage between 2 and earth
OK: 3 V or less
(Engine: Cranking)
0.3 – 4.7 V (Engine: Idling)
NG
Measure at the fuel pressure sensor connector B-101.
• Disconnect the connector, and measure at the harness side.
• Voltage between 1 and earth (Ignition switch: ON)
OK: 4.8 – 5.2 V
• Continuity between 3 and earth
OK: Continuity
NG
Check the following connectors:
C-47 <R.H.>, C-163, C-164
OK
NG
Repair
Check trouble symptom.
NG
Check the harness wire between the engine-ECU and the fuel pressure sensor.
OK
NG
Repair
Replace the engine-ECU.
OK
Check the following connectors:
B-101, C-163
OK
NG
Repair
Check trouble symptom.
NG
Check the harness wire between the engine-ECU and the fuel pressure sensor.
OK
NG
Repair
Replace the fuel pressure sensor.
OK
Measure at the engine-ECU connector C-163.
• Connect the connector.
• Voltage between 92 and earth (Engine: idling)
OK: 0.3 – 4.7 V
NG
Check the harness wire between the engine-ECU and the fuel pressure sensor, and repair if necessary.
OK
Check the following connectors:
B-101, C-163
NG
Repair
OK
Check trouble symptom.
NG
Replace the engine-ECU.

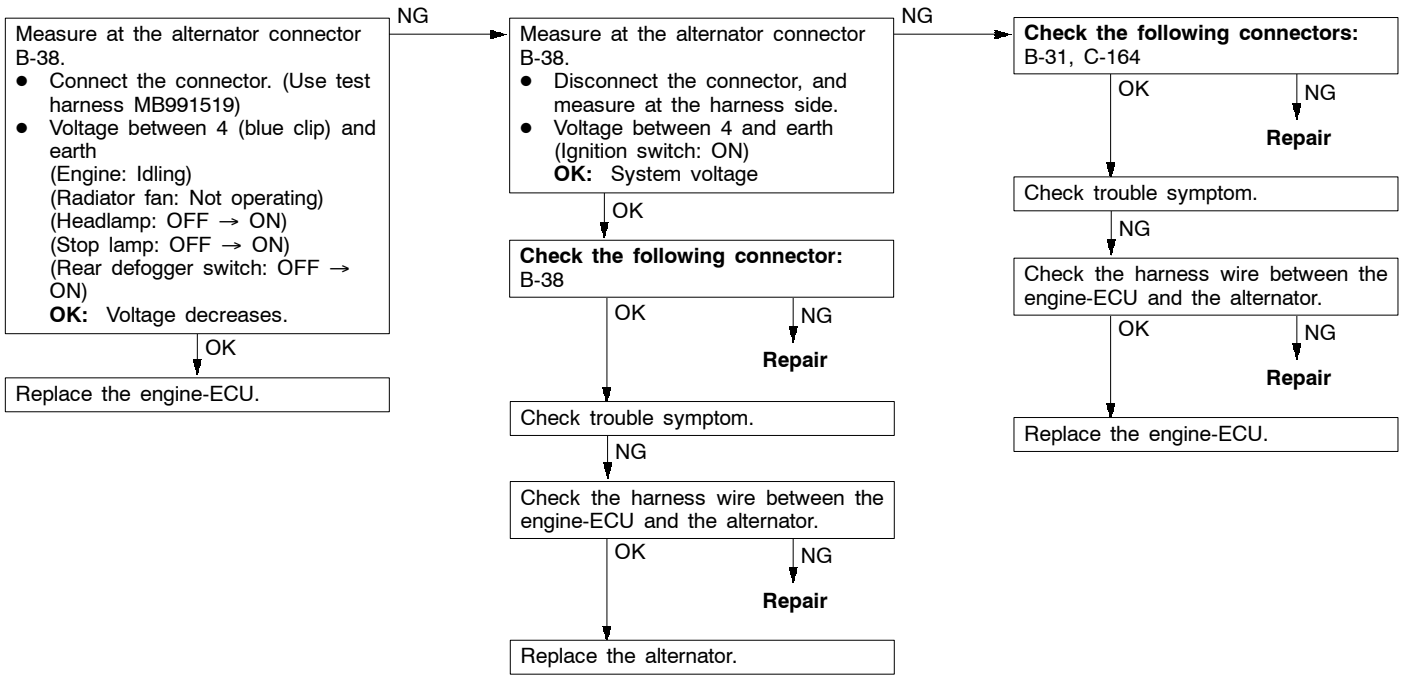
Code No. 59 Oxygen sensor (rear) system	Probable cause
Range of Check ● 3 minutes have passed after engine was started. ● Engine coolant temperature is approx. 80°C or more. ● Idle position switch: OFF ● The throttle position sensor output voltage is 4.1 V or more. ● Open loop control in operation ● 20 seconds have passed after deceleration finished. Set conditions ● The oxygen sensor (rear) output voltage is 0.1 V or less. ● The difference in the maximum and minimum values for the oxygen sensor (rear) output voltage is 0.08 V or less. ● The oxygen sensor (rear) output voltage is 0.5 V or more. ● The above conditions continue for a continuous period of 5 seconds.	● Malfunction of the oxygen sensor (rear) ● Improper connector contact, open circuit or short-circuited harness wire ● Malfunction of the engine-ECU



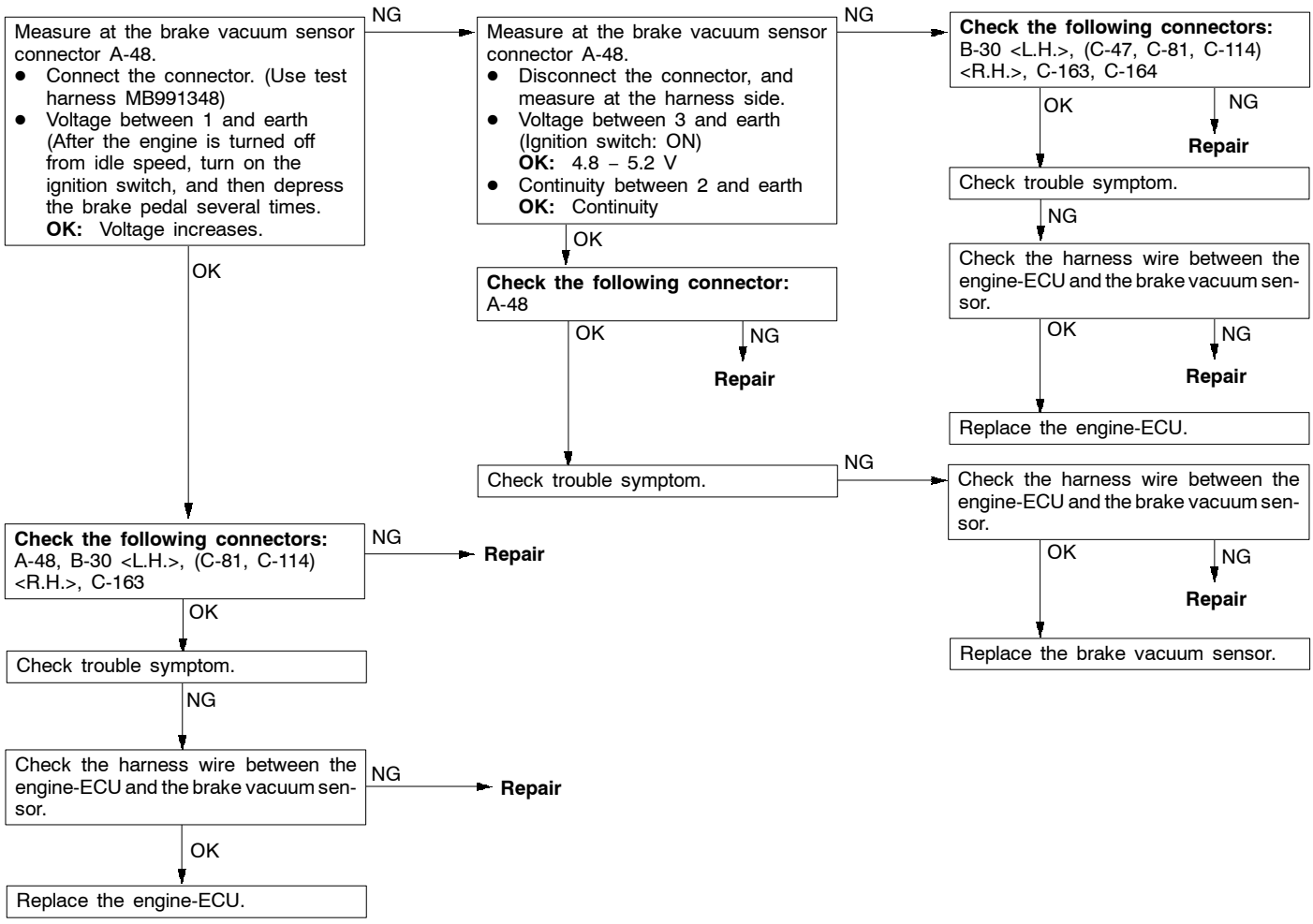
Code No.61 Communication wire with A/T-ECU system	Probable cause
Range of check ● After 60 seconds have passed since the engine have started Set conditions ● Torque reduction request signal from A/T-ECU is input continuously for 1.5 seconds or more.	● Short circuit in ECU communication circuit ● Malfunction of the engine-ECU ● Malfunction of the A/T-ECU



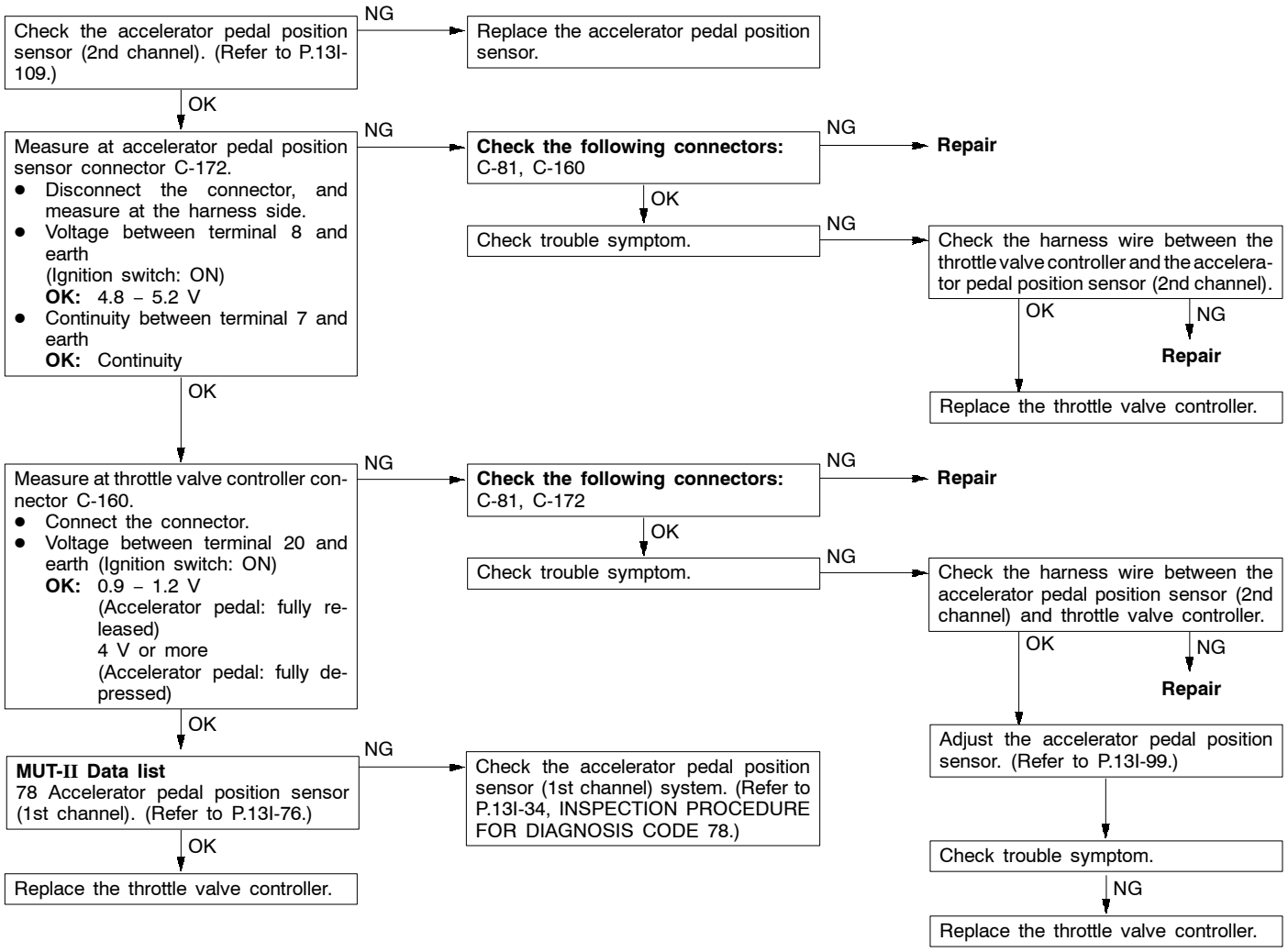
Code No.64 Alternator FR terminal system	Probable cause
Range of check ● Engine speed is 50 r/min or more. Set conditions ● Input voltage from the alternator FR terminal is system voltage for 20 seconds.	● Open circuit in alternator FR terminal circuit ● Malfunction of the engine-ECU



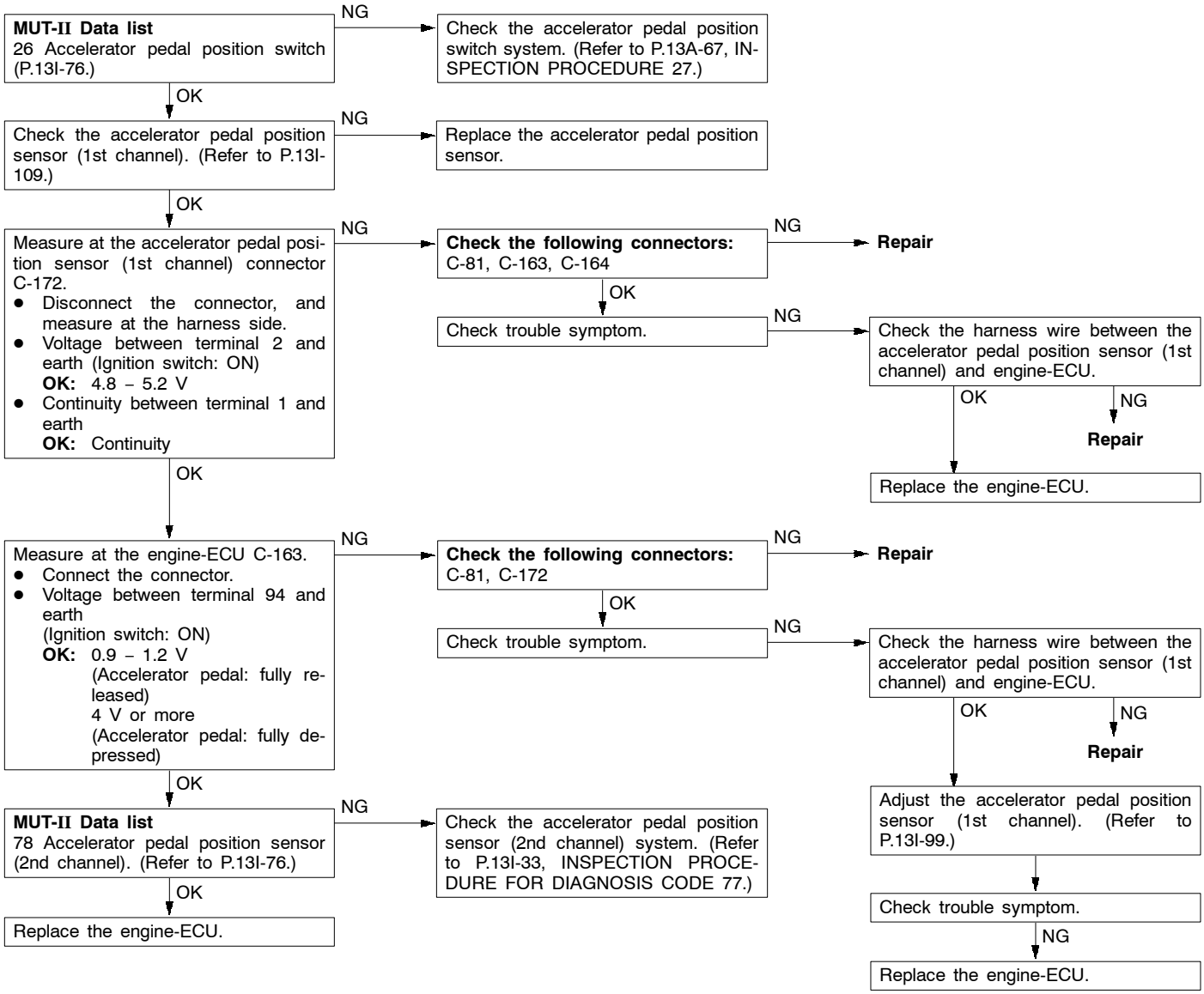
Code No.66 Brake vacuum sensor system	Probable cause
Range of check ● Ignition switch: ON Set conditions ● Sensor output voltage is 4.8 V or more. or ● Sensor output voltage is 0.2 V or less.	● Malfunction of the brake vacuum sensor ● Improper connector contact, open circuit or short-circuited harness wire of the brake vacuum sensor ● Malfunction of the engine-ECU



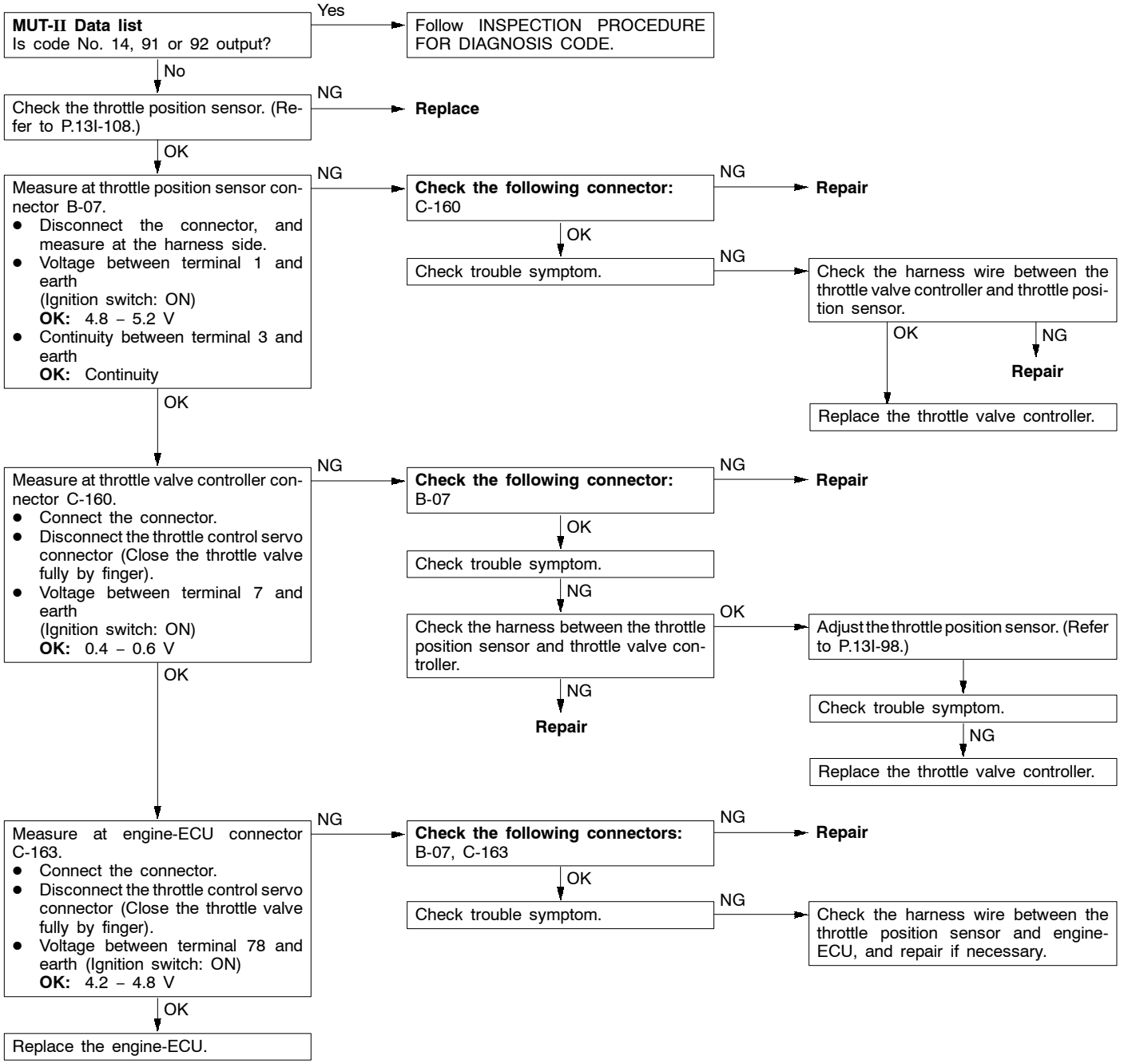
Code No.77 Accelerator pedal position sensor (2nd channel) system	Probable cause
Range of check ● Accelerator pedal position sensor (1st channel) system is normal. ● Communication between the engine-ECU and throttle valve controller is normal. Set conditions ● Output voltage of accelerator position sensor (2nd channel) system is 0.2 V or less for one second. or ● Output voltage of the accelerator pedal position sensor (1st channel) is 2.5 V or less, and output voltage of the accelerator pedal position sensor (2nd channel) is 4.5 V or more for one second. or ● Difference between the accelerator pedal position sensor output voltages (1st and 2nd channels) exceeds 1.0 V (i.e. when the throttle valve opening angle changes slightly).	● Malfunction of the accelerator pedal position sensor (2nd channel) ● Open circuit or short-circuited harness wire in the accelerator pedal position sensor (2nd channel) system, or poor connector contact ● Malfunction of the throttle valve controller ● Malfunction of the engine-ECU



Code No.78 Accelerator pedal position sensor (1st channel) system	Probable cause
Range of check ● Accelerator pedal position sensor (2nd channel) system is normal. ● Communication between the engine-ECU and throttle valve controller is normal. Set conditions ● Output voltage of accelerator position sensor (1st channel) system is 0.2 V or less for one second. or ● Output voltage of the accelerator pedal position sensor (2nd channel) is 2.5 V or less, and (1st channel) output voltage of the accelerator pedal position sensor is 4.5 V or more for one second. or ● Difference between the accelerator pedal position sensor (1st and 2nd channels) output voltages exceeds 1.0 V (i.e. when the throttle valve opening angle changes slightly). or ● Although the accelerator pedal position switch is on, 1st-channel output voltage of the accelerator pedal position sensor exceeds 1.1 V for one second.	● Malfunction of the accelerator pedal position sensor (1st channel) ● Open circuit or short-circuited harness wire in the accelerator pedal position sensor (1st channel) system, or poor connector contact ● ON-seizure of the accelerator pedal position switch ● Malfunction of the throttle valve controller ● Malfunction of the engine-ECU



Code No.79 Throttle position sensor (1st channel) system	Probable cause
The throttle valve controller determines a failure, and sends it result to the engine-ECU. Range of check ● Ignition switch: ON ● System voltage: 8 V or more Set conditions ● Output voltage of the sensor remains 0.2 V for one second. or ● Output voltage of the sensor remains 4.9 V for one second. or ● Output voltage of the throttle position sensor (1st and 2nd channels) remains outside 4 – 6 V for four seconds.	● Malfunction of the throttle position sensor (1st channel) ● Open circuit or short-circuited harness wire in the throttle position sensor (1st channel), or poor connector contact ● Malfunction of the throttle valve controller ● Malfunction of the engine-ECU



Code No.89 Abnormal fuel pressure system	Probable cause
Range of check ● Engine: Idling (during stoichio-feedback operation) Set conditions ● Fuel injection correction value remains excessively low for ten seconds or more. or ● Fuel injection correction value remains excessively high for ten seconds or more.	● Malfunction of the fuel pump (high pressure) ● Malfunction of the intake air temperature sensor ● Malfunction of the barometric pressure sensor ● Malfunction of the air flow sensor ● Malfunction of the engine-ECU

MUT-II Data list
13 Intake air temperature sensor. (Refer to P.13I-76.)
→ NG → Check the intake air temperature sensor system. (Refer to P.13I-16, INSPECTION PROCEDURE FOR DIAGNOSIS CODE No.13.)
↓ OK

MUT-II Data list
25 Barometric air temperature sensor. (Refer to P.13I-76.)
→ NG → Check the barometric air temperature sensor system. (Refer to P.13I-22, INSPECTION PROCEDURE FOR DIAGNOSIS CODE No.25.)
↓ OK

MUT-II Data list
12 Air flow sensor. (Refer to P.13I-76.)
→ NG → Check the air flow sensor system. (Refer to P.13I-15, INSPECTION PROCEDURE FOR DIAGNOSIS CODE No.12.)
↓ OK

Replace the fuel pump (high pressure).

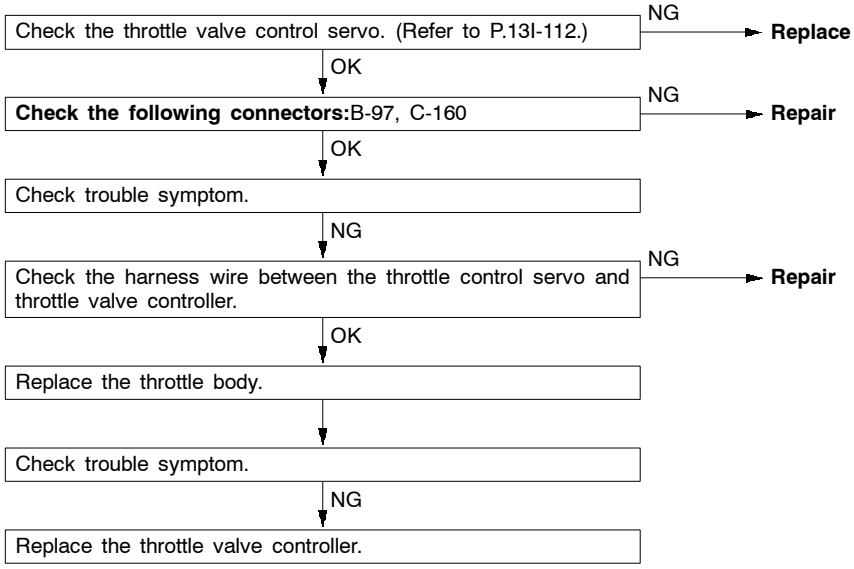
Code No.91 Electronic-controlled throttle valve system	Probable cause
Range of check ● Ignition switch: ON ● Error in communication from the engine-ECU to throttle valve controller Set conditions ● Output voltage of the throttle position sensor (2nd channel) fluctuates significantly (approx. 1 V or more) from an expected value. Range of check ● Ignition switch: ON ● Error in communication from the throttle valve controller to engine-ECU Set conditions ● The throttle valve opening angle (voltage) which the engine-ECU requested of the throttle valve controller is significantly different from output voltage of the (2nd channel) throttle position sensor (approx. one volt).	● Short in communication line ● Malfunction of the engine-ECU ● Malfunction of the throttle valve controller

MUT-II Self-Diag code
Is any other diagnosis code than No.94 output?
→ Yes → Follow INSPECTION PROCEDURE FOR DIAGNOSIS CODE.
↓ No

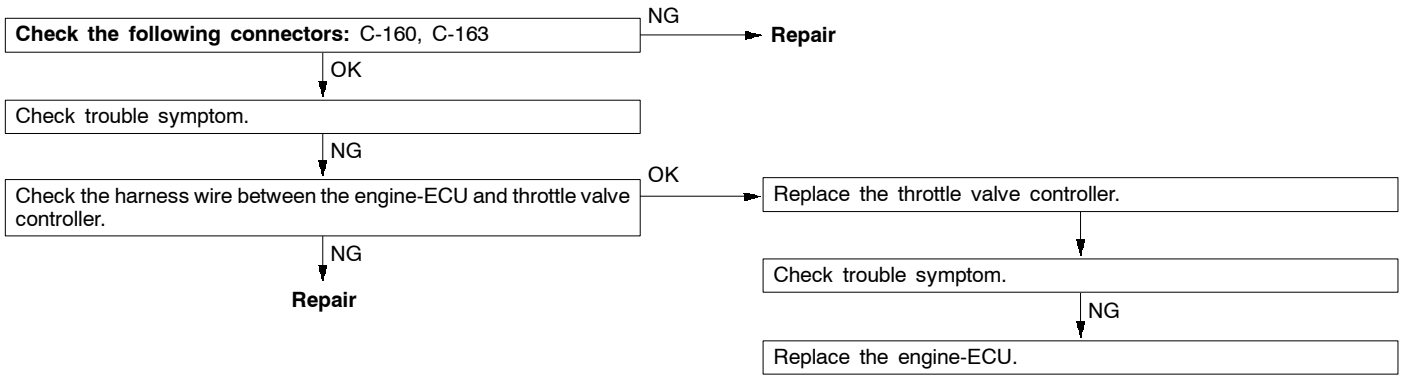
Check the harness wire between the throttle valve controller and engine-ECU.
→ NG → **Repair**
↓ OK

Replace the throttle valve controller.

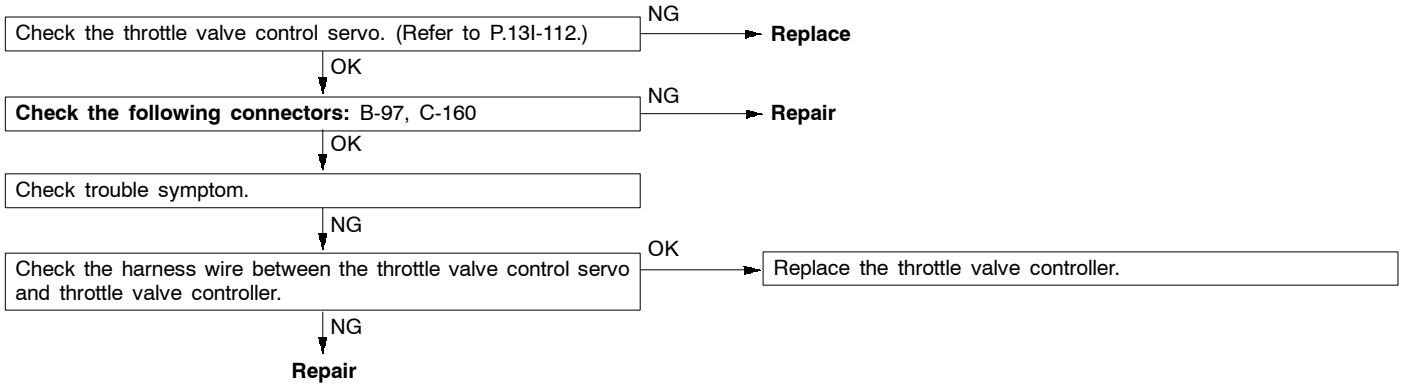
Code No.92 Throttle valve position feedback system	Probable cause
The throttle valve controller determines if a failure is present, and sends its result to the engine-ECU. Range of check ● Ignition switch: ON ● System voltage: 8 V or more Set condition ● Motor position feedback system is defective (System detects a motor overcurrent, or that actual and projected opening angles of the throttle position sensor (1st channel) are different by 1.0 V or more.	● Malfunction of the throttle position sensor (1st channel) ● Open circuit or short-circuited harness wire in the throttle position sensor system (1st channel), or poor connector contact ● Malfunction of the throttle valve controller



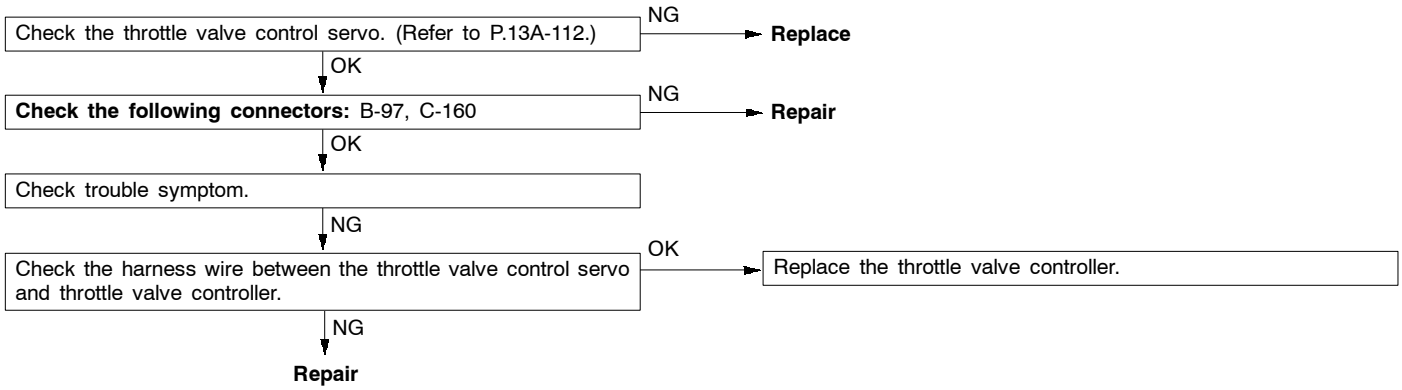
Code No.94 Communication line system with throttle valve controller	Probable cause
Range of check ● Ignition switch: ON ● System voltage: 8 V or more ● Engine: not cranking Set condition ● System detects an error in communication line between the engine-ECU and throttle valve controller.	● Short circuit in communication line ● Malfunction of the engine-ECU ● Malfunction of the throttle valve controller



Code No.95 Throttle valve control servo motor (Motor 1st phase malfunction) system	Probable cause
Range of check ● Throttle valve control servo relay: ON ● System voltage: 8 V or more Set conditions ● Throttle valve control servo drive circuit is shorted to earth. ● Other power source interferences with throttle valve control servo drive circuit. ● Throttle valve control servo drive circuit is open circuit.	● Malfunction of the throttle valve control servo ● Open circuit or short-circuited harness wire in throttle valve control servo system, or poor connector contact ● Malfunction of the throttle valve controller



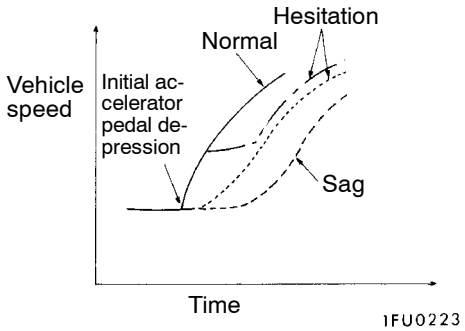
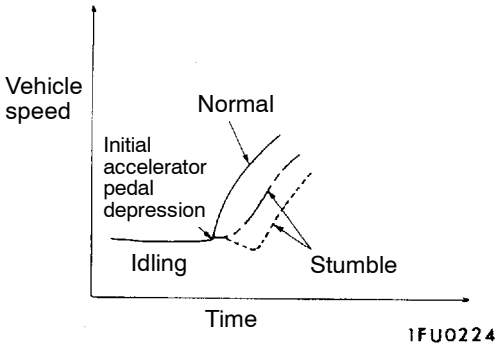
Code No.99 Throttle valve control servo motor (Motor 2nd phase malfunction) system	Probable cause
Range of check ● Throttle valve control servo relay: ON ● System voltage: 8V or more Set conditions ● Throttle valve control servo drive circuit is shorted to earth. ● Other power source interferes with throttle valve control servo drive circuit. ● Throttle valve control servo drive circuit is open-circuited.	● Malfunction of the throttle valve control servo ● Open circuit or short-circuited harness wire in the throttle valve control servo system, or poor connector contact ● Malfunction of the throttle valve controller



INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble symptom		Inspection procedure No.	Reference page
Communication with MUT-II is impossible.	Communication with all systems is not possible.	1	13I-41
	Communication with engine-ECU only is not possible.	2	13I-42
Engine warning lamp and related parts	The engine warning lamp does not illuminate right after the ignition switch is turned to the ON position.	3	13I-43
	The engine warning lamp remains illuminating and never goes out.	4	13I-43
Starting	No initial combustion (starting impossible)	5	13I-44
	Initial combustion but no complete combustion (starting impossible)	6	13I-46
	Long time to start (improper starting)		
Idling stability (Improper idling)	Unstable idling (Rough idling, hunting)	7	13I-48
	Idling speed is high. (Improper idling speed)	8	13I-50
	Idling speed is low. (Improper idling speed)		
Idling stability (Engine stalls)	When the engine is cold, it stalls at idling. (Die out)	9	13I-51
	When the engine is hot, it stalls at idling. (Die out)	10	13I-52
	The engine stalls when starting the car. (Pass out)	11	13I-54
	The engine stalls when decelerating.	12	13I-55
Driving	Hesitation, sag or stumble	13	13I-56
	Poor acceleration		
	Surge		
	The feeling of impact or vibration when accelerating	14	13I-57
	The feeling of impact or vibration when decelerating	15	13I-58
	Knocking	16	13I-58
Dieseling		17	13I-58
Too high CO and HC concentration when idling		18	13I-59
Low alternator output voltage (approx. 12.3 V)		19	13I-61
Engine idle speed is incorrect while the A/C is on.		20	13I-61
Fans (radiator fan, A/C condenser fan) are inoperative		21	13I-62
Clutch switch system malfunction <M/T>		22	13I-63
GDI ECO indication lamp system	The GDI ECO indication lamp does not illuminate.	23	13I-64
	The GDI ECO indication lamp remains on (does not extinguish).	24	13I-64

PROBLEM SYMPTOMS TABLE (FOR YOUR INFORMATION)

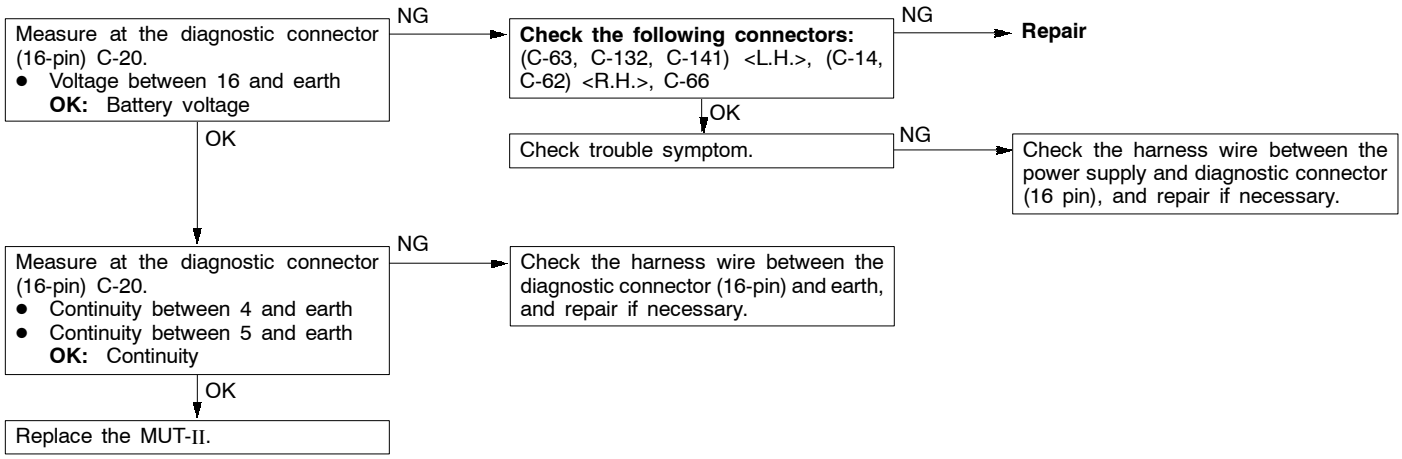
Items		Symptom
Starting	Won't start	The starter is used to crank the engine, but there is no combustion within the cylinders, and the engine won't start.
	Fires up and dies	There is combustion within the cylinders, but then the engine soon stalls.
	Hard starting	Engine starts after cranking a while.
Idling stability	Hunting	Engine speed doesn't remain constant; changes at idle.
	Rough idle	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 idle.
	Incorrect idle speed	The engine doesn't idle at the usual correct speed.
	Engine stall (Die out)	The engine stalls when the foot is taken from the accelerator pedal, regardless of whether the vehicles is moving or not.
	Engine stall (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 speed) 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 speed) during such acceleration. Serious hesitation is called "sag". 
	Poor acceleration	Poor acceleration 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 speed increase is delayed when the accelerator pedal is initially depressed for acceleration. 

Items		Symptom
Driving	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 condition in which the engine continues to run after the ignition switch is turned to OFF. Also called "Dieseling".

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

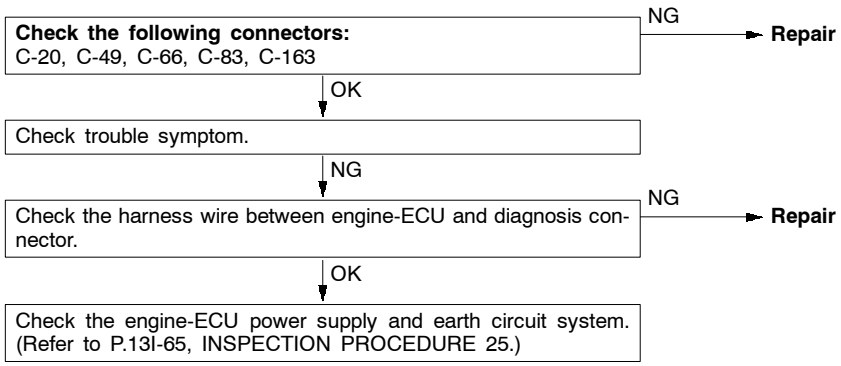
INSPECTION PROCEDURE 1

Communication with MUT-II is not possible. (Communication with all systems is not possible.)	**Probable cause**
The cause is probably a defect in the power supply system (including earth) for the diagnosis line.	• Malfunction of the connector • Malfunction of the harness wire



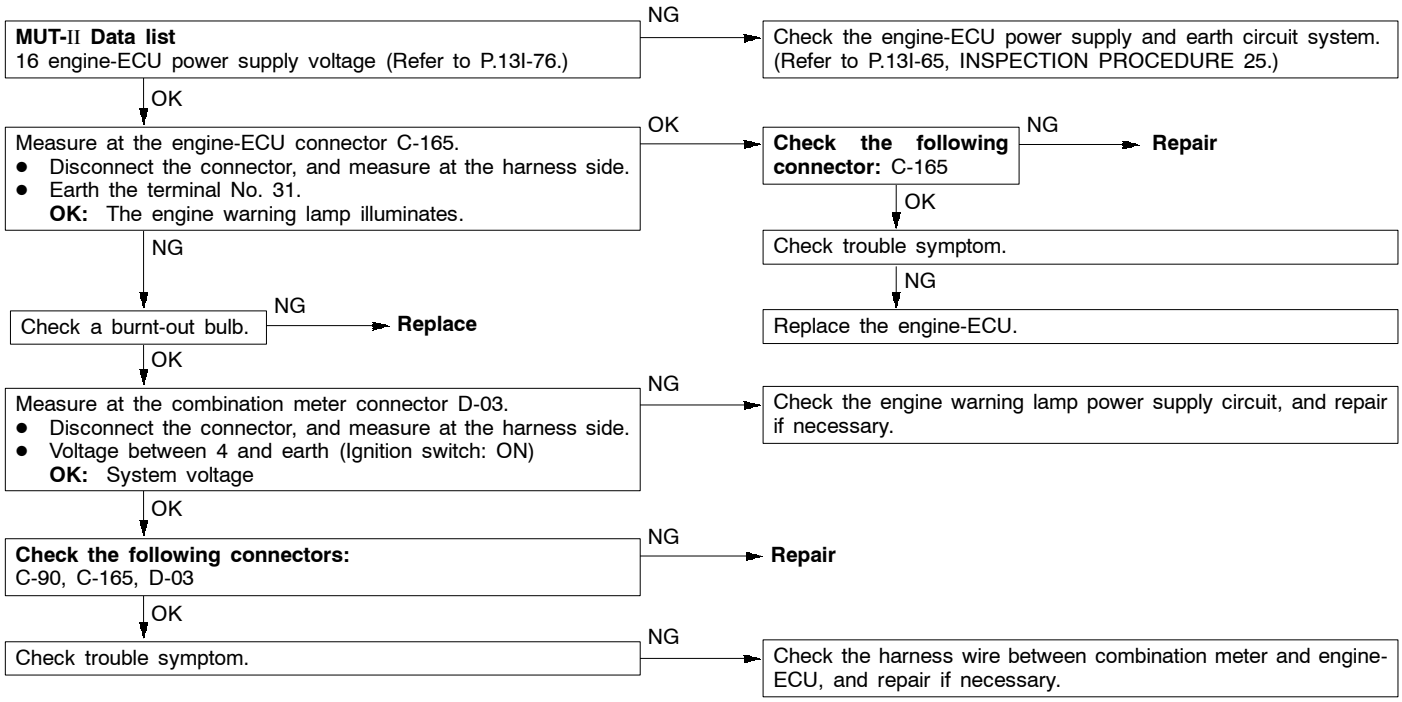
INSPECTION PROCEDURE 2

MUT-II communication with engine-ECU is impossible.	Probable cause
One of the following causes may be suspected. ● No power supply to engine-ECU. ● Defective earth circuit of engine-ECU. ● Defective engine-ECU. ● Improper communication line between engine-ECU and MUT-II	● Malfunction of engine-ECU power supply circuit ● Malfunction of engine-ECU ● Open circuit between the engine-ECU and diagnosis connector



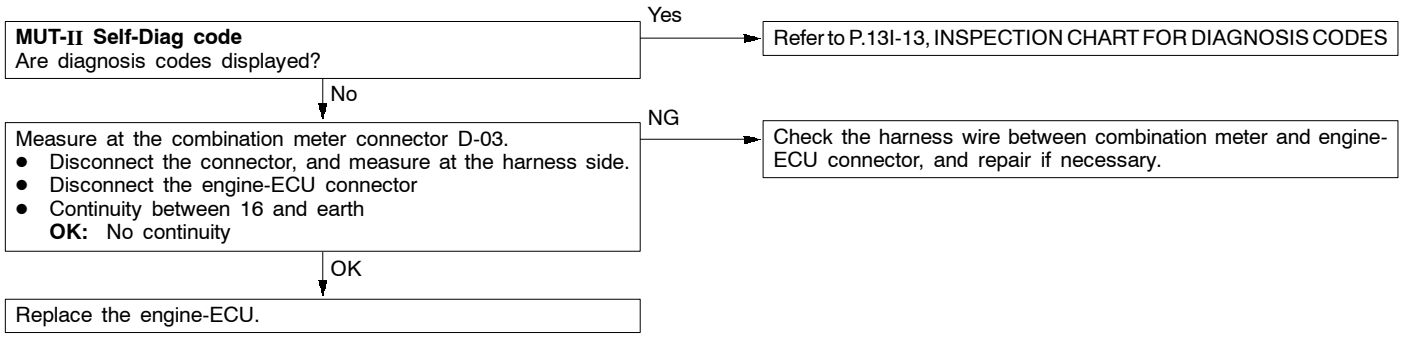
INSPECTION PROCEDURE 3

The engine warning lamp does not illuminate right after the ignition switch is turned to the ON position.	Probable cause
Because there is a burnt-out bulb, the engine-ECU causes the engine warning lamp to illuminate for five seconds immediately after the ignition switch is turned to ON. If the engine warning lamp does not illuminate immediately after the ignition switch is turned to ON, one of the malfunctions listed at right has probably occurred.	• Burnt-out bulb • Defective warning lamp circuit • Malfunction of the engine-ECU



INSPECTION PROCEDURE 4

The engine warning lamp remains illuminating and never goes out.	Probable cause
In cases such as the above, the cause is probably that the engine-ECU is detecting a problem in a sensor or actuator, or that one of the malfunctions listed at right has occurred.	• Short-circuit between the engine warning lamp and engine-ECU • Malfunction of the engine-ECU



INSPECTION PROCEDURE 5

No initial combustion (starting impossible)	Probable cause
This is caused by incorrect fuel supply into the combustion chamber, and improper ignition circuit. Besides that, foreign material may be contaminated in fuel.	• Malfunction of the fuel supply system • Malfunction of the ignition system • Malfunction of the engine-ECU

Check system voltage while the engine is cranking.
OK: 8 V or more
NG → Check the battery. (Refer to GROUP 55 – Battery.)
OK ↓

MUT-II Self-Diag code
Is a diagnosis code displayed?
Yes → Refer to P.13I-13, INSPECTION CHART FOR DIAGNOSIS CODES.
No ↓

MUT-II Data list
16 System voltage (Refer to P.13I-76.)
NG → Check the engine control relay and ignition switch-IG system. (Refer to P.13I-66, INSPECTION PROCEDURE 26.)
OK ↓

Does the camshaft rotate when the engine is cranking?
No → Check if the timing belt is broken or damaged.
Yes ↓

MUT-II Actuator test
07 Fuel pump (low pressure) (Refer to P.13I-82.)
NG → Check the fuel pump (low pressure) system. (Refer to P.13I-71, INSPECTION PROCEDURE 30.)
OK ↓

MUT-II Data list
22 Crank angle sensor (Refer to P.13I-76.)
NG → Check the crank angle sensor system. (Refer to P.13I-19, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 22.)
OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13I-76.)
NG → Check the engine coolant temperature sensor system. (Refer to P.13I-18, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)
OK ↓

MUT-II Data list
14 Throttle position sensor (2nd channel) (Refer to P.13I-76.)
NG → Check the throttle position sensor (2nd channel) system. (Refer to P.13I-17, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 14.)
OK ↓

Inspect engine start ability by cranking the engine while the accelerator pedal is slightly depressed.
OK → Clean around the throttle valve. (Refer to P.13I-98.)
NG ↓

Check fuel leakage. (Refer to P.13I-104.)
NG → **Repair**
OK ↓

Measure low fuel pressure between the fuel pump (low pressure) and fuel pump (high pressure). (Refer to P.13I-100.)
NG → **Repair**
OK ↓

Measure at ignition coil connectors B-01, B-11, B-89, B-104.
- Connect the connector.
- Connect a timing light to the No.1 terminal of each connector in turn.
  (Engine cranking)
  OK: The timing light flashes.

NG → Check abnormal fuel combustion system. (Refer to P.13I-26, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 44.)
OK ↓

Check ignition timing while the engine is cranking.
OK: Approx. 5° BTDC
NG → Check that the crank angle sensor and timing belt cover are properly installed.
OK ↓

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OK

Check ignition coil spark for each cylinder.
(1) Remove the ignition coil.
(2) Install a new spark plug to the removed ignition coil.
(3) Disconnect the injector intermediate connector.

Caution
Never touch the connector terminal as approx. 100 V is applied to the injector, or you are seriously injured.

(4) Earth the spark plug electrode securely.
(5) Check that the spark plug ignites when the engine is cranked.

NG → Replace the ignition coil.

OK

Check all the following items:
- Spark plug
- Compression pressure
- Foreign material (such as water or kerosine) entered the fuel lines

OK

Check trouble symptom.

NG → Replace the injector.

INSPECTION PROCEDURE 6

Initial combustion takes place, but does not complete (start impossible), too long time to start (poor start)	Probable cause
This may be caused by improper spark plug ignition (poor spark), improper mixture during engine cranking, improper fuel pressure.	• Malfunction of the fuel supply system • Malfunction of the fuel pressure sensor • Malfunction of the ignition system • Malfunction of the electronic-controlled throttle vale system • Malfunction of the engine-ECU

Check system voltage while the engine is cranking.
OK: 8 V or more
NG → Check the battery. (Refer to GROUP 55 – Battery.)
OK ↓

MUT-II Self-Diag code
Is a diagnosis code displayed?
Yes → Refer to P.13I-13, INSPECTION CHART FOR DIAGNOSIS CODES.
No ↓

MUT-II Actuator test
07 Fuel pump (low pressure) (Refer to P.13I-82.)
NG → Check the fuel pump (low pressure) system. (Refer to P.13I-71, INSPECTION PROCEDURE 30.)
OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13I-76.)
NG → Check the engine coolant temperature system. (Refer to P.13I-18, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)
OK ↓

MUT-II Data list
18 Cranking signal (Refer to P.13I-76.)
NG → Check the ignition switch-ST system <M/T>. (Refer to P.13I-66, INSPECTION PROCEDURE 27.)
Check the ignition switch-ST system and inhibitor switch <A/T>. (Refer to P.13I-67, INSPECTION PROCEDURE 28.)
OK ↓

MUT-II Data list
74 Fuel pressure sensor (Refer to P.13I-79.)
NG → Check an abnormal fuel pressure system. (Refer to P.13I-28, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 56.)
OK ↓

Check fuel leakage. (Refer to P.13I-104.)
NG → **Repair**
OK ↓

Is the engine started normally when it is cranked with the accelerator pedal depressed slightly?
Yes → Clean around the throttle valve. (Refer to P.13I-98.)
No ↓

MUT-II Data list
14 Throttle position sensor (2nd channel) (Refer to P.13I-76.)
NG → Check the throttle position sensor (2nd channel) system. (Refer to P.13I-17, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 14.)
OK ↓

Check ignition timing when the engine is cranked.
OK: approx. 5° BTDC
NG → Check that the crank angle sensor and timing belt cover are properly installed.
OK ↓

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OK

Check ignition coil spark for each cylinder.
(1) Remove the ignition coil.
(2) Install a new spark plug to the removed ignition coil.
(3) Disconnect the injector intermediate connector.

Caution
Never touch the connector terminal as approx. 100 V is applied to the injector, or you are seriously injured.

(4) Earth the spark plug electrode securely.
(5) Check that the spark plug ignites when the engine is cranked.

NG → Replace the ignition coil.

OK

Check all the following items:
- Spark plug
- Compression pressure
- Foreign material (such as water or kerosine) entered the fuel lines

OK

Check trouble symptom.

NG → Replace the injector.

INSPECTION PROCEDURE 7

Unstable idling (rough idle, hunting)	Probable cause
This malfunction is probably caused by a faulty ignition system, improper air/fuel ratio, a faulty electronic-controlled throttle valve system, improper compression pressure, etc. As many causes can be suspected, diagnose from easier items.	• Malfunction of the ignition system • Malfunction of the air/fuel ratio control system • Malfunction of the electronic-control throttle valve system • Improper compression pressure • Air sucking into the air intake system

Has the battery been disconnected recently?
- Yes → Warm up the engine, and then let it run at idle for approx. ten minutes.
- No ↓

MUT-II Self-Diag code
Is a diagnosis code displayed?
- Yes → Refer to P.13I-13, INSPECTION CHART FOR DIAGNOSIS CODES.
- No ↓

Does the engine idle speed fluctuates excessively (excessive hunting)?
- Yes → Clean around the throttle valve. (Refer to P.13I-98.)
- No ↓

MUT-II Data list
14 Throttle position sensor (2nd channel) (Refer to P.13I-76.)
- NG → Check the throttle position sensor (2nd channel) system. (Refer to P.13I-17, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 14.)
- OK ↓

MUT-II Data list
79 Throttle position sensor (1st channel) (Refer to P.13I-76.)
- NG → Check the throttle valve position feedback system. (Refer to P.13I-37, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 92.)
- OK ↓

MUT-II Data list
26 Accelerator pedal position switch (Refer to P.13I-76.)
- NG → Check the accelerator pedal position switch system. (Refer to P.13I-68, INSPECTION PROCEDURE 29.)
- OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13I-76.)
- NG → Check the intake air temperature sensor system. (Refer to P.13I-16, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 13.)
- OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer to P.13I-76.)
- NG → Check the barometric pressure sensor system. (Refer to P.13I-22, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 25.)
- OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13I-76.)
- NG → Check the engine coolant temperature sensor. (Refer to P.13I-18, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)
- OK ↓

MUT-II Actuator test
08 Purge control solenoid valve (Refer to P.13I-82.)
- NG → Check the purge control solenoid valve system. (Refer to P.13I-71, INSPECTION PROCEDURE 32.)
- OK ↓

MUT-II Data list
59 Oxygen sensor (rear) (Refer to P.13A–76.)
- Transmission: 2nd gear <M/T>, L range <A/T>
- Driving with throttle widely open

OK: 600 – 1,000 mV
- NG → Check the oxygen sensor (rear) system. (Refer to P.13I-30, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 59.)
- OK ↓

MUT-II Data list
11 Oxygen sensor (front)
OK: 600 – 1,000 mV when the engine is suddenly raced
- NG → Check the oxygen sensor (front) system. (Refer to P.13I-14, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 11.)
- OK ↓

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OK

MUT-II Data list
11 Oxygen sensor (front)
OK: 0 – 400 mV and 600 – 1,000 mV alternates when the engine is idling (wait for four minutes after the engine started).

NG → Measure fuel high-pressure between the fuel pump (high pressure) and injector. (Refer to P.13I-100.)

OK → Check that air is sucked in the air intake system.
- Broken intake manifold gasket
- Damaged vacuum hose
- Damaged air intake hose

NG → **Repair**

OK

MUT-II Data list
27 Power steering fluid pressure switch (Refer to P.13I-76.)

NG → Check the power steering fluid pressure switch system. (Refer to P.13I-72, INSPECTION PROCEDURE 33.)

OK

MUT-II Data list
28 A/C switch (Refer to P.13I-76.)

NG → Check the A/C switch and A/C relay system. (Refer to P.13I-72, INSPECTION PROCEDURE 34.)

OK

MUT-II Data list
48 M/T oil temperature sensor (Refer to P.13I-76.)

NG → Check the M/T oil temperature sensor system. (Refer to P.13I-73, INSPECTION PROCEDURE 35.)

OK

MUT-II Data list
29 Inhibitor switch (Refer to P.13I-76.)

NG → Check the ignition switch-ST and inhibitor switch. <A/T> (Refer to P.13I-67, INSPECTION PROCEDURE 28.)

OK

MUT-II Data list
67 Stop lamp switch (Refer to P.13I-76.)

NG → Check the stop lamp switch. (Refer to P.13I-74, INSPECTION PROCEDURE 36.)

OK

MUT-II Data list
31 Small lamp switch (Refer to P.13I-76.)

NG → Check the small lamp switch system. (Refer to P.13I-75, INSPECTION PROCEDURE 37.)

OK

MUT-II Data list
68 EGR valve (Refer to P.13I-76.)

NG → Check the EGR valve. (Refer to P.13I-70, INSPECTION PROCEDURE 31.)

OK

Check ignition timing. (Refer to GROUP 11D – Engine Adjustment.)

NG → Check that the crank angle sensor and timing belt cover are properly installed.

OK

Check ignition coil spark for each cylinder.
(1) Remove the ignition coil.
(2) Install a new spark plug to the removed ignition coil.
(3) Disconnect the injector intermediate connector.

Caution
Never touch the connector terminal as approx. 100 V is applied to the injector, or you are seriously injured.

(4) Earth the spark plug electrode securely.
(5) Check that the spark plug ignites when the engine is cranked.

NG → Replace the ignition coil.

OK

Clean around the throttle valve. (Refer to P.13I-98.)

Check trouble symptom.

NG

Check all the following items in that order.
(1) Spark plugs
(2) Exhaust gas emission control system
(3) EGR system
(4) Compression pressure
(5) Foreign material (such as water or kerosine)entered the fuel line.
(6) Air is sucked in the air intake system, or EGR gas leaks.
- Damaged intake manifold gasket
- Damaged air intake hose
- Damaged vacuum hose
- Faulty EGR valve seat

INSPECTION PROCEDURE 8

Idle speed is high or low (Improper idling)	Probable cause
The cause is probably that the intake air amount during idling is too great or too small.	• Malfunction of the electronic-controlled throttle valve system • Malfunction of the throttle body

MUT-II Self-Diag code
Is a diagnosis code displayed?
Yes → (Refer to P.13I-13, INSPECTION CHART FOR DIAGNOSIS CODES.)
No ↓

MUT-II Data list
14 Throttle position sensor (2nd channel) (Refer to P.13I-76.)
NG → Check the throttle position sensor (2nd channel). (Refer to P.13I-17, INSPECTION PROCEDURE FOR DIAGNOSIS CODES 14.)
OK ↓

MUT-II Actuator test
08 Purge control solenoid valve (Refer to P.13I-82.)
NG → Check the purge control solenoid valve. (Refer to P.13I-71, INSPECTION PROCEDURE 32.)
OK ↓

MUT-II Data list
26 Accelerator pedal position switch (Refer to P.13I-76.)
NG → Check the accelerator pedal position switch system. (Refer to P.13I-68, INSPECTION PROCEDURE 29.)
OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13I-76.)
NG → Check the engine coolant temperature sensor. (Refer to P.13I-18, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)
OK ↓

MUT-II Data list
28 A/C switch (Refer to P.13I-76.)
NG → Check the A/C switch and A/C relay system. (Refer to P.13I-72, INSPECTION PROCEDURE 34.)
OK ↓

MUT-II Data list
48 M/T oil temperature sensor (Refer to P.13I-76.)
NG → Check the M/T oil temperature sensor. (Refer to P.13I-73, INSPECTION PROCEDURE 35.)
OK ↓

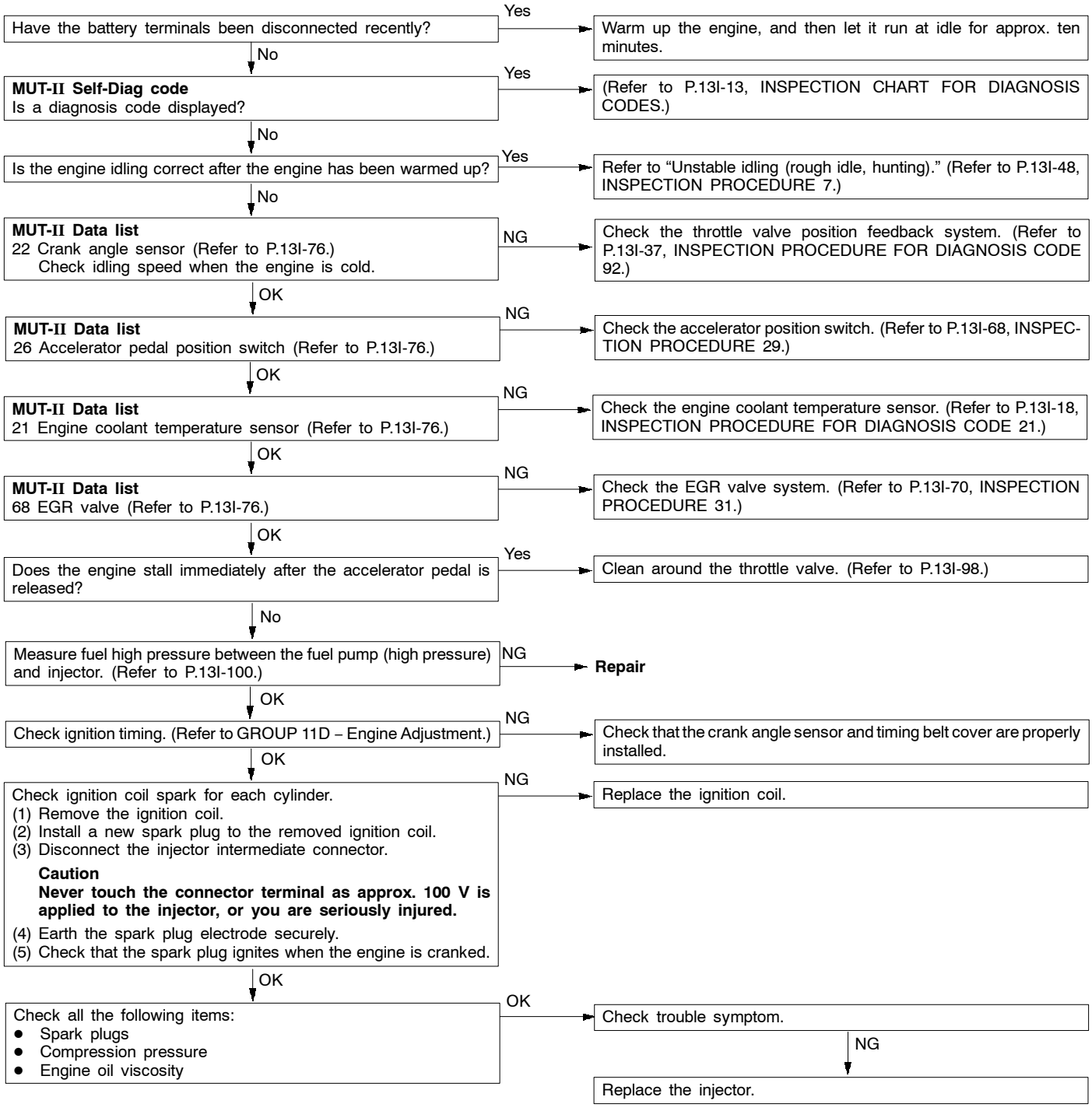
MUT-II Data list
29 Inhibitor switch (Refer to P.13I-76.)
→ Check the ignition switch-ST and inhibitor switch. <A/T> (Refer to P.13I-67, INSPECTION PROCEDURE 28.)
OK ↓

MUT-II Data list
67 Stop lamp switch (Refer to P.13I-76.)
NG → Check the stop lamp switch system. (Refer to P.13I-74, INSPECTION PROCEDURE 36.)
OK ↓

- Clean around the throttle valve. (Refer to P.13I-98.)
- Adjust the throttle position sensor. (Refer to P.13I-98.)

INSPECTION PROCEDURE 9

When the engine is cold, it stalls at idling. (Die out)	Probable cause
The cause is probably an incorrect air/fuel ratio or poor intake air amount when the engine is cold.	• Malfunction of the electronic-control throttle valve system • Malfunction of the throttle body



INSPECTION PROCEDURE 10

When the engine is hot, it stalls at idling. (Die out)	Probable cause
The cause is probably an improper air/fuel ratio, faulty electronic-controlled throttle valve system, compression pressure. In addition, if the engine stalls suddenly, another possible cause might be a poor connector contact.	• Malfunction of the ignition system • Malfunction of air/fuel ratio control system • Malfunction of electronic-controlled throttle valve system • Malfunction of the throttle body • Poor connector contact • Improper compression pressure • Air stuck in the air intake system

Have the battery terminals been disconnected recently?
- Yes → Warm up the engine, and then let it run at idle for approx. ten minutes.
- No ↓

MUT-II Self-Diag code
Is a diagnosis code displayed?
- Yes → Refer to P.13I-13, INSPECTION CHART FOR DIAGNOSIS CODES.
- No ↓

MUT-II Data list
79 Throttle position sensor (1st channel) (Refer to P.13I-76.)
- NG → Check the throttle position sensor (1st channel) system. (Refer to P.13I-35, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 79.)
- OK ↓

Is it easy to reproduce the engine stall?
- No → While carrying out an intermittent malfunction simulation test. (Refer to GROUP 00 – Points to Note for Intermittent Malfunction.), check for sudden changes in the following signals.
  - Crank angle sensor signal
  - Injector drive signal
  - Fuel pump (low pressure) drive signal
  - Air flow sensor
  - Primary ignition signal
  - Power supply to the engine-ECU
- Yes ↓

MUT-II Data list
26 Accelerator pedal position switch (Refer to P.13I-76.)
- NG → Check the accelerator pedal position switch. (Refer to P.13I-68, INSPECTION PROCEDURE 29.)
- OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13I-76.)
- NG → Check the intake air temperature sensor. (Refer to P.13I-16, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 13.)
- OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer to P.13I-76.)
- NG → Check the barometric pressure sensor. (Refer to P.13I-22, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 25.)
- OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13I-76.)
- NG → Check the engine coolant temperature sensor. (Refer to P.13I-18, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)
- OK ↓

MUT-II Data list
59 Oxygen sensor (rear) (Refer to P.13A–76.)
- Transmission: 2nd gear <M/T>, L range <A/T>
- Driving with throttle widely open

OK: 600 – 1,000 mV
- NG → Check the oxygen sensor (rear) system. (Refer to P.13I-30, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 59.)
- OK ↓

MUT-II Data list
11 Oxygen sensor (front)
OK: 600 – 1,000 mV when the engine is suddenly raced
- NG → Check the oxygen sensor (front) system. (Refer to P.13I-14, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 11.)
- OK ↓

MUT-II Data list
11 Oxygen sensor (front)
OK: 0 – 400 mV and 600 – 1,000 mV alternates when the engine is idling (wait for four minutes after the engine started).
- NG → Measure fuel high-pressure between the fuel pump (high pressure) and injector. (Refer to P.13I-100.)
  - OK → Check that air is sucked in the air intake system.
    - Broken intake manifold gasket
    - Damaged vacuum hose
    - Damaged air intake hose
  - NG → **Repair**
- OK ↓

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OK

MUT-II Data list
27 Power steering fluid pressure switch (Refer to P.13I-76.)

NG → Check the power steering fluid pressure switch system. (Refer to P.13I-72, INSPECTION PROCEDURE 33.)

OK

MUT-II Data list
28 A/C switch (Refer to P.13I-76.)

NG → Check the A/C switch and A/C relay system. (Refer to P.13I-72, INSPECTION PROCEDURE 34.)

OK

MUT-II Data list
31 Small lamp switch (Refer to P.13I-76.)

NG → Check the small lamp switch system. (Refer to P.13I-75, INSPECTION PROCEDURE 37.)

OK

MUT-II Data list
29 Inhibitor switch (Refer to P.13I-76.)

NG → Check the ignition switch-ST and inhibitor switch. <A/T> (Refer to P.13I-67, INSPECTION PROCEDURE 28.)

OK

MUT-II Data list
34 Air flow sensor reset signal (Refer to P.13I-76.)

NG → Check the air flow sensor system. (Refer to P.13I-15, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 12.)

OK

MUT-II Data list
68 EGR valve (Refer to P.13I-76.)

NG → Check the EGR valve. (Refer to P.13I-70, INSPECTION PROCEDURE 31.)

OK

Does the engine stall immediately after the accelerator pedal is released?

Yes → Clean around the throttle valve. (Refer to P.13I-98.)

No

Check ignition timing. (Refer to GROUP 11D – Engine Adjustment.)

NG → Check that the crank angle sensor and timing belt cover are properly installed.

OK

Check ignition coil spark for each cylinder.
(1) Remove the ignition coil.
(2) Install a new spark plug to the removed ignition coil.
(3) Disconnect the injector intermediate connector.

Caution
Never touch the connector terminal as approx. 100 V is applied to the injector, or you are seriously injured.

(4) Earth the spark plug electrode securely.
(5) Check that the spark plug ignites when the engine is cranked.

NG → Replace the ignition coil.

OK

Check all the following items:
- Spark plugs
- Compression pressure
- Foreign material (such as water or kerosine) entered the fuel lines

INSPECTION PROCEDURE 11

The engine stalls when starting the car. (Pass out)	Probable cause
The cause is probably poor ignition due to a malfunctioning spark plug (weak spark), or an incorrect air/fuel ratio when the accelerator is depressed.	• Malfunction of the ignition system • Malfunction of the EGR valve • Air stuck in the air intake system

MUT-II Self-Diag code
Is a diagnosis code displayed?
- Yes → (Refer to P.13I-13, INSPECTION CHART FOR DIAGNOSIS CODES.)
- No ↓

MUT-II Data list
68 EGR valve (Refer to P.13I-76.)
- NG → Check the EGR valve. (Refer to P.13I-70, INSPECTION PROCEDURE 31.)
- OK ↓

MUT-II Actuator test
08 Purge control solenoid valve (Refer to P.13I-82.)
- NG → Check the purge control solenoid valve system. (Refer to P.13I-71, INSPECTION PROCEDURE 32.)
- OK ↓

Check ignition coil spark for each cylinder.
(1) Remove the ignition coil.
(2) Install a new spark plug to the removed ignition coil.
(3) Disconnect the injector intermediate connector.

Caution
Never touch the connector terminal as approx. 100 V is applied to the injector, or you are seriously injured.

(4) Earth the spark plug electrode securely.
(5) Check that the spark plug ignites when the engine is cranked.
- NG → Replace the ignition coil.
- OK ↓

Check all the following items:
(1) Spark plug
(2) Check if air is stuck in the air intake system.
- Damage intake manifold gasket
- Damaged or disconnected vacuum hose
- Damaged air intake hose

INSPECTION PROCEDURE 12

The engine stalls when decelerating.	Probable cause
The cause is probably an improper air/fuel ratio due to a faulty EGR system, or poor intake air volume due to a faulty electronic-controlled throttle valve system.	• Malfunction of the electronic-controlled throttle valve system • Malfunction of the EGR valve

Have the battery terminals been disconnected recently?
- Yes → Warm up the engine, and then let it run at idle for approx. ten minutes.
- No ↓

MUT-II Self-Diag code
Is a diagnosis code displayed?
- Yes → (Refer to P.13I-13, INSPECTION CHART FOR DIAGNOSIS CODES.)
- No ↓

MUT-II Data list
26 Accelerator pedal position switch (Refer to P.13I-76.)
- NG → Check the accelerator pedal position switch. (Refer to P.13I-68, INSPECTION PROCEDURE 29.)
- OK ↓

MUT-II Data list
79 Throttle position sensor (1st channel) (Refer to P.13I-76.)
- NG → Check the throttle valve position feedback system. (Refer to P.13I-37, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 92.)
- OK ↓

MUT-II Data list
68 EGR valve (Refer to P.13I-76.)
- NG → Check the EGR valve system. (Refer to P.13I-70, INSPECTION PROCEDURE 31.)
- OK ↓

Check ignition coil spark for each cylinder.
(1) Remove the ignition coil.
(2) Install a new spark plug to the removed ignition coil.
(3) Disconnect the injector intermediate connector.

Caution
Never touch the connector terminal as approx. 100 V is applied to the injector, or you are seriously injured.

(4) Earth the spark plug electrode securely.
(5) Check that the spark plug ignites when the engine is cranked.
- NG → Replace the ignition coil.
- OK ↓

Check all the following items:
- Spark plug
- Clean around the throttle valve (Refer to P.13I-98.)

INSPECTION PROCEDURE 13

Hesitation, sag, stumble, poor acceleration or surge	Probable cause
The cause is probably a malfunction of the ignition system, electronic-controlled throttle valve system, compression pressure, etc.	• Malfunction of the ignition system • Malfunction of the air/fuel ratio control system • Malfunction of the electronic-controlled throttle valve system • Improper compression pressure • Air stuck in the air intake system

MUT-II Self-Diag code
Is a diagnosis code displayed?
Yes → (Refer to P.13I-13, INSPECTION CHART FOR DIAGNOSIS CODES.)
OK ↓

Check ignition timing. (Refer to GROUP 11D – Engine Adjustment.)
NG → Check that the crank angle sensor and timing belt cover are properly installed.
OK ↓

MUT-II Data list
26 Accelerator pedal position switch (Refer to P.13I-76.)
NG → Check the accelerator pedal position switch. (Refer to P.13I-68, INSPECTION PROCEDURE 29.)
OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13I-76.)
NG → Check the intake air temperature sensor. (Refer to P.13I-16, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 13.)
OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer to P.13I-76.)
NG → Check the barometric pressure sensor. (Refer to P.13I-22, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 25.)
OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13I-76.)
NG → Check the engine coolant temperature sensor. (Refer to P.13I-18, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)
OK ↓

MUT-II Data list
79 Throttle position sensor (1st channel) (Refer to P.13I-76.)
NG → Check the throttle valve position feedback system. (Refer to P.13I-38, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 99.)
OK ↓

MUT-II Data list
59 Oxygen sensor (rear) (Refer to P.13I-76.)
- Transmission: 2nd gear <M/T>, L range <A/T>
- Driving with throttle widely open

OK: 600 – 1,000 mV
NG → Check the oxygen sensor (rear) system. (Refer to P.13I-30, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 59.)
OK ↓

MUT-II Data list
11 Oxygen sensor (front)
OK: 600 – 1,000 mV when the engine is suddenly raced
NG → Check the oxygen sensor (front) system. (Refer to P.13I-14, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 11.)
OK ↓

MUT-II Data list
11 Oxygen sensor (front)
OK: 0 – 400 mV and 600 – 1,000 mV alternates when the engine is idling (wait for four minutes after the engine started).
NG → Measure fuel high-pressure between the fuel pump (high pressure) and injector. (Refer to P.13I-100.)
OK ↓

Check that air is sucked in the air intake system.
- Broken intake manifold gasket
- Damaged vacuum hose
- Damaged air intake hose

OK ↓

MUT-II Data list
68 EGR valve (Refer to P.13I-76.)
NG → Check the EGR valve. (Refer to P.13I-70, INSPECTION PROCEDURE 31.)
OK ↓

MUT-II Actuator test
08 Purge control solenoid valve (Refer to P.13I-82.)
NG → Check the purge control solenoid valve. (Refer to P.13I-71, INSPECTION PROCEDURE 32.)
OK ↓

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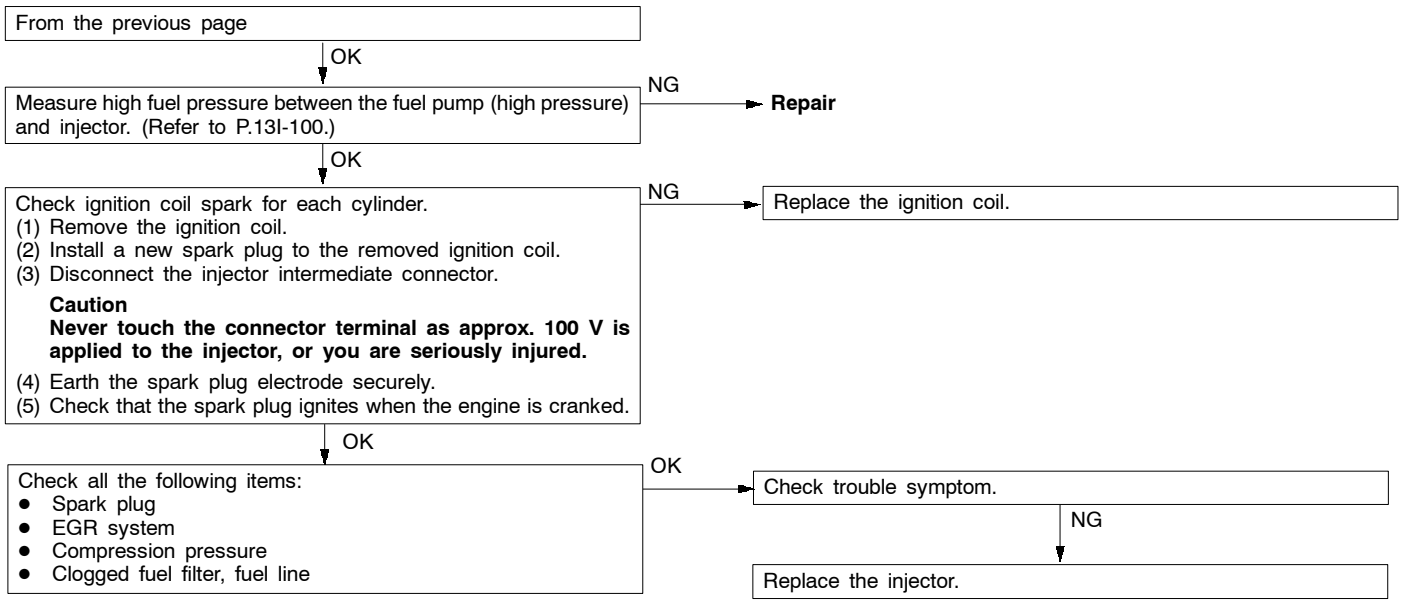
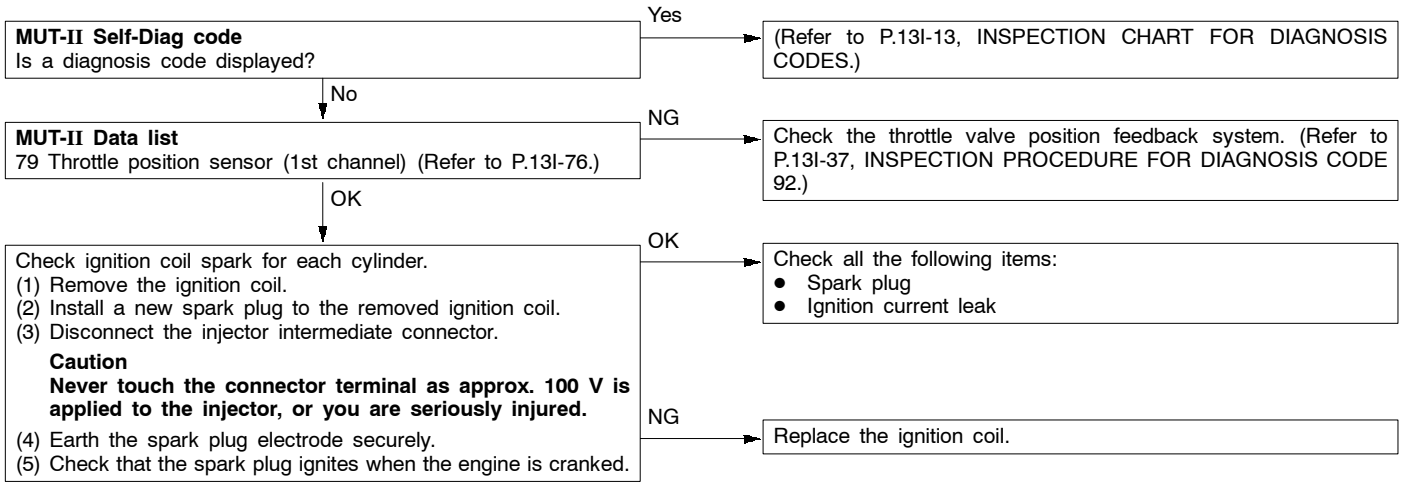


INSPECTION PROCEDURE 14

The feeling of impact when accelerating	Probable cause
The cause is probably an ignition leak being generated in line with an increase in the spark plug request voltage during acceleration.	● Malfunction of the ignition system



INSPECTION PROCEDURE 15

The feeling of impact when decelerating	Probable cause
The cause is probably insufficient intake air due to a faulty electronic-controlled throttle valve system.	• Malfunction of the electronic-controlled throttle valve system

MUT-II Self-Diag code
Is a diagnosis code displayed?
Yes → (Refer to P.13I-13, INSPECTION CHART FOR DIAGNOSIS CODES.)
No ↓

MUT-II Data list
79 Throttle position sensor (1st channel) (Refer to P.13I-76.)
NG → Check the throttle valve position feedback system. (Refer to P.13I-37, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 92.)
OK ↓

MUT-II Data list
26 Accelerator pedal position switch (Refer to P.13I-76.)
NG → Check the accelerator pedal position switch system. (Refer to P.13I-68, INSPECTION PROCEDURE 29.)
OK ↓

Clean around the throttle valve. (Refer to P.13I-98.)

INSPECTION PROCEDURE 16

Knocking	Probable cause
The cause is probably incorrect detonation control or improper heat range of the spark plugs.	• Malfunction of the detonation sensor • Improper heat range of the spark plugs

MUT-II Self-Diag code
Is a diagnosis code displayed?
Yes → (Refer to P.13I-13, INSPECTION CHART FOR DIAGNOSIS CODES.)
No ↓

Does knocking occur when the vehicle is driven with the detonation sensor disconnected?
(At this time, use the MUT-II to check whether the ignition timing is retarded from when the detonation sensor connector is connected.)
No → Check the detonation sensor system. (Refer to P.13I-23, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 31.)
Yes ↓

Check all the following items:
- Spark plug
- Foreign material (such as water or kerosine) entered the fuel lines

INSPECTION PROCEDURE 17

Run-on (dieseling)	Probable cause
The cause is probably fuel leak from injector(s)	• Malfunction of the injector

Replace the injector.

INSPECTION PROCEDURE 18

Too high CO and HC concentration when idling	Probable cause
The cause is probably an incorrect air/fuel ratio	• Malfunction of air/fuel ratio control system • Deterioration of the catalyst

MUT-II Self-Diag code
Is a diagnosis code displayed?
Yes → (Refer to P.13I-13, INSPECTION CHART FOR DIAGNOSIS CODES.)
No ↓

Check ignition timing. (Refer to GROUP 11D – Engine Adjustment.)
NG → Check that the crank angle sensor and timing belt cover are properly installed.
OK ↓

MUT-II Data list
21 Engine coolant temperature sensor (Refer to P.13I-76.)
NG → Check the engine coolant temperature sensor. (Refer to P.13I-18, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 21.)
OK ↓

MUT-II Data list
13 Intake air temperature sensor (Refer to P.13I-76.)
NG → Check the intake air temperature sensor. (Refer to P.13I-16, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 13.)
OK ↓

MUT-II Data list
25 Barometric pressure sensor (Refer to P.13I-76.)
NG → Check the barometric pressure sensor. (Refer to P.13I-22, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 25.)
OK ↓

MUT-II Data list
59 Oxygen sensor (rear) (Refer to P.13I-76.)
- Transmission: 2nd gear <M/T>, L range <A/T>
- Driving with throttle widely open

OK: 600 – 1,000 mV
NG → Check the oxygen sensor (rear) system. (Refer to P.13I-30, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 59.)
OK ↓

MUT-II Data list
11 Oxygen sensor (front)
OK: 600 – 1,000 mV when the engine is suddenly raced
NG → Check the oxygen sensor (front) system. (Refer to P.13I-14, INSPECTION PROCEDURE FOR DIAGNOSIS CODE 11.)
OK ↓

MUT-II Data list
11 Oxygen sensor (front)
OK: 0 – 400 mV and 600 – 1,000 mV alternates when the engine is idling (wait for four minutes after the engine started).
OK → Replace the oxygen sensor (front).
→ Check trouble symptom.
NG ↓

Measure fuel high-pressure between the fuel pump (high pressure) and injector. (Refer to P.13I-100.)
NG → **Repair**
OK ↓

Check ignition coil spark for each cylinder.
(1) Remove the ignition coil.
(2) Install a new spark plug to the removed ignition coil.
(3) Disconnect the injector intermediate connector.

Caution
Never touch the connector terminal as approx. 100 V is applied to the injector, or you are seriously injured.

(4) Earth the spark plug electrode securely.
(5) Check that the spark plug ignites when the engine is cranked.

OK ↓
NG → Replace the ignition coil.

Check all the following items:
- Spark plug
- EGR system
- Compression pressure
- Clogged fuel filter or line

OK ↓

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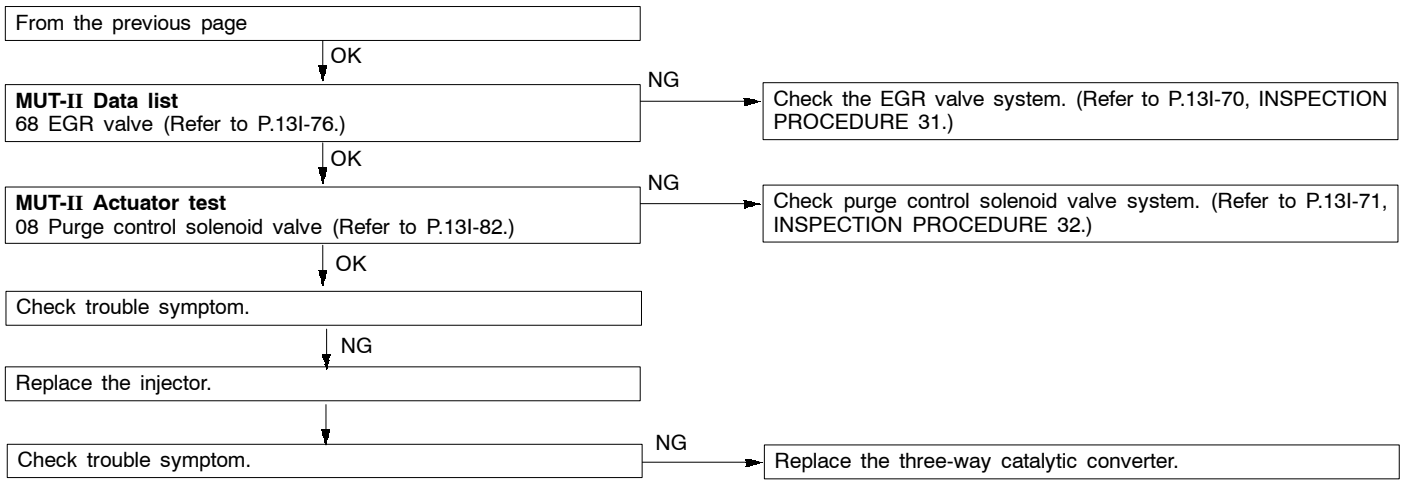
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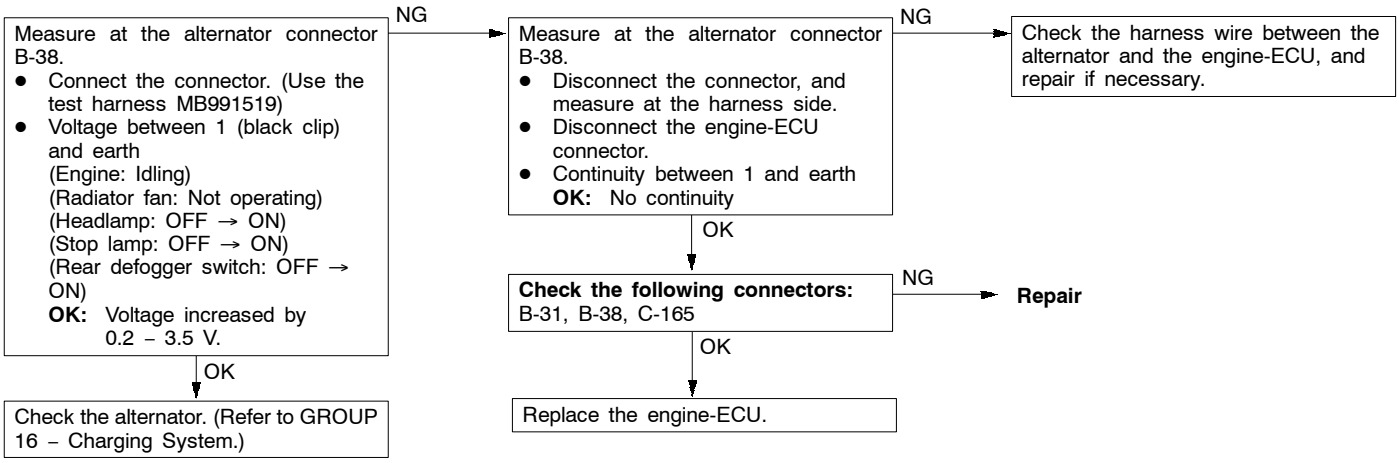
OK
MUT-II Data list
68 EGR valve (Refer to P.13I-76.)
NG
Check the EGR valve system. (Refer to P.13I-70, INSPECTION PROCEDURE 31.)
OK
MUT-II Actuator test
08 Purge control solenoid valve (Refer to P.13I-82.)
NG
Check purge control solenoid valve system. (Refer to P.13I-71, INSPECTION PROCEDURE 32.)
OK
Check trouble symptom.
NG
Replace the injector.
Check trouble symptom.
NG
Replace the three-way catalytic converter.

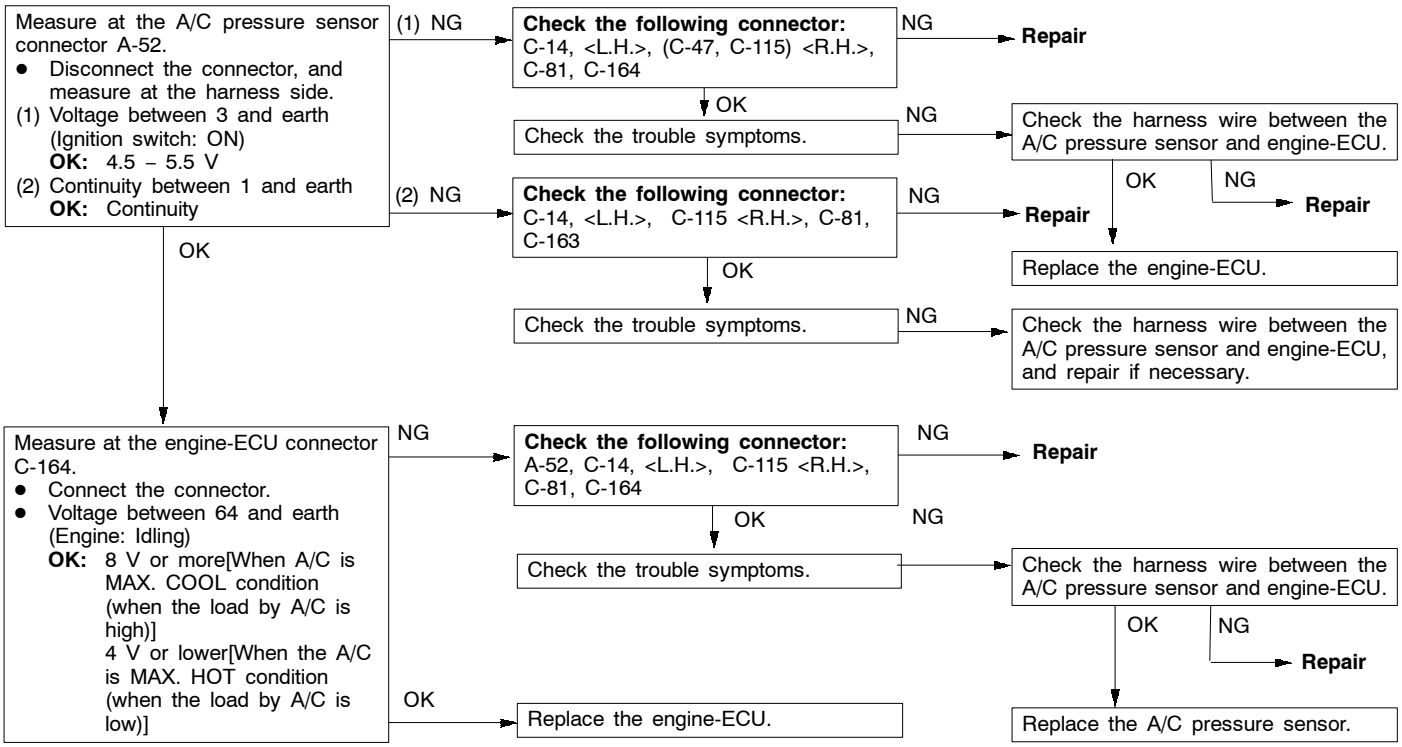
INSPECTION PROCEDURE 19

Low alternator output voltage (approx. 12.3 V)	Probable cause
The cause is probably a malfunction of the alternator or one of the problems listed at right.	• Malfunction of the charging system • Open circuit between the alternator G terminal and the engine-ECU • Malfunction of the engine-ECU



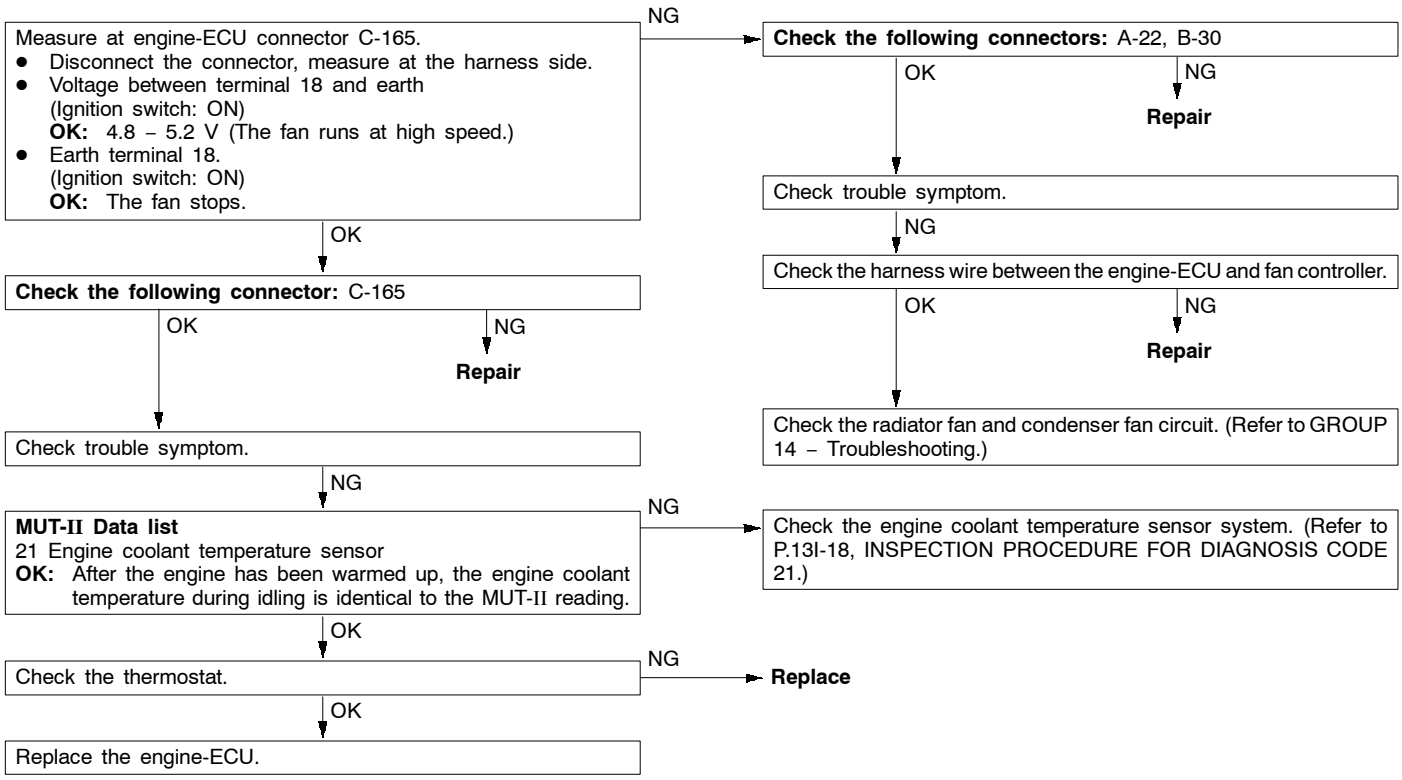
INSPECTION PROCEDURE 20

Idling speed is improper when A/C is operating	Probable cause
If the engine-ECU detects that the air conditioner is on, it activates the idle speed control (ISC) servo to control idle-up operation. The A/C-ECU judges if the load caused by air conditioner operation is high or low, and converts it to voltage signal (high or low voltage) and inputs the signal to the engine-ECU. Based on this voltage signal, the engine-ECU controls the idle-up speed (for high or low load).	• Malfunction of the A/C control system • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the A/C pressure sensor • Malfunction of the engine-ECU



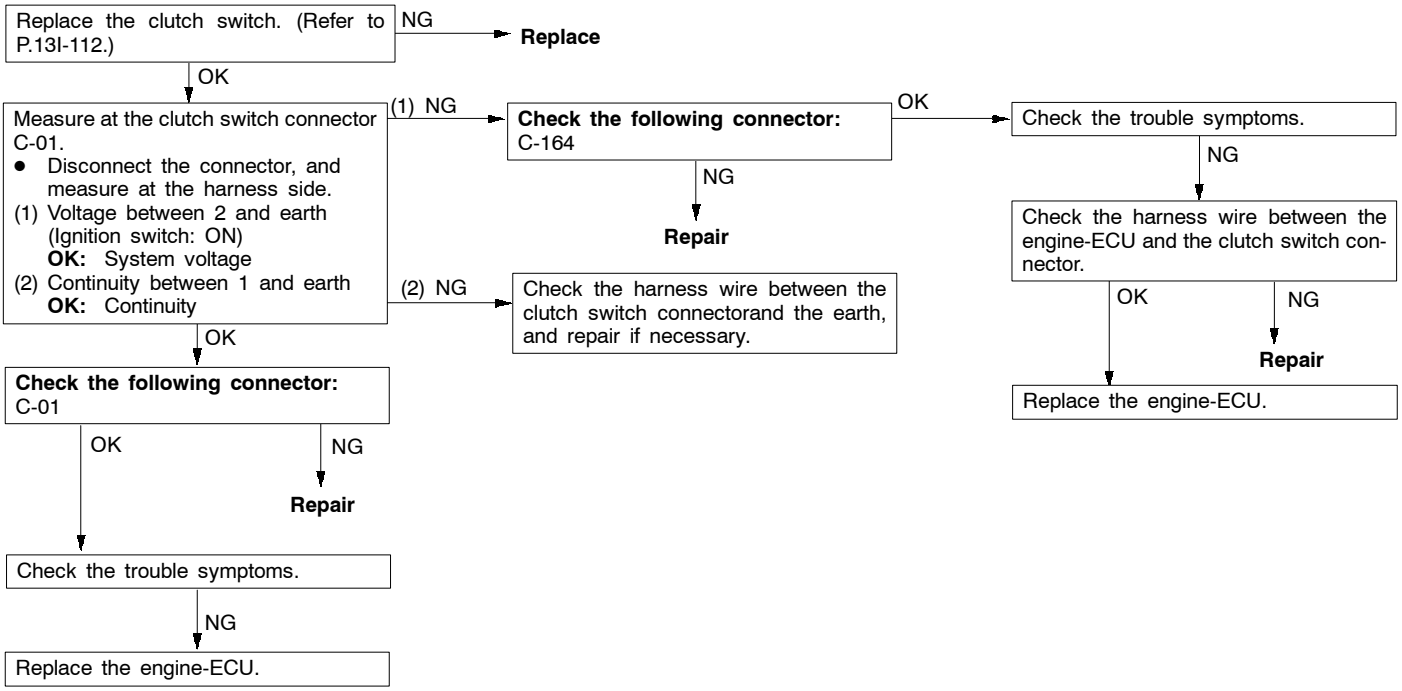
INSPECTION PROCEDURE 21

Fans (radiator fan, A/C condenser fan) are inoperative.	Probable cause
The engine-ECU sends a duty signal to the fan controller according to engine coolant temperature, vehicle speed, or A/C switch. The fan controller controls radiator fan and condenser fan speeds, based on this signal. (The closer the terminal voltage comes to 5 V, the higher the fan speed becomes.)	• Malfunction of the fan motor relay • Malfunction of the fan motor • Malfunction of the fan controller • Open or short circuit, or poor connector contact • Malfunction of the engine-ECU



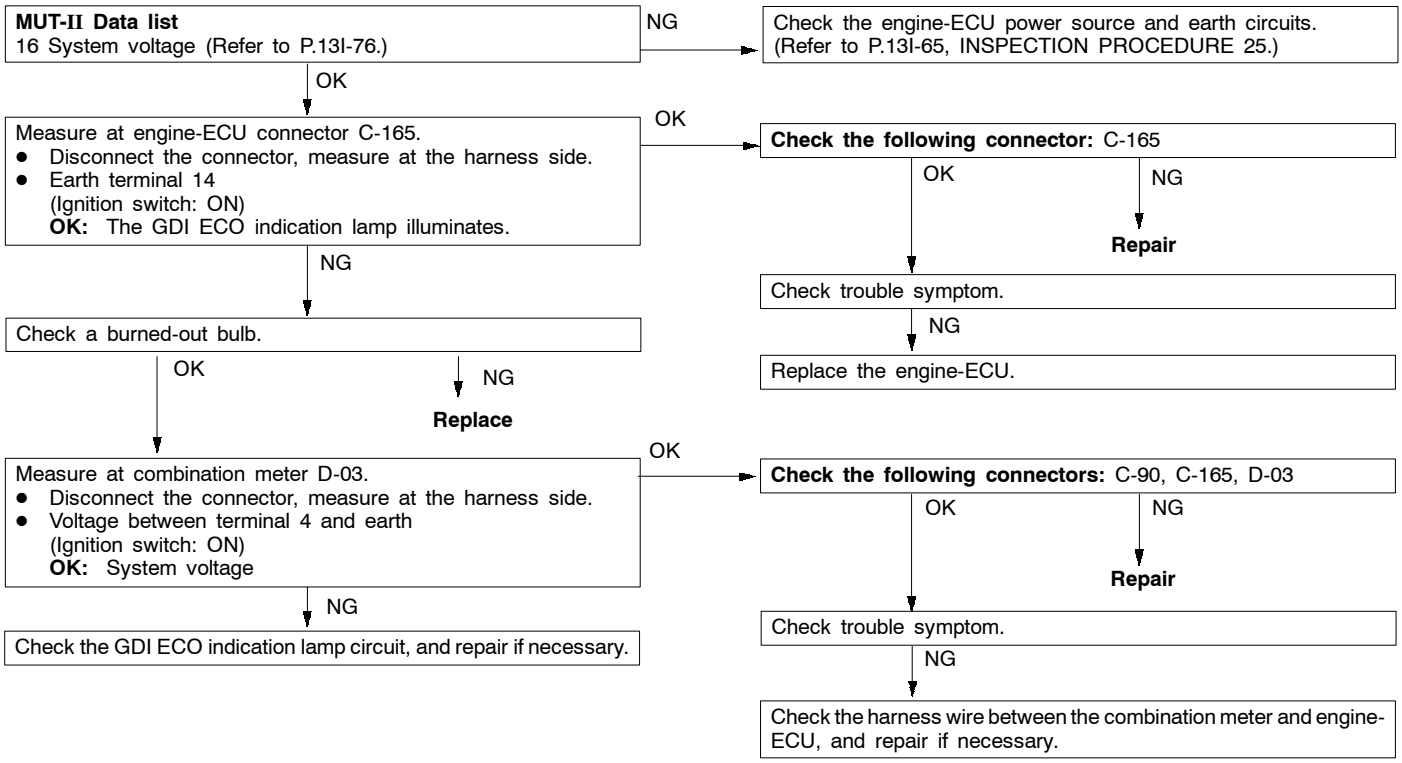
INSPECTION PROCEDURE 22

Clutch switch system malfunction	Probable cause
The clutch pedal switch sends a signal indicating clutch pedal depression to the engine-ECU. The engine-ECU controls the fuel injection properly according to this signal, thus prevents the fluctuation of the engine speed during shift change.	• Malfunction of the clutch switch • Open circuit or short-circuited harness wire in the clutch switch circuit • Malfunction of the engine-ECU



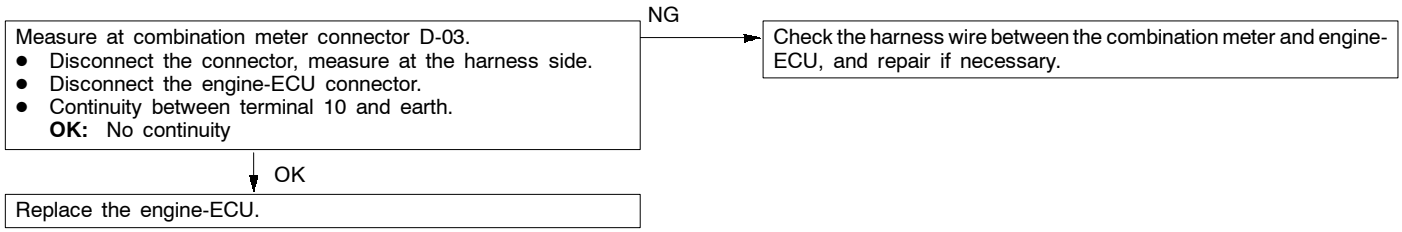
INSPECTION PROCEDURE 23

The GDI ECO indication lamp does not illuminate.	Probable cause
If the GDI ECO indication lamp does not illuminate after turning on the ignition switch, the causes listed in the right column are suspected.	• Burned-out GDI ECO indication lamp bulb • Open circuit or short -circuited harness wire in the GDI ECO indication lamp circuit • Malfunction of the engine-ECU



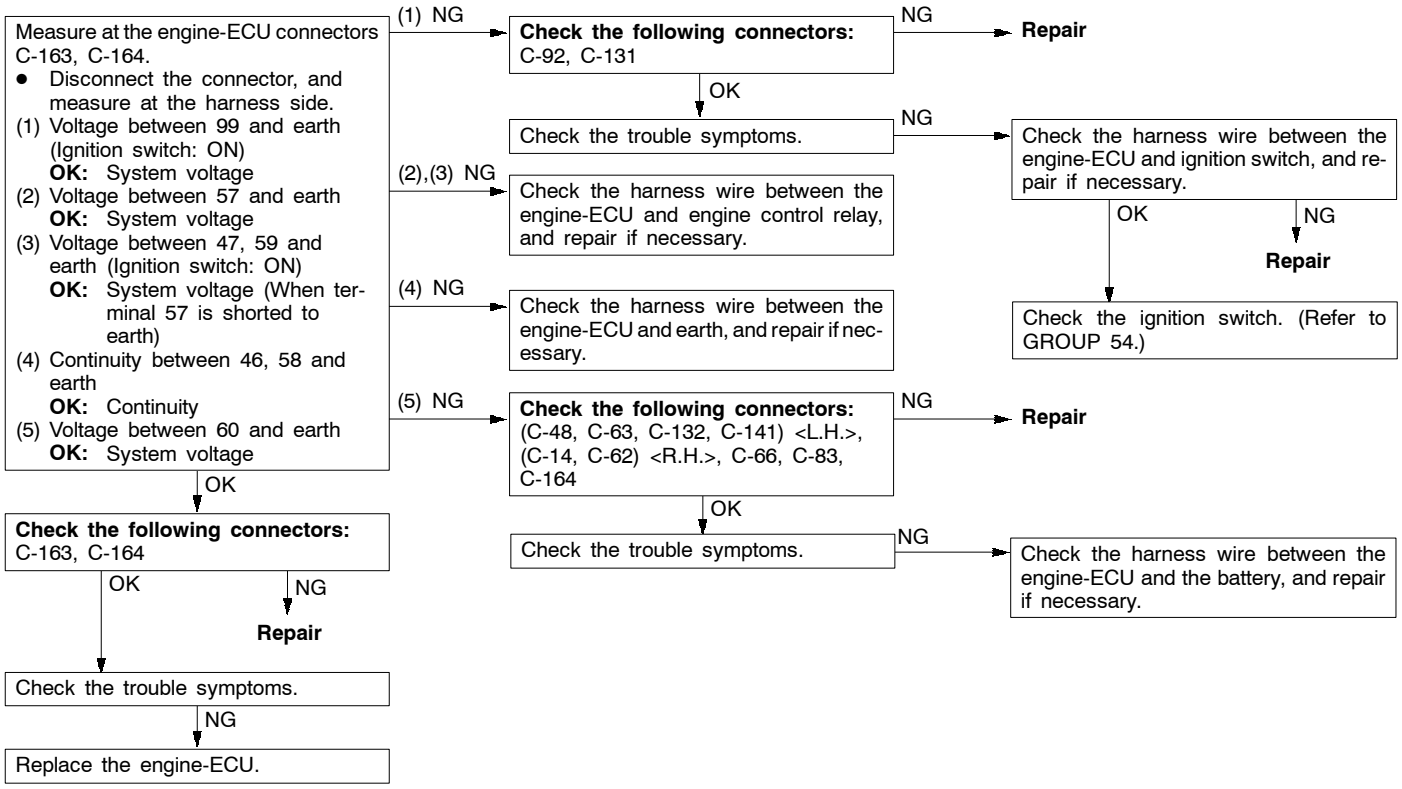
INSPECTION PROCEDURE 24

The GDI ECO indication lamp remains on (does not extinguish).	Probable cause
If the GDI ECO indication lamp does not extinguish during high load operation, the causes listed int right column are suspected.	• Short circuit between the GDI ECO indication lamp and engine-ECU • Malfunction of the engine-ECU



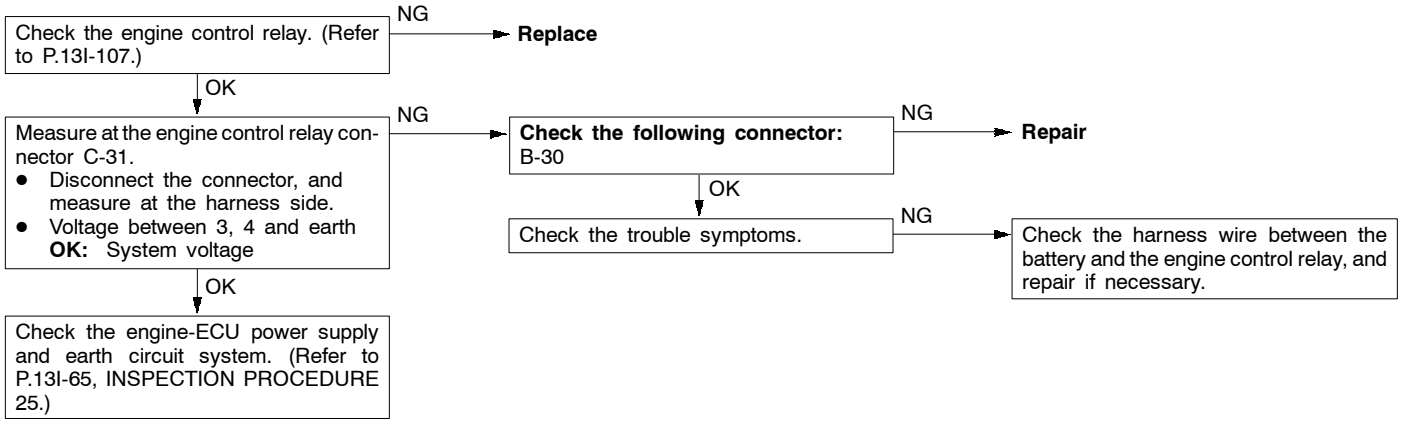
INSPECTION PROCEDURE 25

Engine-ECU power supply and earth circuit system	Probable cause
The cause is probably a malfunction of the engine-ECU or one of the problems listed at right.	• Open circuit or short-circuited harness wire in the engine-ECU power supply circuit • Open circuit or short-circuited harness wire in the engine-ECU earth circuit • Malfunction of the engine-ECU



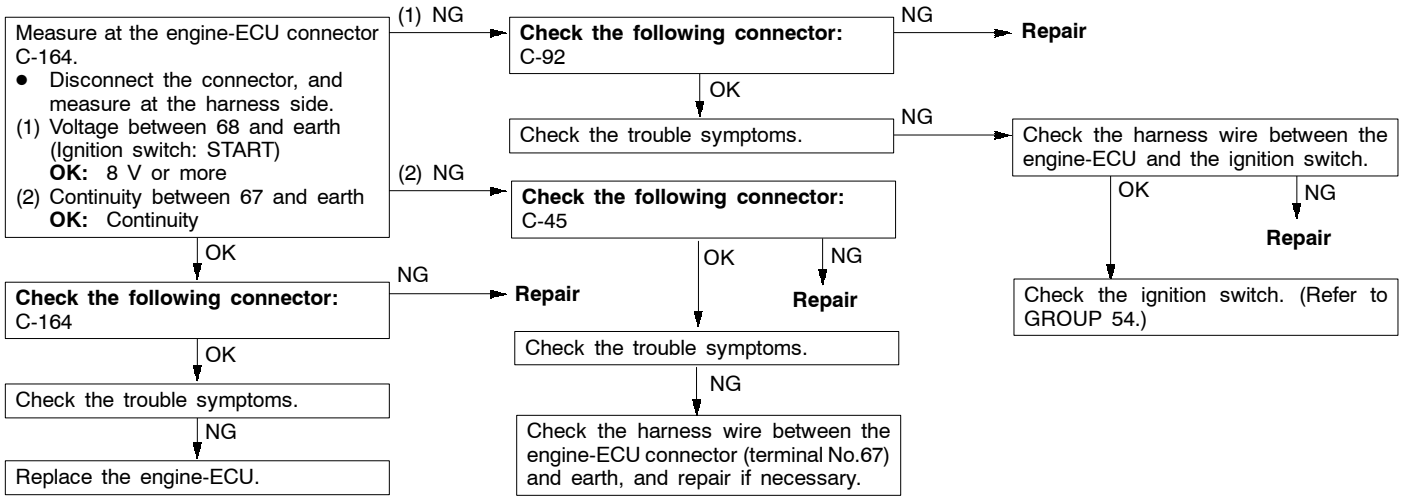
INSPECTION PROCEDURE 26

Engine control relay and ignition switch-IG system	Probable cause
When the ignition switch ON signal is input to the engine-ECU, the engine-ECU turns on the engine control relay. This causes system voltage to be supplied to the engine-ECU and to the sensors and actuators.	• Malfunction of the ignition switch • Malfunction of the engine control relay • Open circuit or short-circuited harness wire of the engine control relay circuit • Malfunction of the engine-ECU



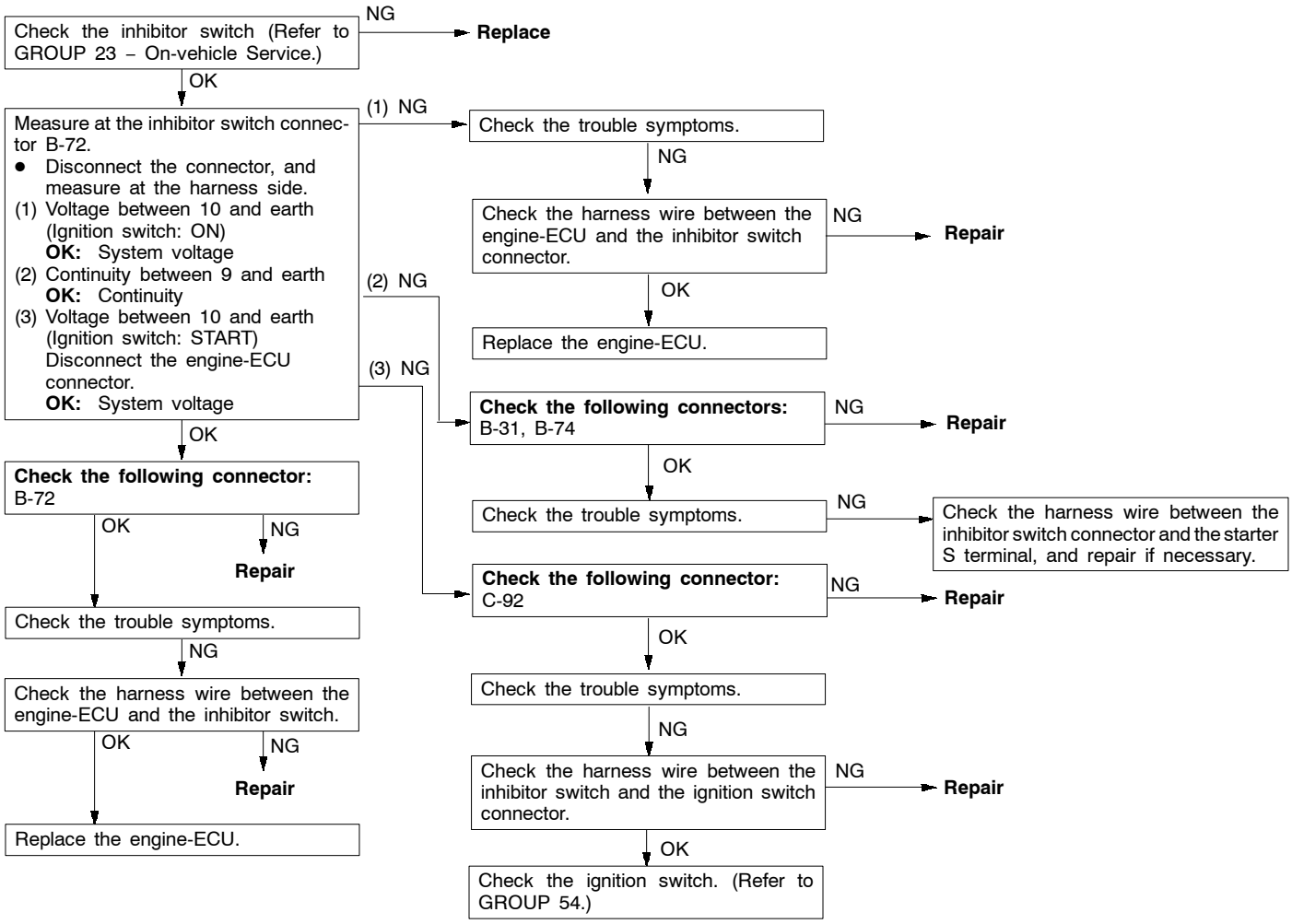
INSPECTION PROCEDURE 27

Ignition switch-ST system <M/T>	Probable cause
The ignition switch-ST outputs a HIGH signal to the engine-ECU while the engine is cranking. The engine-ECU uses this signal to carry out functions such as fuel injection control during starting.	• Malfunction of the ignition switch • Open circuit or short-circuited harness wire of the ignition switch circuit • Malfunction of the engine-ECU



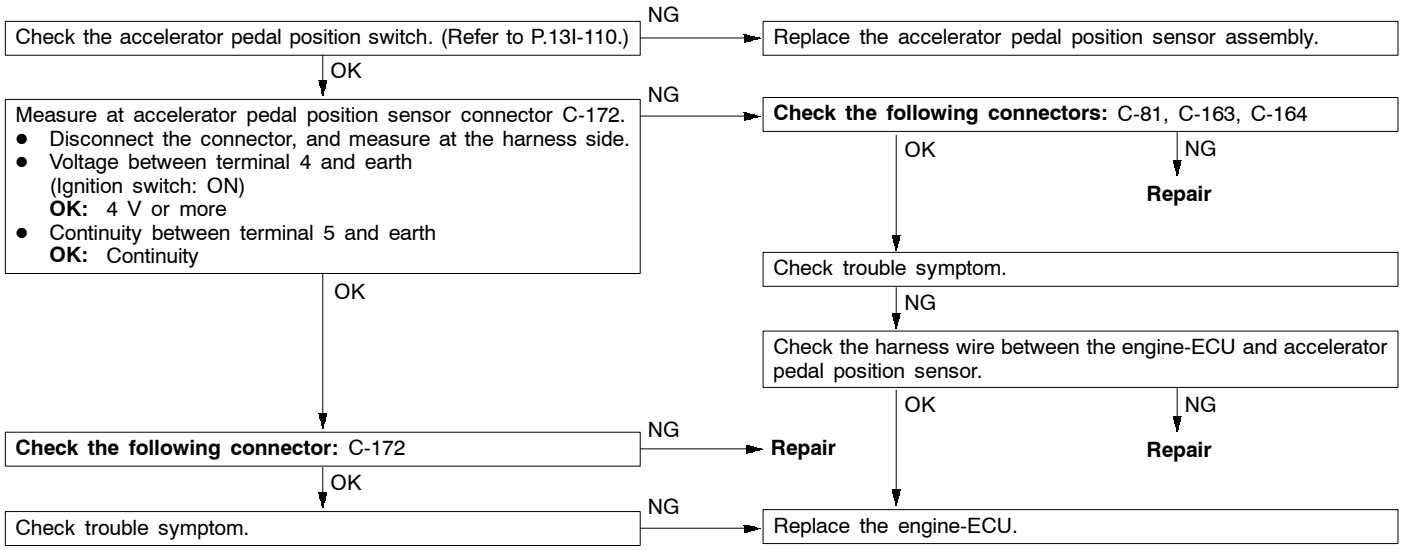
INSPECTION PROCEDURE 28

Ignition switch-ST and inhibitor switch system <A/T>	Probable cause
The ignition switch-ST outputs a HIGH signal to the engine-ECU while the engine is cranking, and the engine-ECU uses this signal to carry out functions such as fuel injection control during starting. The inhibitor switch inputs the position of the selector lever to the engine-ECU. The engine-ECU uses this signal to carry out idle speed control.	• Malfunction of the ignition switch • Malfunction of the inhibitor switch • Open circuit or short-circuited harness wire between ignition switch and inhibitor switch • Malfunction of the engine-ECU



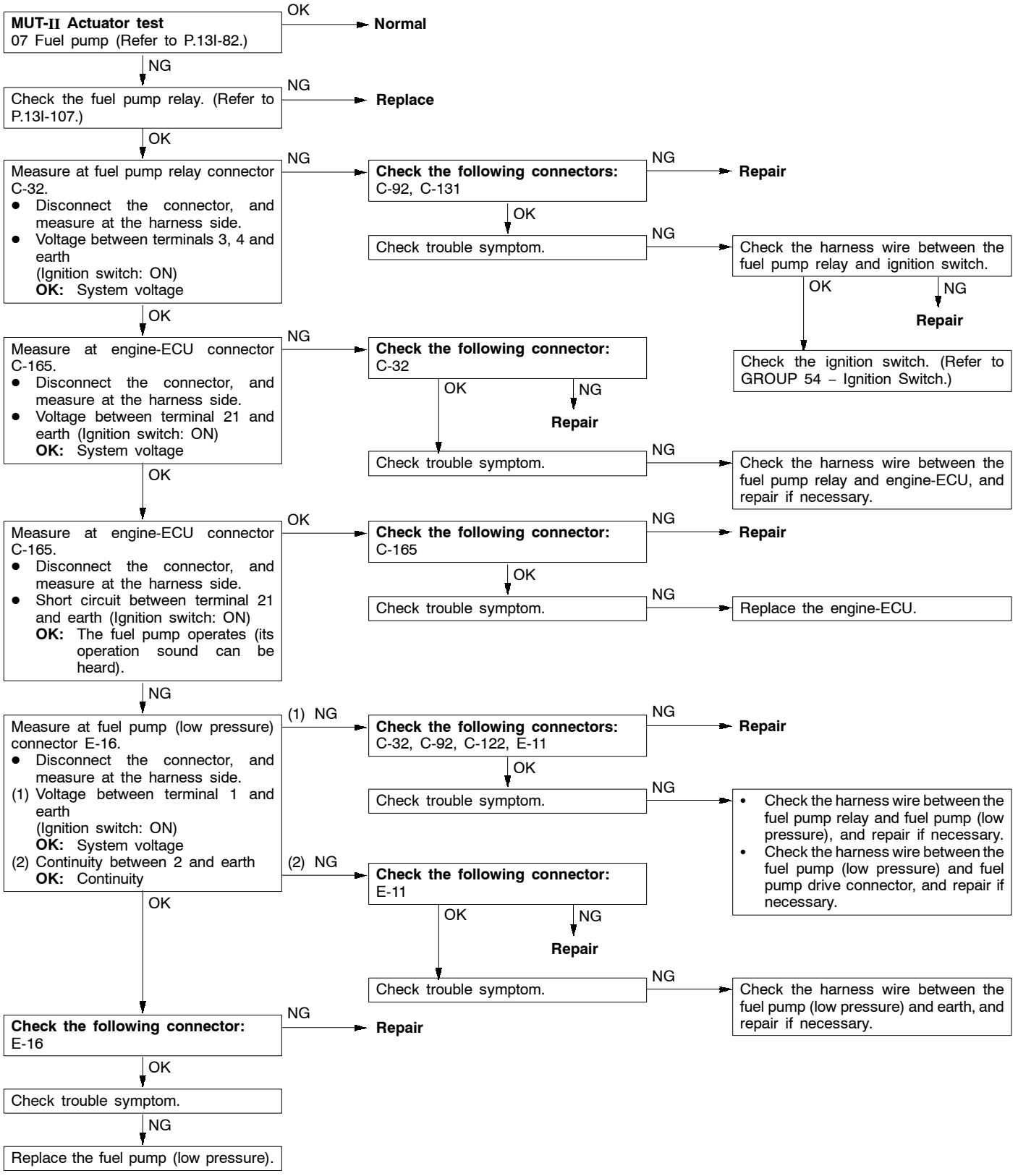
INSPECTION PROCEDURE 29

Accelerator pedal position switch system	Probable cause
The accelerator pedal position switch detects that the accelerator pedal is fully closed, and sends a signal to the engine-ECU. The engine-ECU controls idle speed, based on this signal.	• Maladjustment of the accelerator cable • Maladjustment of the accelerator pedal position switch • Open circuit or short-circuited harness wire in the accelerator pedal position switch system, or poor connector contact • Malfunction of the engine-ECU



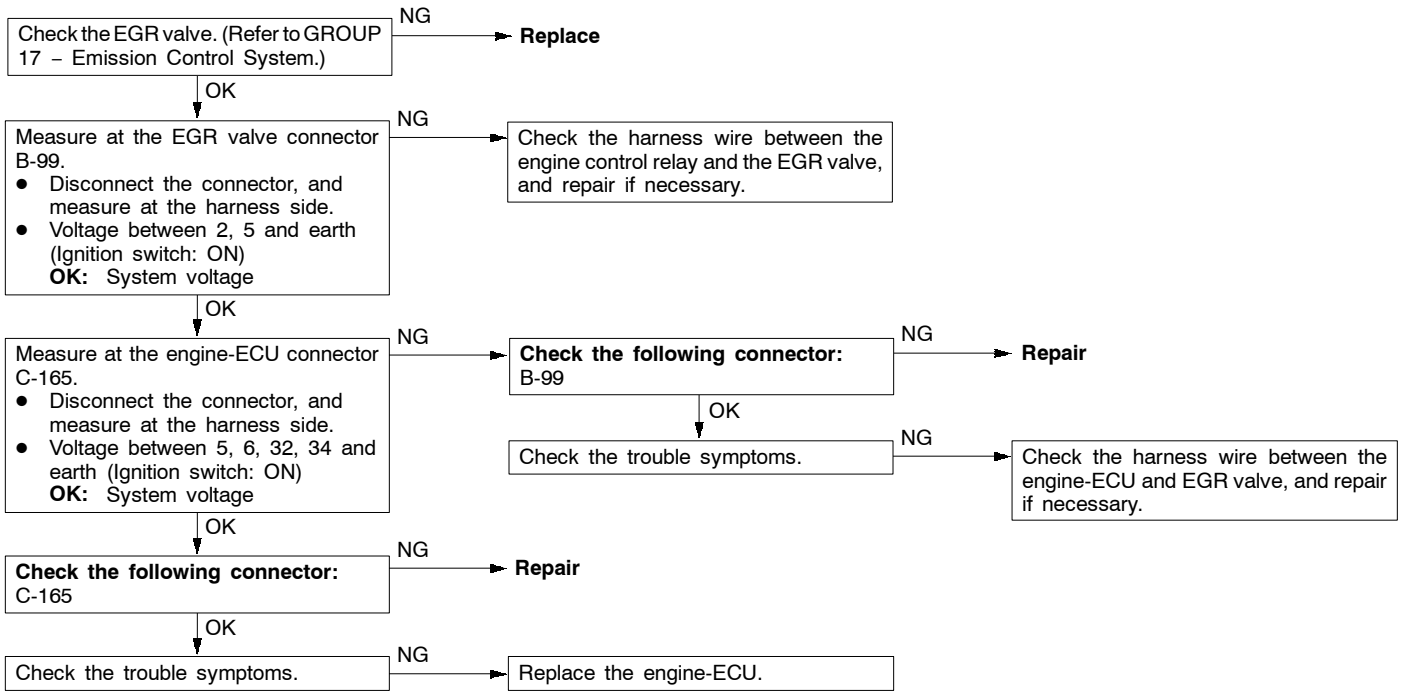
INSPECTION PROCEDURE 30

Fuel pump (low pressure) system	Probable cause
The engine-ECU turns on the fuel pump relay while the engine is cranking or running, and supplies power source to the fuel pump (low pressure).	• Malfunction of the fuel pump relay • Malfunction of the fuel pump (low pressure) • Open circuit or short-circuited harness wire in the fuel pump (low pressure) circuit, or poor connector contact • Malfunction of the engine-ECU



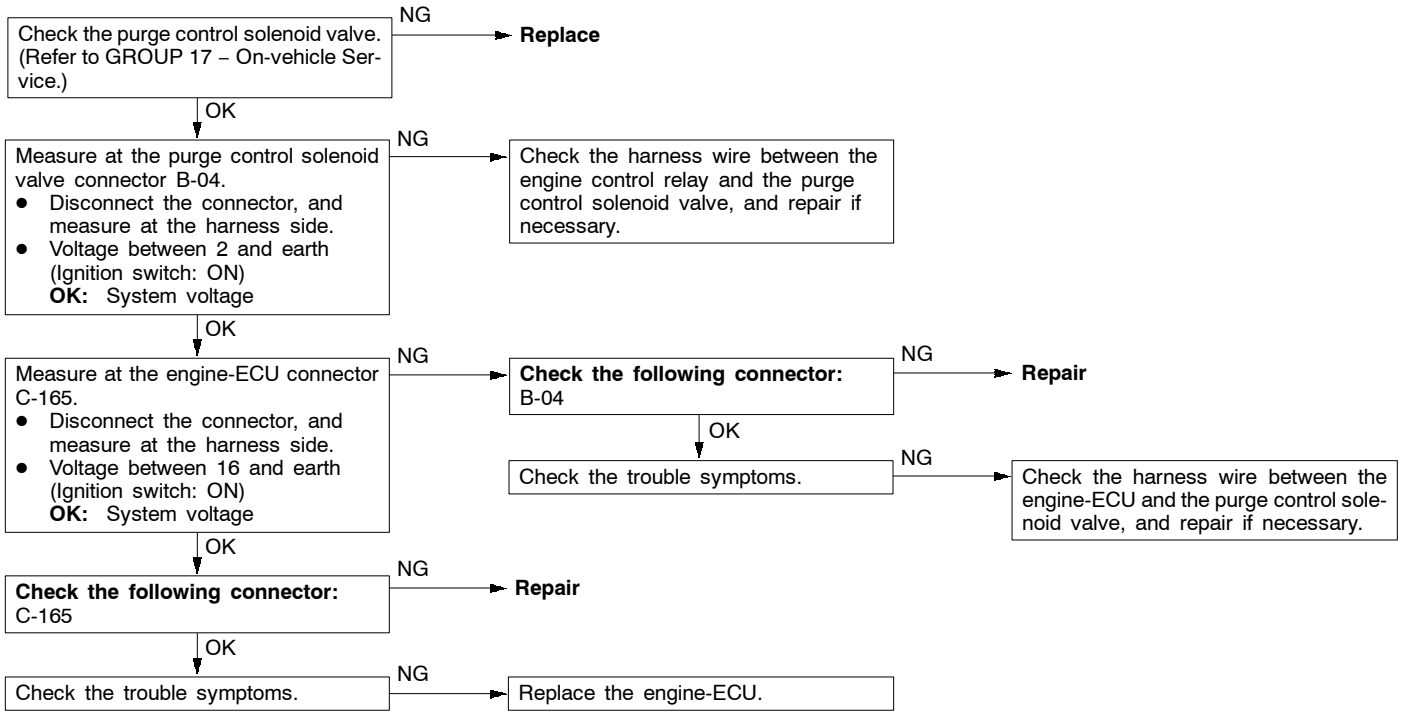
INSPECTION PROCEDURE 31

EGR valve (stepper motor) system	Probable cause
The engine-ECU controls the EGR valve (stepper motor) in order to control the amount of exhaust gas mixed in the intake air.	• Malfunction of the EGR valve • Open circuit or short-circuited harness wire in the EGR valve circuit • Malfunction of the engine-ECU



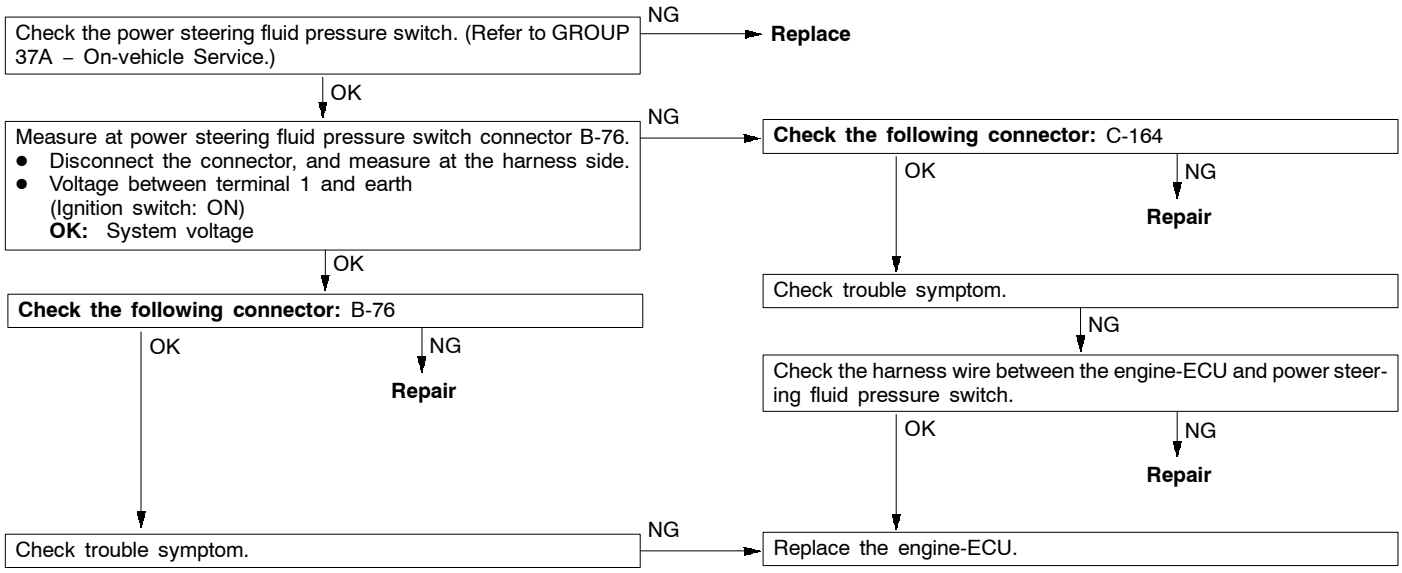
INSPECTION PROCEDURE 32

Purge control solenoid valve system	Probable cause
The engine-ECU controls the purge control solenoid valve in order to control the purge air coming from the canister.	• Malfunction of the purge control solenoid valve • Open circuit or short-circuited harness wire in the purge control solenoid valve circuit • Malfunction of the engine-ECU



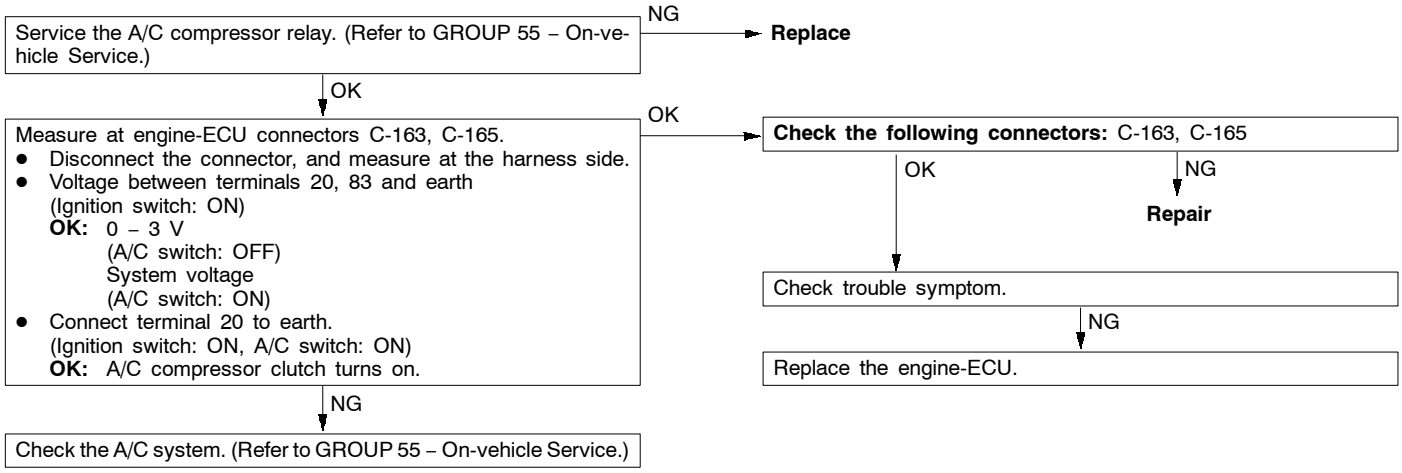
INSPECTION PROCEDURE 33

Power steering fluid pressure switch system	Probable cause
The power steering fluid pressure switch sends a signal to the engine-ECU according to power steering load. Based on this signal, the engine-ECU controls the throttle control servo so that idle speed increases when the power steering is in operation.	• Malfunction of the power steering fluid pressure switch • Open circuit or short-circuited harness wire in the power steering fluid pressure switch circuit, or poor connector contact • Malfunction of the engine-ECU



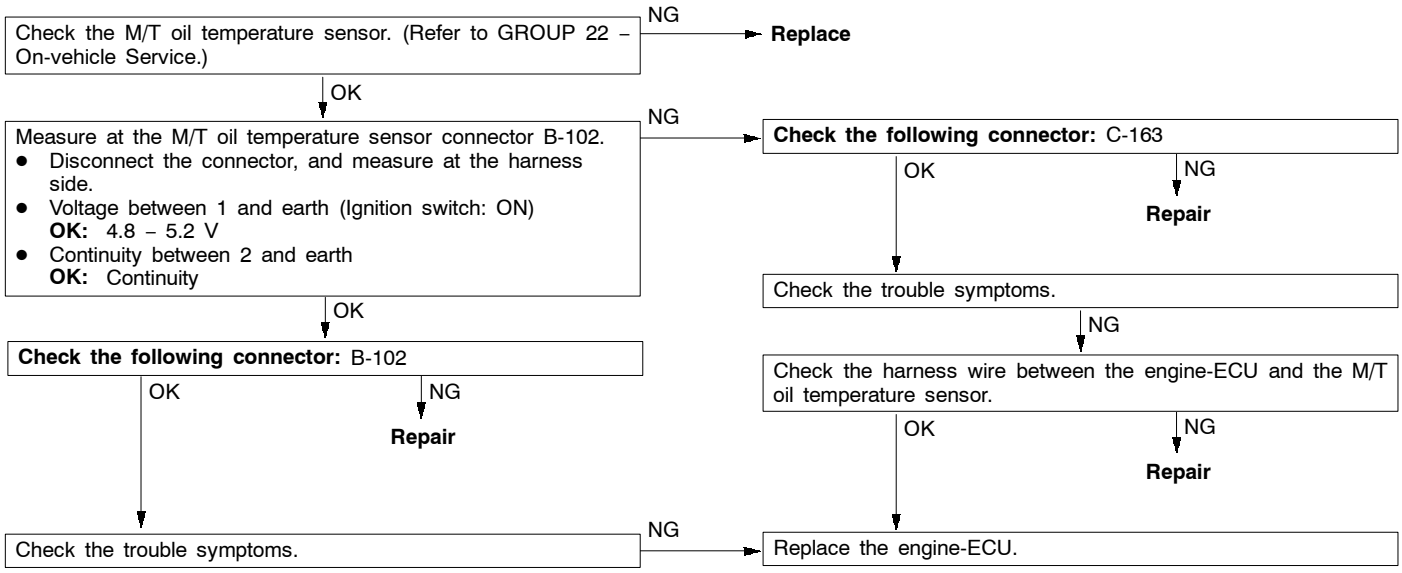
INSPECTION PROCEDURE 34

A/C switch and A/C relay system	Probable cause
If the engine-ECU receives a 'A/C on' signal, it operates the throttle control servo and A/C compressor magnetic clutch so that idle speed increases.	• Malfunction of the A/C control system • Malfunction of the A/C switch • Open circuit or short-circuited harness wire in the A/C switch circuit, or poor connector contact • Malfunction of the engine-ECU



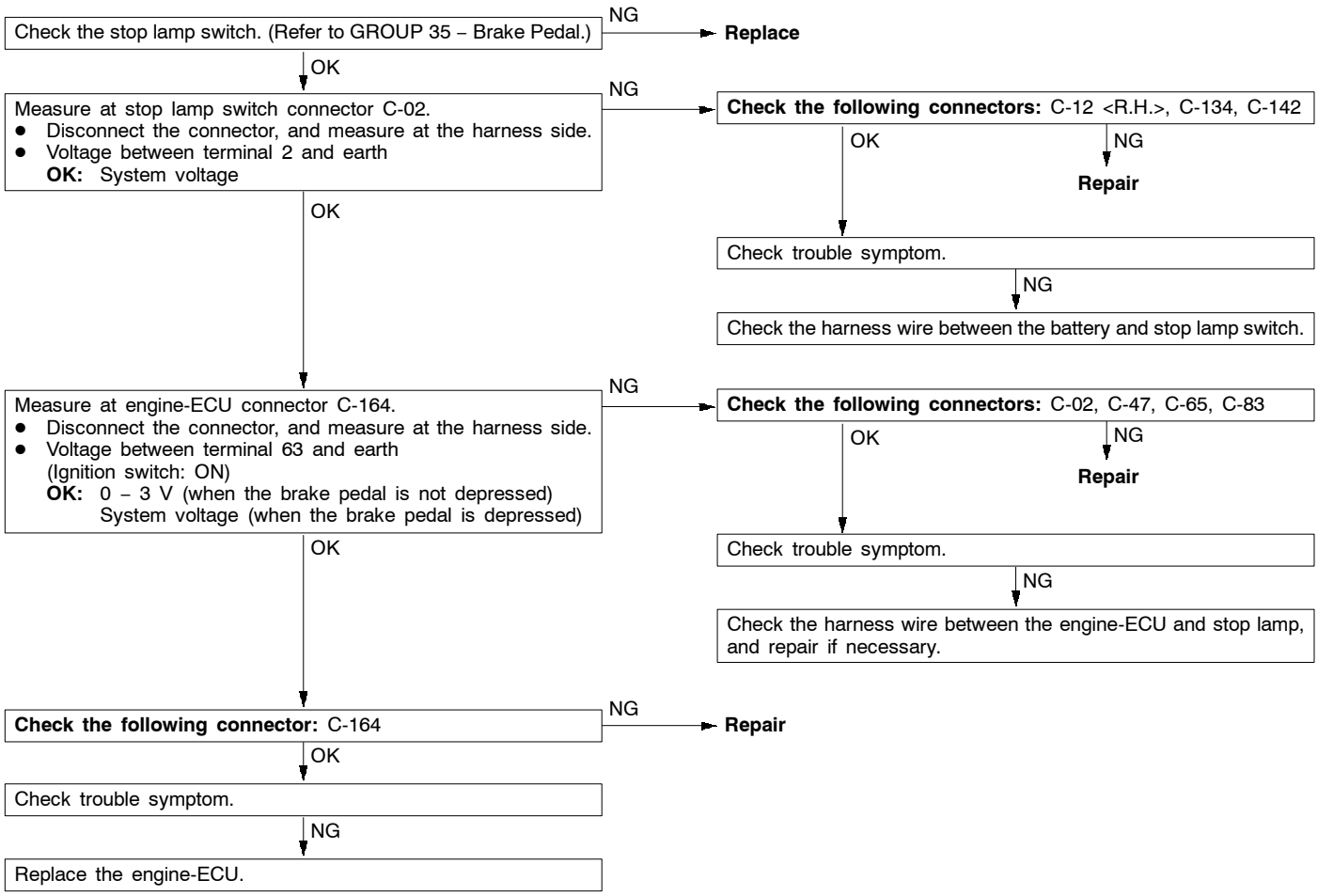
INSPECTION PROCEDURE 35

M/T oil temperature sensor system	Probable cause
This sensor inputs the manual transmission oil temperature to the engine-ECU. The engine-ECU uses this input to control the throttle valve control servo so that the idle speed is increased when the manual transmission oil temperature becomes low.	• Malfunction of the M/T oil temperature sensor • Open circuit or short-circuited harness wire in the M/T oil temperature sensor circuit • Malfunction of the engine-ECU



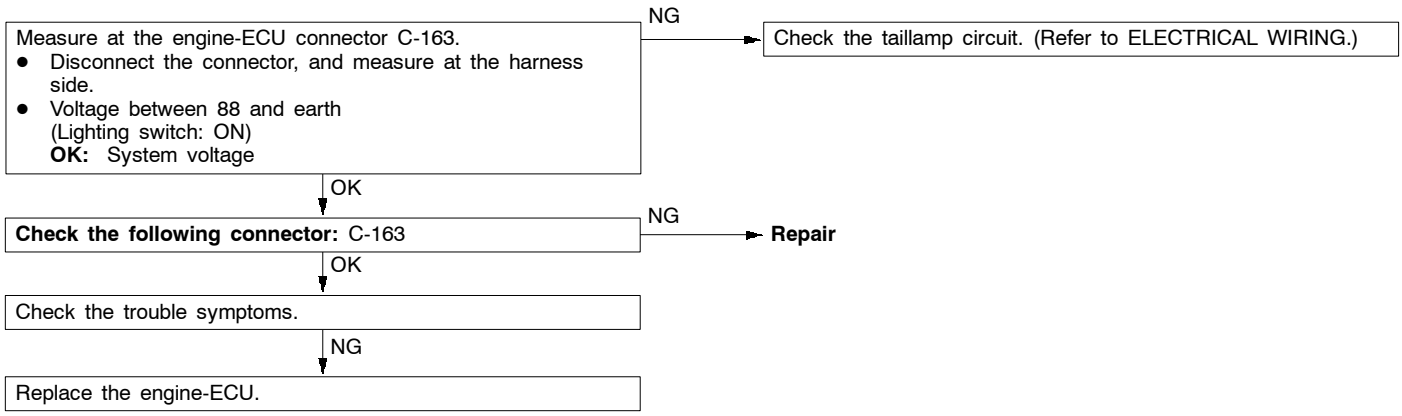
INSPECTION PROCEDURE 36

Stop lamp switch system	Probable cause
The engine-ECU determines whether the brake pedal is depressed or not, by means of the stop lamp switch input signal.	• Malfunction of the stop lamp switch • Open circuit or short-circuited harness wire in the stop lamp circuit, or poor connector contact • Malfunction of the engine-ECU



INSPECTION PROCEDURE 37

Small lamp switch	Probable cause
The engine-ECU determines whether the small lamp switch is on or off. According to that information, the engine-ECU controls alternator output current when the vehicle is started.	• Improper connector contact, open circuit or short-circuited harness wire in the taillamp circuit • Malfunction of the engine-ECU



DATA LIST REFERENCE TABLE

Caution
When shifting the select lever to D range, the brakes should be applied so that the vehicle does not move forward.

NOTE
*1: Within four minutes after starting the engine
*2: Transmission oil temperature is 50 °C or more
*3: In a new vehicle [driven approximately 500 km or less], the injector drive time is sometimes 10% longer than the standard time.
*4: The accelerator pedal position switch normally turns off when the voltage of the accelerator pedal position sensor (1st channel) is 300 – 500 mV higher than the voltage at the idle position. If the accelerator pedal position switch turns back on after the accelerator pedal position sensor voltage has risen by 500 mV and the throttle valve has opened, the accelerator pedal position switch and the accelerator pedal position sensor (1st channel) need to be adjusted.

Item No.	Check items	Requirements		Normal condition	Inspection procedure No.	Reference page
11	Oxygen sensor	Engine: After warm-up	Idling	0 mV *1	Code No.11	13I-14
			Sudden racing	600 – 1,000 mV		
			2,500 r/min	400 mV or less and 600 – 1,000 mV alternates.		
12	Air flow sensor	• Engine coolant temperature: 80 – 95°C • Lamps, electric cooling fan and all accessories: OFF • Transmission: Neutral (A/T: P range)	Idling	20 – 55 Hz	–	–
			2,500 r/min	70 – 90 Hz		
			Racing	Frequency increases in response to racing.		
13	Intake air temperature sensor	Ignition switch: ON	Intake air temperature: –20°C	–20°C	Code No.13	13I-16
			Intake air temperature: 0°C	0°C		
			Intake air temperature: 20°C	20°C		
			Intake air temperature: 40°C	40°C		
			Intake air temperature: 80°C	80°C		

Item No.	Check items	Requirements		Normal condition	Inspection procedure No.	Reference page
14	Throttle position sensor (2nd channel)	• Engine coolant temperature: 80 – 95°C • Ignition switch: ON (Engine stopped)	Release the accelerator pedal.	4,500 – 5,500 mV	Code No.14	13I-17
			Depress the accelerator pedal gradually.	Voltage decreases in response to the pedal depression.		
			Depress the accelerator pedal fully.	400 – 600 mV		
16	Power supply voltage	Ignition switch: ON		System voltage	Procedure No.25	13I-65
18	Cranking signal (Ignition switch – ST)	Transmission: Neutral (A/T: P range)	Engine: Stopped	OFF	Procedure No.27 <M/T> Procedure No.28 <A/T>	13I-66 <M/T> 13I-67 <A/T>
			Engine: Cranking	ON		
21	Engine coolant temperature sensor	Ignition switch: ON	Engine coolant temperature: –20°C	–20°C	Code No.21	13I-18
			Engine coolant temperature: 0°C	0°C		
			Engine coolant temperature: 20°C	20°C		
			Engine coolant temperature: 40°C	40°C		
			Engine coolant temperature: 80°C	80°C		
22	Crank angle sensor	• Engine: cranking • Tachometer: Connected	Compare the engine speed readings on the tachometer and the MUT-II.	Accord	–	–
		• Engine: Idling • Accelerator pedal position switch: ON	Engine coolant temperature: –20°C	1,300 – 1,500 r/min		
			Engine coolant temperature: 0°C	1,200 – 1,400 r/min		
			Engine coolant temperature: 20°C	1,050 – 1,250 r/min		
			Engine coolant temperature: 40°C	850 – 1,050 r/min		
			Engine coolant temperature: 80°C	500 – 700 r/min <M/T>*1,*2 550 – 750 r/min <A/T>*1		

Item No.	Check items	Requirements		Normal condition	Inspection procedure No.	Reference page
25	Barometric pressure sensor	Ignition switch: ON	Altitude: 0 m	101 kPa	Code No.25	13I-22
			Altitude: 600 m	95 kPa		
			Altitude: 1,200 m	88 kPa		
			Altitude: 1,800 m	81 kPa		
26	Accelerator pedal position switch	Ignition switch: ON (Depress and release the accelerator pedal several times)	Release the accelerator pedal.	ON	Procedure No.29	13I-68
			Depress the accelerator pedal slightly.	OFF		
27	Power steering fluid pressure switch	Engine: Idling	Steering wheel stationary	OFF	Procedure No.33	13I-72
			Steering wheel turning	ON		
28	A/C switch	Engine: Idling (The A/C compressor is running when the A/C switch is on.)	A/C switch: OFF	OFF	Procedure No.34	13I-72
			A/C switch: ON	ON		
29	Inhibitor switch	Ignition switch: ON	Selector lever: P or N	P, N	Procedure No.28	13I-67
			Selector lever: D, 2, L or R	D, 2, L, R		
31	Small lamp switch	Engine: Idling	Lighting switch: OFF	OFF	Procedure No.37	13I-75
			Lighting switch: ON	ON		
34	Air flow sensor reset signal	Engine: After having warmed up	Engine is idling	ON	Code No.12	13I-15
			3,000 r/min	OFF		
37	Volumetric efficiency	• Engine coolant temperature: 80 – 95°C • Lamps, electric cooling fan and all accessories: OFF • Transmission: Neutral (A/T: P range)	Engine is idling	15 – 35%	–	–
			2,500 r/min	15 – 35%		
			Engine is suddenly raced	Volumetric efficiency increases in response to racing		
38	Crank angle sensor	• Engine: Cranking [reading is possible at 2,000 r/min or less] • Tachometer: Connected		Engine speeds displayed on the MUT-II and tachometer are identical.	–	–

Item No.	Check items	Requirements		Normal condition	Inspection procedure No.	Reference page
41	Injector drive time *2	• Engine coolant temperature: 80 – 95°C • Lamps, electric cooling fan and all accessories: OFF • Transmission: Neutral (A/T: P range)	Idling	0.4 – 0.6 ms*1	–	–
			2,500 r/min	0.4 – 0.8 ms		
			Sudden racing	Increases		
44	Ignition advance	• Engine: After warm-up • Set a timing light.	Idling	15 – 25°BTDC *1	Code No.44	13I-26
			2,500 r/min	25 – 35°BTDC		
48	M/T oil temperature sensor	Drive after the engine has warmed up.	Drive for 15 minutes or more.	Gradually increases to 50 – 90°C.	Procedure No.35	13I-73
49	A/C relay	Engine: After warm-up, idling	A/C switch: OFF	OFF (compressor clutch is not operating)	Procedure No.34	13I-72
			A/C switch: ON	ON (compressor clutch is operating)		
59	Oxygen sensor (rear)	• Transmission: 2nd gear <M/T>, L range <A/T> • Drive with throttle widely open	3,500 r/min	600 – 1,000 mV	Code No.59	13I-30
66	Brake vacuum sensor	• Engine coolant temperature: 80 – 95°C • Lamps, electric cooling fan and all accessories: OFF • Transmission: Neutral (A/T: P range)	Stop the engine from idling speed, and then depress the brake pedal several times with the ignition switch on.	Displayed pressure increases.	Code No.66	13I-32
67	Stop lamp switch	Ignition switch: ON	Brake pedal: Depressed	OFF	Procedure No.36	13I-74
			Brake pedal: Released	ON		

Item No.	Check items	Requirements		Normal condition	Inspection procedure No.	Reference page
68	EGR valve	• Engine coolant temperature: 80 – 95°C • Lamps, electric cooling fan and all accessories: OFF • Transmission: Neutral	Idling	0 – 15 STEP	Procedure No.31	13I-70
			2,500 r/min	0 – 10 STEP		
74	Fuel pressure sensor	• Engine coolant temperature: 80 – 95°C • Lamps, electric cooling fan and all accessories: OFF • Transmission: Neutral (A/T: P range)	Leave the engine running at the idle speed for more than three minutes	4 – 6.9 MPa	Code No.56	13I-28
77	Accelerator pedal position sensor (2nd channel)	Ignition switch: ON	Release the accelerator pedal.	935 – 1,135 mV	Code No.77	13I-33
			Depress the accelerator pedal gradually.	Increases in response to the pedal depression stroke.		
			Depress the accelerator pedal fully.	4,000 mV or more		
78	Accelerator pedal position sensor (1st channel*3)	Ignition switch: ON	Release the accelerator pedal.	935 – 1,135 mV	Code No.78	13I-34
			Depress the accelerator pedal gradually.	Increases in response to pedal depression stroke.		
			Depress the accelerator pedal fully.	4,000 mV or more		

Item No.	Check items	Requirements		Normal condition	Inspection procedure No.	Reference page
79	Throttle position sensor (1st channel)	• Engine coolant temperature: 80 – 95°C • Ignition switch: ON (Engine stopped)	Release the accelerator pedal.	450 – 800 mV	Code No.79	13I-35
			Depress the accelerator pedal gradually.	Increases in response to pedal depression stroke.		
			Depress the accelerator pedal fully	4,200 – 4,900 mV		
		Engine: After warm-up, idling	No load	450 – 1,000 mV		
			A/C switch: OFF → ON	Increases by 100 – 600 mV.		
			Selector lever: N → D range	Increases by 0 – 200 mV.		
99	Fuel injection mode	Engine: After warm up	Idling (for several minutes after engine start)	Lean compression	–	–
			2,500 r/min	Stoichio metric feedback		
			Sudden racing after idle position	Open loop		

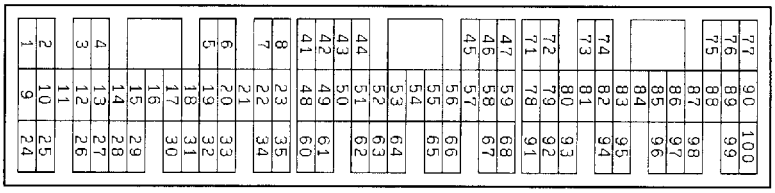
ACTUATOR TEST REFERENCE TABLE

Item No.	Inspection item	Drive contents	Inspection contents	Normal condition	Inspection procedure No.	Reference page
01	Injectors	Cut fuel to No. 1 injector	Engine: After having warmed up/Engine is idling (Cut the fuel supply to each injector in turn and check cylinders which don't affect idling.)	Idling condition becomes different (becomes unstable).	Code No. 41	13I-24
02		Cut fuel to No. 2 injector				
03		Cut fuel to No. 3 injector				
04		Cut fuel to No. 4 injector				
07	Fuel pump (low pressure)	Fuel pump operates and fuel is recirculated.	Ignition switch: ON	Sound of operation is heard.	Procedure No. 30	13I-69
08	Purge control solenoid valve	Solenoid valve turns from OFF to ON.	Ignition switch: ON	Sound of operation can be heard when solenoid valve is driven.	Procedure No. 32	13I-71
17	Basic ignition timing	Set the engine-ECU to ignition timing adjustment mode	Idling after engine warm up	5°BTDC	–	–
21	Fan controller	Drive the fan motor	Ignition switch: ON	The fan motor operates	Procedure No.21	13I-62
34	Electronic-controlled throttle valve system	Close the throttle valve fully	Ignition switch: ON	Operation sound can be heard	Code No.91	13I-36

CHECK AT THE ENGINE-ECU TERMINALS

TERMINAL VOLTAGE CHECK CHART

Engine-ECU Connector Terminal Arrangement



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Terminal No.	Check item	Check requirements (engine condition)	Normal condition
1	No.1 injector	Engine: Warm up, and then depress the accelerator pedal suddenly from the idle speed.	Decreases slightly for short time from 9 – 13 V.
9	No.2 injector		
24	No.3 injector		
2	No.4 injector		
3	No.1 ignition coil	Engine: 3,000 r/min	0.1 – 2.0 V
13	No.2 ignition coil		
12	No.3 ignition coil		
4	No.4 ignition coil		
5	EGR valve (D)	Ignition switch: Immediately after turning ON	5 – 8 V (fluctuates for approx. three seconds)
6	EGR valve (C)		
32	EGR valve (B)		
34	EGR valve (A)		
8	Alternator G terminal	• Engine: Warm up, and then idling • Radiator fan: not operating • Headlamp: OFF → ON • Stop lamp: OFF → ON • Rear defogger switch: OFF → ON	Voltage increases by 0.2 – 3.5 V
52	Alternator FR terminal	• Engine: Warm up, and then idling • Radiator fan: not operating • Headlamp: OFF → ON • Stop lamp: OFF → ON • Rear defogger: OFF → ON	Voltage decreases
14	GDI ECO indication lamp	Constant speed driving at 40 km/h	0 – 3 V
		Engine: Depress the accelerator pedal suddenly from the idle speed.	System voltage

Terminal No.	Check item	Check requirements (engine condition)		Normal condition
16	Purge control solenoid valve	• Engine coolant temperature: 80 – 95°C • Ignition switch: ON	Engine: stopped	System voltage
			Engine: Start the engine, and then increase engine speed up to 3,500 r/min.	Voltage decreases.
18	Fan controller	Radiator and condenser fans are not operating.		0 – 0.3 V
		Radiator and condenser fans are operating.		0.7 V or more
20	A/C relay	• Engine: idling • A/C switch: OFF → ON (Compressor is operating)		System voltage, or changes from momentarily 6 V or more to 0 → 3 V
21	Fuel pump relay	Ignition switch: ON	Engine: stopped	System voltage
			Engine: Idling	0 – 3 V
31	Engine warning lamp	Ignition switch: OFF → ON		0 – 3 V → System voltage (after several seconds)
41	Sensor power supply	Ignition switch: ON		4.5 – 5.5 V
42	Power supply to accelerator pedal position sensor (1st channel)	Ignition switch: ON		4.5 – 5.5 V
43	Crank angle sensor	Engine: Cranking		0.4 – 4.0 V
		Engine: Idling		1.5 – 2.5 V
44	Engine coolant temperature sensor	Ignition switch: ON	Engine coolant temperature: 0°C	3.2 – 3.8 V
			Engine coolant temperature: 20°C	2.3 – 2.9 V
			Engine coolant temperature: 40°C	1.3 – 1.9 V
			Engine coolant temperature: 80°C	0.3 – 0.9 V
45	Tachometer output	Engine: 3,000 r/min		2.0 – 9.0 V
47	Power supply	Ignition switch: ON		System voltage
59				
50	Camshaft position sensor	Engine: Cranking		0.3 – 3.0 V
		Engine: Idling		0.5 – 3.5 V
51	Barometric pressure sensor	Ignition switch: ON	Altitude: 0 m	3.7 – 4.3 V
			Altitude: 1,200 m	3.2 – 3.8 V

Terminal No.	Check item	Check requirements (engine condition)		Normal condition
53	Oxygen sensor (rear)	• Transmission: 2nd gear <M/T>, L range <A/T> • Engine speed: 3,500 r/min or more • Driving with the throttle valve widely open		0.6 – 1.0 V
54	Power steering fluid pressure switch	Engine: Warm up, and then idling	Steering wheel stationary	System voltage
			Steering wheel turning	0 – 3 V
55	Injector driver relay	Ignition switch: OFF		0 – 0.1 V
		Ignition switch: ON		0.5 – 1.0 V
56	Throttle valve control servo relay	Ignition switch: OFF		0 – 0.3 V
		Ignition switch: ON		0.5 – 1.0 V
57	Engine control relay	Ignition switch: OFF		0 – 3 V
		Ignition switch: ON		System voltage
60	Back-up power source	Ignition switch: OFF		System voltage
61	Air flow sensor	Engine: Idling		2.2 – 3.2 V
		Engine: 2,500 r/min		
62	Intake air temperature sensor	Ignition switch: ON	Intake air temperature: 0°C	3.2 – 3.8 V
			Intake air temperature: 20°C	2.3 – 2.9 V
			Intake air temperature: 40°C	1.5 – 2.1 V
			Intake air temperature: 80°C	0.4 – 1.0 V
63	Stop lamp switch	Depress the brake pedal.		System voltage
		Release the brake pedal.		0 – 3 V
64	A/C pressure sensor	Engine: Idling	Set the A/C switch to MAX. COOL (under high load)	8 V or more
			Set the A/C switch to MAX. HOT (under low load)	4 V or less
66	Clutch switch <M/T>	Depress the clutch pedal		0 – 3 V
		Release the clutch pedal		System voltage

Terminal No.	Check item	Check requirements (engine condition)		Normal condition
67	Inhibitor switch <A/T>	Ignition switch: ON	Selector lever: P or N range	0 – 3 V
			Selector lever: Other than P or N range	8 – 14 V
68	Ignition switch – ST	Engine: Cranking		8 V or more
71	Oxygen sensor (front)	Engine: Warm up, and then hold the engine speed at 2,500 r/min (Use a digital voltmeter).		0 ↔ 0.8 V alternates.
73	M/T oil temperature sensor <M/T>	M/T oil temperature: 25°C		2.4 – 2.7 V
		M/T oil temperature: 80°C		0.5 – 0.8 V
74	Brake vacuum sensor	Engine: Stop the engine from idle speed, turn the ignition switch ON, and then depress the brake pedal several times.		Voltage increases
76	Air flow sensor reset signal	Engine: idling		0 – 1 V
		Engine: 3,000 r/min		6 – 9 V
78	Throttle position sensor (2nd channel)	Ignition switch: ON	Release the accelerator pedal.	4.5 – 5.5 V
			Depress the accelerator pedal fully.	0.4 – 0.6 V
79	Accelerator pedal position switch	Ignition switch: ON	Release the accelerator pedal.	0 – 1 V
			Depress the accelerator pedal slightly.	4 V or more
80	Vehicle speed sensor	• Ignition switch: ON • Move the vehicle forward.		0 V ↔ system voltage alternates.
83	A/C switch	Engine: idling	A/C switch: OFF	0 – 3 V
			A/C switch: ON (Compressor is operating)	System voltage
88	Small lamp switch	Lighting switch: OFF		0 – 3 V
		Lighting switch: ON (Taillamp: ON)		System voltage
89	Oxygen sensor (front) heater	Engine: idling		0 – 3 V
		Engine: 3,500 r/min		System voltage
92	Fuel pressure sensor	Engine: Idling		0.3 – 4.7 V

Terminal No.	Check item	Check requirements (engine condition)		Normal condition
94	Accelerator pedal position sensor 1	Ignition switch: ON	Release the accelerator pedal.	0.9 – 1.2 V
			Depress the accelerator pedal fully.	4 V or more
96	Injector open circuit check signal	Engine: Increase engine speed from idle speed to 4,000 r/min.		Decreases slightly (approx.0.7 V) from 4.5 V – 5.0 V.
99	Ignition switch – IG	Ignition switch: ON		System voltage

CHECK CHART FOR RESISTANCE AND CONTINUITY BETWEEN TERMINALS

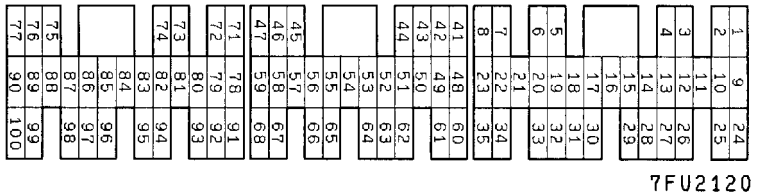
1. Turn the ignition switch to OFF.
2. Disconnect the engine-ECU connector.
3. Measure the resistance and check for continuity between the terminals of the engine-ECU harness-side connector while referring to the check chart.

   NOTE
   (1) When measuring resistance and checking continuity, a harness for checking contact pin pressure should be used instead of inserting a test probe.
   (2) Checking need not be carried out in the order given in the chart.

   Caution
   If the terminals that should be checked are mistaken, or if connector terminals are not correctly shorted to earth, damage may be caused to the vehicle wiring, sensors, engine-ECU and/or ohmmeter.
   Be careful to prevent this!

4. If the ohmmeter shows any deviation from the standard value, check the corresponding sensor, actuator and related electrical wiring, and then repair or replace.
5. After repair or replacement, recheck with the ohmmeter to confirm that the repair or replacement has corrected the problem.

Engine-ECU Harness Side Connector Terminal Arrangement

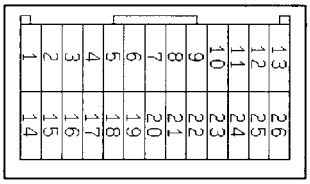


Terminal No.	Check item	Standard value, normal condition (check requirements)
16 – 47	Purge control solenoid valve	36 – 44 Ω (at 20°C)
89 – 47	Oxygen sensor (front) heater	11 – 18 Ω (at 20°C)
46 – Body earth	Earth	Continuity (0 Ω)
58 – Body earth		
5 – 47	EGR valve (B)	15 – 20 Ω (at 20°C)
6 – 47	EGR valve (C)	
32 – 47	EGR valve (B)	
34 – 47	EGR valve (A)	
72 – 79	Accelerator pedal position switch	Continuity (when the accelerator pedal is released)
		No continuity (when the accelerator pedal is slightly depressed)
62 – 72	Intake air temperature sensor	5.3 – 6.7 kΩ (when intake air temperature is 0°C)
		2.3 – 3.0 kΩ (when intake air temperature is 20°C)
		1.0 – 1.5 kΩ (when intake air temperature is 40°C)
		0.30 – 0.42 kΩ (when intake air temperature is 80°C)
44 – 72	Engine coolant temperature sensor	5.1 – 6.5 kΩ (when engine coolant temperature is 0°C)
		2.1 – 2.7 kΩ (when engine coolant temperature is 20°C)
		0.9 – 1.3 kΩ (when engine coolant temperature is 40°C)
		0.26 – 0.36 kΩ (when engine coolant temperature is 80°C)
67 – Body earth	Inhibitor switch <A/T>	Continuity (when the selector lever is at P or N range)
		No continuity (when the selector lever is at a range other than P or N)

CHECK AT THE THROTTLE VALVE CONTROLLER TERMINALS

TERMINAL VOLTAGE CHECK CHART

Throttle Valve Controller Terminal Arrangement



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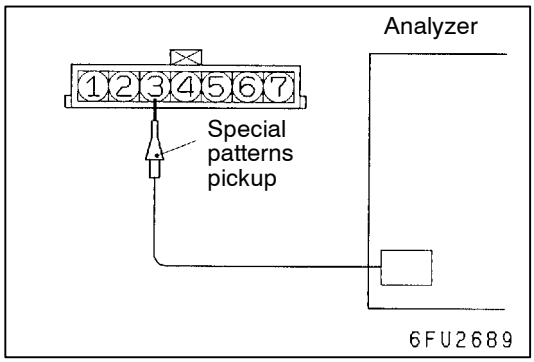
Terminal No.	Check items	Requirements		Normal value
1	Throttle valve control servo (A+)	• Ignition switch: ON • Accelerator pedal: Fully opened → fully closed		Decreases slightly from system voltage.
9	Throttle valve control servo (B+)			
14	Throttle valve control servo (A–)	• Ignition switch: ON • Accelerator pedal: Fully closed → fully opened		Decreases slightly (approx. 2 V) from system voltage.
15	Throttle valve control servo (B–)			
2	Power supply to throttle valve control servo	Ignition switch: ON		System voltage
5	Power supply	Ignition switch: ON		System voltage
6	Sensor voltage	Ignition switch: ON		4.5 – 5.5 V
7	Throttle position sensor (1st channel)	Ignition switch: ON	Release the accelerator pedal.	0.4 – 0.8 V
			Depress the accelerator pedal fully.	4.2 – 4.9 V
20	Accelerator pedal position sensor (2nd channel)	Ignition switch: ON	Release the accelerator pedal.	0.9 – 1.2 V
			Depress the accelerator pedal fully.	4 V or more
22	Ignition switch – IG	Ignition switch: ON		System voltage



INSPECTION PROCEDURE USING AN ANALYZER

AIR FLOW SENSOR (AFS)

Measurement Method

1. Disconnect the air flow sensor connector, and connect the special tool (test harness: MB991709) in between. (All terminals should be connected.)
2. Connect the analyzer special patterns pickup to air flow sensor connector terminal 3.

Alternate Method (Test harness not available)

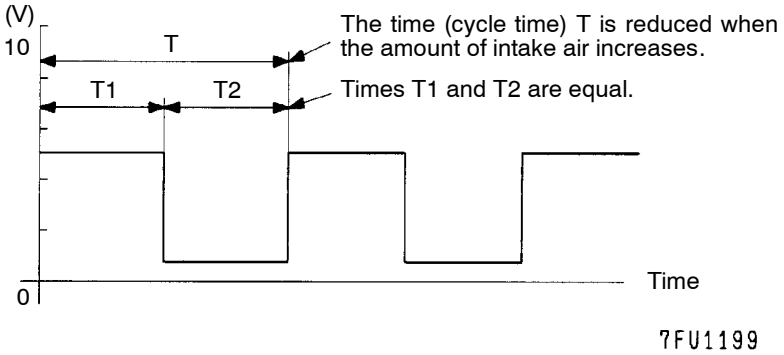
1. Connect the analyzer special patterns pickup to engine-ECU terminal 61.

Standard Wave Pattern

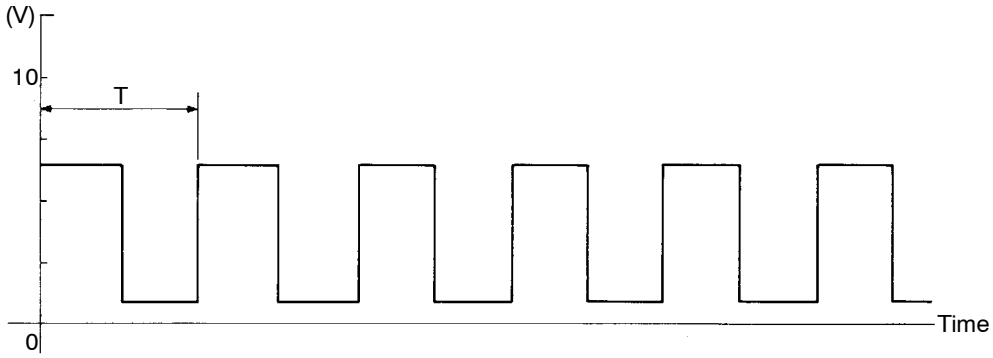
Observation conditions

Function	Special patterns
Pattern height	Low
Pattern selector	Display
Engine r/min	Idle speed

Standard wave pattern

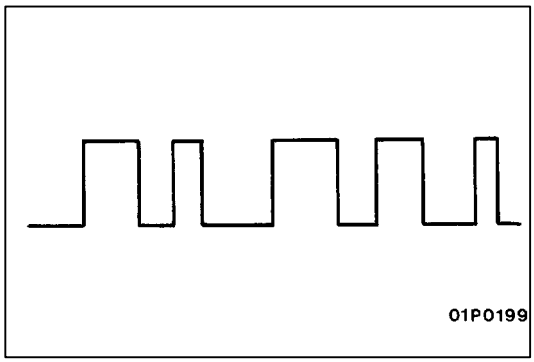


Observation conditions (from conditions above engine speed is increased by racing.)



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.

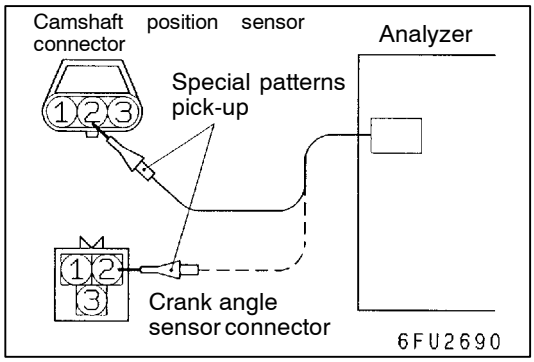
- Example 2

  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.



CAMSHAFT POSITION SENSOR AND CRANK ANGLE SENSOR

Measurement Method

1. Disconnect the camshaft position sensor connector and connect the special tool (test harness: MB991709) in between. (All terminals should be connected.)
2. Connect the analyzer special patterns pickup to camshaft position sensor terminal 2.
3. Disconnect the crank angle sensor connector and connect the special tool (test harness: MD998478) in between.
4. Connect the analyzer special patterns pickup to crank angle sensor terminal 2.

Alternate Method (Test harness not available)

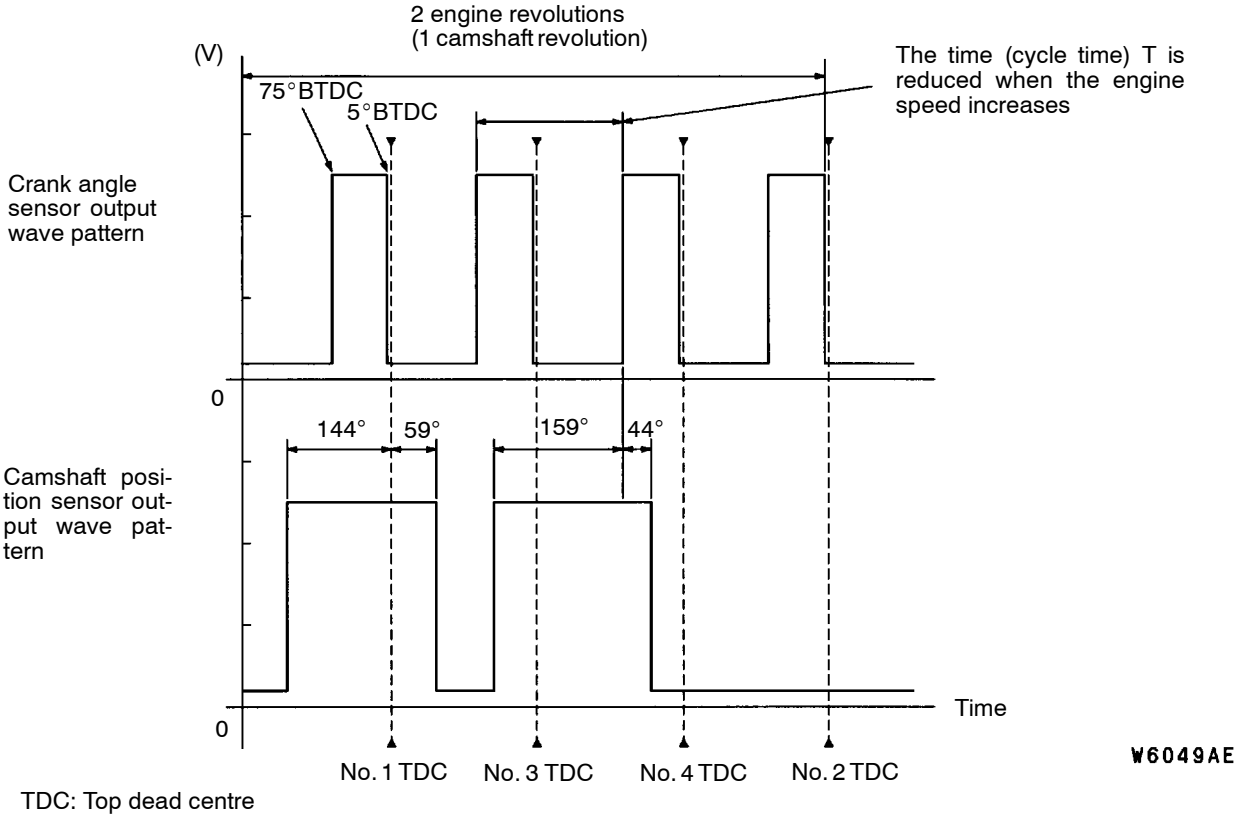
1. Connect the analyzer special patterns pickup to engine-ECU terminal 50. (When checking the camshaft position sensor signal wave pattern.)
2. Connect the analyzer special patterns pickup to engine-ECU terminal 43. (When checking the crank angle sensor signal wave pattern.)

Standard Wave Pattern

Observation conditions

Function	Special patterns
Pattern height	Low
Pattern selector	Display
Engine r/min	Idle speed

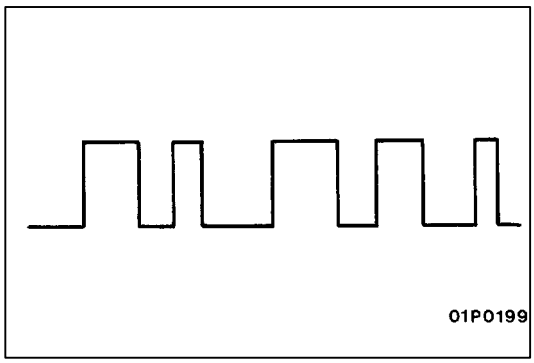
Standard wave pattern



TDC: Top dead centre

Wave Pattern Observation Points

Check that cycle time T becomes shorter when the engine speed increases.



Examples of Abnormal Wave Patterns

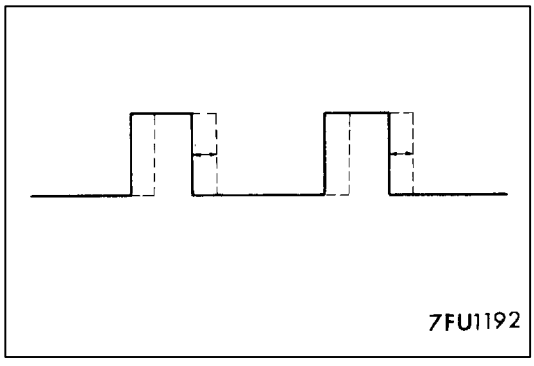
- Example 1

  Cause of problem

  Sensor interface malfunction

  Wave pattern characteristics

  Rectangular wave pattern is output even when the engine is not started.



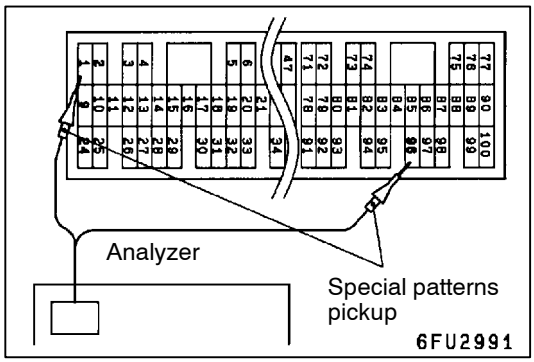
- Example 2

  Cause of problem

  Loose timing belt
  Abnormality in sensor disk

  Wave pattern characteristics

  Wave pattern is displaced to the left or right.



INJECTORS AND INJECTOR OPEN CIRCUIT CHECK SIGNAL

Measurement Method

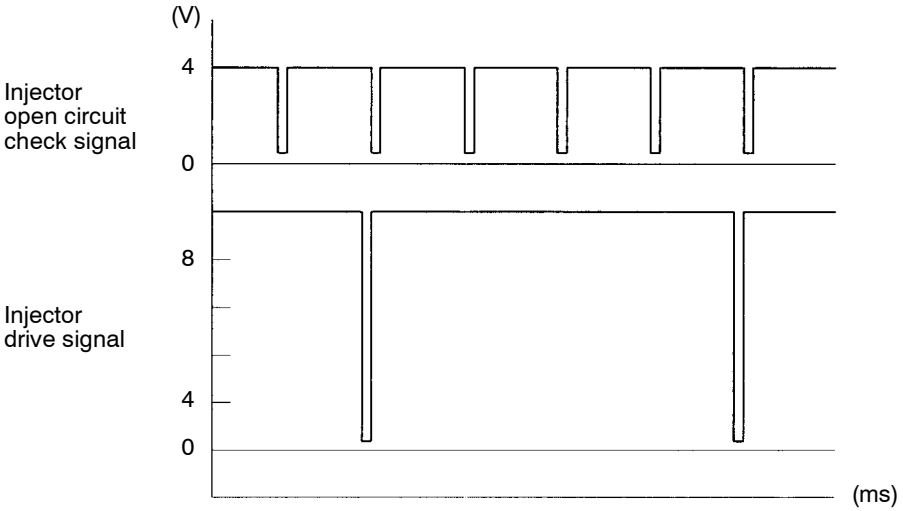
1. Connect the analyzer special patterns pickup to terminal 1 (No.1 injector) of the engine-ECU connector.
2. Connect the analyzer special patterns pickup to terminal 96 (injector open circuit check signal) of the engine-ECU connector.
3. After checking terminal 1 (No.1 injector), check terminal 9 (No.2 injector), terminal 24 (No.3 injector) and terminal 2 (No.4 injector).

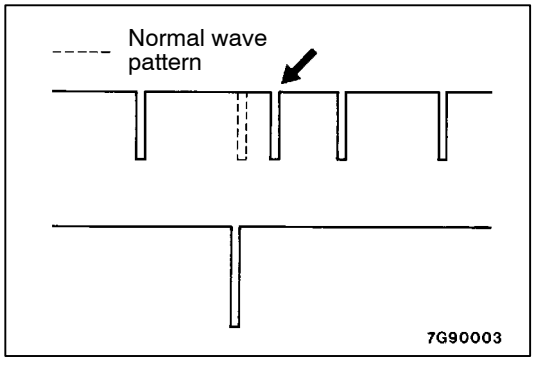
Standard Wave Pattern

Observation conditions

Function	Special pattern
Pattern height	Low
Pattern selector	Display
Engine r/min	Idle speed

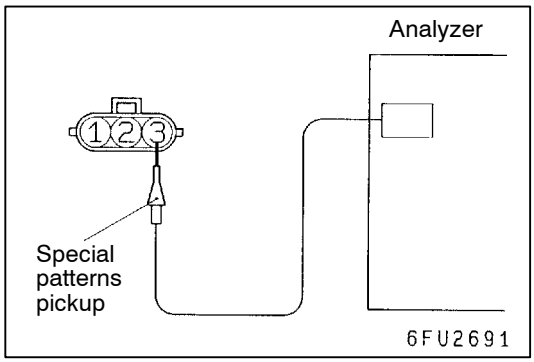
Standard wave pattern





Wave Pattern Observation Points

- Check that the injector drive time is identical to the time displayed on the MUT-II.
- Check that the injector signals become greatly extended but soon return to their normal wave length when the engine is suddenly raced.
- Check that the injector open circuit check signal is synchronized with each rising portion of the injector drive signal.



IGNITION COIL AND POWER TRANSISTOR

Power transistor control signal

Measurement Method

1. Disconnect the ignition coil connector, and connect the special tool (test harness: MB991658) in between. (All terminals should be connected.)
2. Connect the analyzer special patterns pickup to terminal 3 of each ignition coil connector in turn.

Alternate Method (Test harness not available)

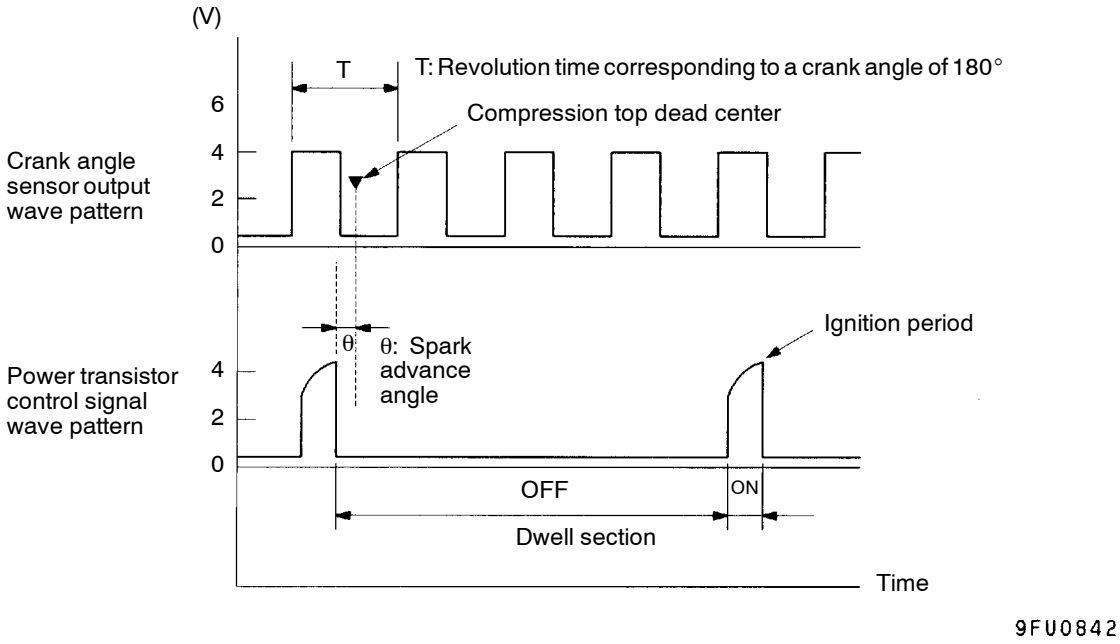
1. Connect the analyzer special patterns pickup to engine-ECU terminal 3 (No. 1 ignition coil), terminal 13 (No. 2 ignition coil), terminal 12 (No. 3 ignition coil), terminal 4 (No. 4 ignition coil) respectively.

Standard Wave Pattern

Observation condition

Function	Special patterns
Pattern height	Low
Pattern selector	Display
Engine r/min	Approx. 1,200 r/min

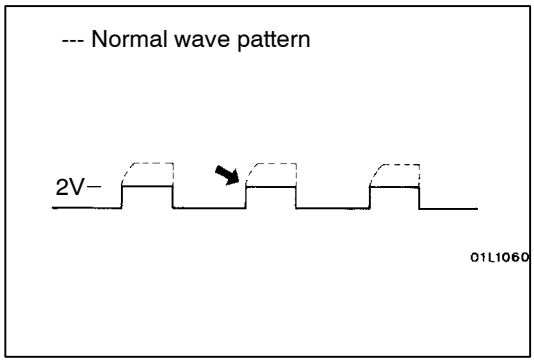
Standard wave pattern

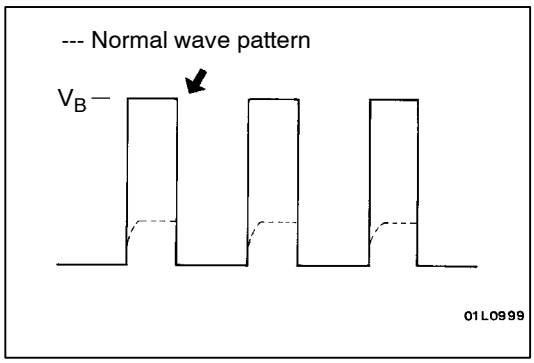


Wave Pattern Observation Points

Point: Condition of wave pattern build-up section and maximum voltage (Refer to abnormal wave pattern examples 1 and 2.)

Condition of wave pattern build-up section and maximum voltage	Probable cause
Rises from approx. 2V to approx. 4.5V at the top-right	Normal
2V rectangular wave	Open-circuit in ignition primary circuit
Rectangular wave at power voltage	Power transistor malfunction





Examples of Abnormal Wave Patterns

- Example 1

  Wave pattern during engine cranking

  Cause of problem

  Open-circuit 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

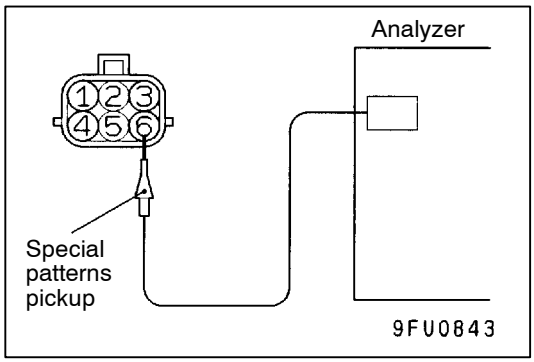
  Wave pattern during engine cranking

  Cause of problem

  Malfunction in power transistor

  Wave pattern characteristics

  Power voltage results when the power transistor is ON.



EGR VALVE (STEPPER MOTOR)

Measurement Method

1. Disconnect the EGR valve connector, and connect the special tool (test harness: MB991658) in between.
2. Connect the analyzer special patterns pickup to the EGR valve-side connector terminal 1, terminal 3, terminal 4 and terminal 6 respectively.

Alternate Method (Test harness not available)

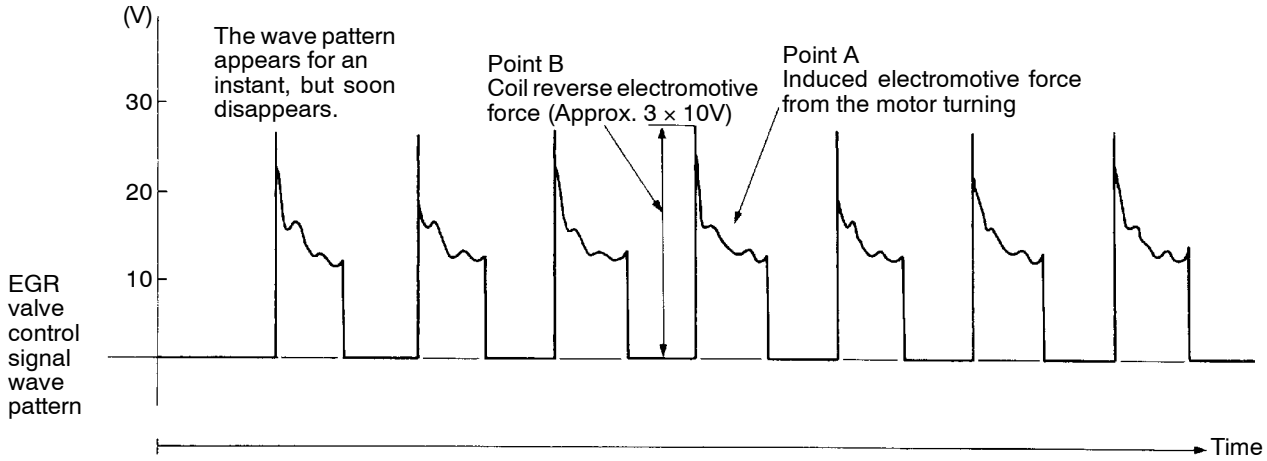
1. Connect the analyzer special patterns pickup to engine-ECU terminal 5, connection terminal 6, connection terminal 32, and connection terminal 34 respectively.

Standard Wave Pattern

Observation conditions

Function	Special patterns
Pattern height	High
Pattern selector	Display
Engine r/min	Racing

Standard wave pattern



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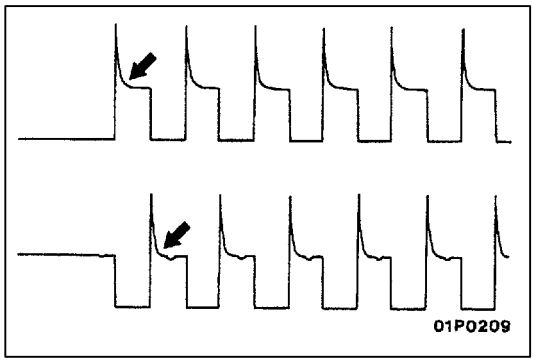
Wave Pattern Observation Points

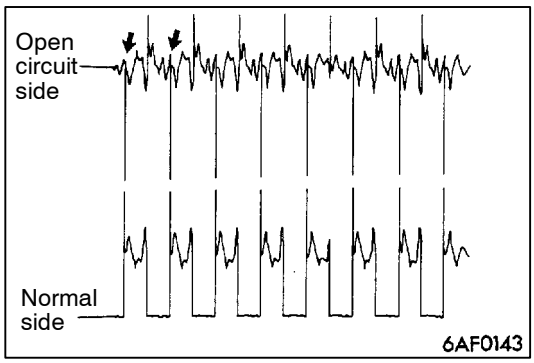
Check that the standard wave pattern appears when the EGR control servo is operating.
Point A: Presence or absence of induced electromotive force from the motor turning. (Refer to the abnormal wave pattern.)

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





Examples of Abnormal Wave Pattern

- Example 1

  Cause of problem

  Motor is malfunctioning. (Motor is not operating.)

  Wave pattern characteristics

  Induced electromotive force from the motor turning does not appear.

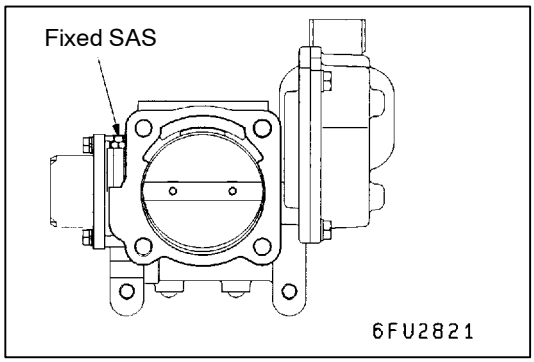
- Example 2

  Cause of problem

  Open circuit in the line between the EGR valve and the engine-ECU

  Wave pattern characteristics

  Current is not supplied to the motor coil on the open circuit side. (Voltage does not drop to 0 V.)
  Furthermore, the induced electromotive force waveform at the normal side is slightly different from the normal waveform.

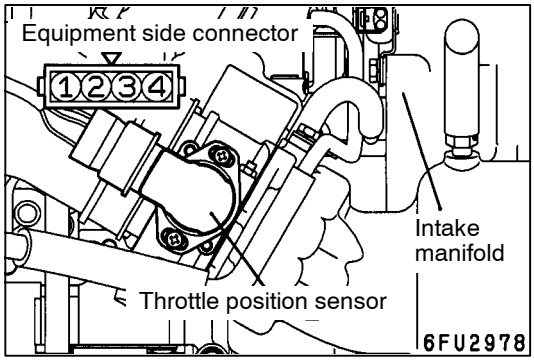


ON-VEHICLE SERVICE

Caution
(1) Never attempt to tamper the fixed SAS. The fixed SAS is precisely adjusted at factory.
(2) Should it be tampered, the full closed position of the throttle valve will be changed. This causes the engine-ECU to learn a wrong position of the throttle valve.

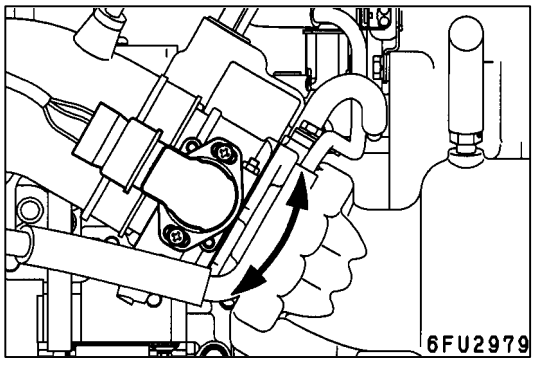
THROTTLE BODY (THROTTLE VALVE ARE) CLEANING

1. Start the engine, and warm it up until engine coolant temperature reaches 80°C. Then stop the engine.
2. Remove the air intake hose at the throttle body side.
3. Apply cleaning agent to the throttle valve through the intake port of the throttle valve, and then leave it for approx. five minutes.
4. Start the engine, race it several times, and then let it run at idle for approx. one minute.
5. If carbon deposits are not removed from the throttle vale area, repeat steps (3) and (4).
6. Install the air intake hose.
7. Use the MUT-II or disconnect the negative battery cable from the battery terminal in order to erase a diagnosis code. Wait for at least ten seconds, and then let the engine run at idle again for approx. ten minutes.



THROTTLE POSITION SENSOR ADJUSTMENT

1. Connect the MUT-II to the diagnosis connector.
2. Disconnect the throttle valve control servo connector.
3. Turn the ignition switch to ON (but do not start the engine).



4. Check the output voltage of the throttle position sensor (1st channel) when the throttle valve is fully closed by your finger.

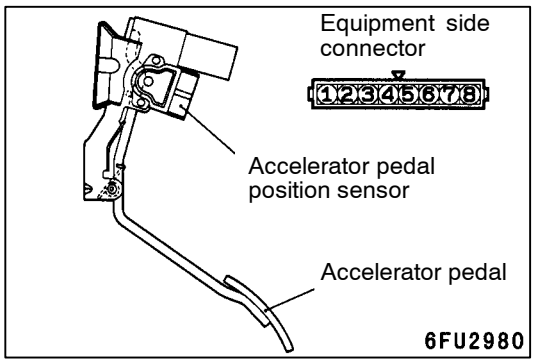
   Standard value: 0.4 – 0.6 V

5. If not within the standard value, loosen the throttle position sensor mounting bolts. Then rotate the sensor body to adjust.

6. Check the output voltage of the throttle position sensor (2nd channel) when the throttle valve is fully closed by your finger.

   Standard value: 4.2 – 4.8 V

7. If not within the standard value, replace the throttle position sensor.
8. Turn the ignition switch to OFF.
9. Reconnect the throttle valve control servo connector.
10. If a diagnosis code is displayed, erase the diagnosis code by using the MUT-II.
11. Remove the MUT-II.



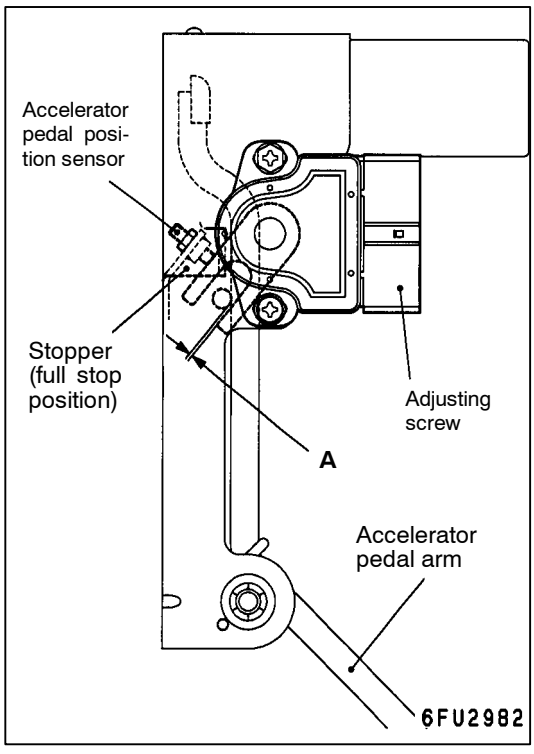
ACCELERATOR PEDAL POSITION SENSOR ADJUSTMENT

Caution

(1) Never attempt to tamper the accelerator pedal position sensor. The sensor position is precisely adjusted at factory.

(2) Should it be tampered, follow the procedure below:

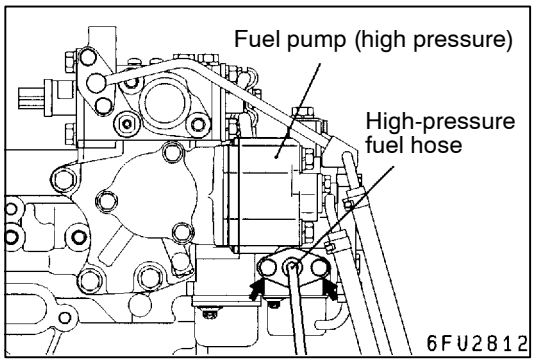
1. Remove the accelerator pedal complete.
2. Connect the MUT-II to the diagnosis connector.
3. Loosen the accelerator pedal position sensor attaching bolts to allow it to be loosely fitted.



4. Ensure that the accelerator pedal arm contacts the full-stop position stopper.
5. Turn the adjusting screw so that clearance “A” is 0.5 – 0.93 mm (Refer to the left figure).
6. Secure the adjusting screw with the lock nut.
7. Turn the ignition switch to the ON position (but do not start the engine).
8. Rotate the accelerator pedal position sensor to adjust sensor output voltage to the standard value.

   Standard value: 0.985 – 1.085 V

9. Tighten the sensor mounting bolts securely.
10. Install the accelerator pedal complete.

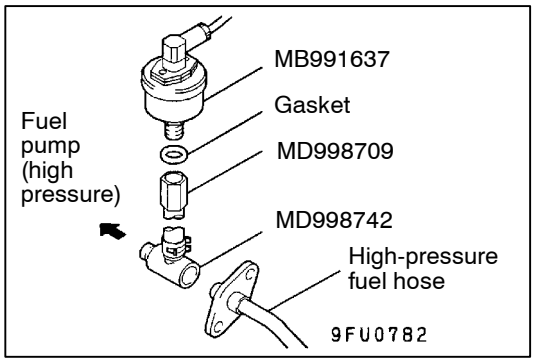


FUEL PRESSURE TEST

MEASUREMENT OF FUEL LOW PRESSURE BETWEEN FUEL PUMP (LOW PRESSURE) AND FUEL PUMP (HIGH PRESSURE)

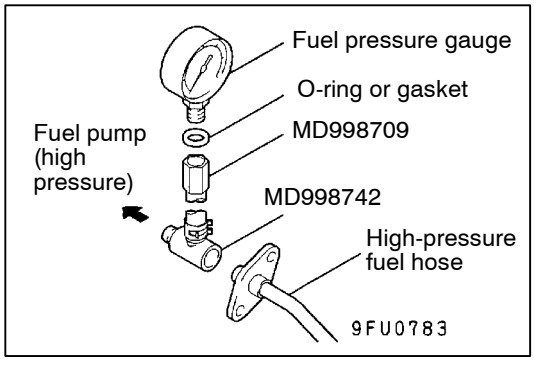
1. Release residual pressure from the fuel pipe line to prevent fuel gush out. (Refer to P.13I-104.)
2. Disconnect the high-pressure fuel hose at the fuel pump (high pressure) side.

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. Remove the union joint and bolt from the special tool (adapter hose) and instead attach the special tool (hose adapter) to the adapter hose.
4. Install the special tool (for measuring the fuel pressure) that was set up in step 3.

<When using the fuel pressure gauge set (special tool)>
(1) Install the special tool (for measuring the fuel pressure) between the high-pressure fuel hose and the fuel pump (high pressure).
(2) Install the fuel pressure gauge set (special tool) on the special tool (for measuring the fuel pressure) putting the gasket between them.
(3) Connect the lead wire of the fuel pressure gauge set (special tool) to the power supply (cigarette lighter socket) and to the MUT-II.



<When using the fuel pressure gauge>
(1) Install the fuel pressure gauge on the special tool (for measuring the fuel pressure) putting a suitable O-ring or gasket between them.
(2) Install the special tool which was set up in step (1) between the high-pressure fuel hose and the fuel pump (high pressure).

5. Connect the MUT-II to the diagnosis connector.
6. Turn the ignition switch to ON. (But do not start the engine.)

7. Select “Item No.07” from the MUT-II Actuator test to drive the fuel pump (low pressure) at the fuel tank side. Check that there are no fuel leaks from any parts.
8. Finish the actuator test or turn the ignition switch to OFF.
9. Start the engine and run at idle.
10. Measure fuel pressure while the engine is running at idle.

    Standard value: approximately 324 kPa

11. Check to see that fuel pressure at idle does not drop even after the engine has been raced several times.
12. If fuel pressure is out of the standard value, troubleshoot and repair according to the table below.

Symptom	Probable cause	Remedy
• Fuel pressure too low • Fuel pressure drops after racing	Clogged fuel filter	Replace fuel filter
	Fuel leaking to return side due to poor fuel pressure regulator (low pressure) valve seating or settled spring	Replace fuel pressure regulator (low pressure)
	Low fuel pump (low pressure) delivery pressure	Replace the fuel pump (low pressure)
Fuel pressure too high	Binding valve in fuel pressure regulator (low pressure)	Replace fuel pressure regulator (low pressure)
	Clogged fuel return hose or pipe	Clean or replace hose or pipe

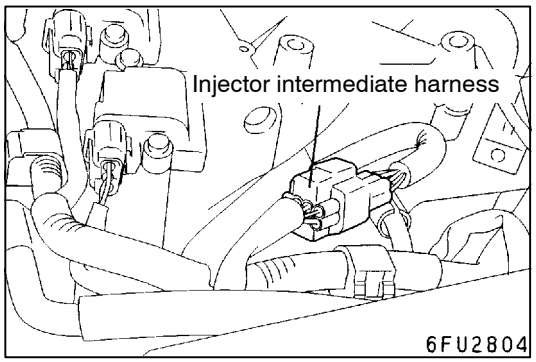
13. Stop the engine and check change of fuel pressure gauge reading. Normal if the reading does not drop within 2 minutes. If it does, observe the rate of drop and troubleshoot and repair according to the table below.

Symptom	Probable cause	Remedy
Fuel pressure drops gradually after engine is stopped	Leaky fuel pressure regulator (low pressure) valve seat	Replace fuel pressure regulator (low pressure)
Fuel pressure drops sharply immediately after engine is stopped	Check valve in fuel pump (low pressure) is held open	Replace the fuel pump (low pressure)

14. Release residual pressure from the fuel pipe line. (Refer to P.13I-104.)
15. Remove the fuel pressure gauge and special tools from the fuel pump (high pressure).

    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.

16. Replace the O-ring at the end of the high-pressure fuel hose with a new one. Furthermore, apply engine oil to the new O-ring before replacement.
17. Fit the high-pressure fuel hose to the fuel pump (high pressure) and tighten the mounting bolt to specified torque.
18. Check for any fuel leaks by following the procedure in step 7.
19. Disconnect the MUT-II.



MEASUREMENT OF FUEL HIGH PRESSURE BETWEEN FUEL PUMP (HIGH PRESSURE) AND INJECTORS

NOTE
Measurement of the fuel pressure between the fuel pump (high pressure) and the injectors should be carried out after checking that the fuel pressure between the fuel pump (low pressure) and the fuel pump (high pressure) is normal.

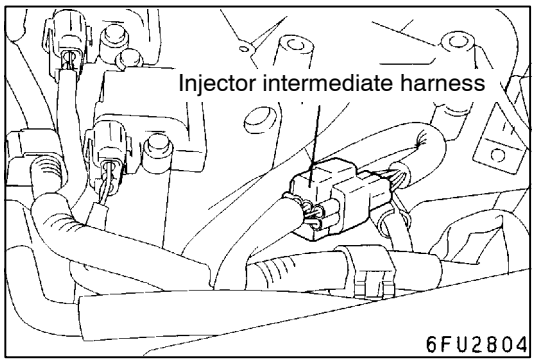
1. Connect the MUT-II to the diagnosis connector.
2. Disconnect the injector intermediate harness connector.
3. Turn the ignition switch to ON.
4. Select "Item No.74" from the MUT-II Data list.
5. Crank the engine continuously for 2 seconds or more, and visually check that there are no fuel leaks from any parts.

   Caution
   If any fuel leaks appear, stop cranking immediately and repair the source of the leak.
6. Check if the fuel pressure is more than 1 MPa immediately after 20 seconds have passed since cranking was finished.
7. If the fuel pressure is lower than 1 MPa, it means that there is likely to be a leak in the high-pressure fuel system, so this system should be checked.
8. Turn the ignition switch to OFF.
9. Connect the injector intermediate harness connector.
10. Start the engine and run at idle.
11. Measure fuel pressure while the engine is running at idle.

    Standard value: 4 – 6.9 MPa
12. Check to see that fuel pressure at idle does not drop even after the engine has been raced several times.
13. If fuel pressure is out of the standard value, troubleshoot and repair according to the table below.

Symptom	Probable cause	Remedy
• Fuel pressure too low • Fuel pressure drops after racing	Fuel leaking to return side due to poor fuel pressure regulator (high pressure) valve seating or settled spring	Replace fuel pressure regulator (high pressure)
	Low fuel pump (high pressure) delivery pressure	Replace the fuel pump (high pressure)
Fuel pressure too high	Binding valve in fuel pressure regulator (high pressure)	Replace fuel pressure regulator (high pressure)
	Clogged fuel return hose or pipe	Clean or replace hose or pipe

14. Stop the engine and turn the ignition switch to OFF.
15. Disconnect the MUT-II.



FUEL LEAK CHECK

1. Connect the MUT-II to the diagnosis connector.
2. Disconnect the injector intermediate harness connector.
3. Turn the ignition switch to ON.
4. Select “Item No.74” from the MUT-II Data list.
5. Crank the engine continuously for two seconds or more, and visually check that there are no fuel leaks from any parts.

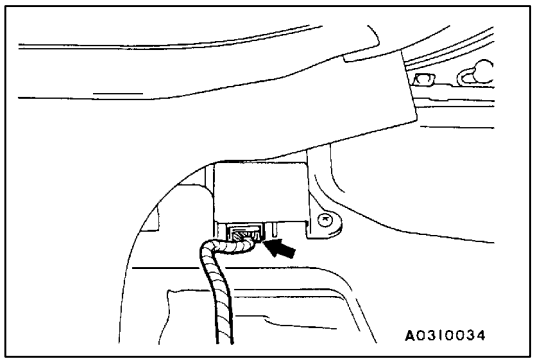
   Caution
   If any fuel leaks appear, stop cranking immediately and repair the source of the leak.

6. Crank the engine, and then measure fuel pressure immediately after 20 seconds.

   Limit: Minimum 1 MPa

   Caution
   If the fuel pressure is less than 1 MPa, there may be a partial fuel leak in the high-pressure fuel system.

7. Turn off the ignition switch.
8. Reconnect the injector intermediate connector.
9. Remove the MUT-II.



FUEL PUMP CONNECTOR DISCONNECTION (HOW TO REDUCE FUEL PRESSURE)

When removing the fuel pipe, hose, etc., since fuel pressure in the fuel pipe line is high, do the following operation so as to release fuel pressure in the line and prevent fuel from running out.

1. Remove the fuel filler cap to release pressure in the fuel tank.
2. Remove the rear seat cushion.
3. Disconnect the fuel wiring harness from the floor wiring harness (RH), which is located under the floor carpet.
4. Connect the MUT-II to the diagnosis connector.

   Caution
   Turn off the ignition switch before disconnecting or connecting the MUT-II.

5. Turn off the ignition switch.
6. Select “Item No.74” from the MUT-II Data list.
7. Crank the engine for at least two seconds.
8. If the engine is not be started, use the MUT-II to make sure that the fuel pressure is 0.5 MPa or less. Then turn off the ignition switch.

9. If the engine is started, release fuel pressure by the following procedure:
   (1) Turn off the ignition switch, and then stop the engine.
   (2) Disconnect one of the ignition coil connectors.
   (3) Crank the engine for at least two seconds.
   (4) If the engine is not be started, use the MUT-II to make sure that the fuel pressure is 0.5 MPa or less. Then turn off the ignition switch.
   (5) If the engine is started, stop it by racing and use the MUT-II to make sure that the fuel pressure is 0.5 MPa or less. Then turn off the ignition switch.
   (6) Reconnect the ignition coil connector.

   Caution
   Clean the spark plug which corresponds to the disconnected ignition coil connector.

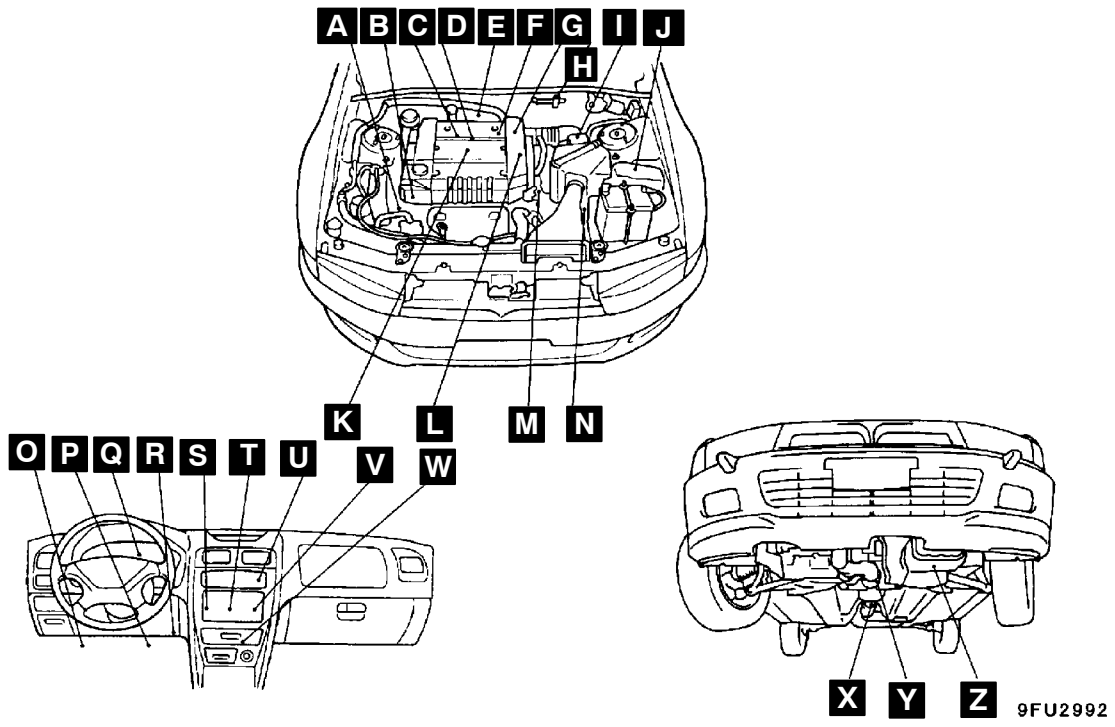
10. Remove the MUT-II.
11. Connect the fuel wiring harness to the floor wiring harness (RH).
12. Install the rear seat cushion.

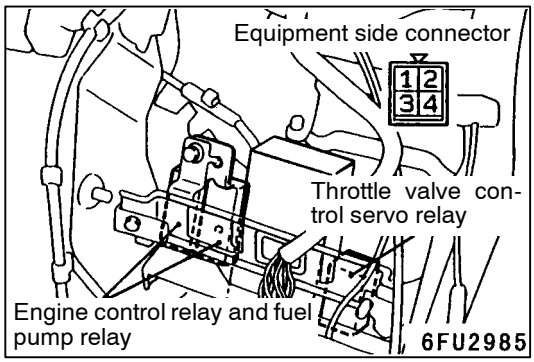
FUEL PUMP OPERATION CHECK

This procedure is the same as for the 4G6-MPI engine.

COMPONENT LOCATION

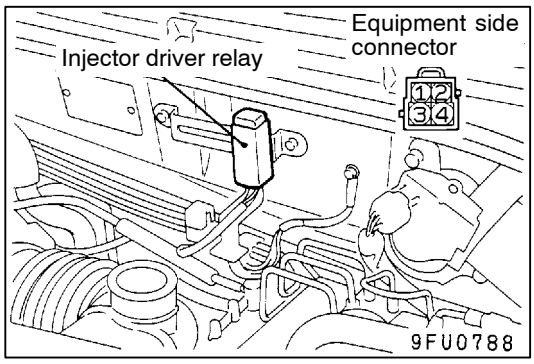
Name	Symbol	Name	Symbol
A/C relay	J	Fuel pressure sensor	L
A/C switch	U	Fuel pump relay	S
		GDI ECO indication lamp	Q
Accelerator pedal position sensor (1st and 2nd channels)	P	Ignition coil	K
		Inhibitor switch <A/T>	N
Air flow sensor (with intake air temperature sensor and barometric pressure sensor)	I	Injectors	D
		Injector driver	E
Camshaft position sensor	L	Injector driver relay	H
		M/T oil temperature sensor <M/T>	Z
Clutch switch <M/T>	Q	Oxygen sensor (front)	Y
Crank angle sensor	B	Oxygen sensor (rear)	X
Detonation sensor	C	Power steering fluid pressure switch	A
Diagnosis connector	R	Purge control solenoid valve	G
EGR valve	F	Throttle position sensor	G
Engine control relay	S	Throttle valve controller	T
Engine coolant temperature sensor	L	Throttle valve control servo	G
Engine-ECU	W	Throttle valve control servo relay	V
Engine warning lamp (CHECK ENGINE lamp)	Q	Vehicle speed sensor	M





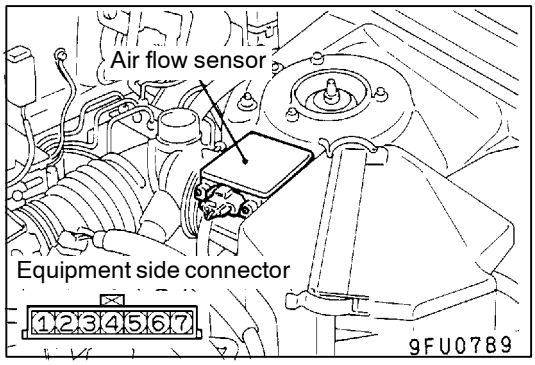
ENGINE CONTROL RELAY, FUEL PUMP RELAY AND THROTTLE VALVE CONTROL SERVO RELAY CONTINUITY CHECK

Battery voltage	Terminal No.			
	1	2	3	4
Not supplied		○		○
Supplied	○	⊖	○	⊕



INJECTOR DRIVER RELAY CONTINUITY CHECK

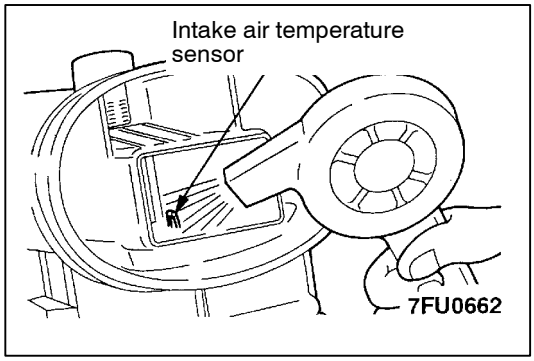
Battery voltage	Terminal No.			
	1	2	3	4
Not supplied			○	○
Supplied	○	○	⊕	○



INTAKE AIR TEMPERATURE SENSOR CHECK

1. Disconnect the air flow sensor connector.
2. Measure resistance between terminals 5 and 6.

   Standard value:
   2.3 – 3.0 kΩ (at 20°C)
   0.30 – 0.42 kΩ (at 80°C)

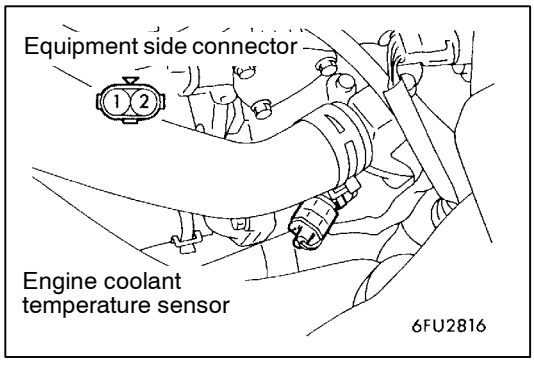


3. Measure resistance while heating the sensor using a hair drier.

   Normal condition:

Temperature (°C)	Resistance (kΩ)
Higher	Smaller

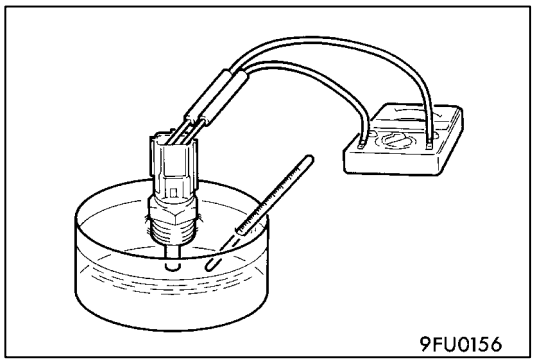
4. If the value deviates from the standard value or the resistance remains unchanged, replace the air flow sensor assembly.



ENGINE COOLANT TEMPERATURE SENSOR CHECK

Caution
Be careful not to touch the connector (resin section) with the tool when removing and installing.

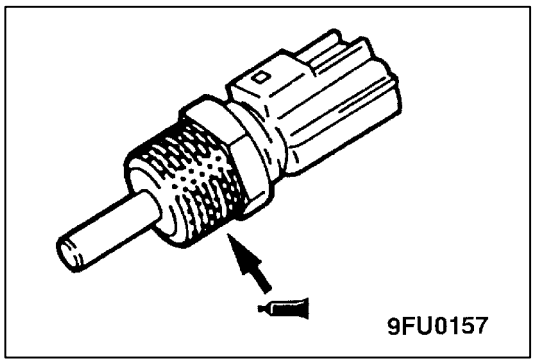
1. Remove the engine coolant temperature sensor.



2. With temperature sensing portion of engine coolant temperature sensor immersed in hot water, check resistance.

   Standard value:
   2.1 – 2.7 kΩ (at 20°C)
   0.26 – 0.36 kΩ (at 80°C)

3. If the resistance deviates from the standard value greatly, replace the sensor.

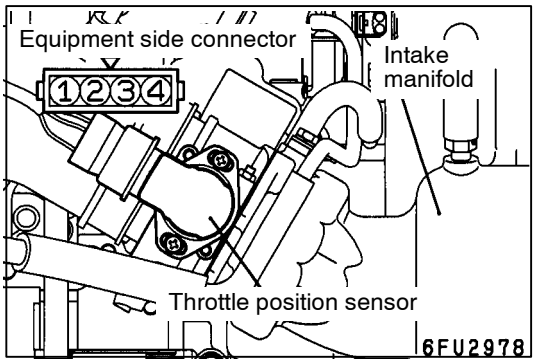


4. Apply sealant to threaded portion.

   Specified sealant:
   3M NUT Locking Part No.4171 or equivalent

5. Install the engine coolant temperature sensor and tighten it to the specified torque.

   Tightening torque: 29 Nm



THROTTLE POSITION SENSOR CHECK

1. Disconnect the throttle position sensor connector.
2. Measure the resistance between throttle position sensor side connector terminal 1 and terminal 3.

   Standard value: 1.7 – 3.3 kΩ

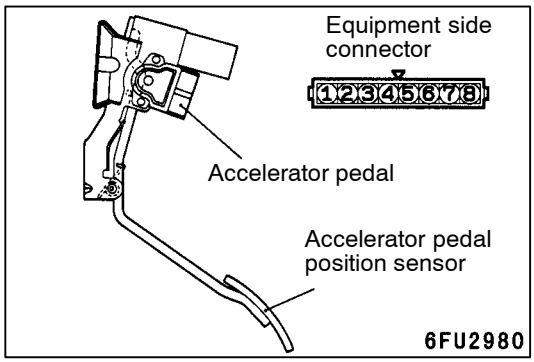
3. Measure resistance between terminal Nos. 1 and 2 as well as 1 and 4 of the throttle position sensor connector, respectively.

   Normal condition:

Throttle valve slowly open until fully open from the idle position	Changes smoothly in proportion to the opening angle of the throttle valve

4. If the resistance is outside the standard value, or if it doesn't change smoothly, replace the throttle position sensor.

   NOTE
   For the throttle position sensor adjustment procedure, refer to P.13I-98.



ACCELERATOR PEDAL POSITION SENSOR (1ST AND 2ND CHANNELS) CHECK

1. Disconnect the accelerator pedal position sensor connector.
2. Measure resistance between terminal Nos.2 (1st channel power supply) and 1 (1st channel earth) as well as between terminal Nos.8 (2nd channel power supply) and terminal No.7 (2nd channel earth) of the sensor connector.

   Standard value: 3.5 – 6.5 kΩ

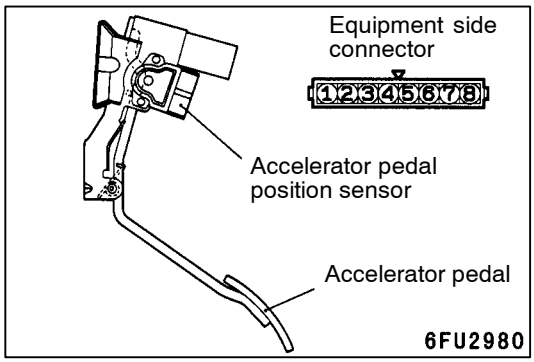
3. Measure resistance between terminal Nos.2 (1st channel power supply) and 3 (1st channel output) as well as between terminal Nos.8 (2nd channel power supply) and terminal No.6 (2nd channel output) of the sensor connector.

   Normal condition:

Depress the accelerator pedal slowly.	Resistance value changes in accordance with the accelerator pedal depression smoothly.

4. If not within the standard value, or resistance value does not change smoothly, replace the accelerator pedal position sensor.

   NOTE
   After replacement, adjust the accelerator pedal position sensor. (Refer to P.13I-99.)



ACCELERATOR PEDAL POSITION SWITCH CHECK

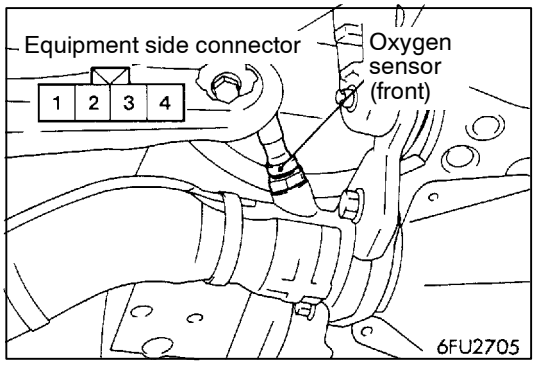
1. Disconnect the accelerator pedal position sensor connector.
2. Check continuity between terminal Nos. 4 (accelerator pedal position switch) and 5 (earth) of the connector.

Normal condition

Accelerator pedal	Continuity
Depressed	No continuity
Released	Continuity (0 Ω)

3. If defective, replace the accelerator pedal position sensor.

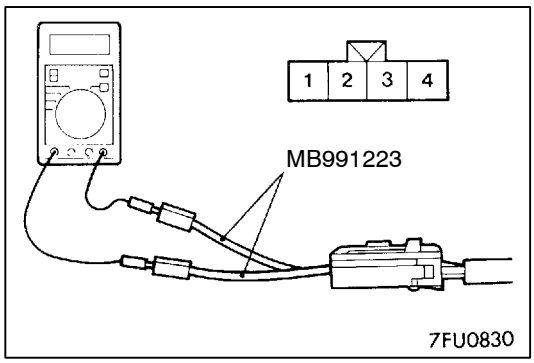
NOTE
After replacement, adjust the accelerator pedal position sensor. (Refer to P.13I-99.)



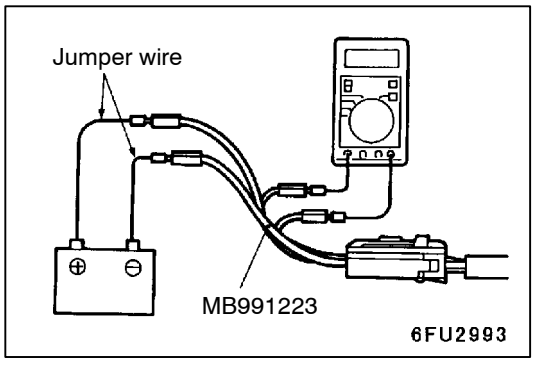
OXYGEN SENSOR CHECK

<Oxygen sensor (front)>

1. Disconnect the oxygen sensor connector and connect the special tool (harness set) to the connector on the oxygen sensor side.



2. Make sure that there is continuity (11 – 18 Ω at 20°C) between terminal 3 and terminal 4 on the oxygen sensor connector.
3. If there is no continuity, replace the oxygen sensor.
4. Warm up the engine until engine coolant is 80°C or higher.



5. Use a jumper wire to connect terminal 3 of the oxygen sensor connector to the battery (+) terminal and terminal 4 to the battery (–) terminal.

Caution
Be very careful when connecting the jumper wire; incorrect connection can damage the oxygen sensor.

6. Connect a digital voltage meter between terminal 1 and terminal 2.

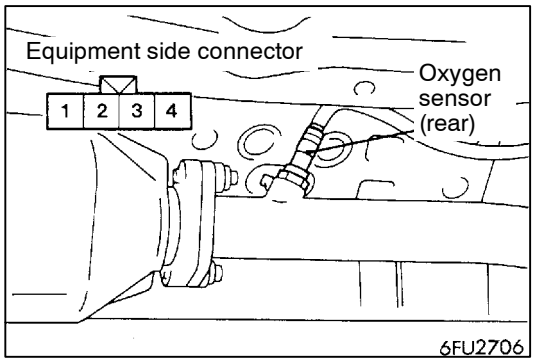
7. While repeatedly racing the engine, measure the oxygen sensor output voltage.

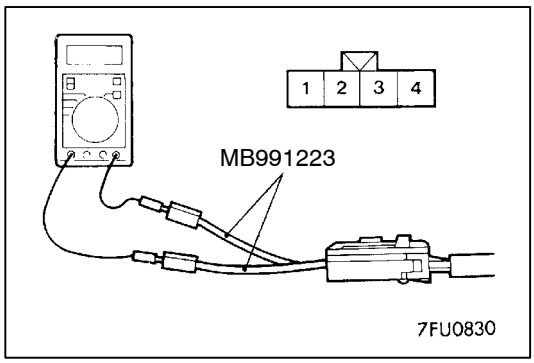
Standard value:

Engine	Oxygen sensor output voltage	Remarks
When racing the engine	0.6 – 1.0 V	If you make the air/fuel ratio rich by racing the engine repeatedly, a normal oxygen sensor will output a voltage of 0.6 – 1.0 V.

8. If the sensor is defective, replace the oxygen sensor.

NOTE
For removal and installation of the oxygen sensor, refer to GROUP 15 – Exhaust Pipe and Main Muffler.

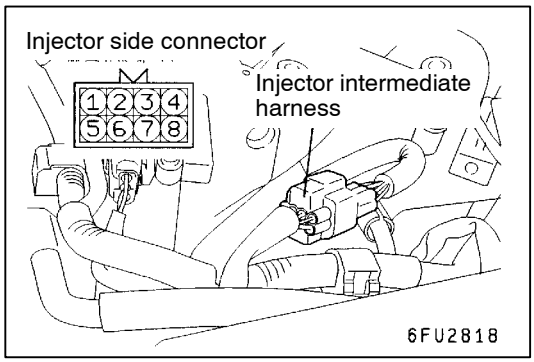




<Oxygen sensor (rear)>

1. Disconnect the oxygen sensor connector and connect the special tool (test harness set) to the connector on the oxygen sensor side.
2. Make sure that there is continuity (11 – 18 Ω at 20°C) between terminal 3 and terminal 4 on the oxygen sensor connector.
3. If there is no continuity, replace the oxygen sensor.

NOTE
(1) If the MUT-II does not display the standard value although no abnormality is found by the above mentioned continuity test and harness check, replace the oxygen sensor (rear).
(2) For removal and installation of the oxygen sensor, refer to GROUP 15 – Exhaust Pipe and Main Muffler.



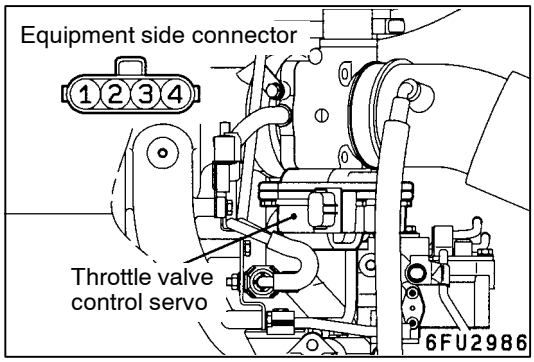
INJECTOR CHECK

1. Disconnect the injector intermediate harness connector.
2. Measure the resistance between each of the terminals.

Standard value: 0.9 – 1.1 Ω (at 20°C)

Injector	Measurement terminal
No.1 cylinder	1 – 2
No.2 cylinder	3 – 4
No.3 cylinder	5 – 6
No.4 cylinder	7 – 8

3. Connect the injector intermediate harness connector.



THROTTLE VALVE CONTROL SERVO CHECK

Operation Check

1. Disconnect the air intake hose from the throttle body.
2. Turn on the ignition switch.
3. Check that the throttle valve opens or closes in response to the accelerator pedal depression.

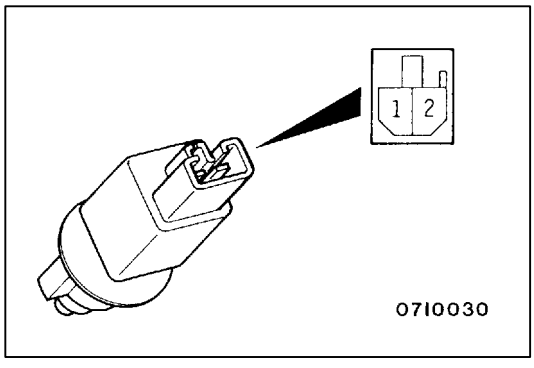
Check of Coil Resistance

1. Disconnect the throttle valve control servo connector.
2. Measure resistance between the throttle valve control servo connector terminals.

Standard value:

Terminals to be measured	Resistance value (Ω)
1 – 3	1.35 – 1.65 (at 20°C)
2 – 4	

3. Check that there is no continuity between the terminals and body.



CLUTCH SWITCH CHECK

1. Disconnect the connector.
2. Check for continuity between the terminals of the switch.

Measurement conditions	Terminal No.	
	1	2
When clutch pedal is depressed.	○	○
When clutch pedal is not depressed.		

PURGE CONTROL SOLENOID VALVE CHECK

Refer to GROUP 17 – Emission Control System.

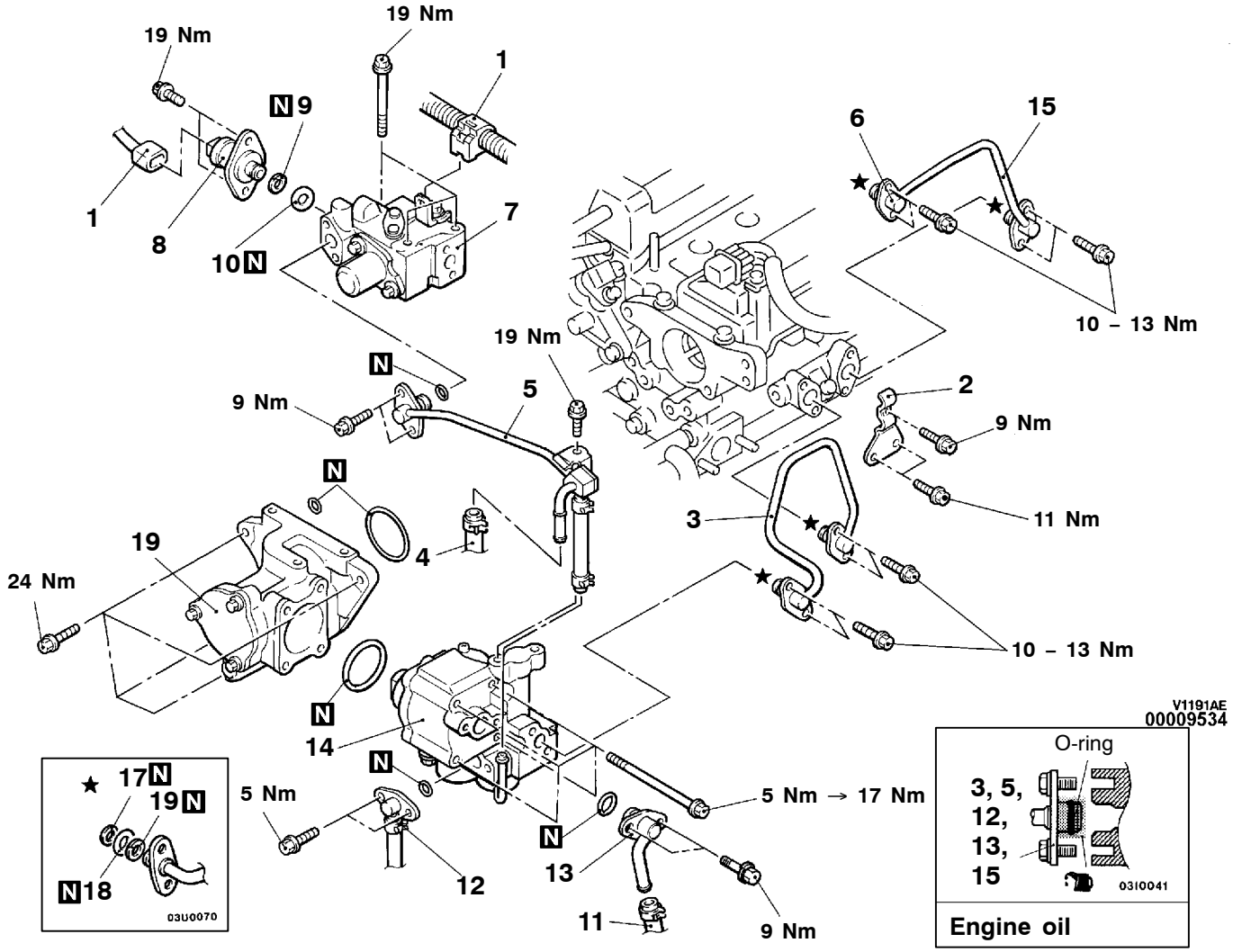
EGR VALVE CHECK

Refer to GROUP 17 – Emission Control System.

FUEL PUMP (HIGH PRESSURE) AND FUEL PRESSURE REGULATOR (HIGH PRESSURE)

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Prevention of fuel discharge <before removal only> (Refer to P.13I-104.)
- Engine Cover Removal and Installation
- Air Cleaner Assembly Removal and Installation
- Fuel Leak Check <after installation only> (Refer to P.13I-104.)



Fuel pressure regulator (High pressure) removal steps

1. Harness connector and clamp
4. Fuel return hose connection
▶C◀ 5. Low-pressure fuel pipe
▶C◀ 6. Fuel return pipe connection
7. Fuel pressure regulator (high pressure) assembly
8. Fuel pressure sensor assembly
▶F◀ 9. O-ring
▶F◀ 10. Back-up ring
▶B◀ 16. Back-up ring A
▶B◀ 17. O-ring
▶B◀ 18. Back-up ring

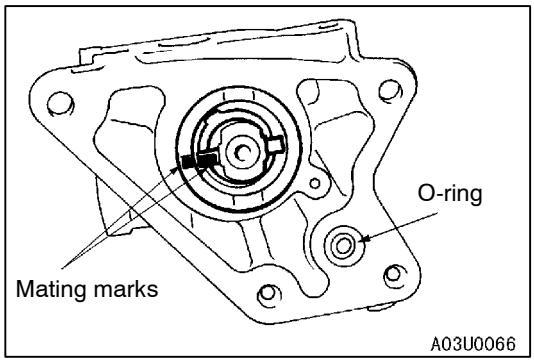
Fuel pump (High pressure) removal steps

- Intake manifold removal (Refer to GROUP 15.)

2. Fuel pipe clamp
▶C◀ 3. Fuel feed pipe
▶C◀ 5. Low-pressure fuel pipe
11. Fuel return hose connection
▶E◀ 12. Fuel pressure hose connection
13. Fuel nipple assembly
▶D◀ 14. Fuel pump (high pressure)
▶B◀ 16. Back-up ring A
▶B◀ 17. O-ring
▶B◀ 18. Back-up ring

Pump camshaft case removal steps

7. Fuel pressure regulator (high pressure) assembly
▶D◀ 14. Fuel pump (high pressure)
▶C◀ 15. Fuel return pipe
▶B◀ 16. Back-up ring A
▶B◀ 17. O-ring
▶B◀ 18. Back-up ring
▶A◀ 19. Pump camshaft case

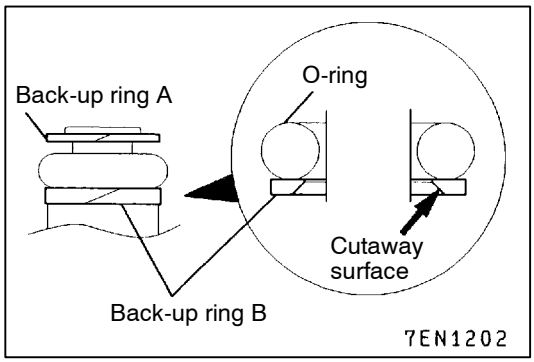


INSTALLATION SERVICE POINTS

▶A◀ PUMP CAMSHAFT CASE ASSEMBLY INSTALLATION

1. Set the No.1 cylinder to the compression top dead centre position.
2. Align the mating mark on the housing of the pump camshaft case assembly with the mating mark on the coupling, and then install the pump camshaft case assembly to the engine.

Caution
Take care not to drop the O-ring.



▶B◀ BACK-UP RING B/O-RING/BACK-UP RING A INSTALLATION

Install the back-up rings and the O-ring as shown in the illustration.

Caution

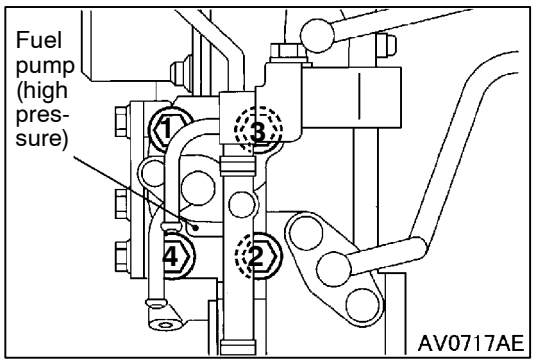
1. **Install the back-up ring B facing its cutaway surface toward the opposite side of the O-ring as shown in the illustration.**
2. **Confirm the outer diameter of the back-up ring A. Take care not to install the back-up ring for the fuel pressure sensor by mistake. (Outer diameter of the back-up ring A: 14.8 mm)**

▶C◀ FUEL RETURN PIPE/LOW-PRESSURE FUEL PIPE/FUEL FEED PIPE INSTALLATION

Apply a small amount of fresh engine oil to the O-ring.

Caution

Take care not to let any of the engine oil get inside the fuel pump (high pressure), fuel pressure regulator (high pressure) or the delivery pipe assembly.



▶D◀ FUEL PUMP (HIGH PRESSURE) INSTALLATION

Use a torque wrench with a precision of 0.5 Nm to tighten the fuel pump mounting bolts according to the following procedure.

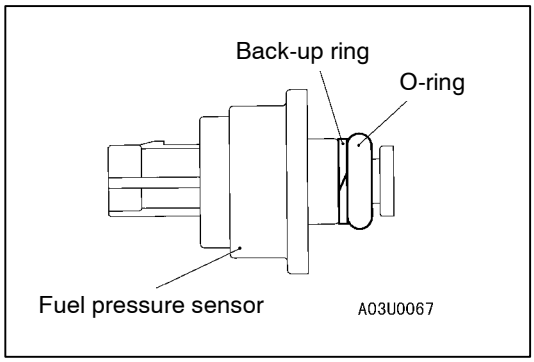
1. Tighten the bolts to 5 Nm in the order shown in the illustration.
2. Tighten the bolts to 17 Nm in the order shown in the illustration. The overall difference in tightening torque between the four bolts should be within 2 Nm.

▶E◀ HIGH-PRESSURE FUEL HOSE INSTALLATION

1. Apply a small amount of fresh engine oil to the O-ring.

   Caution
   Take care not to let any of the engine oil get inside the fuel pump (high pressure).

2. While being careful not to damage the O-ring, turn the high-pressure fuel hose to the left and right and connect it to the fuel pump (high pressure). After connecting, check that the hose turns smoothly.
3. If the hose does not turn smoothly, the cause may be that the O-ring is getting caught. Disconnect the hose, check the O-ring for damage and re-connect the hose to the fuel pump (high pressure) and then re-check.



▶F◀ BACK-UP RING/O-RING INSTALLATION

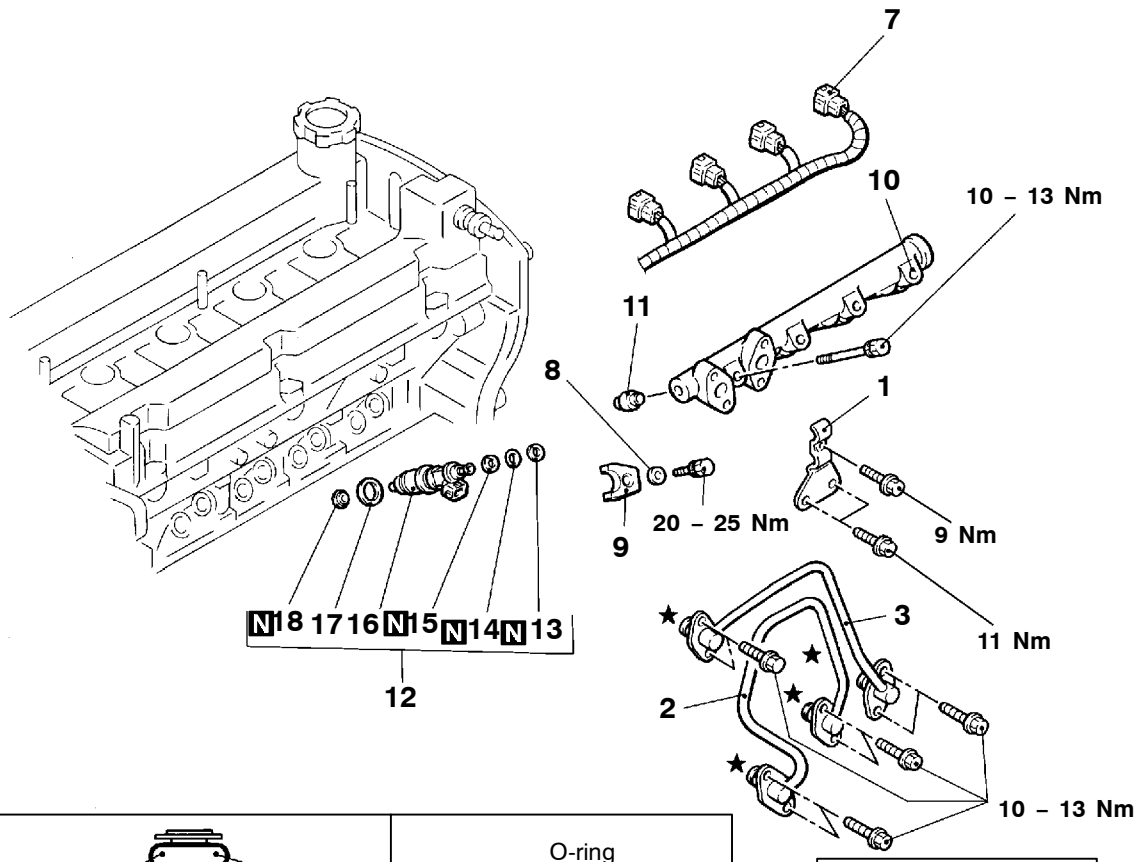
Install the back-up ring and the O-ring as shown in the illustration.

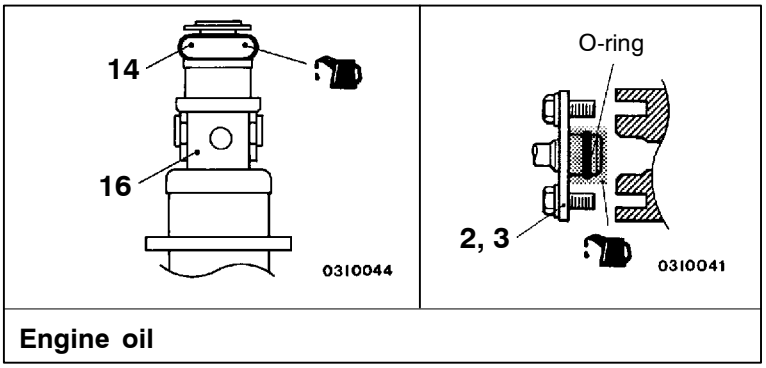
Caution
Take care not to install the back-up ring A for the injector, fuel feed pipe or fuel return pipe by mistake. (Outer diameter of the back-up ring for the fuel pressure sensor: 15.1 mm)

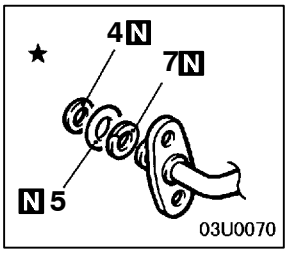
INJECTOR

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Prevention of fuel discharge <before removal only> (Refer to P.13I-104.)
- Engine Cover Removal and Installation
- Air Cleaner Assembly Removal and Installation
- Intake Manifold Removal and Installation (Refer to GROUP 15.)
- Fuel Leak Check <after installation only> (Refer to P.13I-104.)







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Removal steps

1. Fuel pipe clamp
▶D◀ 2. Fuel feed pipe
▶D◀ 3. Fuel return pipe
▶C◀ 4. Back-up ring A
▶C◀ 5. O-ring
▶C◀ 6. Back-up ring B
◀A▶ 7. Injector harness connector
8. Washer
9. Injector holder
◀B▶ ▶B◀ 10. Delivery pipe assembly
11. Insulator
◀B▶ ▶B◀ 12. Fuel injector assembly
13. Back-up ring
14. O-ring
15. Back-up ring
16. Fuel injector
17. Gasket
▶A◀ 18. Corrugated washer

REMOVAL SERVICE POINTS

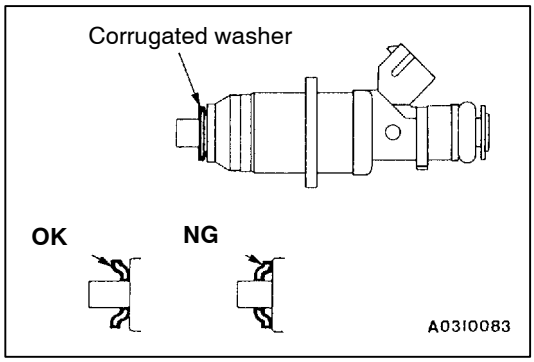
◀A▶ INJECTOR HARNESS CONNECTOR DISCONNECTION

Caution
Disconnect the battery (–) cable from its terminal before carrying out this operation.

◀B▶ DELIVERY PIPE ASSEMBLY/FUEL INJECTOR ASSEMBLY REMOVAL

Remove the delivery pipe assembly with the fuel injector assembly still attached.

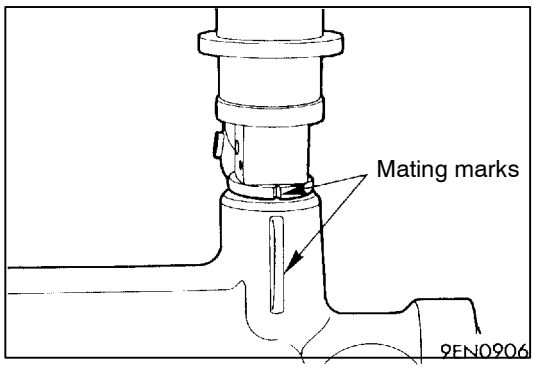
Caution
Be careful not to drop the fuel injector assembly when removing the delivery pipe assembly.



INSTALLATION SERVICE POINTS

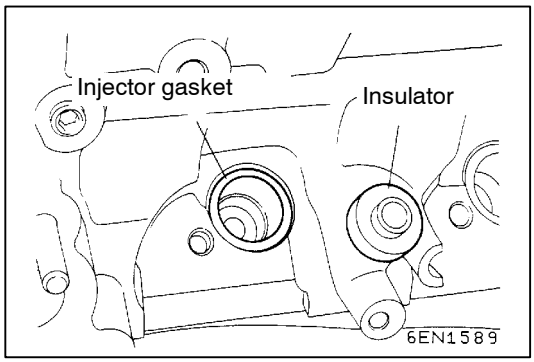
▶A◀ CORRUGATED WASHER INSTALLATION

Caution
1. **The corrugated washer should always be replaced with a new part.**
2. **There should be no scratches or foreign particles on the corrugated washer mounting surface of the injector.**
3. **Be careful not to mistake the corrugated washer installation direction.**



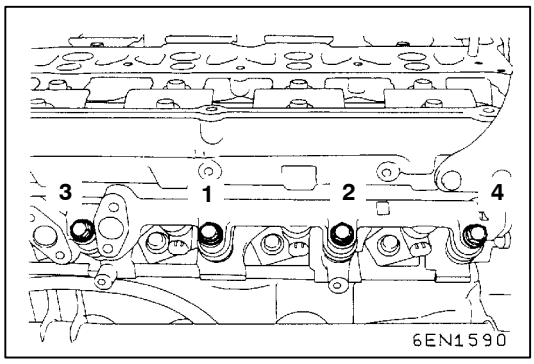
▶B◀ FUEL INJECTOR ASSEMBLY/DELIVERY PIPE ASSEMBLY INSTALLATION

1. Apply mashine oil or gasoline to the O-ring of the injector.
2. Insert the injector assemblies straight into the injector mounting holes on the delivery pipe assembly.
3. Rotate the injector. If it does not rotate freely, remove the injector to check the O-ring for damage. If the O-ring is damaged, replace the O-ring. Then assemble the injector again and confirm that it rotates freely.
4. Align the mating marks on the injector and the delivery pipe.

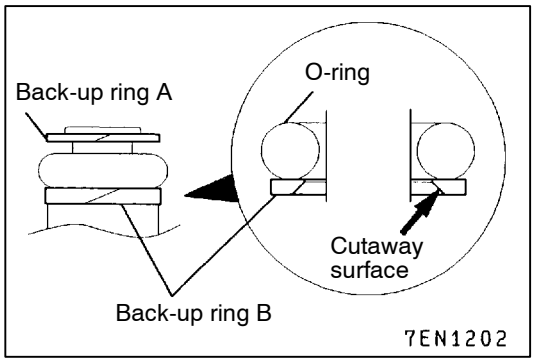


5. Install the injector gasket and the insulator. As the insulator is likely to drop off, apply Vaseline or equivalent before installing to the cylinder head.
6. Install the delivery pipe and injector assembly to the cylinder head, and tighten it loosely.
7. Install the injector holder and the washer, and then tighten them to the specified torque.

Caution
Observe the specified torque strictly.



8. Tighten the delivery pipe and injector assembly in the shown order to the specified torque.



▶C◀ BACK-UP RING B/O-RING/BACK-UP RING A INSTALLATION

Install the back-up rings and the O-ring as shown in the illustration.

Caution
1. **Install the back-up ring B facing its cutaway surface toward the opposite side of the O-ring as shown in the illustration.**
2. **Confirm the outer diameter of the back-up ring A. Take care not to install the back-up ring for the fuel pressure sensor by mistake. (Outer diameter of the back-up ring A: 14.8 mm)**

▶D◀ FUEL RETURN PIPE/FUEL FEED PIPE INSTALLATION

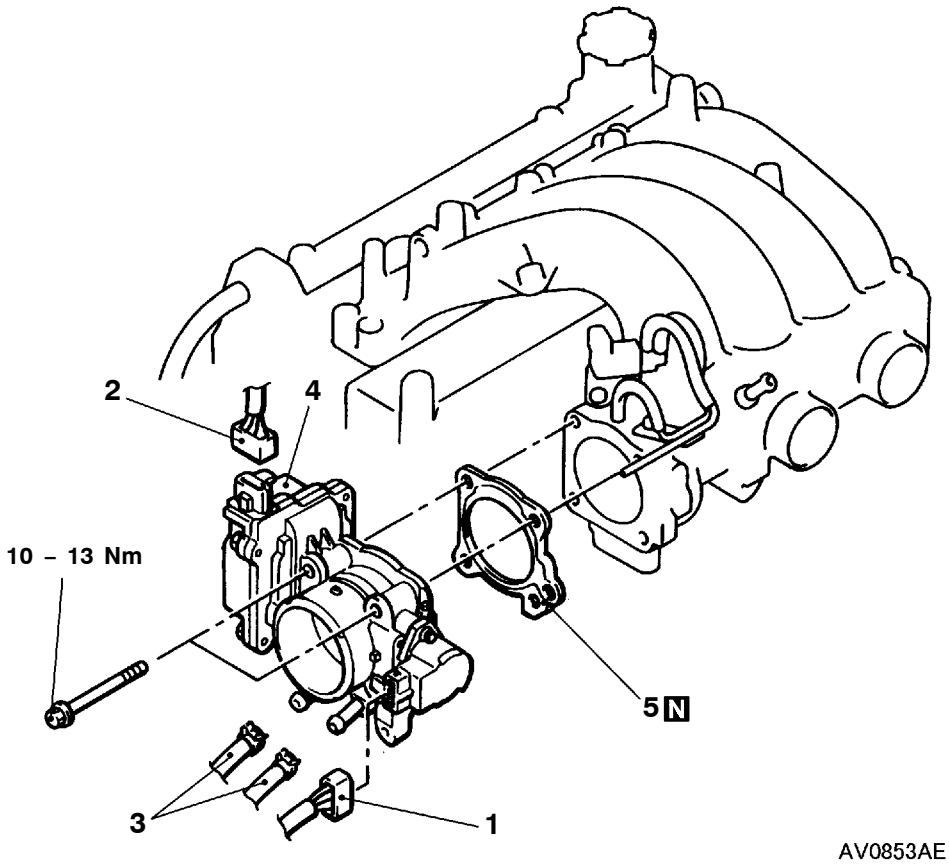
Apply a small amount of fresh engine oil to the O-ring.

Caution
Take care not to let any of the engine oil get inside the fuel pump (high pressure), fuel pressure regulator (high pressure) and delivery pipe.

THROTTLE BODY

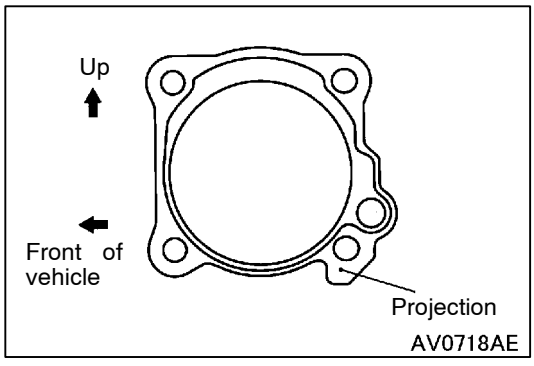
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Engine Coolant Draining and Supplying (Refer to GROUP 14 – On-vehicle Service.)
- Engine Cover Removal and Installation
- Air Cleaner Assembly Removal and Installation



Removal steps

1. Throttle position sensor connector
2. Throttle control servo connector
3. Water hose connection
▶B◀ 4. Throttle body assembly
▶A◀ 5. Throttle body gasket



INSTALLATION SERVICE POINT

▶A◀ THROTTLE BODY GASKET INSTALLATION

Position the projection as shown in the illustration.

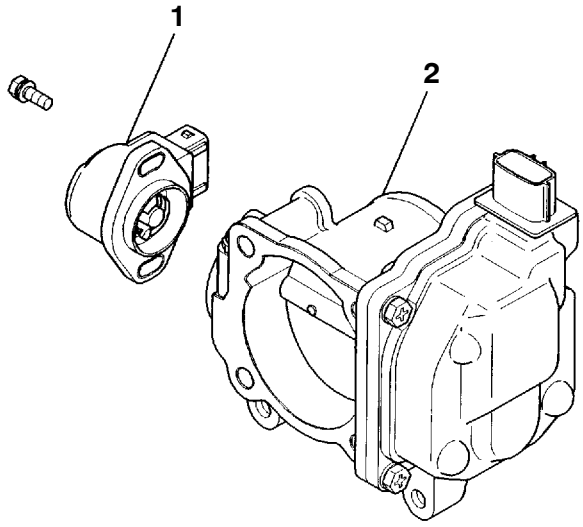
▶B◀ THROTTLE BODY INSTALLATION

If the throttle body is replaced, initialize the electronic-controlled throttle valve system.

Initialization

Turn on the ignition switch, and turn off it within one second. Then leave it for at least ten seconds with the ignition switch off.

DISASSEMBLY AND REASSEMBLY



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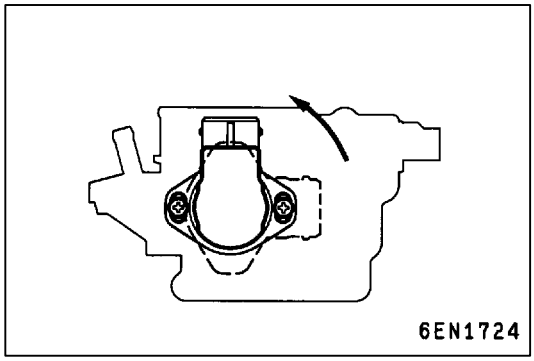
Disassembly steps

▶A◀ 1. Throttle position sensor
2. Throttle body



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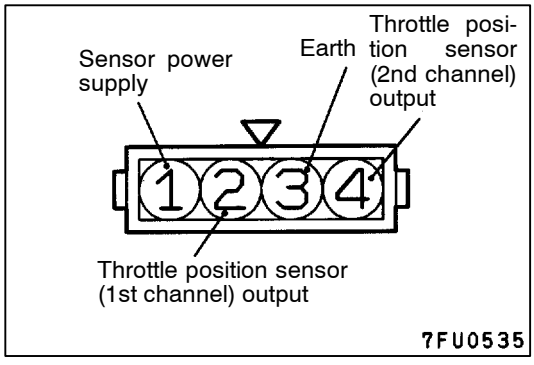

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REASSEMBLY SERVICE POINTS

▶A◀ THROTTLE POSITION SENSOR

1. Position the throttle position sensor on the throttle body along the dotted line as shown in the illustration.
2. Rotate the throttle position sensor anticlockwise as shown in the illustration, and then tighten the screws.
3. Measure resistance value between terminal Nos. 1 (sensor power supply) and 2 (throttle position sensor 1st-channel output) as well as 1 (sensor power supply) and 4 (throttle position sensor 2nd-channel output).

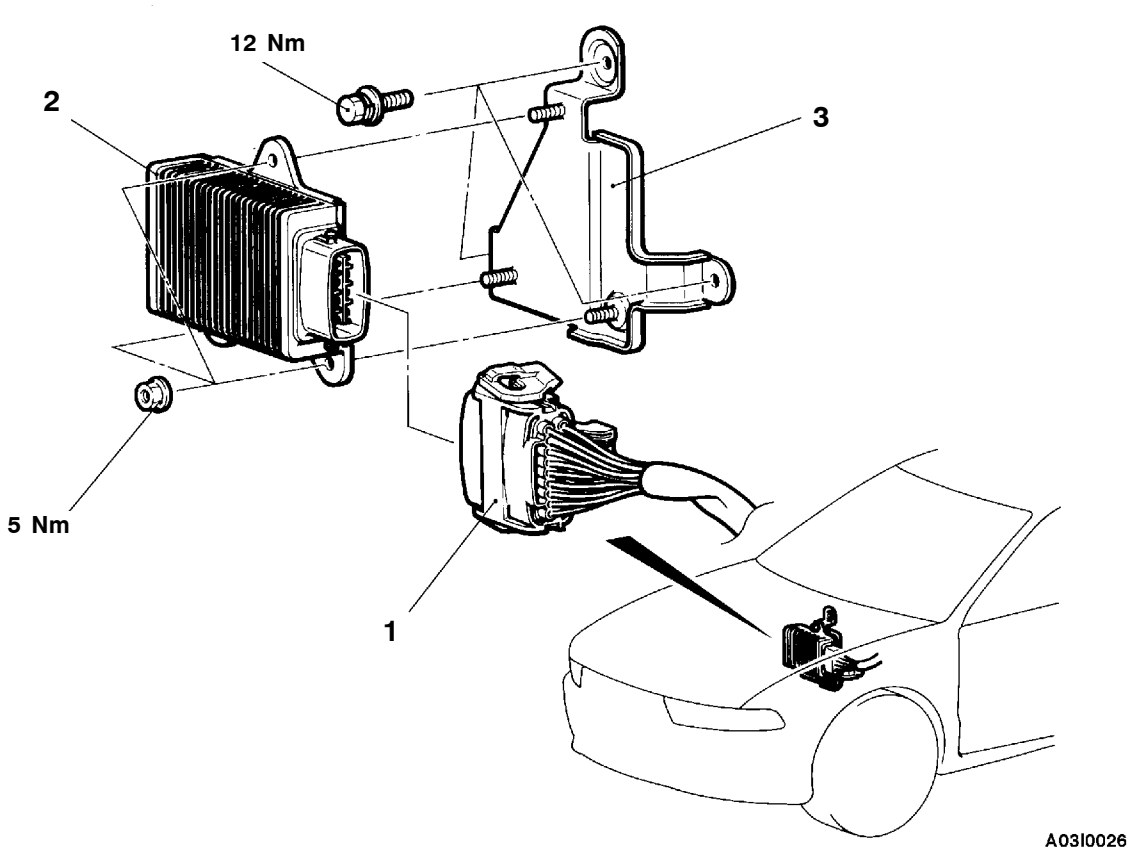
Normal condition

Open the throttle valve slowly from the idle position to full-open position.	Resistance value changes smoothly in response to throttle valve opening angle.

4. If the resistance value does not change smoothly, replace the throttle position sensor.

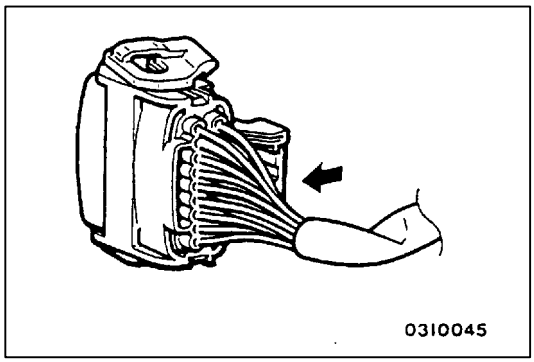
INJECTOR DRIVER

REMOVAL AND INSTALLATION



Removal steps

◀A▶ 1. Injector driver connector
◀B▶ 2. Injector driver
3. Bracket



REMOVAL SERVICE POINT

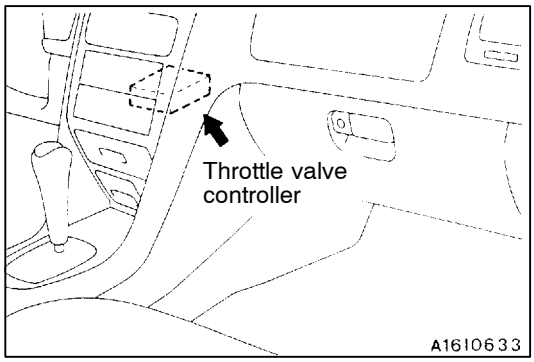
◀A▶ INJECTOR DRIVER CONNECTOR DISCONNECTION

Press the injector driver connector in the place shown in the illustration to disconnect the injector driver connector.

Caution
Disconnect the battery (–) cable from its terminal before carrying out this operation.

◀B▶ INJECTOR DRIVER REMOVAL

Caution
Care must be taken when handling the injector driver as it is hot after driving.



THROTTLE VALVE CONTROLLER

INSTALLATION SERVICE POINT

If the throttle valve controller is replaced, initialize the electronic-controlled throttle valve system.

Initialization

Turn on the ignition switch, and turn off it within one second. Then leave it for at least ten seconds with the ignition switch off.

NOTES

ENGINE COOLING

CONTENTS

GENERAL

OUTLINE OF CHANGE

The following service procedures have been added for the lineup of 4G64-GDI engines. The other items are the same as the procedures for the 4G63-MPI engines.

SERVICE SPECIFICATIONS

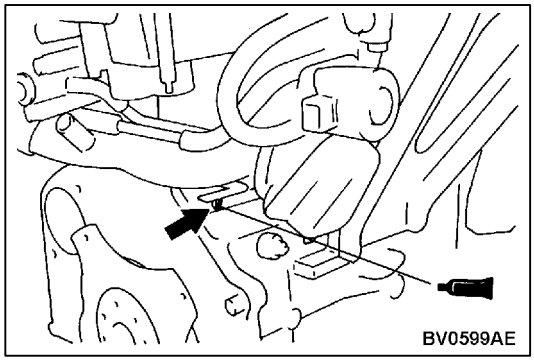
Items		Standard value	Limit
Thermostat	Valve opening temperature of thermostat °C	85 ± 1.5	–
	Full-opening temperature of thermostat °C	98	–
	Valve lift (at 95°C) mm	8.5 or more	–

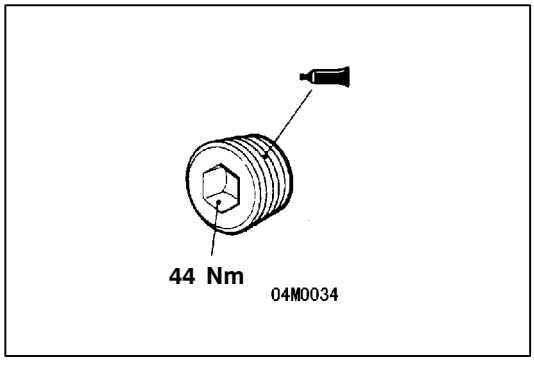
LUBRICANT

Items	Quantity L
MITSUBISHI GENUINE COOLANT or equivalent	7

SEALANTS

Items	Specified sealant	Remarks
Cylinder block drain plug	3M Nut Locking Part No. 4171 or equivalent	Drying sealant
Thermostat case assembly	Mitsubishi Genuine Parts No. MD970389 or equivalent	Semi-drying sealant





ON-VEHICLE SERVICE

ENGINE COOLANT REPLACEMENT

1. Drain the engine coolant by removing the drain plug and then the radiator cap.
2. Remove the drain plug from the cylinder block to drain the engine coolant.
3. Remove the reserve tank to drain the engine coolant.
4. When the engine coolant has drained, pour in water from the radiator cap to clean the engine coolant line.
5. Coat the thread of the cylinder block drain plug with the specified sealant and tighten to the specified torque.

   Specified sealant:
   3M Nut Locking Part No. 4171 or equivalent
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:
   MITSUBISHI GENUINE COOLANT or equivalent

   Quantity: 7 L

   Caution
   Do not use alcohol or methanol anti-freeze or any engine coolants mixed with alcohol or methanol anti-freeze. The use of an improper anti-freeze can cause the corrosion of the aluminium components.

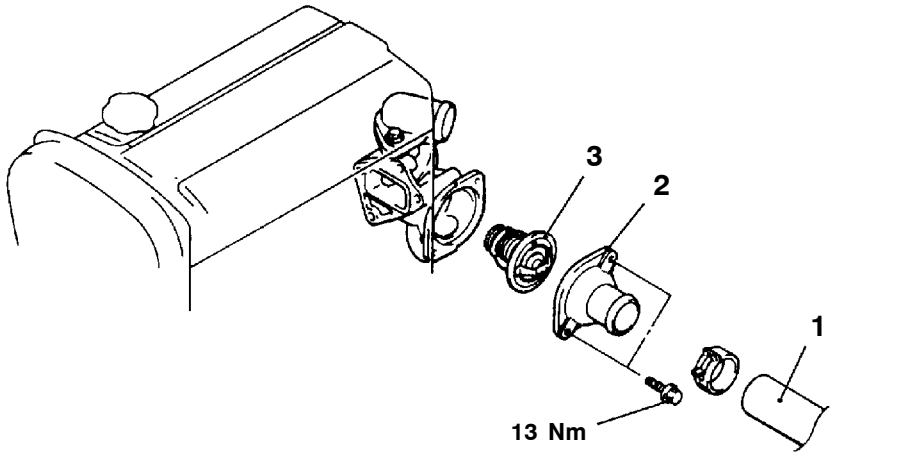
   NOTE
   For Norway, the non-amine type of antifreeze should be used.

9. Install the radiator cap securely.
10. Start the engine and warm the engine until the thermostat opens. (Touch the radiator hose with your hand to check that warm water is flowing.)
11. After the thermostat opens, race the engine several times, and then stop the engine.
12. Cool down the engine, and then pour engine coolant into the reserve tank until the level reaches the FULL line. If the level is low, repeat the operation from step 9.

THERMOSTAT

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Engine Coolant Draining and Supplying (Refer to P.14-2.)
- Air Intake Duct Removal and Installation



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Removal steps

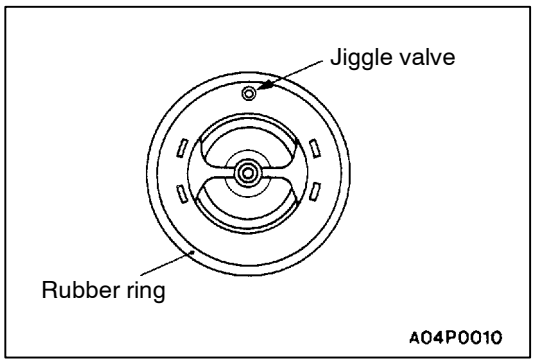
◀A▶ ▶B◀ 1. Radiator lower hose connection
2. Water inlet fitting

▶A◀ 3. Thermostat

REMOVAL SERVICE POINT

◀A▶ RADIATOR LOWER HOSE DISCONNECTION

After making mating marks on the radiator hose and the hose clamp, disconnect the radiator hose.



INSTALLATION SERVICE POINTS

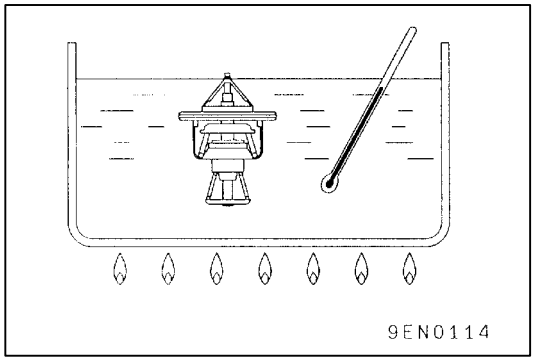
▶A◀ THERMOSTAT INSTALLATION

Install the thermostat so that the jiggle valve is facing straight up.

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. If the rubber ring is damaged, replace the thermostat.

▶B◀ RADIATOR LOWER HOSE CONNECTION

1. Insert each hose as far as the projection of the water inlet fitting.
2. Align the mating marks on the radiator hose and hose clamp, and then connect the radiator hose.



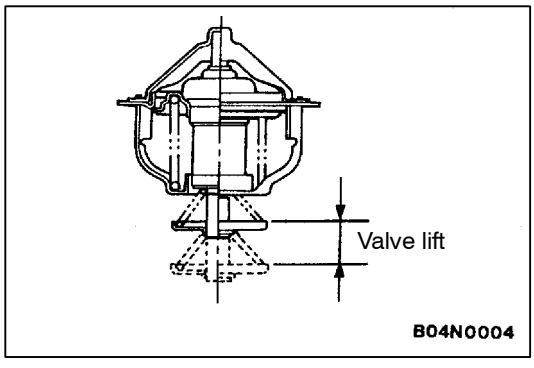
INSPECTION

THERMOSTAT CHECK

1. Immerse the thermostat in water, and heat the water while stirring. Check the thermostat valve opening temperature.

   Standard value:

   Valve opening temperature: 85 ± 1.5°C



2. Check that the amount of valve lift is at the standard value when the water is at the full-opening temperature.

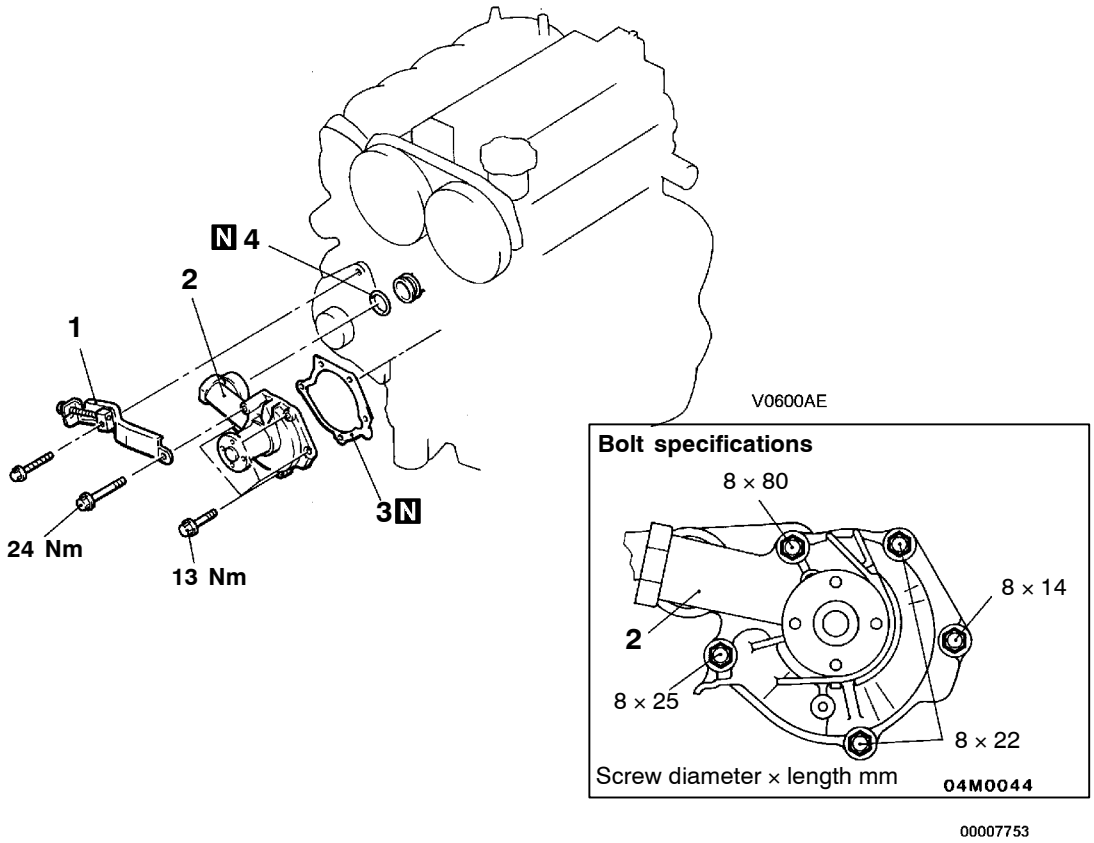
   Standard value:
   Full-opening temperature: 98°C
   Amount of valve lift: 8.5 mm or more

   NOTE
   Measure the valve height when the thermostat is fully closed, and use this measurement to calculate the valve height when the thermostat is fully open.

WATER PUMP

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Engine Coolant Draining and Supplying (Refer to P.14-2.)
- Engine Cover Removal
- Timing Belt Removal and Installation (Refer to GROUP 11D.)



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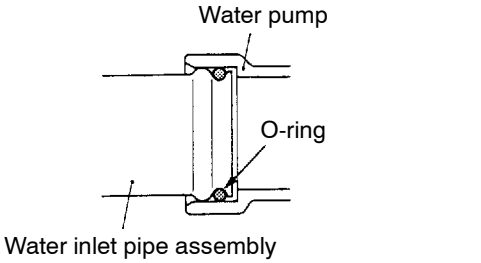
Removal steps
1. Alternator brace
2. Water pump
3. Water pump gasket
▶A◀ 4. O-ring



INSTALLATION SERVICE POINT

▶A◀ O-RING INSTALLATION

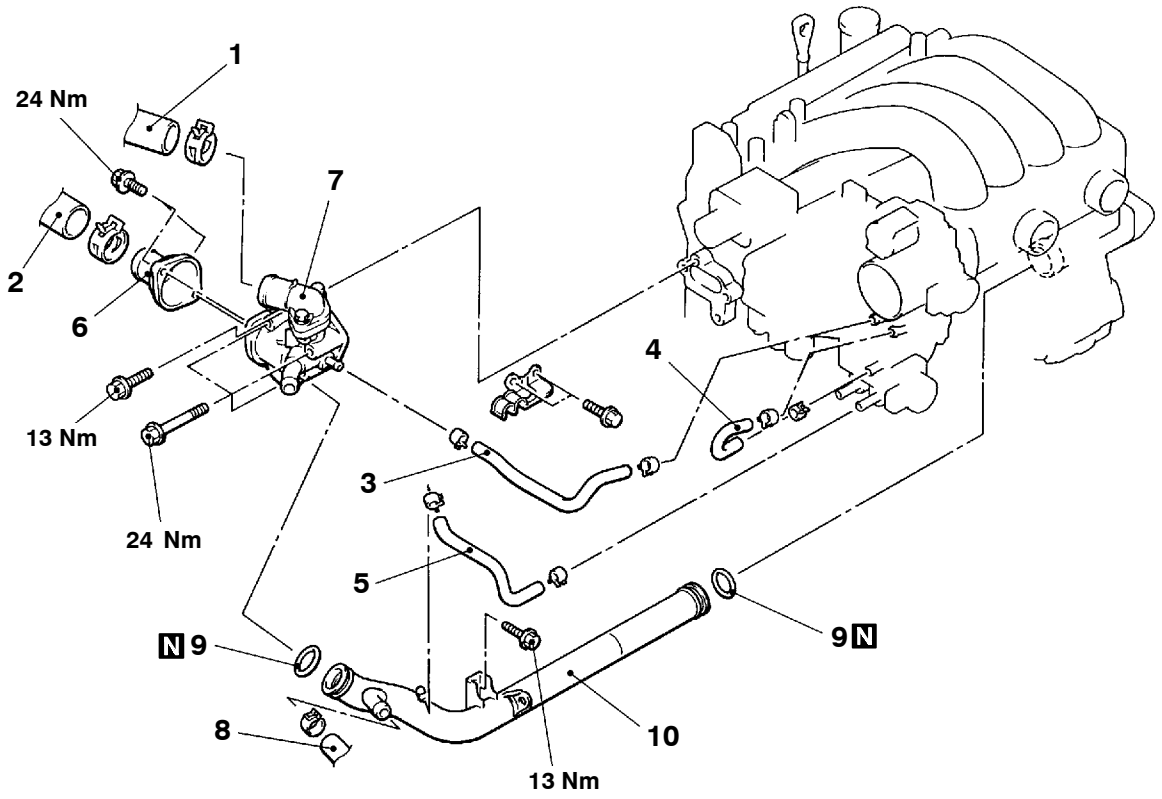
Insert the O-ring to the water inlet pipe assembly, and coat the outer circumference of the O-ring with water or engine coolant.

Caution
Do not allow engine oil or other greases to adhere to the O-ring

WATER HOSE AND WATER PIPE

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Engine Coolant Draining and Supplying (Refer to P.14-2.)
- Engine Cover Removal and Installation
- Air Cleaner Assembly Removal and Installation



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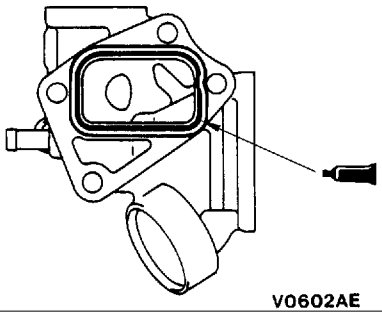

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Sealant:
Mitsubishi Genuine Part No. MD970389 or equivalent

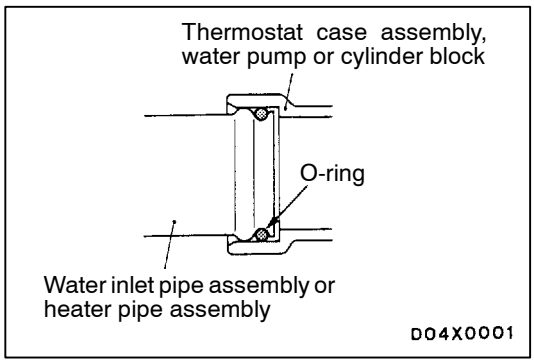
Removal steps

◀A▶ ▶C◀ 1. Radiator upper hose connection
◀A▶ ▶C◀ 2. Radiator lower hose connection
3. Water hose
4. Water hose
5. Water hose
6. Water inlet fitting
▶B◀ 7. Thermostat case assembly
8. Heater hose connection
▶A◀ 9. O-ring
10. Water inlet pipe

REMOVAL SERVICE POINT

◀A▶ RADIATOR UPPER HOSE/RADIATOR LOWER HOSE DISCONNECTION

After making mating marks on the radiator hose and the hose clamp, disconnect the radiator hose.



INSTALLATION SERVICE POINTS

▶A◀ O-RING INSTALLATION

Insert the O-ring to the water inlet pipe assembly or the heater pipe assembly and coat the outer circumference of the O-ring with water or engine coolant.

Caution
Do not allow engine oil or other greases to adhere to the O-ring

▶B◀ THERMOSTAT CASE ASSEMBLY INSTALLATION

Squeeze out the sealant from the tube evenly and apply it so that there is not too much sealant and no places without sealant.

Specified Sealant:
Mitsubishi Genuine Parts No. MD970389 or equivalent

▶C◀ RADIATOR LOWER HOSE/RADIATOR UPPER HOSE CONNECTION

1. Insert each hose as far as the projection of the water inlet fitting or water outlet fitting.
2. Align the mating marks on the radiator hose and hose clamp, and then connect the radiator hose.

INSPECTION

WATER PIPE AND HOSE CHECK

Check the water pipe and hose for cracks, damage, clog and replace them if necessary.

INTAKE AND EXHAUST

CONTENTS

GENERAL

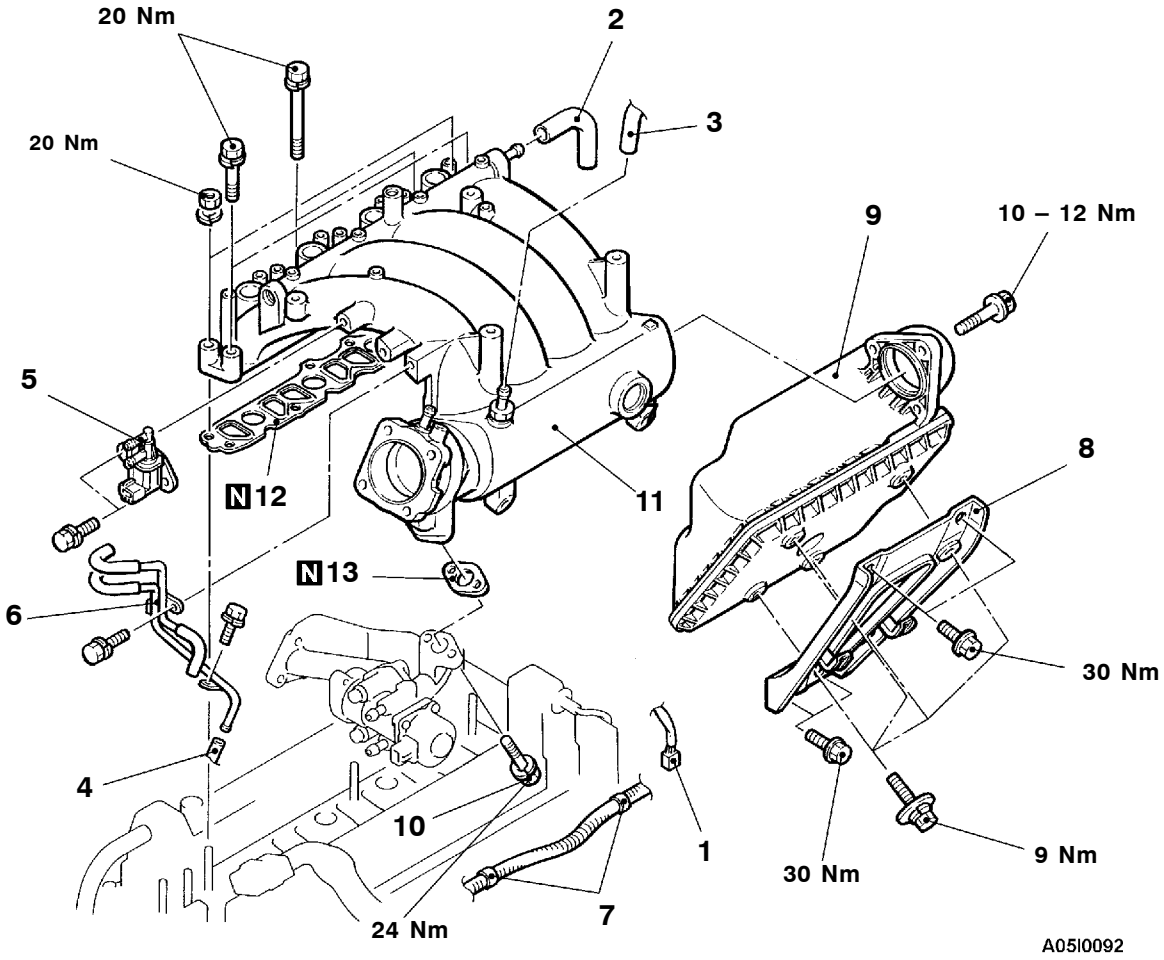
OUTLINE OF CHANGE

The following service procedure have been added for the lineup of the 4G64-GDI engines. Still, the other items are the same as the ones for the 4G63-MPI engines.

INTAKE MANIFOLD

REMOVAL AND INSTALLATION

Pre-removal and Post–installation Operation
- Engine Coolant Draining and Supplying (Refer to GROUP 14 – On-vehicle Service.)
- Engine Cover Removal and Installation
- Air Cleaner Assembly Removal and Installation
- Ignition Coil Removal and Installation
- Throttle Body Removal and Installation (Refer to GROUP 13I.)

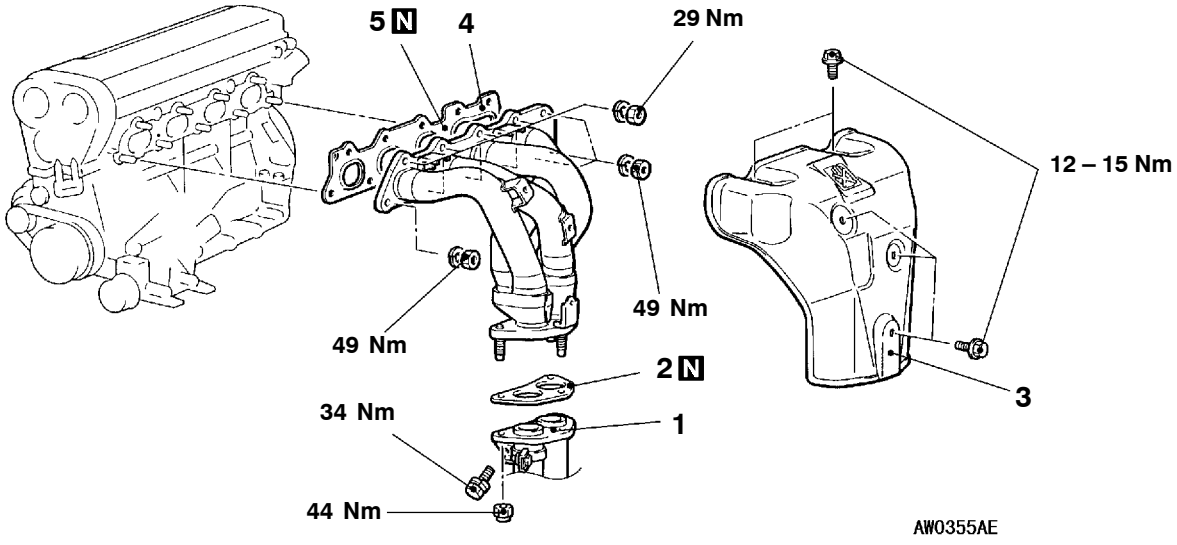


Removal steps
1. Engine harness connector and clamp
2. PCV hose
3. Brake booster vacuum hose connection
4. Vacuum hose connection
5. Purge solenoid valve
6. Vacuum pipe and hose assembly
7. Alternator harness clamp
8. Intake manifold stay
9. Air intake plenum resonator
10. Intake manifold and EGR valve support connecting bolt
11. Intake manifold
12. Intake manifold gasket
13. Gasket

EXHAUST MANIFOLD

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
Under Cover Removal and Installation



Removal steps

1. Front exhaust pipe connection
2. Gasket
3. Heat protector
4. Exhaust manifold
5. Exhaust manifold gasket

NOTES

ENGINE ELECTRICAL

CONTENTS

CHARGING SYSTEM

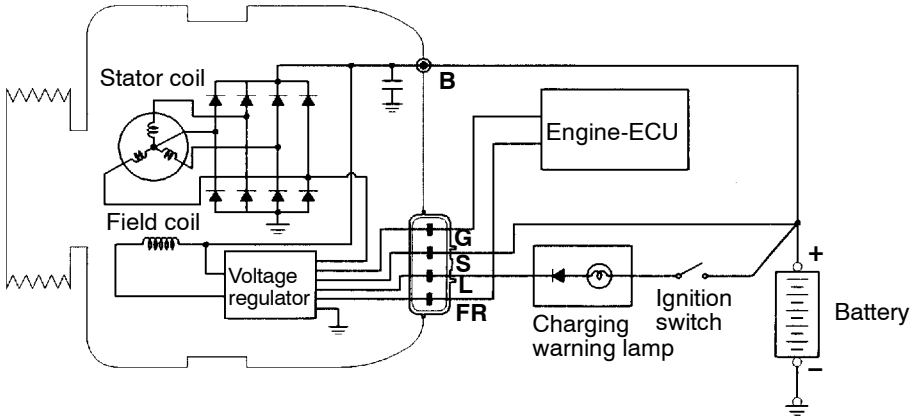
GENERAL

OUTLINE OF CHANGE

The following service procedures have been added to correspond to the introduction of the 4G64-GDI engine. The other service procedures are the same as for the 4G63-MPI engine.

GENERAL INFORMATION

SYSTEM DIAGRAM



9EN0870

ALTERNATOR SPECIFICATIONS

Items	4G64-GDI
Type	Battery voltage sensing
Rated output V/A	12/100
Voltage regulator	Electronic built-in type

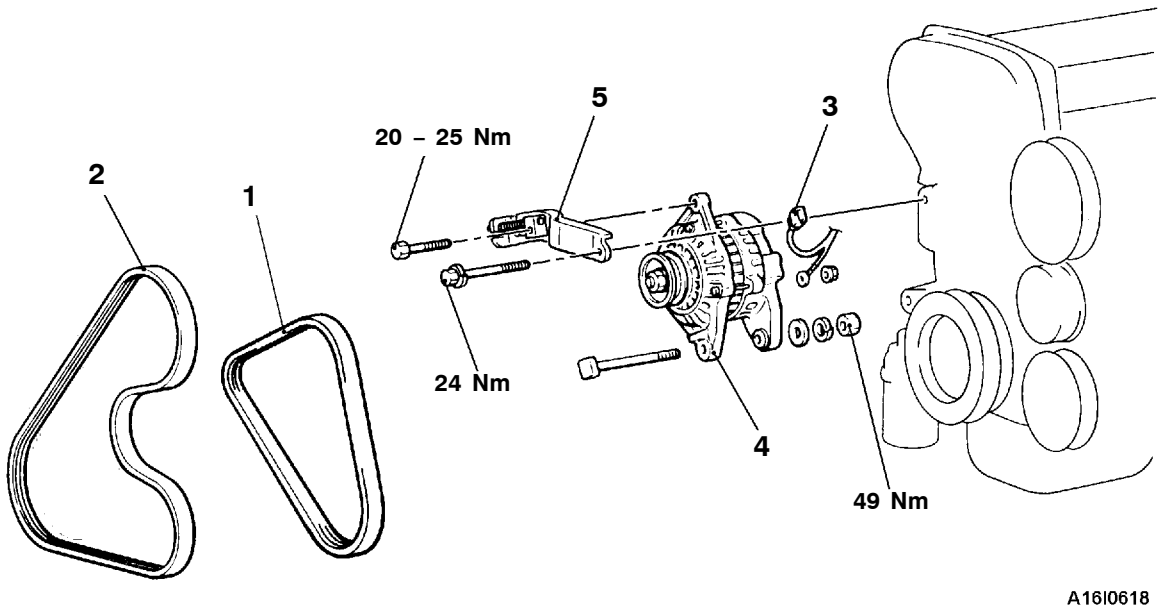
ALTERNATOR

16100140286

REMOVAL AND INSTALLATION

Pre-removal Operation
Under Cover and Side Cover (R.H. side) Removal

Post-installation Operation
- Drive Belt Tension Adjustment
  (Refer to GROUP 11D – On-vehicle Service.)
- Under Cover and Side Cover (R.H. side) Installation



Removal steps

1. Drive belt (Power steering, A/C)
2. Drive belt (Alternator)
3. Alternator connector
4. Alternator
5. Alternator brace

STARTING SYSTEM

GENERAL

OUTLINE OF CHANGE

The following service procedures have been added to correspond to the introduction of the 4G64-GDI engine. The other service procedures are the same as for the 4G63-MPI engine.

GENERAL INFORMATION

STARTER MOTOR SPECIFICATIONS

Items	4G64-GDI
Type	Reduction drive with planetary gear
Rated output kW/V	1.4/12
No. of pinion teeth	8

IGNITION SYSTEM

GENERAL

OUTLINE OF CHANGE

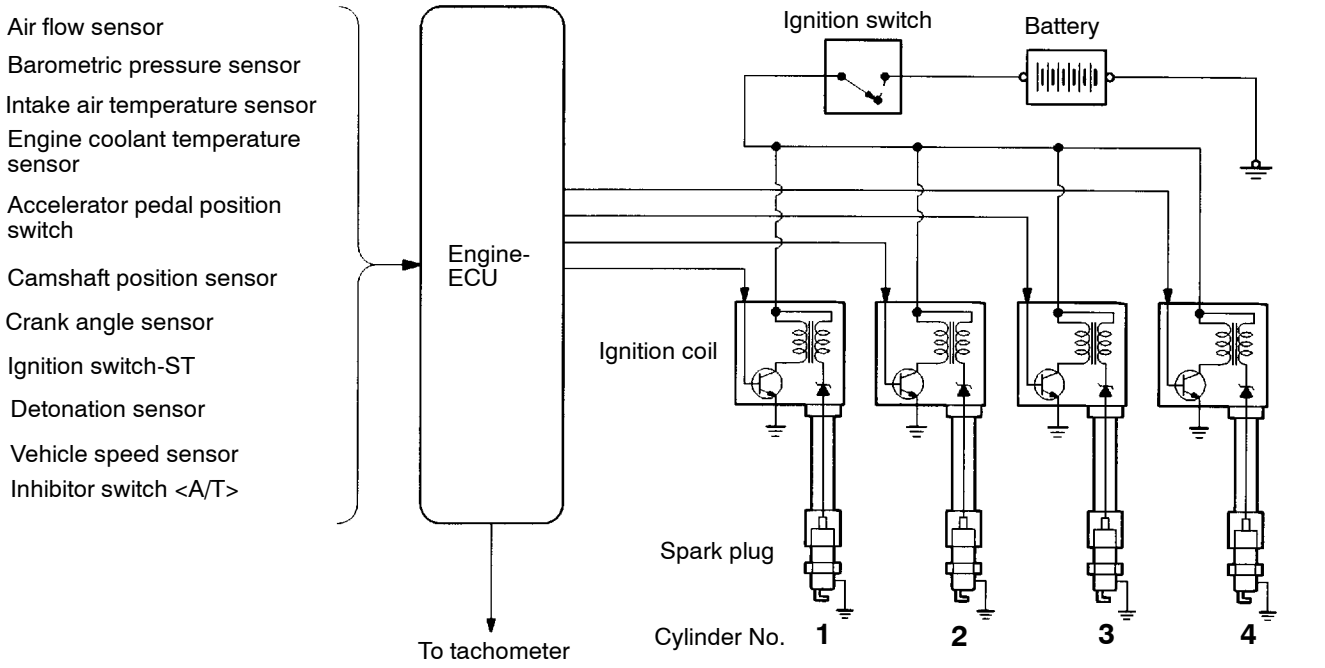
The following service procedures have been added to correspond to the introduction of the 4G64-GDI engine.

GENERAL INFORMATION

This system is equipped with four ignition coils with built-in power transistors for each of the cylinders. Interruption of the primary current flowing in the primary side of an ignition coil generates a high voltage in the secondary side of the ignition coil. The high voltage thus generated is applied to the spark plugs to generate sparks.
The engine-ECU turns the power transistors inside the ignition coils alternately on and off. This causes the primary currents in the ignition coils to be alternately interrupted and allowed to flow to fire the cylinders in the order 1 – 3 – 4 – 2.

The engine-ECU determines which ignition coil should be controlled by means of the signals from the camshaft position sensor and the crank angle sensor. It also detects the crankshaft position, in order to provide ignition at the most appropriate timing in response to the engine operation conditions.
When the engine is cold or running at high altitudes, the ignition timing is slightly advanced to provide optimum performance. Furthermore, if knocking occurs, the ignition timing is gradually retarded until knocking ceases.

SYSTEM DIAGRAM



IGNITION COIL SPECIFICATION

Items	Specification
Type	Molded 4-coil

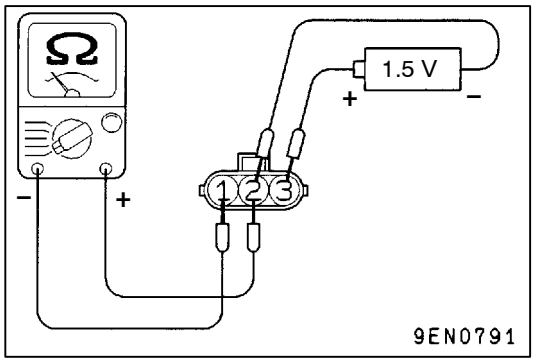
SPARK PLUG SPECIFICATION

Items	Specification
NGK	IZFR5B

SERVICE SPECIFICATIONS

SPARK PLUG

Items	Standard value	Limit
Spark plug gap mm	0.5 – 0.6	0.75
Spark plug insulation resistance MΩ	–	1



ON-VEHICLE SERVICE

IGNITION COIL (WITH BUILT-IN POWER TRANSISTOR) CHECK

PRIMARY COIL AND POWER TRANSISTOR CONTINUITY CHECK

NOTE
1. An analogue-type circuit tester should be used.
2. Connect the negative (–) probe of the circuit tester to terminal 1.

Caution
This test must be performed quickly (in less than 10 seconds) to prevent coil from burning and power transistor from breakage.

Voltage: 1.5V	Terminal No.		
	1	2	3
When current is flowing	○	⊖	⊕
When current is not flowing			

SECONDARY COIL CHECK

NOTE

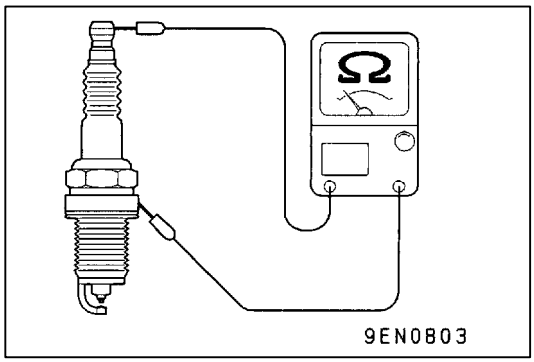
It is impossible to check the secondary coil through the continuity check as a diode is integrated in the secondary coil circuit of this ignition coil. So, check the secondary coil in the following procedure.

1. Disconnect the ignition coil connector.
2. Remove the ignition coil and install a new spark plug to the ignition coil.
3. Connect the ignition coil connector.
4. Earth the side electrode of the spark plug and crank the engine.
5. Check that spark is produced between the electrodes of the spark plug.
6. If no spark is produced, replace the ignition coil with a new one and recheck.
7. If spark is produced with the new ignition coil, replace the old one as it is faulty. If no spark is produced again, the ignition circuit is suspected as faulty. Check the ignition circuit.

SPARK PLUG CHECK AND CLEANING

Caution

1. **The spark plug gap for iridium plugs should not be adjusted.**
2. **Cleaning iridium plugs may result in damage to the iridium tip. Therefore, if cleaning is necessary because the plug is sooty, use a plug cleaner, and do not clean the plug for more than 20 seconds in order to preserve the electrodes. A wire brush should never be used.**
3. **The spark plugs in GDI engines are special iridium plugs in which the electrodes can become black even when the plugs are working normally. Carbon which may become deposited on these plugs burns off more readily than with conventional plugs, and so should not cause any problems with spark plug performance. Judgement of whether a spark plug is operating normally or not should be made by checking the insulation resistance.**



1. Remove the ignition coils.
2. Remove the spark plugs.
3. Check the spark plug gap. Replace the spark plug if the gap exceeds the limit.

   Limit: 0.75 mm

   Standard value: 0.5 – 0.6 mm
4. Measure the spark plug insulation resistance. Replace the spark plug if the measured value is lower than the limit value.

   Limit: 1 MΩ
5. Clean the spark plug holes.
6. Install the spark plugs.
7. Install the ignition coils.

CAMSHAFT POSITION SENSOR CHECK

Refer to GROUP 13I – Troubleshooting.

CRANK ANGLE SENSOR CHECK

Refer to GROUP 13I – Troubleshooting.

DETONATION SENSOR CHECK

Check the detonation sensor circuit if self-diagnosis code, No. 31 is shown.

NOTE
For information concerning the self-diagnosis codes, refer to GROUP 13I – Troubleshooting.

ENGINE AND EMISSION CONTROL

CONTENTS

ENGINE CONTROL SYSTEM <4G64–GDI>

GENERAL

OUTLINE OF CHANGE

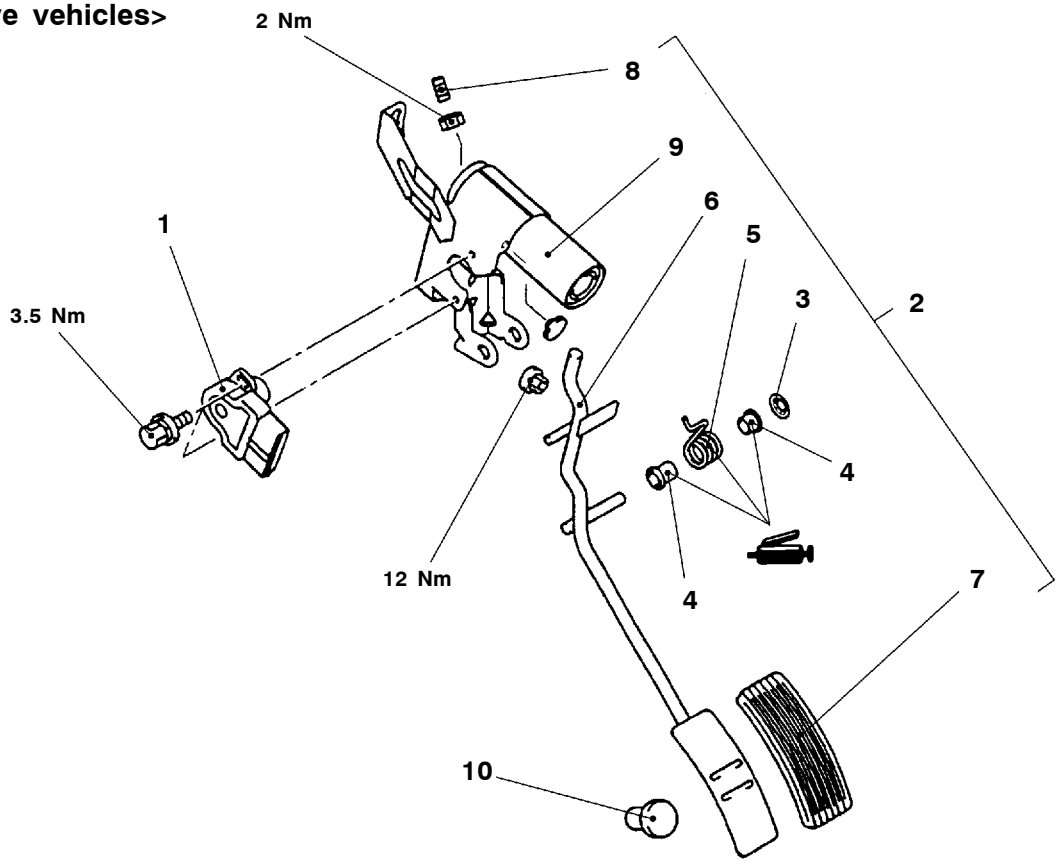
The following service procedures for the accelerator pedal with the accelerator pedal position sensor (APS) have been added to correspond to the introduction of the 4G64-GDI engine.

ACCELERATOR CABLE AND PEDAL

REMOVAL AND INSTALLATION

Post-installation Operation
Check and Adjustment of the Accelerator Pedal Position Sensor (Refer to GROUP 13I – On-vehicle Service.)

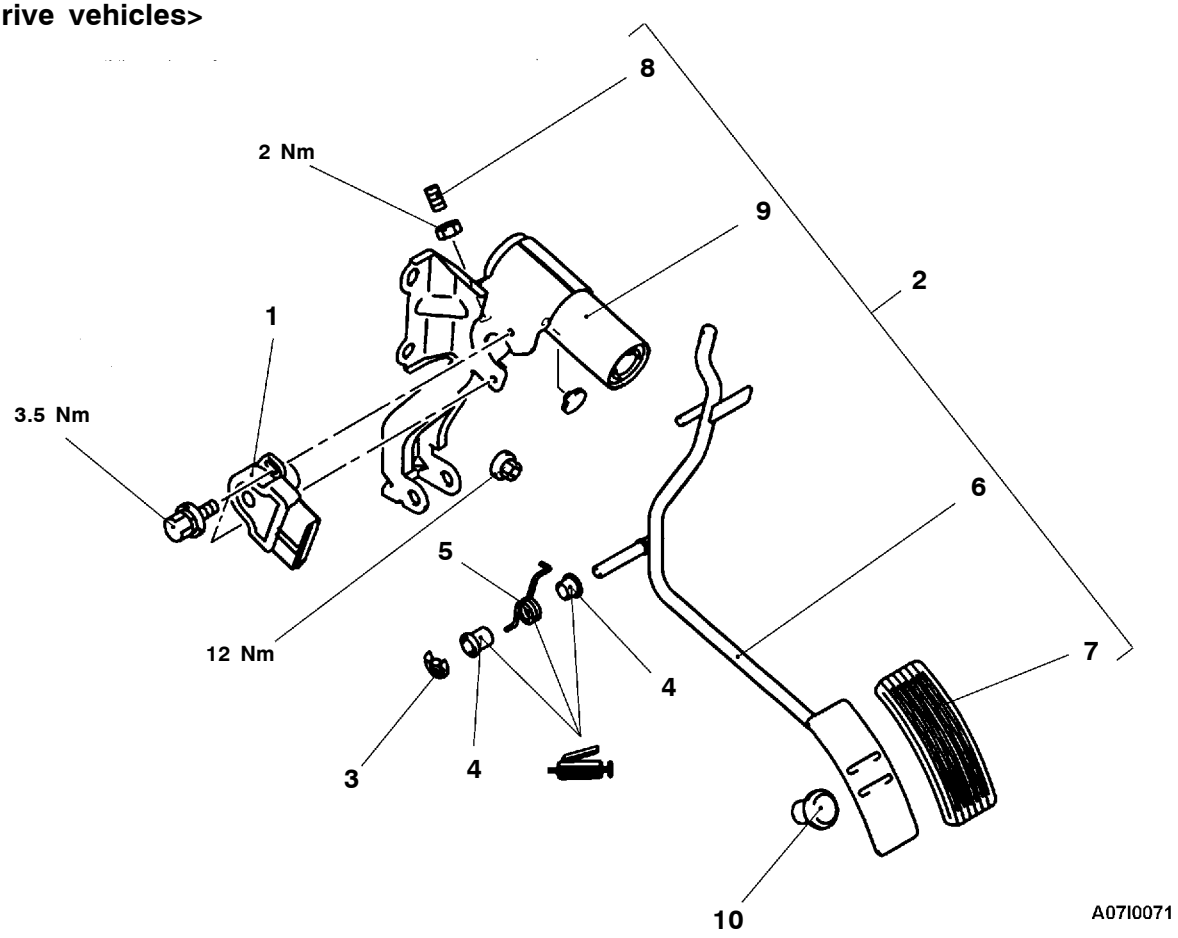
<L.H. drive vehicles>



Removal steps

1. Accelerator pedal position sensor
2. Accelerator pedal assembly
3. Snap ring
4. Bushing
5. Return spring
6. Accelerator pedal
7. Accelerator pedal pad
8. Adjusting screw
9. Accelerator pedal bracket
10. Stopper

<R.H. drive vehicles>



Removal steps

1. Accelerator pedal position sensor
2. Accelerator pedal assembly
3. Snap ring
4. Bushing
5. Return spring
6. Accelerator pedal
7. Accelerator pedal pad
8. Adjusting screw
9. Accelerator pedal bracket
10. Stopper

AUTO-CRUISE CONTROL SYSTEM <4G64-GDI>

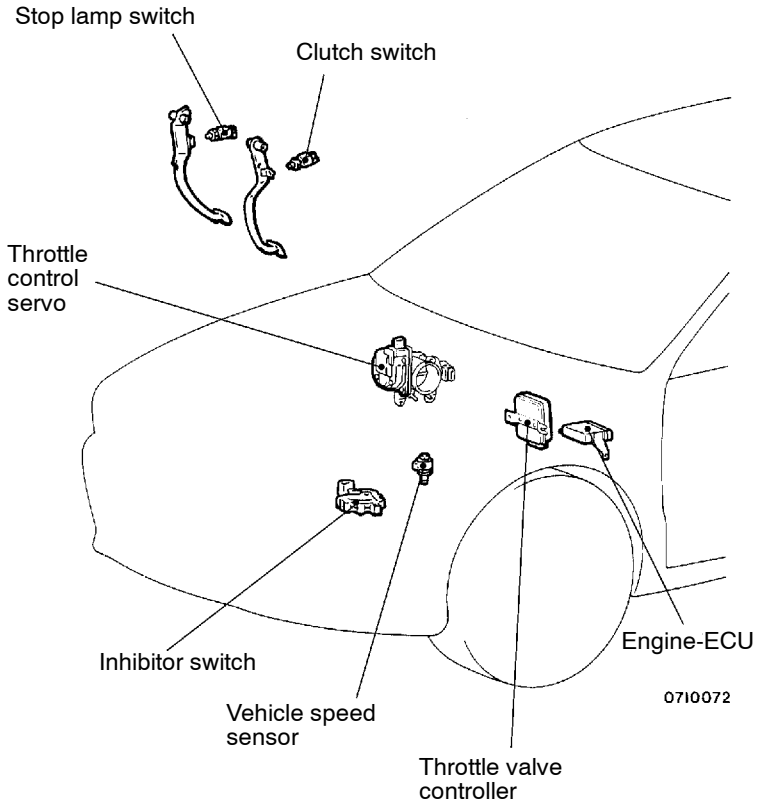
GENERAL

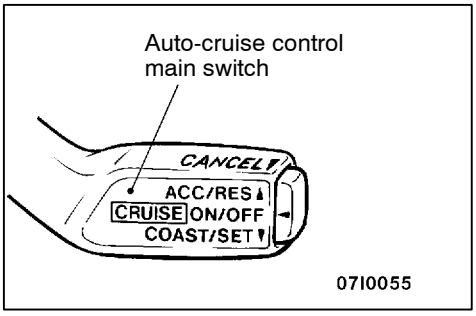
OUTLINE OF CHAGNE

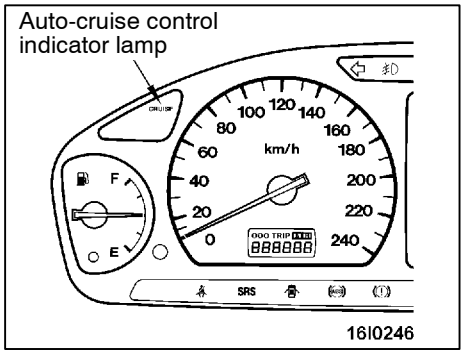
The following service procedures have been added to correspond to the introduction of the electronically controlled throttle valve system and a built-in auto-cruise control switch.

GENERAL INFORMATION

By using the auto-cruise control, the driver can drive at the speed he/she likes (in a range of approximately 40–200 km/h) without depressing the accelerator pedal.







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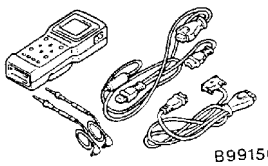
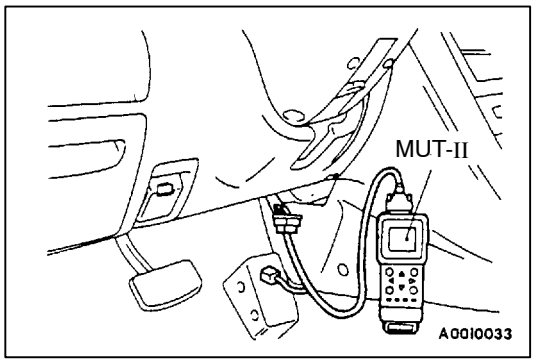
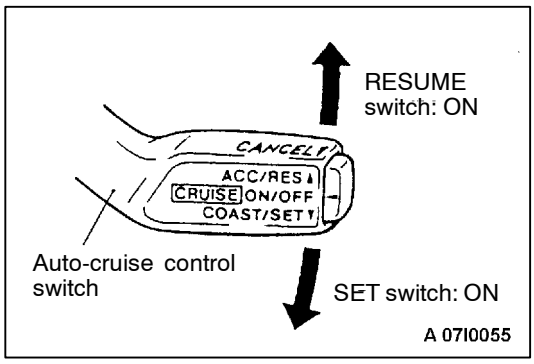
SPECIAL TOOL

Tool	Number	Name	Use
 B991502	MB991502	MUT-II sub assembly	• Reading diagnosis codes • Auto-cruise control system check





TROUBLESHOOTING

DIAGNOSIS FUNCTION

METHOD OF READING THE DIAGNOSIS CODES

WHEN USING THE MUT-II

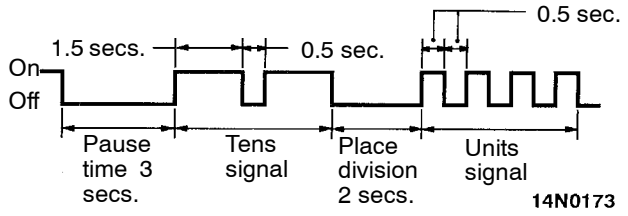
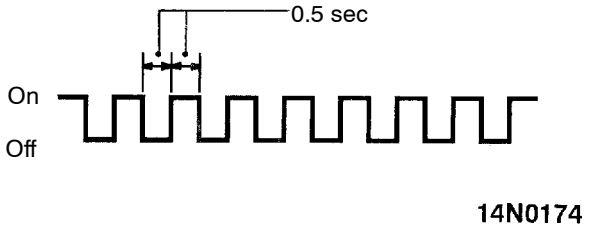
Connect the MUT-II to the diagnosis connector and take a reading of the diagnosis codes.

Caution
Turn off the ignition switch before connecting or disconnecting the MUT-II.

WHEN USING THE AUTO-CRUISE CONTROL INDICATOR LAMP

1. Turn the ignition switch to ON, and then turn on the MAIN switch of the auto-cruise control switch.
2. Turn off the MAIN switch of the auto-cruise control switch and the ignition switch.
3. While the MAIN switch and the SET switch of the auto-cruise control switch remain on, turn the ignition switch to ON. Then turn on the RESUME switch of the auto-cruise control switch within one second.

Indication of diagnosis code by the auto-cruise control indicator lamp

When the diagnosis code No.23 is output	When no diagnosis code is output
	

METHOD OF ERASING DIAGNOSIS CODES

WHEN USING THE MUT-II

Connect the MUT-II to the diagnosis connector and erase the diagnosis code.

Caution
Turn off the ignition switch before connecting or disconnecting the MUT-II.

WHEN NOT USING THE MUT-II

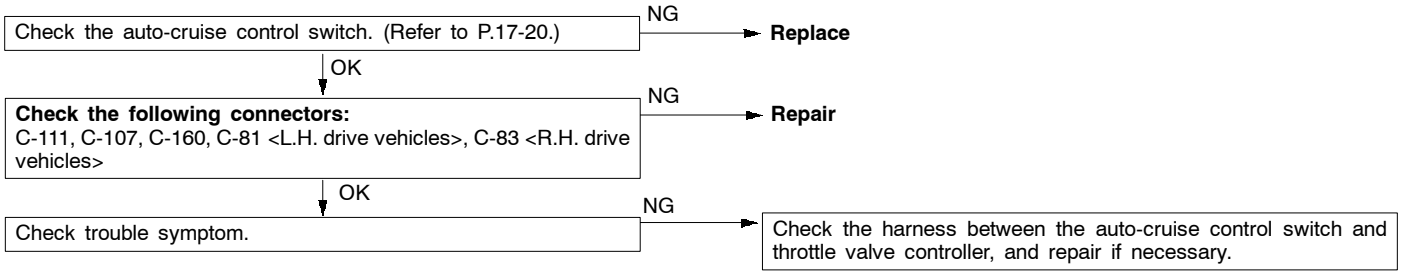
1. Turn the ignition switch to OFF.
2. After disconnecting the battery cable from the battery (–) terminal for 10 seconds or more, reconnect the cable.

INSPECTION CHART FOR DIAGNOSIS CODES

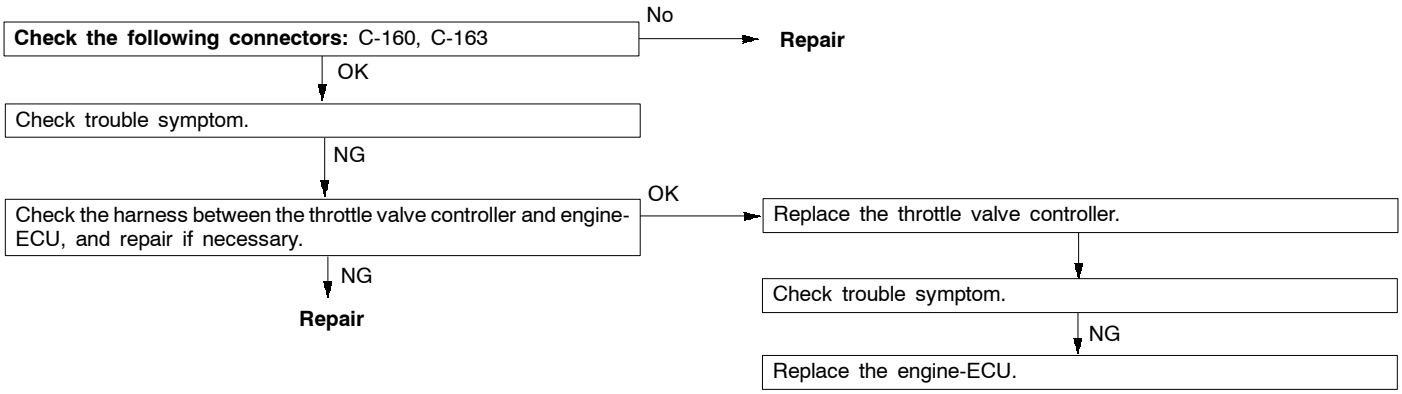
Code No.	Diagnosis item	Reference page
15	Auto-cruise control switch system	17-7
21	Cancel latch signal system	17-7
22	Stop lamp switch system	17-8
23	Engine-ECU system	17-9

INSPECTION PROCEDURE FOR DIAGNOSIS CODES

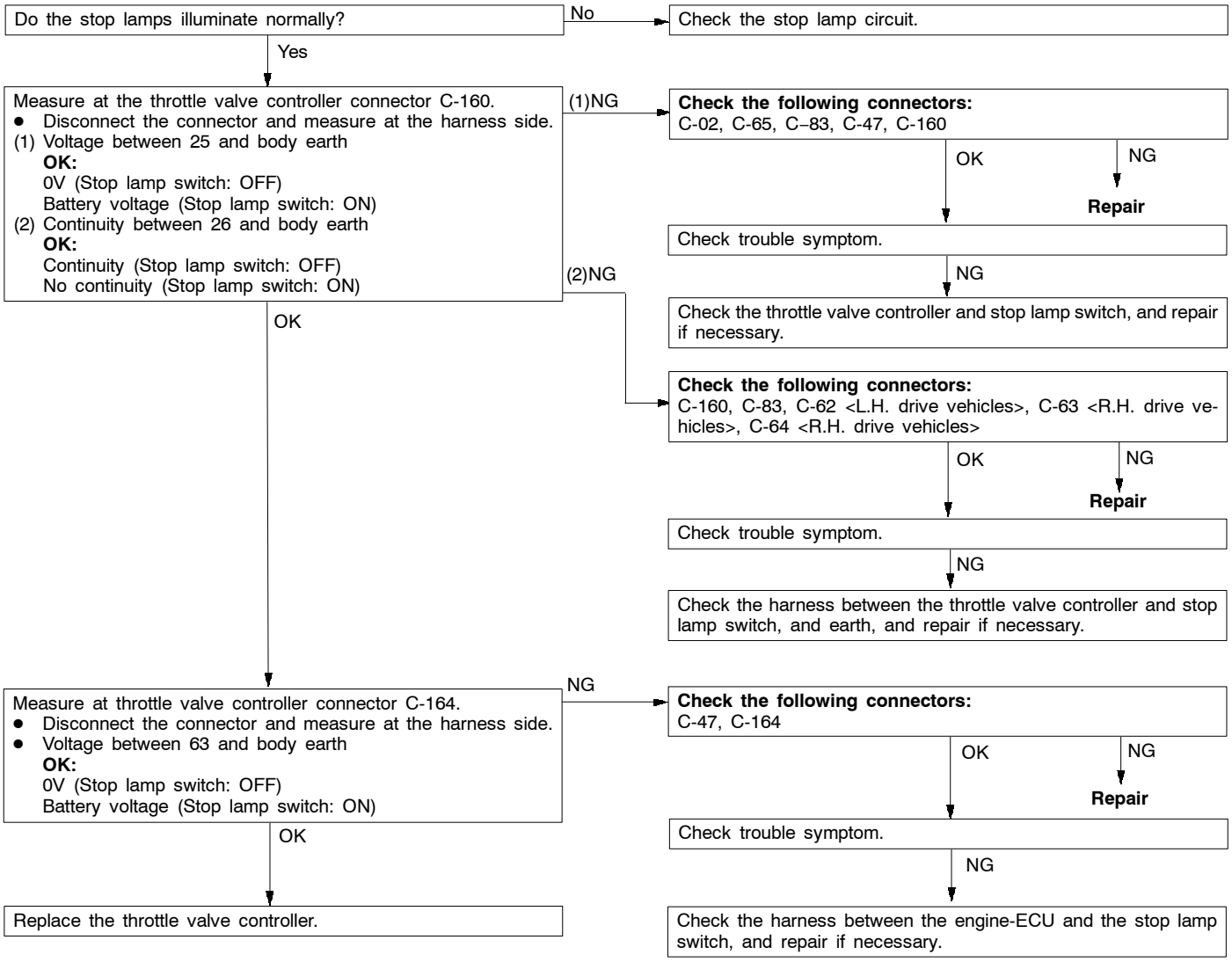
Code No. 15 Auto-cruise control switch system	Probable cause
This diagnosis code is output if the RESUME and SET switches of the auto-cruise control switch remain on.	• Malfunction of the auto-cruise control switch • Malfunction of the connector • Malfunction of the harness



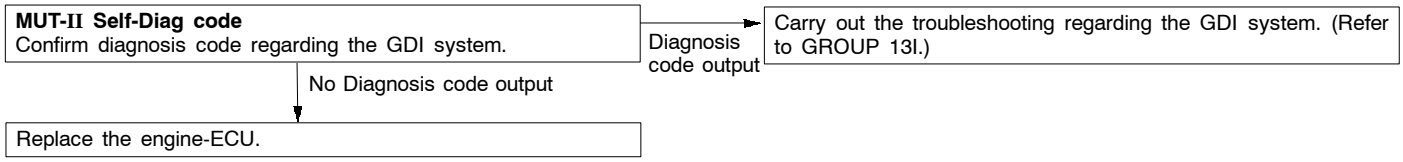
Code No. 21 Cancel latch signal system	Probable cause
The throttle valve controller and the engine-ECU send a cancel holding information to the engine-ECU via a cancel latch signal line and the serial communication line. This diagnosis code is output if there is a failure in the cancel latch signal line, or a disaccord in the communication data.	• Malfunction of the connector • Malfunction of the harness • Malfunction of the throttle vale controller • Malfunction of the auto-cruise control-ECU



Code No. 22 Stop lamp switch system	Probable cause
This diagnosis code is output when the throttle valve controller detects a failure in the stop lamp switch output.	• Malfunction of the connector or harness wire • Malfunction of the stop lamp switch • Malfunction of the throttle valve controller



Code No. 23 Engine-ECU system	Probable cause
This diagnosis code is output if the engine-ECU system is defective as follows: ● Communication error between the throttle valve controller and the engine-ECU ● Malfunction of the throttle position sensor ● Malfunction of the accelerator pedal position sensor ● Malfunction of the throttle control servo ● Malfunction of the vehicle speed sensor	● Malfunction of the connector ● Malfunction of the harness ● Malfunction of the engine-ECU



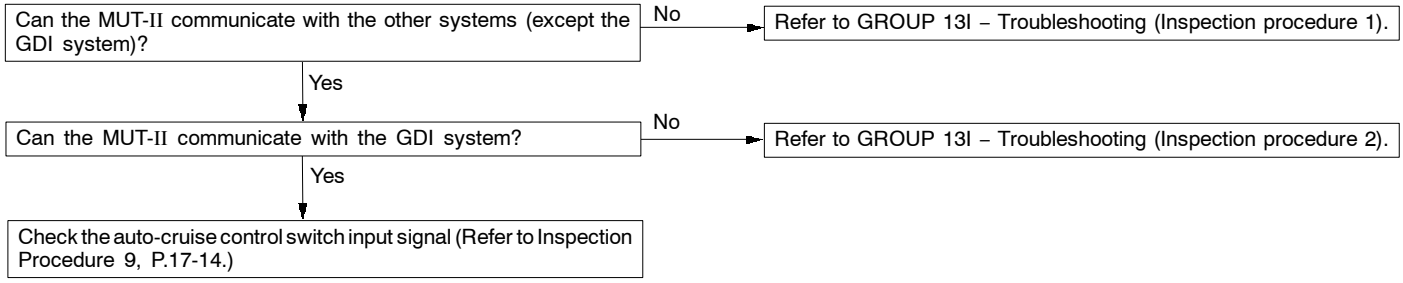
INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble symptom		Inspection procedure No.	Reference page
Communication with MUT-II is not possible.		1	17-10
Auto-cruise control is not cancelled.	Even if brake pedal is depressed	2	17-10
	Even if clutch pedal is depressed <M/T>	3	17-11
	Even if select lever is set to N range <A/T>	4	17-11
	Even if CANCEL switch is set to ON	5	17-12
Auto-cruise control cannot be set.		6	17-12
Hunting (repeated acceleration and deceleration) occurs at the set vehicle speed.		7	17-13
When the MAIN switch of the auto-cruise control switch is turned on, the auto-cruise control indicator lamp does not illuminate. (However, the auto-cruise control is normal.)		8	17-13

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

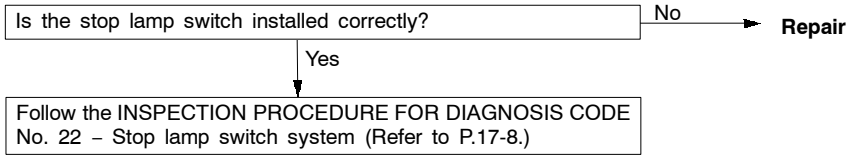
Inspection Procedure 1

Communication with MUT-II is not possible.	Probable cause
If the MUT-II can not also communicate with the systems other than the GDI system, the diagnosis line circuit may be defective. If the MUT-II can not communicate with only the GDI system and the auto-cruise control system, the harness wire between the engine-ECU and the diagnosis connector, may be defective. In addition, if the the MUT-II can not communicate with only the auto-cruise control system, the auto-cruise control switch circuit may be defective.	• Malfunction of the connector or harness • Malfunction of the auto-cruise control switch • Malfunction of the throttle valve controller • Malfunction of the engine-ECU



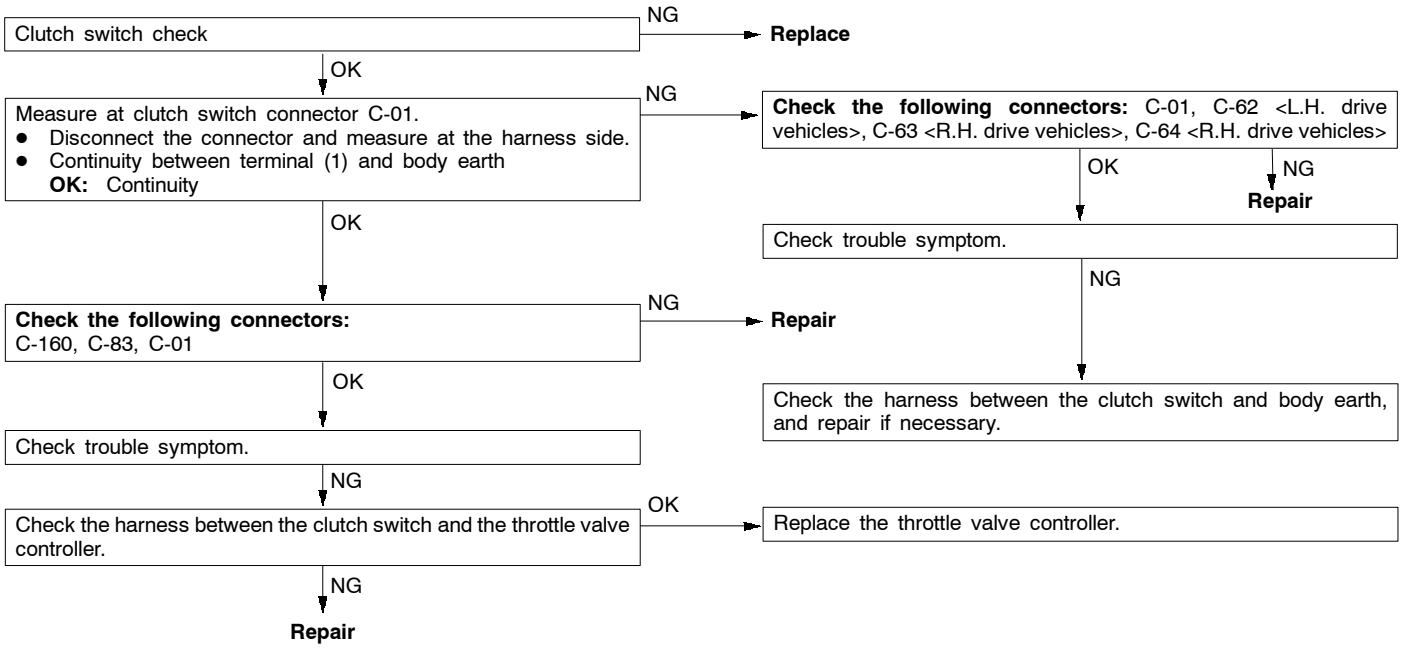
Inspection Procedure 2

Auto-cruise control can not be cancel even if brake pedal is depressed.	Probable cause
The cause is probably a malfunction of the stop lamp switch, or the stop lamp circuit.	• Malfunction of the connector or the harness • Malfunction of the stop lamp switch • Malfunction of the throttle valve controller • Malfunction of the engine-ECU



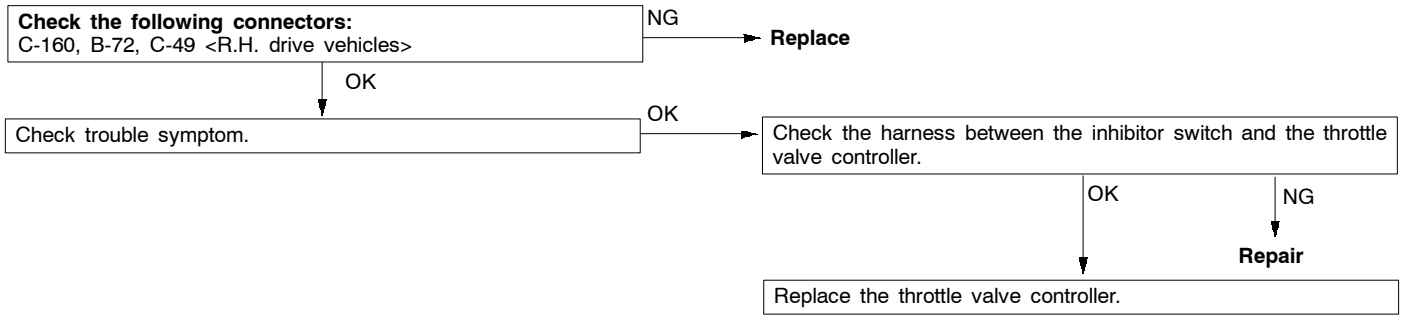
Inspection Procedure 3

Even if clutch pedal is depressed, auto-cruise control is not cancelled. <M/T>	Probable cause
The cause is probably a malfunction of clutch switch or clutch switch circuit.	• Malfunction of the clutch switch • Malfunction of the connector • Malfunction of the harness • Malfunction of the throttle valve controller



Inspection Procedure 4

Even if select lever is set to N range, auto-cruise control is not cancelled. <A/T>	Probable cause
The cause is probably a defective inhibitor switch circuit.	• Malfunction of the connector or harness • Malfunction of the inhibitor switch • Malfunction of the throttle valve controller



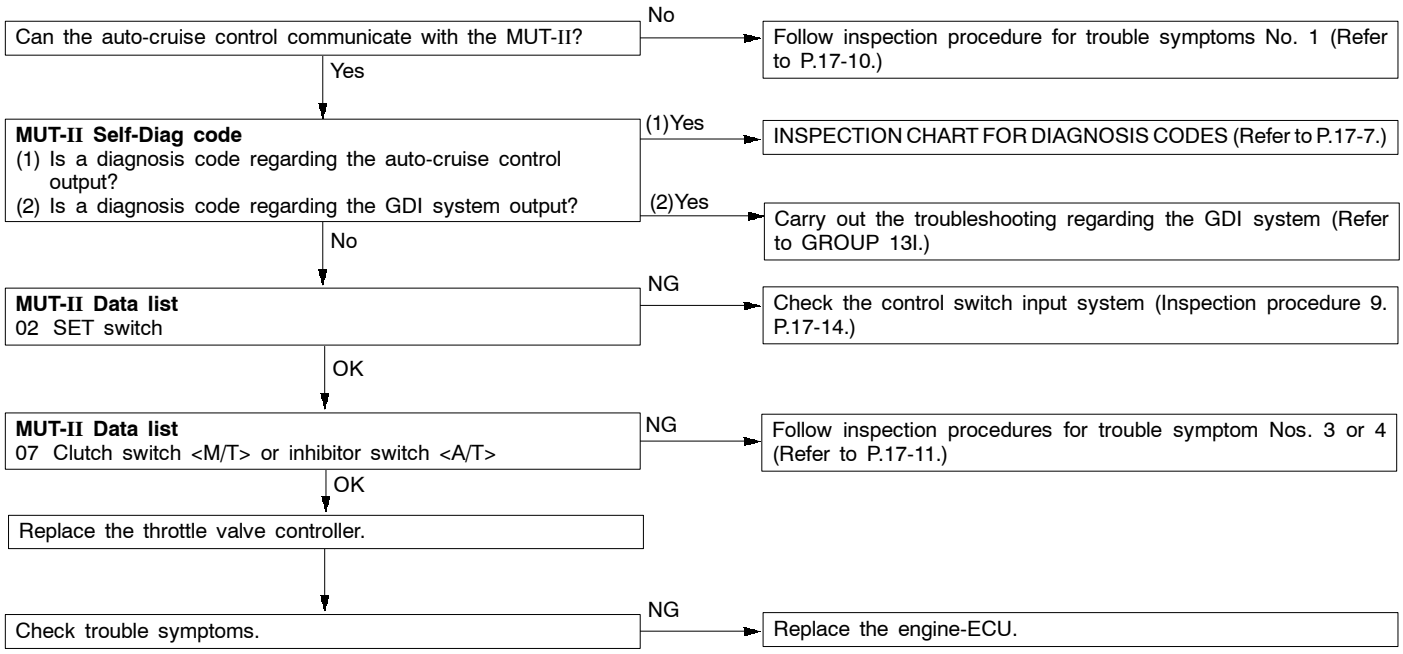
Inspection Procedure 5

Even if auto-cruise control CANCEL switch is set to ON, auto-cruise control is not cancelled.	Probable cause
The cause is probably an open-circuit in the circuit inside the CANCEL switch.	• Malfunction of the auto-cruise control switch

Replace the auto-cruise control switch.

Inspection Procedure 6

Auto-cruise control cannot be set.	Probable cause
The cause is probably that the fail-safe function is cancelling auto-cruise control. In this case, the MUT-II can be used to check the trouble symptoms in each system by inspecting the diagnosis codes. The MUT-II can also be used to check if the circuits of each input switch are normal or not by inspecting the input switch codes.	• Malfunction of the auto-cruise control switch • Malfunction of the harnesses or connectors • Malfunction of the control switch • Malfunction of the throttle valve controller • Malfunction of the engine-ECU



Inspection Procedure 7

Hunting (repeated acceleration and deceleration) occurs at the set vehicle speed.	Probable cause
The cause is probably a malfunction of vehicle speed sensor or throttle control servo. In either case, a diagnosis code regarding the GDI system must be confirmed.	• Malfunction of the connector and harness • Malfunction of the vehicle speed sensor • Malfunction of the throttle control servo • Malfunction of the throttle valve controller • Malfunction of the engine-ECU

MUT-II Self-Diag code
Is a diagnosis code regarding the GDI system output?
- Yes → Follow the troubleshooting regarding the GDI system (Refer to GROUP 13I).
- No → Replace the throttle valve controller.

Check trouble symptoms.
- NG → Replace the engine-ECU.

Inspection Procedure 8

When the MAIN switch of the auto-cruise control switch is turned on, the auto-cruise control indicator lamp does not illuminate. (However, the auto-cruise control is normal.)	Probable cause
There may be a burnt-out bulb or a malfunction of the auto-cruise control indicator lamp circuit.	• Burnt-out bulb • Malfunction of the connector and harness • Malfunction of the engine-ECU

Auto-cruise control indicator lamp bulb check
- NG → **Replace**
- OK ↓

Measure at combination meter connector D-03.
- Disconnect the connector and measure at the harness side.
- Ignition switch: ON
- Voltage between terminal (4) and body earth
  OK: Battery voltage

- NG → **Check the following connector:** D-03
  - OK → Check trouble symptom.
    - NG → Check the harness between the J/B and the combination meter, and repair if necessary.
  - NG → **Repair**
- OK ↓

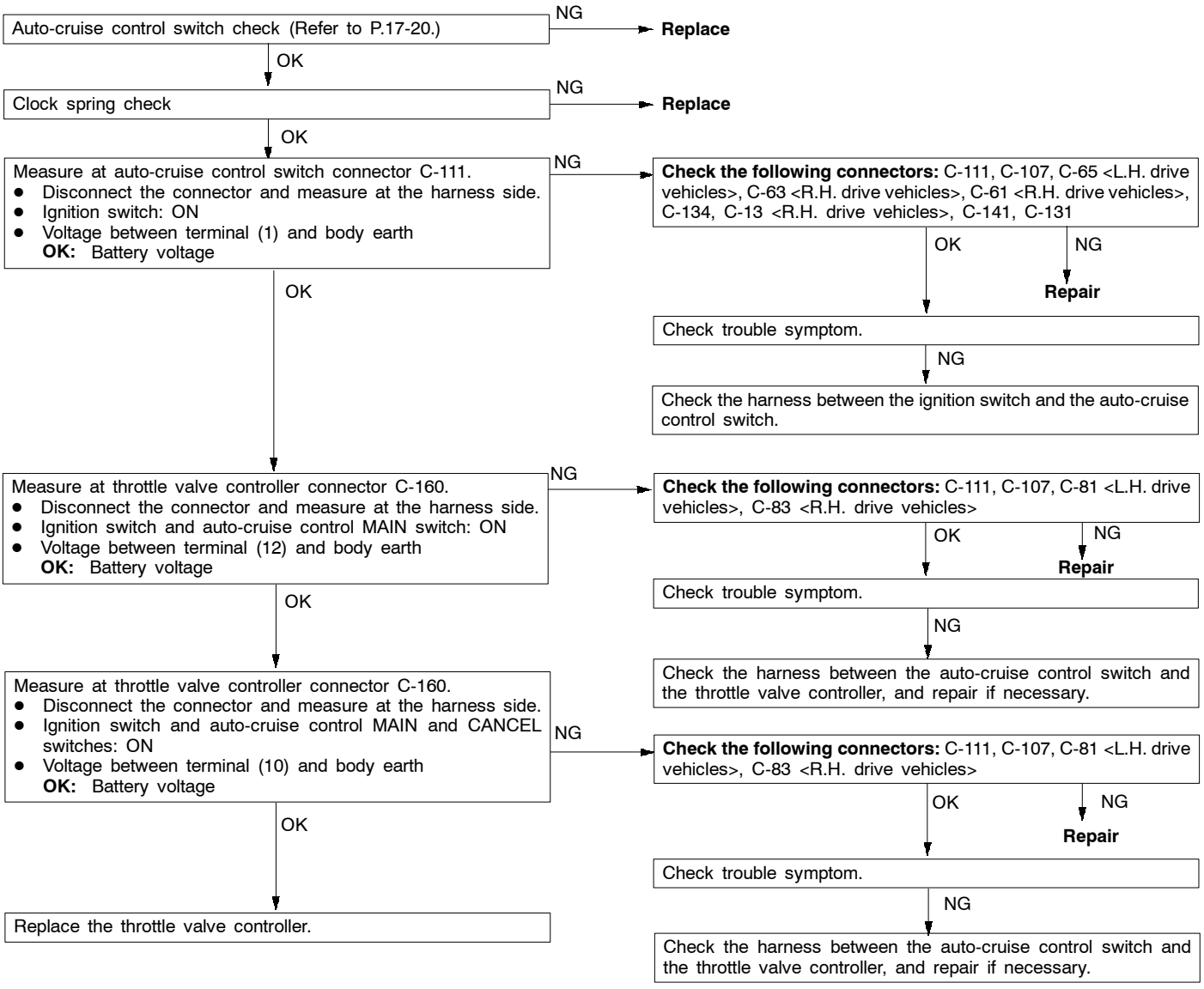
Measure at engine-ECU connector C-165.
- Disconnect the connector and measure at the harness side.
- Ignition switch: ON
- Voltage between terminal (28) and body earth
  OK: Battery voltage

- NG → **Check the following connectors:** D-01, C-90, C-165
  - OK → Check trouble symptom.
    - NG → Check the harness between the combination meter and the engine-ECU, and repair if necessary.
  - NG → **Repair**
- OK ↓

Replace the engine-ECU.

Inspection Procedure 9

Auto-cruise control switch input system check



DATA LIST REFERENCE TABLE

For the data, which is input to the throttle valve controller and the engine-ECU, the following items can be read out by using the MUT-II.

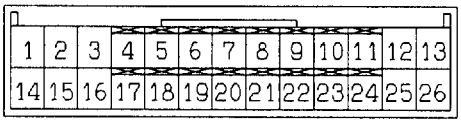
HOW TO READ OUT DATA LIST

1. Connect the MUT-II to the 16-pin diagnosis connector.

   Caution
   Turn off the ignition switch before connecting and disconnecting the MUT-II.
2. Turn the ignition switch to ON, and then turn on the auto-cruise control MAIN switch.
3. Select “auto-cruise control” on the MUT-II menu, and then read out the data list.

Item No.	Check item		Check conditions	Normal condition
01	Auto-cruise control switch	MAIN	MAIN switch: ON	ON
			MAIN switch: OFF	OFF
02		SET	SET switch: ON	ON
			SET switch: OFF	OFF
03		RESUME	RESUME switch: ON	ON
			RESUME switch: OFF	OFF
04		CANCEL	CANCEL switch: ON	ON
			CANCEL switch: OFF	OFF
05	Stop lamp switch		Brake pedal: Depressed	ON
			Brake pedal: Released	OFF
06	Stop lamp switch		Brake pedal: Depressed	OFF
			Brake pedal: Released	ON
07	Clutch switch <M/T>		Clutch pedal: Depressed	ON
			Clutch pedal: Released	OFF
	Inhibitor switch <A/T>		Selector lever: N position	ON
			Selector lever: Other than N position	OFF
08	Idle position switch		Accelerator pedal: Released	ON
			Accelerator pedal: Depressed	OFF
09	Auto-cruise control		Auto-cruise control: Activated	ON
			Auto-cruise control: No activated	OFF
10	Vehicle speed sensor		Road test the vehicle	The speedometer and the MUT-II display the same value.
11	Throttle position sensor 1		Accelerator pedal: Fully depressed	450 – 1,000 mV
			Accelerator pedal: Depressed	The more deeply the pedal is depressed, the higher value the MUT-II displays
			Accelerator pedal: Released	4,200 – 4,900 mV
12	Throttle position sensor 2		Accelerator pedal: Fully depressed	300 – 1,000 mV
			Accelerator pedal: Depressed	The more deeply the pedal is depressed, the higher value the MUT-II displays
			Accelerator pedal: Released	4,500 – 5,500 mV

CHECK AT THE THROTTLE VALVE CONTROLLER TERMINALS



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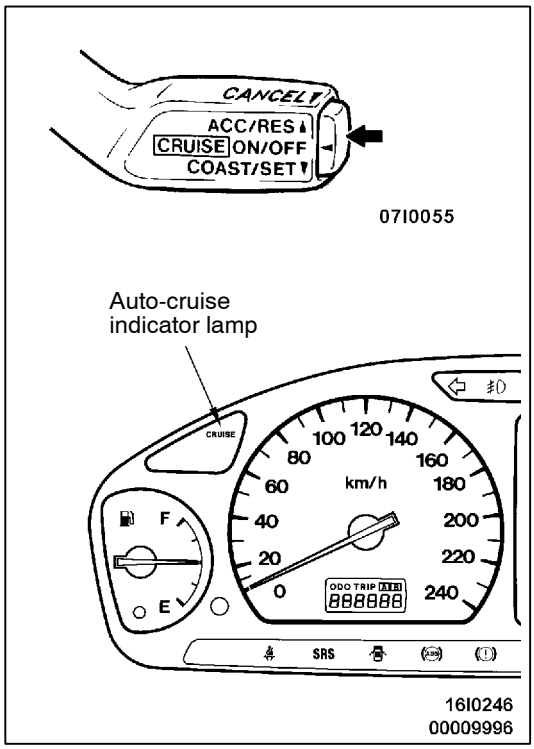
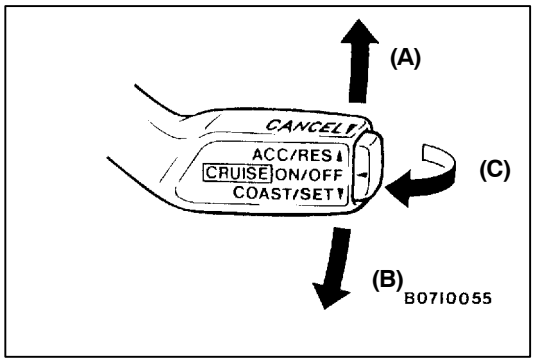
Terminal No.	Check item	Check conditions		Normal condition
1	Throttle control servo (A+)	Ignition switch: ON Accelerator pedal: Fully depressed position to released position		Value changes
9	Throttle control servo (B+)			
14	Throttle control servo (A–)			
15	Throttle control servo (B–)			
2	Throttle control servo power supply	Ignition switch: ON		Battery voltage
3, 4, 16	Earth	–		0 V
5	Power supply	Ignition switch: ON		Battery voltage
6	Sensor power supply	Ignition switch: ON		4.5 – 5.5 V
7	Throttle position sensor 1	Ignition switch: ON	Accelerator pedal: Released	0.4 – 0.8 V
			Accelerator pedal: Fully depressed	3.9 – 4.9 V
10	Auto-cruise control switch	Ignition switch: ON MAIN switch: ON	SET switch: ON	Approximately 3 V
			RESUME switch: ON	Approximately 6 V
			CANCEL switch: ON	Battery voltage
			All swishes: OFF	0 V
11	Clutch switch <M/T>	Ignition switch: ON	Clutch pedal: Depressed	0 V
			Clutch pedal: Released	8 – 14 V
	Inhibitor switch <A/T>	Ignition switch: ON	Selector lever: N or P position	0 V
			Selector lever: Other than the above	8 – 14 V
12	Auto-cruise control switch	Ignition switch: ON	MAIN switch: ON	Battery voltage
			MAIN switch: OFF	0 V
17	Sensor earth	–		0 V

Terminal No.	Check item	Check conditions		Normal condition
20	Accelerator pedal position sensor 2	Ignition switch: ON	Accelerator pedal: Released	0.7 – 1.4 V
			Accelerator pedal: Fully depressed	4 V or more
22	Ignition switch (IG)	Ignition switch: ON		Battery voltage
23	Auto-cruise control cancel latch signal	Auto-cruise control: Activated		0 V
		Auto-cruise control: Not activated		Battery voltage
25	Stop lamp switch	Brake pedal: Depressed		Battery voltage
		Brake pedal: Released		0 V
26	Stop lamp switch	Ignition switch: ON	Brake pedal: Depressed	0 V
			Brake pedal: Released	Battery voltage





ON-VEHICLE SERVICE

The other items than the below are the same as the ones for 4G63-MPI.

AUTO-CRUISE CONTROL SWITCH CHECK

AUTO-CRUISE MAIN SWITCH CHECK

1. Turn the ignition key to ON.
2. Check to be sure that the indicator lamp within the combination meter illuminates when the MAIN switch is switched ON.

AUTO-CRUISE CONTROL SETTING

1. Switch ON the MAIN switch.
2. Drive at the desired speed within the range of approximately 40 – 200 km/h.
3. Push the auto-cruise control switch in the direction of arrow (B).
4. Check to be sure that when the switch is released the speed is the desired constant speed.

   NOTE
   If the vehicles speed decreases to approximately 15 km/h below the set speed because of climbing a hill for example, the auto-cruise control will be cancelled.

SPEED-INCREASE SETTING

1. Set to the desired speed.
2. Push the auto-cruise control switch in the direction of arrow (A).
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
   Acceleration can be continued even if the vehicle speed has passed the high-speed limit (approx. 200 km/h). But the speed when the auto-cruise control switch is released will be recorded as the high-speed limit.

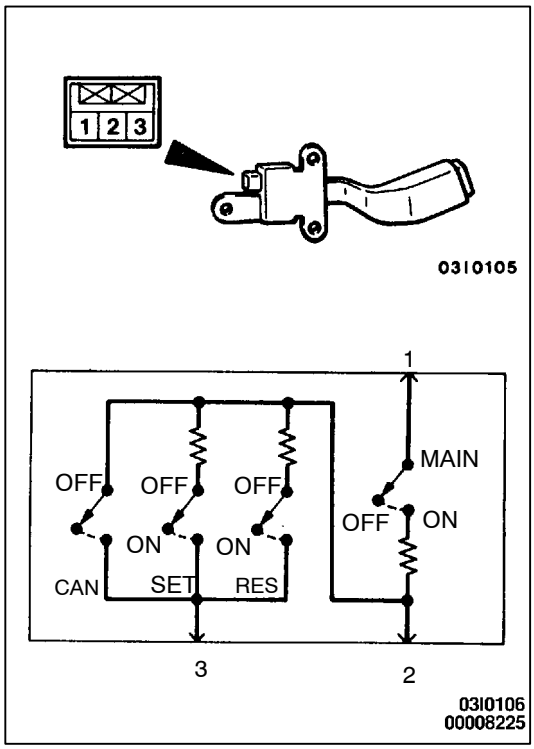
SPEED-REDUCTION SETTING

1. Set to the desired speed.
2. Push the auto-cruise control switch in the direction of arrow (B).
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) during deceleration, the auto-cruise control will be cancelled.

RETURN TO THE SET SPEED BEFORE CANCELLATION AND AUTO-CRUISE CONTROL CANCELLATION

1. Set the auto-cruise speed control.
2. When any of the following operations are performed while at constant speed during auto-cruise control, check if normal driving is resumed and deceleration occurs.
   a. The auto-cruise control switch is pushed in the direction of arrow (C).
   b. The brake pedal is depressed.
   c. The clutch pedal is depressed. <M/T>
   d. The selector lever is moved to the “N” range. <A/T>
3. When the auto-cruise control switch is pushed in the direction of arrow (A) at a vehicle speed of 40 km/h or higher, check if the vehicle speed returns to the speed before auto-cruise control driving was cancelled, and constant speed driving occurs.
4. When the MAIN switch is turned to OFF while driving at constant speed, check if normal driving is resumed and deceleration occurs.



AUTO-CRUISE CONTROL

INSPECTION

AUTO-CRUISE CONTROL SWITCH CHECK

Measure the resistance between the terminals when each of the SET, RESUME, CANCEL and MAIN switches is pressed. If the values measured at this time correspond to those in the table below, then there is no problem.

Switch position	Resistance between terminals	
Switch OFF	No continuity	
CANCEL switch: ON	Terminals 1 and 3	Approx. 3.9 kΩ
	Terminals 2 and 3	Approx. 0 Ω
RESUME switch: ON	Terminals 1 and 3	Approx. 4.8 kΩ
	Terminals 2 and 3	Approx. 910 Ω
SET switch: ON	Terminals 1 and 3	Approx. 4.1 kΩ
	Terminals 2 and 3	Approx. 220 Ω
MAIN switch: ON	Terminals 1 and 2	Approx. 3.9 kΩ

AUTO-CRUISE CONTROL <EXCEPT 4G64-GDI>

GENERAL

OUTLINE OF CHANGE

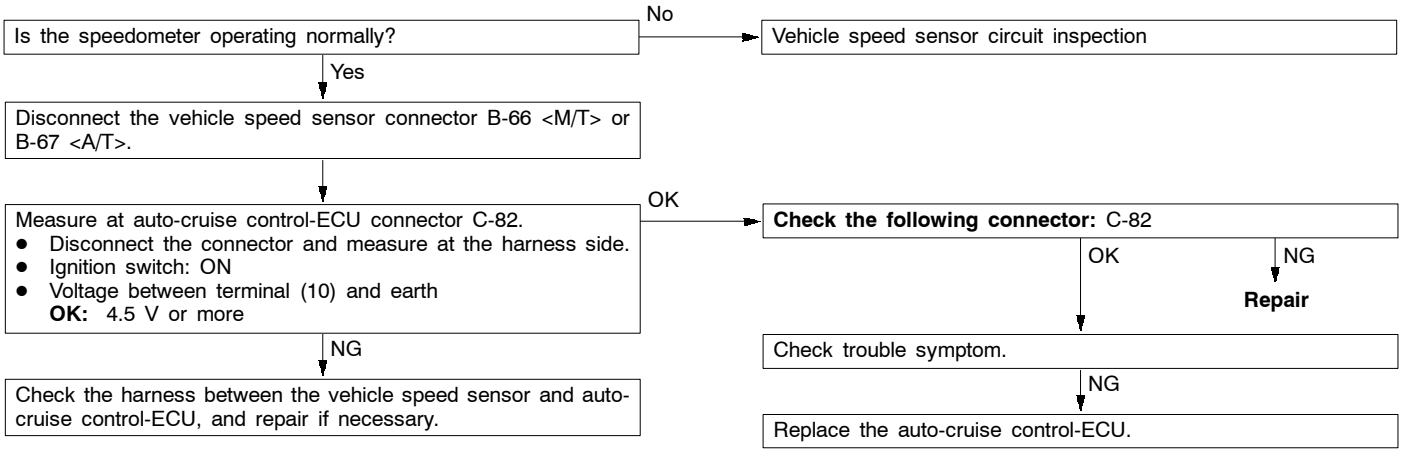
- The following service procedure has been added as an integrated auto-cruise control switch has been newly used.

TROUBLESHOOTING

- The other items than the below are the same as before.

INSPECTION PROCEDURE FOR DIAGNOSIS CODES

Code No. 12 Vehicle speed signal system	Probable cause
This diagnosis code is output if the vehicle speed signals from the vehicle speed sensor are not input to the auto-cruise control-ECU when the vehicle speed is 40 km/h or more.	• Malfunction of the vehicle speed sensor • Malfunction of the connector • Malfunction of the harness • Malfunction of the auto-cruise control-ECU



INSPECTION CHART FOR TROUBLE SYMPTOMS

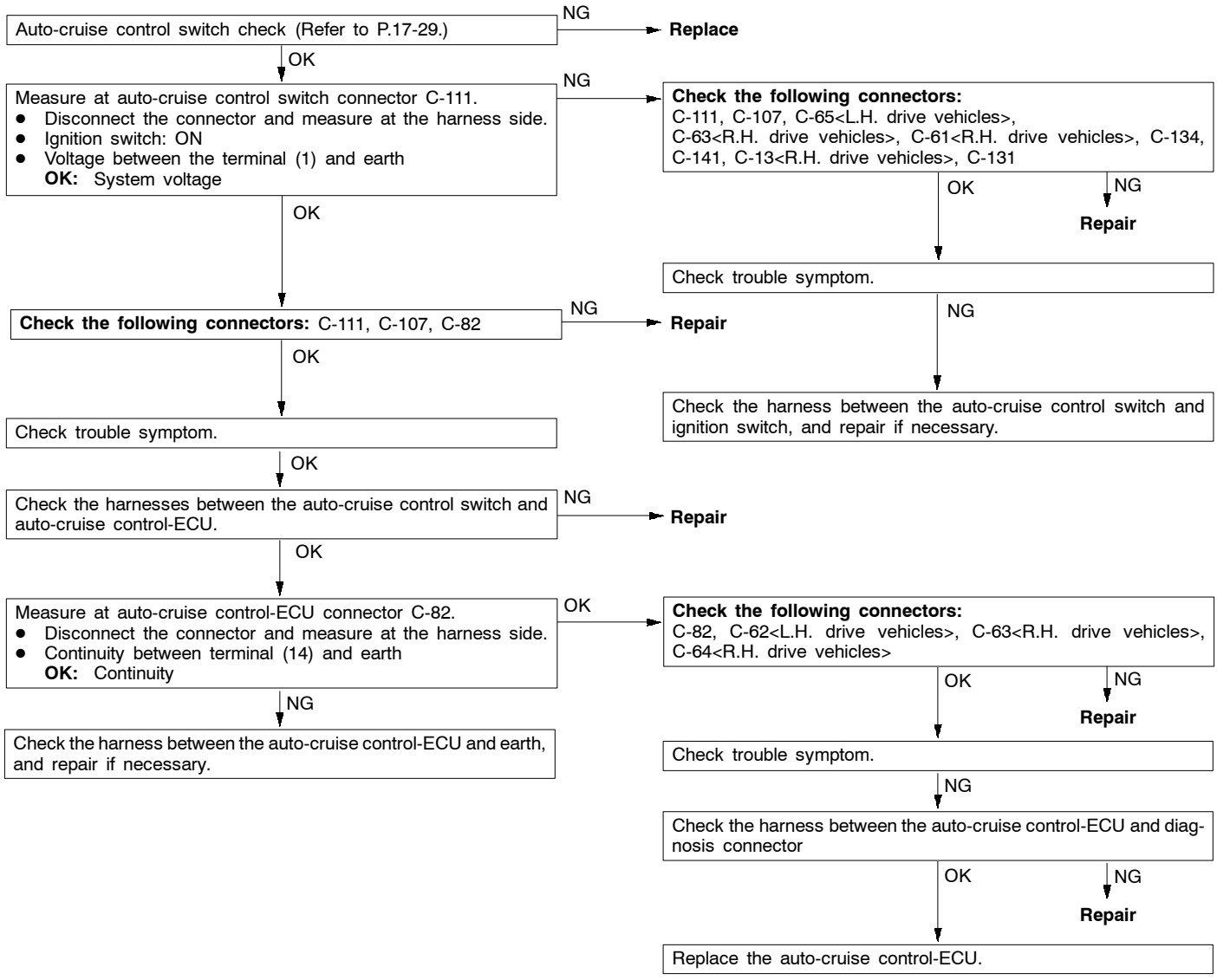
Trouble symptom		Inspection procedure No.	Reference page
Communication with MUT-II is not possible.	Communication with all systems is not possible.	1	*
	Communication with auto-cruise control-ECU only is not possible.	2	17-23
Input switch inspection using the MUT-II is not possible. (However, diagnosis inspection is possible.)		3	17-24
Auto-cruise control is not cancelled.	Even if brake pedal is depressed	4	*
	Even if clutch pedal is depressed <M/T>	5	*
	Even if select lever is set to N range <A/T>	6	*
	Even if CANCEL switch is set to ON	7	*
Auto-cruise control cannot be set.		8	17-25
Hunting (repeated acceleration and deceleration) occurs at the set vehicle speed.		9	*
Even if auto-cruise control MAIN switch is set to ON, auto-cruise indicator lamp in combination meter does not illuminate. (However, auto-cruise control is normal.)		10	17-26

*: Refer to '97 GALANT Workshop Manual (Pub. No. PWDE9611).

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

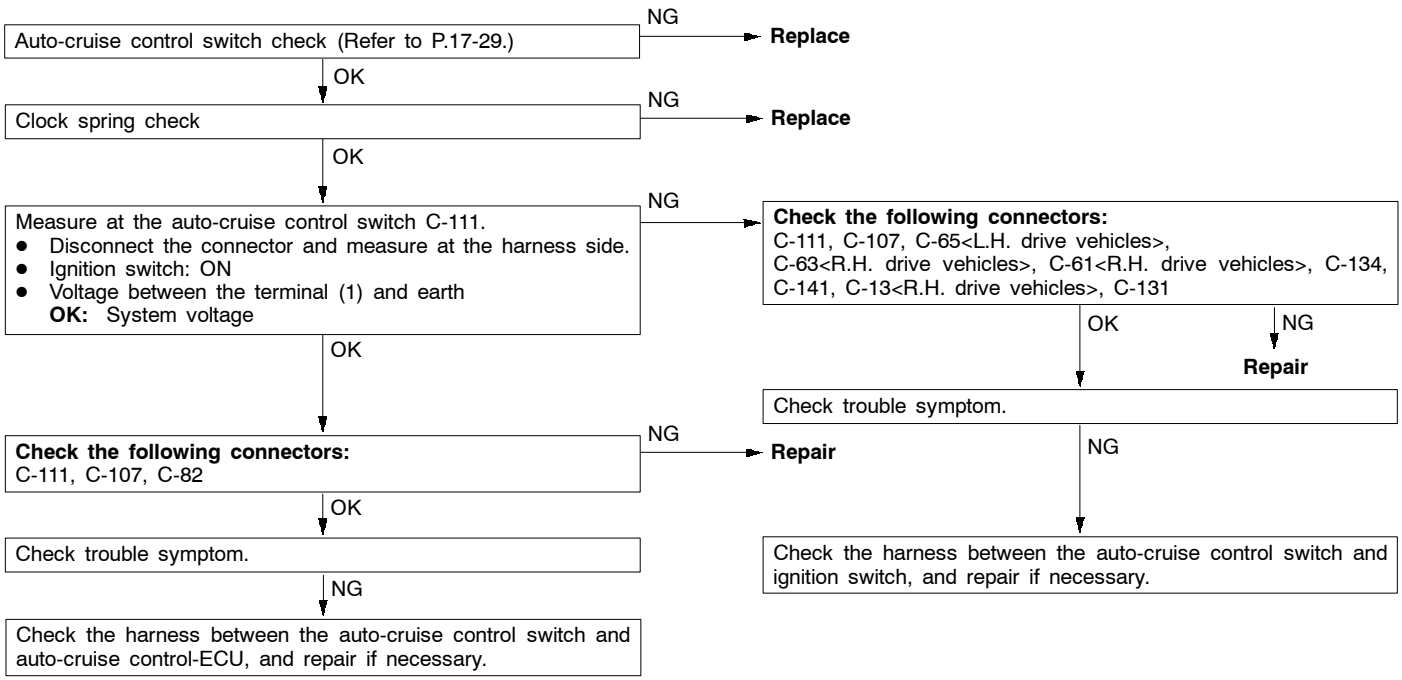
Inspection Procedure 2

Communication with MUT-II is not possible. (Communication with auto-cruise control-ECU only is not possible.)	Probable cause
The cause is probably a malfunction of auto-cruise control MAIN switch circuit or a malfunction of auto-cruise control-ECU earth circuit.	• Malfunction of the auto-cruise control switch • Malfunction of the connector • Malfunction of the harness • Malfunction of the auto-cruise control-ECU



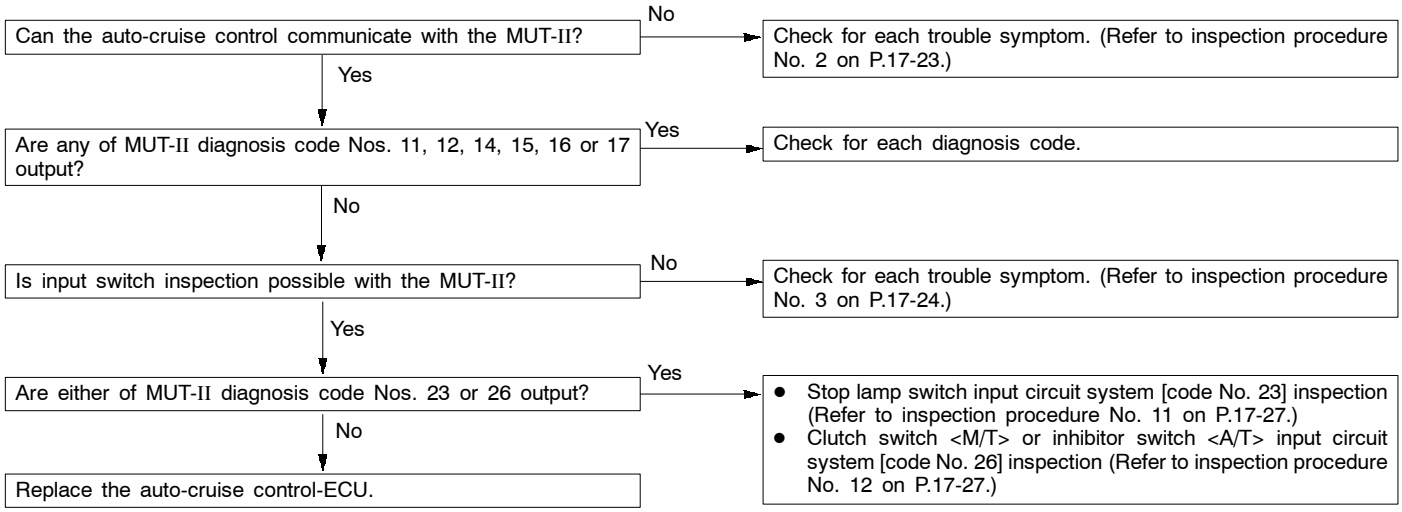
Inspection Procedure 3

Input switch inspection using the MUT-II is not possible. (However, diagnosis inspection is possible.)	Probable cause
The cause is probably a malfunction of auto-cruise control switch circuit system.	• Malfunction of the auto-cruise control switch • Malfunction of the clock spring • Malfunction of the connector • Malfunction of the harness



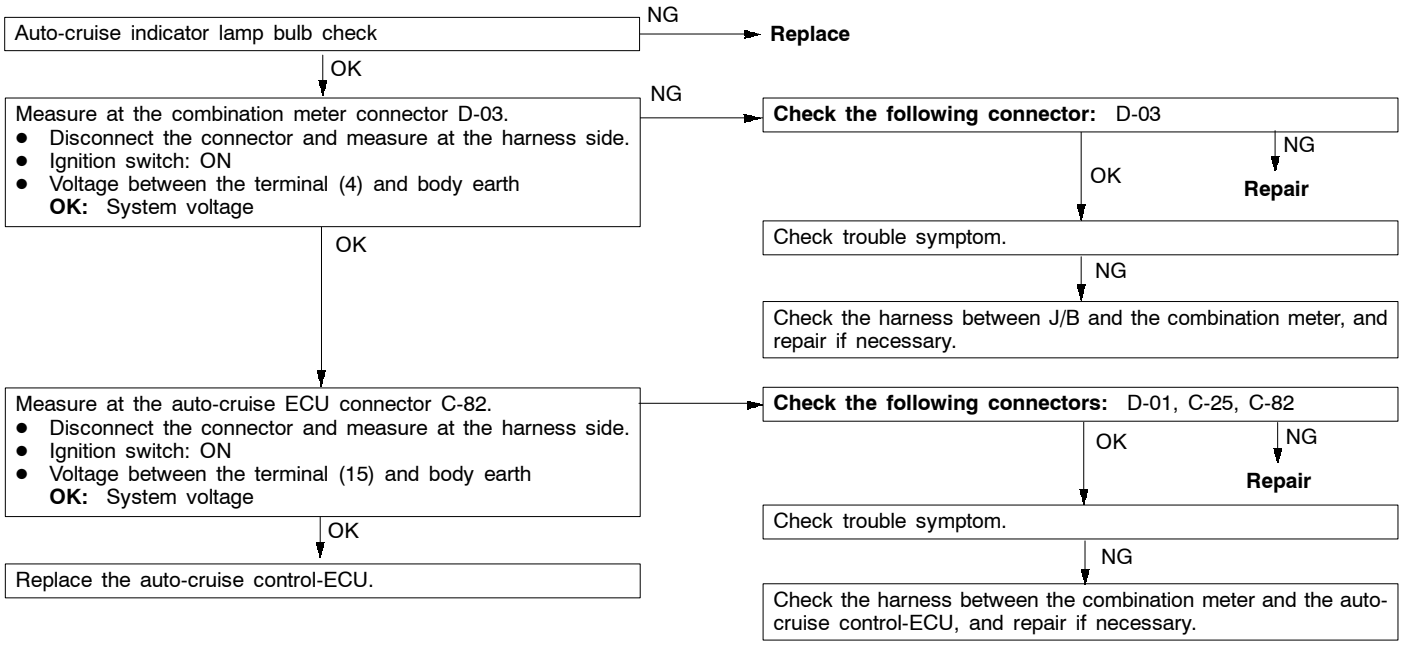
Inspection Procedure 8

Auto-cruise control cannot be set.	Probable cause
The cause is probably that the fail-safe function is cancelling auto-cruise control. In this case, the MUT-II can be used to check the trouble symptoms in each system by inspecting the diagnosis codes. The MUT-II can also be used to check if the circuits of each input switch are normal or not by inspecting the input switch codes.	● Malfunction of the auto-cruise control switch ● Malfunction of the clock spring ● Malfunction of the harnesses or connectors ● Malfunction of the clutch switch <M/T> ● Malfunction of the auto-cruise control-ECU



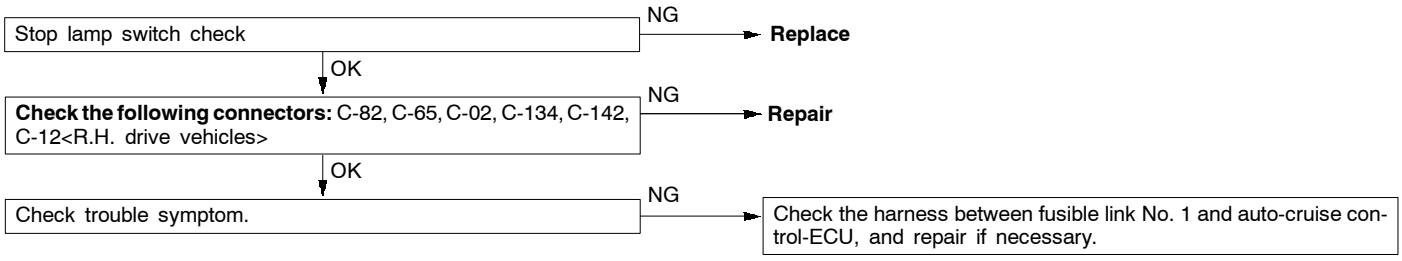
Inspection Procedure 10

Even if auto-cruise control MAIN switch is set to ON, auto-cruise indicator lamp in combination meter does not illuminate. (However, auto-cruise control is normal.)	Probable cause
Bulb or auto-cruise indicator lamp circuit is suspected to be faulty.	• Malfunction of the bulb • Malfunction of the connectors or harnesses • Malfunction of the auto-cruise control-ECU



Inspection Procedure 11

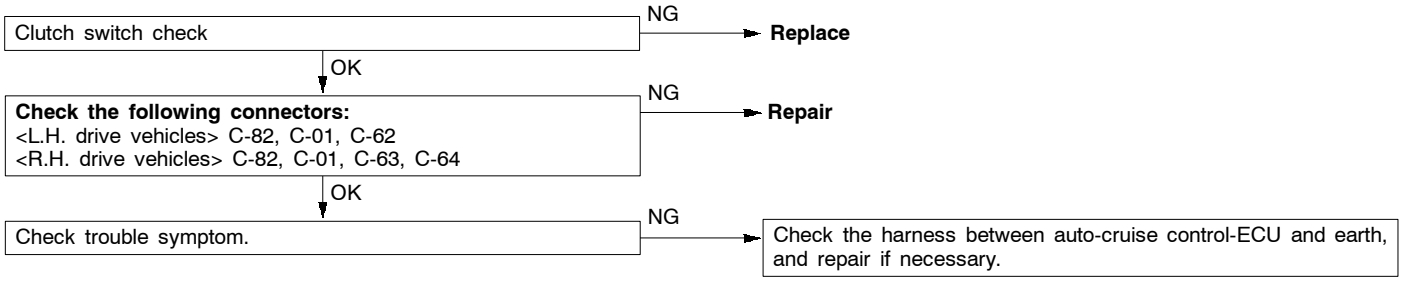
Stop lamp switch input circuit system inspection (Code No. 23)



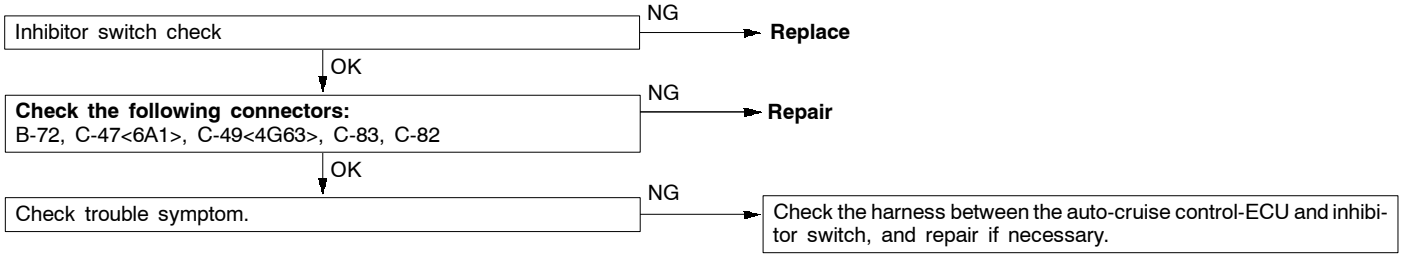
Inspection Procedure 12

Clutch switch <M/T> or inhibitor switch <A/T> input circuit system inspection (Code No. 26)

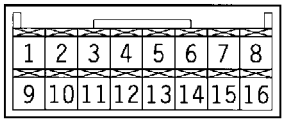
<M/T>



<A/T>



CHECK AT THE ECU TERMINALS



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Terminal No.	Check item	Check conditions		Normal condition
1	Throttle position sensor (accelerator pedal position sensor*) input	When accelerator pedal is fully depressed		4.5–5.5V
		When accelerator pedal is released		0.3–1.0V
2	Idle switch output	When accelerator pedal is depressed	When idle switch is OFF	4.5–5.5V
		When accelerator pedal is not depressed	When idle switch is ON	0V
3	A/T control output	OD-OFF request		0V
		No OD-OFF request		System voltage
4	Stop lamp switch input	When brake pedal is depressed	When stop lamp switch is ON	System voltage
		When brake pedal is not depressed	When stop lamp switch is OFF	0V
5	Pump power supply	Ignition switch : ON Main switch : ON Stop lamp switch : OFF		System voltage
6	ECU power supply	Ignition switch: ON		System voltage
7	Auto-cruise vacuum pump release valve and control valve input	When decelerating with the SET switch while driving at constant speed	Release valve closed	0V
8			Control valve open/closed	System voltage/0V
7		When cancelling constant speed driving with the CANCEL switch	Release valve open	System voltage
8			Control valve open	System voltage
9	Auto-cruise control switch input	When input switch has not been operated	When all switches are OFF	0V
		When input switch is pushed down	When SET switch is ON	Approx. 3V
		When input switch is pushed up	When RESUME switch is ON	Approx. 6V
		When input switch is pulled forward	When CANCEL switch is ON	System voltage
10	Vehicle speed sensor input	When vehicle is moved forwards and backwards, sensor turns ON and OFF repeatedly	When sensor is ON	0V
			When sensor is OFF	4.5V or more

NOTE
*: Vehicles with TCL

Terminal No.	Check item	Check conditions		Normal condition
11	Diagnosis control input	When ignition switch is ON		4V or more
12	ECU power supply	Ignition switch : ON Main switch : ON		System voltage
13	Clutch switch input <M/T>	When pedal is not depressed	When clutch switch is OFF	5V
		When pedal is depressed	When clutch switch is ON	0V
	Inhibitor switch input <A/T>	When select lever is in a position other than N range	When inhibitor switch is OFF	5V
		When select lever is in N range	When inhibitor switch is ON	0V
14	Earth	At any time		Continuity
15	Indicator lamp input (inside combination meter)	When driving at constant speed	When indicator lamp is illuminated	0V
		When constant-speed driving is cancelled	When indicator lamp is switched off	System voltage
16	Auto-cruise vacuum pump motor input	When driving at constant speed using the SET switch	Motor stopped/running	System voltage/0V
		When accelerating with the RESUME switch while driving at constant speed	Motor stopped/running	System voltage/0V
		When decelerating with the SET switch while driving at constant speed	Motor stopped	System voltage
		When cancelling constant speed driving with the CANCEL switch	Motor stopped	System voltage

ON-VEHICLE SERVICE

AUTO-CRUISE CONTROL SWITCH CHECK

Same as the procedure for 4G64-GDI. (Refer to P.17-18.)

AUTO-CRUISE CONTROL

INSPECTION

AUTO-CRUISE CONTROL SWITCH CHECK

Same as the procedure for 4G64-GDI. (Refer to P.17-20.)

EMISSION CONTROL SYSTEM

GENERAL

OUTLINE OF CHANGE

- The following service procedures have been added to correspond to the introduction of the 4G64–GDI engine.

GENERAL INFORMATION

The emission control system consists of the following subsystems:
- Crankcase emission control system
- Evaporative emission control system
- Exhaust emission control system

Items	Name	Specification
Crankcase emission control system	Positive crankcase ventilation (PCV) valve	Variable flow type (Purpose: HC reduction)
Evaporative emission control system	Canister Purge control solenoid valve	Equipped Duty cycle type solenoid valve (Purpose: HC reduction)
Exhaust emission control system	Air-fuel ratio control device–GDI system	Oxygen sensor feedback type (Purpose: CO, HC, NOx reduction)
	Exhaust gas recirculation system • EGR valve	Equipped Stepper motor type (Purpose: NOx reduction)
	Catalytic converter	Monolith type (Purpose: CO, HC, NOx reduction)

EMISSION CONTROL DEVICE REFERENCE TABLE

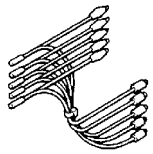
Related parts	Crankcase emission control system	Evaporative emission control system	Air/fuel ratio control system	Catalytic converter	Exhaust gas recirculation system	Reference page
PCV valve	×					17-38*
Purge control solenoid valve		×				17-36
GDI system component		×	×			GROUP 13I
Catalytic converter				×		17-47*
EGR valve					×	17-38

*: Refer to '97 GALANT Workshop Manual (Pub.No. PWDE9611).

SERVICE SPECIFICATIONS

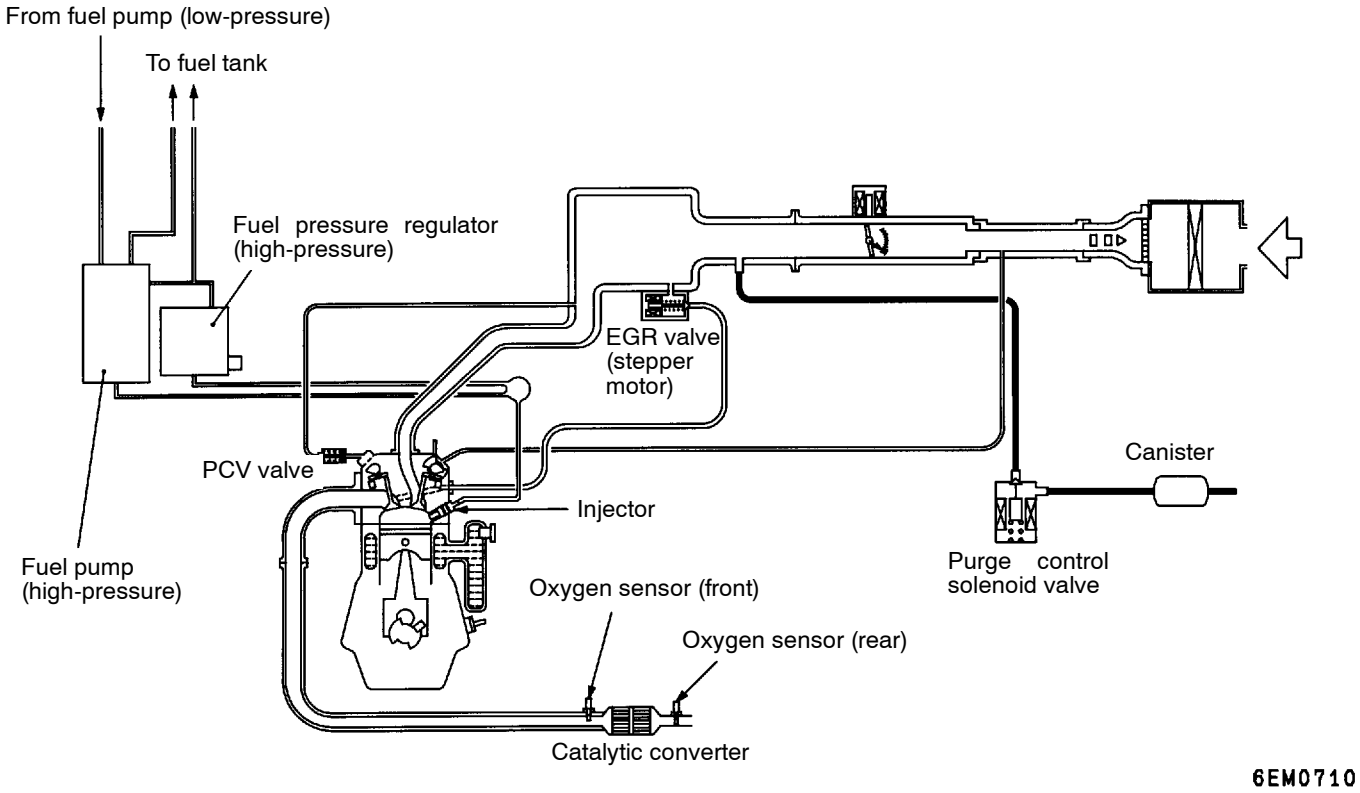
Items	Standard value
Purge control solenoid valve coil resistance (at 20°C) Ω	36 – 44
EGR valve coil resistance (at 20°C) Ω	10 – 20

SPECIAL TOOL

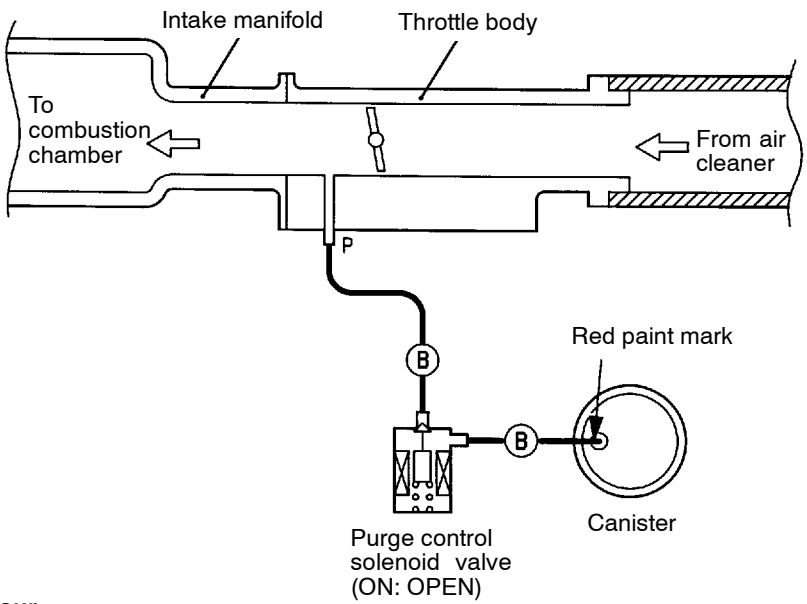
Tool	Number	Name	Use
 B991658	MB991658	Test harness set	Inspection of EGR valve

VACUUM HOSE

VACUUM HOSE PIPING DIAGRAM



VACUUM CIRCUIT DIAGRAM



Vacuum hose colour
B: Black

6EM0711

VACUUM HOSE CHECK

1. Using the piping diagram as a guide, check to be sure that the vacuum hoses are correctly connected.
2. Check the connection condition of the vacuum hoses, (removed, loose, etc.) and check to be sure that there are no bends or damage.

VACUUM HOSE INSTALLATION

1. When connecting the vacuum hoses, they should be securely inserted onto the nipples.
2. Connect the hoses correctly, using the vacuum hose piping diagram as a guide.

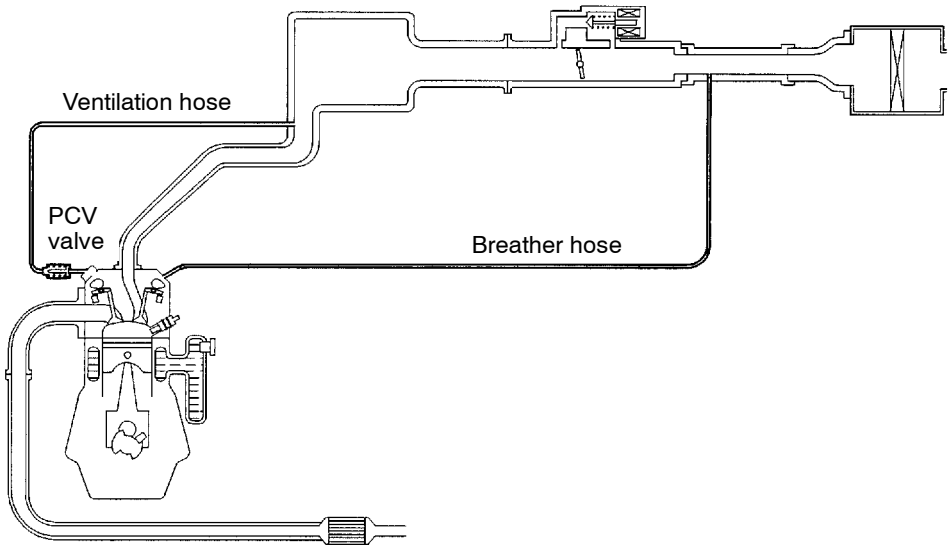
CRANKCASE EMISSION CONTROL SYSTEM

GENERAL INFORMATION

The crankcase emission control system prevents blow-by gases from escaping inside the crankcase into the atmosphere.
Fresh air is sent from the air cleaner into the crankcase through the breather hose. The air becomes mixed with the blow-by gases inside the crankcase.
The blow-by gas inside the crankcase is drawn into the intake manifold through the positive crankcase ventilation (PCV) valve.

The PCV valve lifts the plunger according to the intake manifold vacuum so as to regulate the flow of blow-by gas properly. In other words, the blow-by gas flow is regulated during low load engine operation to maintain engine stability, while the flow is increased during high load operation to improve the ventilation performance.

SYSTEM DIAGRAM



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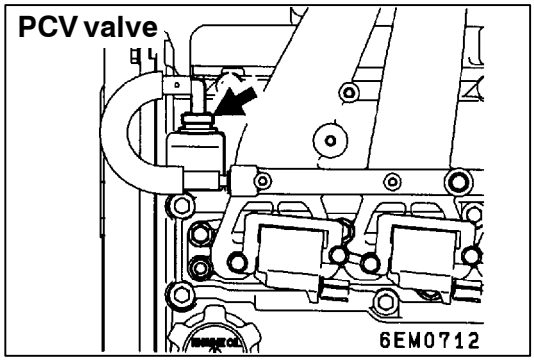
COMPONENT LOCATION

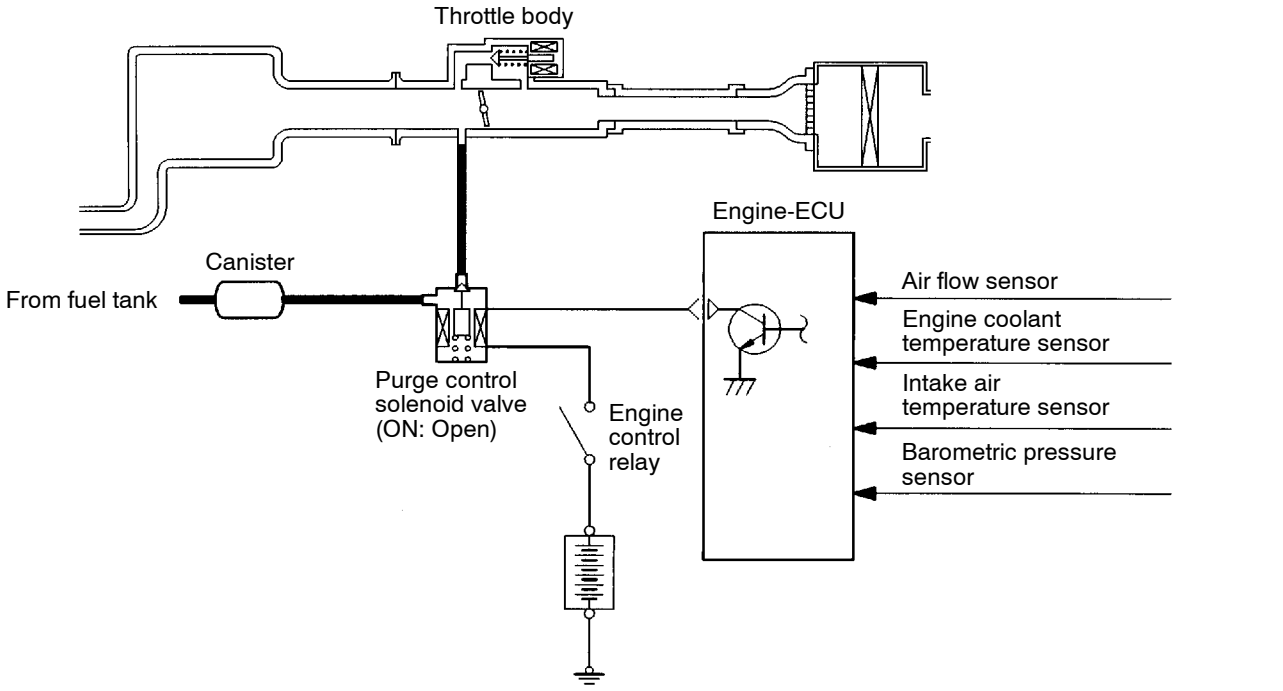


EVAPORATIVE EMISSION CONTROL SYSTEM

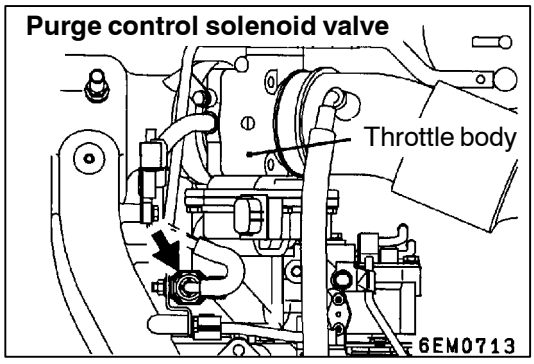
GENERAL INFORMATION

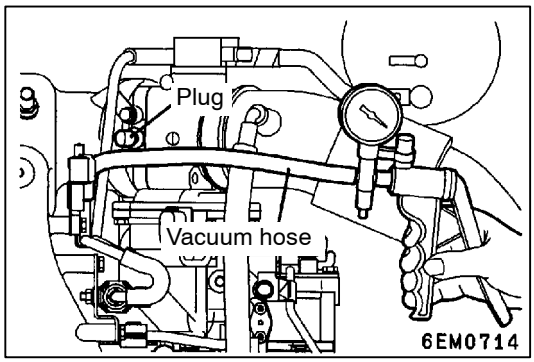
The evaporative emission control system prevents fuel vapours generated in the fuel tank from escaping into the atmosphere.
Fuel vapours from the fuel tank flow through the fuel tank pressure control valve and vapour pipe/hose to be stored temporarily in the canister. When driving the vehicle, fuel vapours stored in the canister flow through the purge solenoid and purge port and go into the intake manifold to be sent to the combustion chamber.
When the engine coolant temperature is low or when the intake air quantity is small (when the engine is at idle, for example), the engine control unit turns the purge solenoid off to shut off the fuel vapour flow to the intake manifold.
This does not only insure the driveability when the engine is cold or running under low load but also stabilize the emission level.

SYSTEM DIAGRAM



COMPONENT LOCATION





PURGE CONTROL SYSTEM CHECK

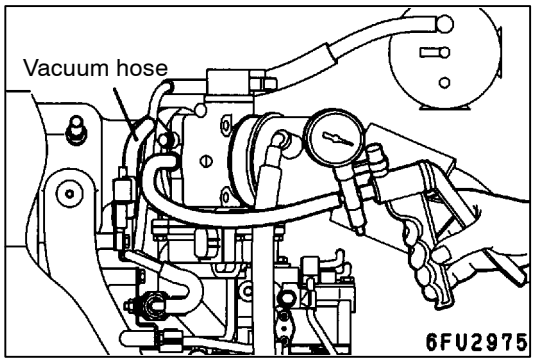
1. Disconnect the vacuum hose from the intake manifold and connect it to a hand vacuum pump.
2. Plug the nipple from which the vacuum hose was removed.
3. When the engine is cold or hot, apply a vacuum of 53 kPa, and check the condition of the vacuum.

When engine is cold
(Engine coolant temperature: 40°C or less)

Engine condition	Normal condition
At idle	Vacuum is maintained
3,000 r/min	

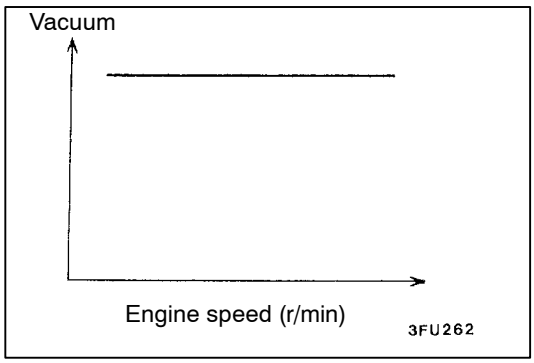
When engine is hot
(Engine coolant temperature: 80°C or higher)

Engine condition	Normal condition
At idle	Vacuum is maintained
3,000 r/min (fore approximately 3 minutes after the engine is started.)	Vacuum will leak.



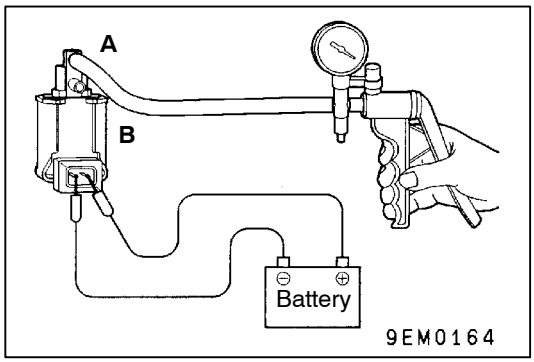
PURGE PORT VACUUM CHECK

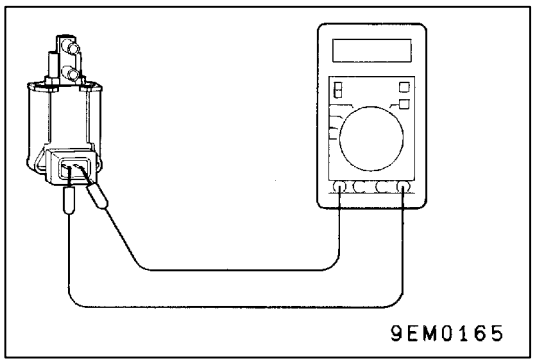
1. Disconnect the vacuum hose from the intake manifold purge vacuum nipple and connect a hand vacuum pump to the nipple.



2. Start the engine and check that the vacuum remains fairly constant after racing the engine.

   NOTE
   If vacuum changes, it is possible that the throttle body purge port may be clogged and require cleaning.





PURGE CONTROL SOLENOID VALVE CHECK

NOTE
When disconnecting the vacuum hose, always make a mark so that it can be reconnected at original position.

1. Disconnect the vacuum hose from the solenoid valve.
2. Disconnect the harness connector.
3. Connect a hand vacuum pump to nipple (A) of the solenoid valve (refer to the illustration at left).
4. Check airtightness by applying a vacuum with voltage applied directly from the battery to the purge control solenoid valve and without applying voltage.

Battery voltage	Normal condition
Applied	Vacuum leaks
Not applied	Vacuum maintained

5. Measure the resistance between the terminals of the solenoid valve.

   Standard value: 36 – 44 Ω (at 20°C)

EXHAUST GAS RECIRCULATION (EGR) SYSTEM

GENERAL INFORMATION

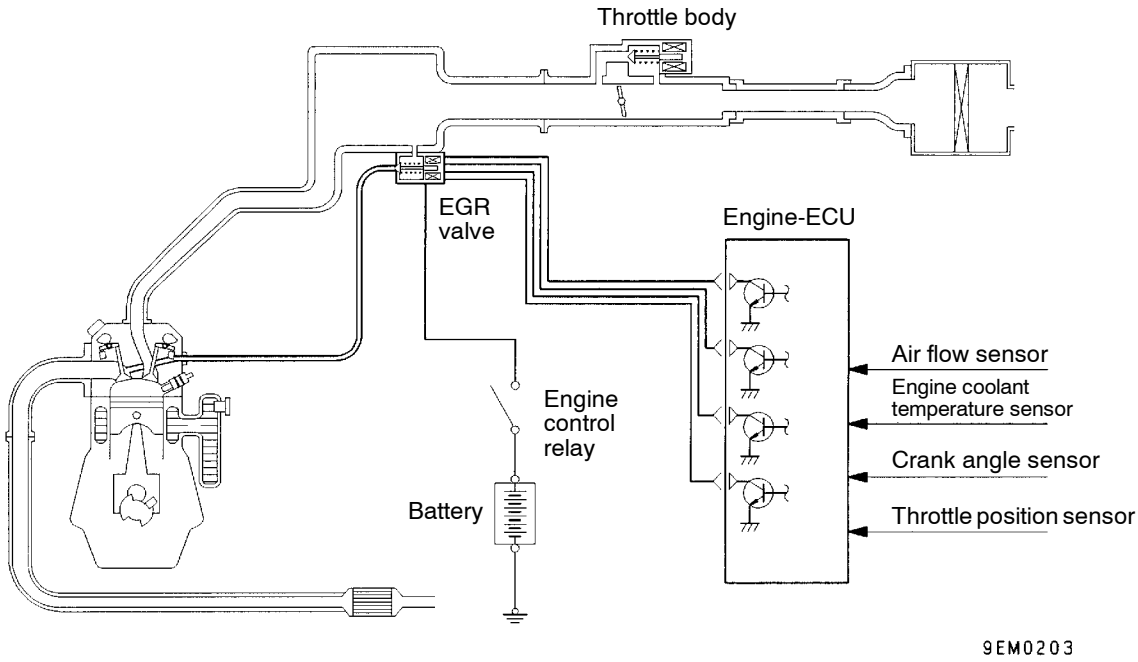
The exhaust gas recirculation (EGR) system lowers the nitrogen oxide (NOx) emission level. When the air/fuel mixture combustion temperature is high, a large quantity of nitrogen oxides (NOx) is generated in the combustion chamber. Therefore, this system recirculates part of emission gas from the exhaust port of the cylinder head to the combustion chamber through the intake manifold to decrease the air/fuel mixture combustion temperature, resulting in reduction of NOx.
The EGR flow rate is controlled by the EGR valve so as not to decrease the driveability.

OPERATION

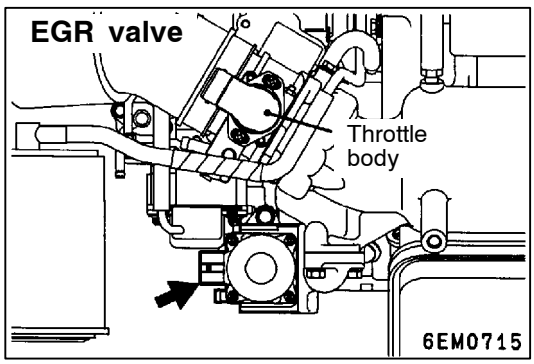
The EGR valve is being closed and dose not recirculate exhaust gases under one of the following conditions. Otherwise, the EGR valve is opened and recirculate exhaust gases.

- The engine coolant temperature is low.
- The engine is at idle.
- The throttle valve is widely opened.

SYSTEM DIAGRAM

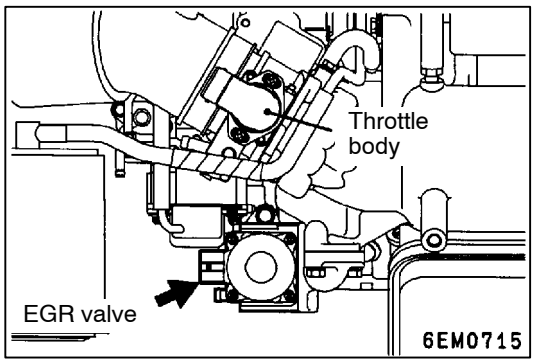


COMPONENT LOCATION



EXHAUST GAS RECIRCULATION (EGR) CONTROL SYSTEM CHECK

Refer to GROUP 13I – Troubleshooting.

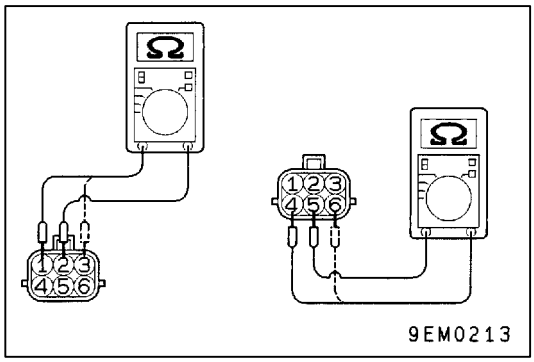


EGR VALVE (STEPPER MOTOR) CHECK

Checking the Operation Sound

1. Check that the operation sound of the stepper motor can be heard from the EGR valve when the ignition switch is turned to ON (without starting the engine).
2. If the operation sound cannot be heard, check the stepper motor drive circuit.

   NOTE
   If the circuit is normal, the cause is probably a malfunction of the stepper motor or of the engine-ECU.



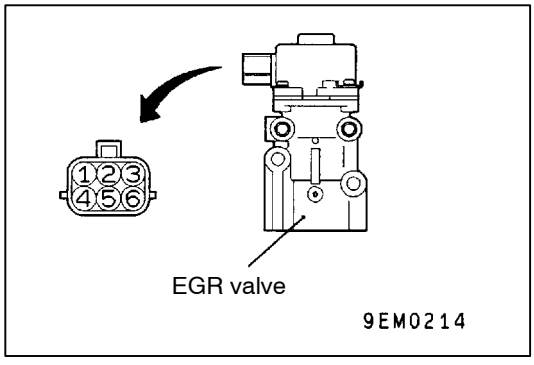
Checking the Coil Resistance

1. Disconnect the EGR valve connector.
2. Measure the resistance between the EGR valve-side connector terminal No.2 and terminal No.1 or terminal No.3.

   Standard value: 10 – 20 Ω (at 20°C)

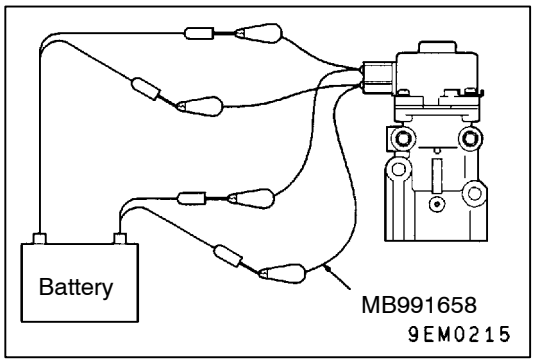
3. Measure the resistance between the EGR valve-side connector terminal No.5 and terminal No.4 or terminal No.6.

   Standard value: 10 – 20 Ω (at 20°C)



Operation Check

1. Remove the EGR valve.
2. Connect the special tool (test harness set) to the EGR valve-side connector.
3. Connect terminal No.2 and terminal No.5 to the positive (+) terminal of power supply of approximately 6 V.
4. Connect each clip to the negative (–) terminal of power supply in the order given below to test if any vibration occurs (as though the stepper motor is shaking slightly) due to the operation of the stepper motor.



(1) Connect terminal No.1 and terminal No.4 to the negative (–) terminal of the power supply.
(2) Connect terminal No.3 and terminal No.4 to the negative (–) terminal of the power supply.
(3) Connect terminal No.3 and terminal No.6 to the negative (–) terminal of the power supply.
(4) Connect terminal No.1 and terminal No.6 to the negative (–) terminal of the power supply.
(5) Connect terminal No.1 and terminal No.4 to the negative (–) terminal of the power supply.
(6) Repeat the test in the order from (5) to (1).

5. If the results of testing show that the vibration could be felt, the stepper motor is normal.

NOTES

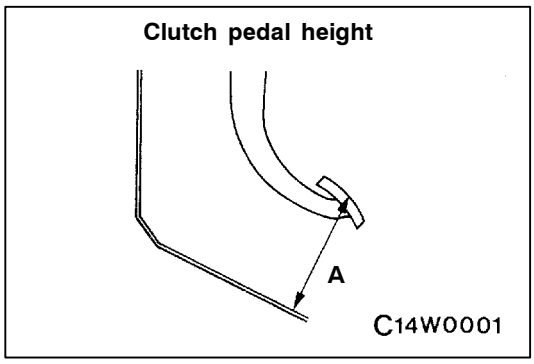
CLUTCH

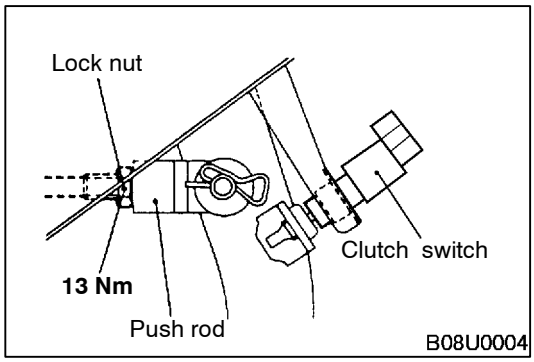
CONTENTS

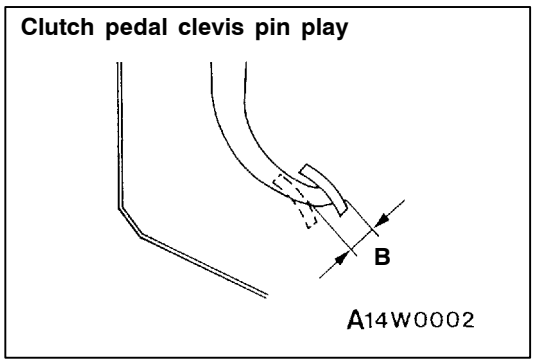
GENERAL

OUTLINE OF CHANGE

- A clutch switch has been newly used. Accordingly, service procedures of the clutch pedal have been added. <4G64>
- Service procedures for the clutch control has been established due to the addition of the clutch fluid line damper. <4G64 L.H. drive vehicles>
- Service procedures for the clutch master cylinder has been established as a damper has been added to the clutch master cylinder. <4G64 R.H. drive vehicles>







ON-VEHICLE SERVICE

CLUTCH PEDAL INSPECTION AND ADJUSTMENT<4G64>

1. Turn up the carpet, etc. under the clutch pedal.
2. Measure the clutch pedal height.
   Standard value (A):

   <L.H. drive vehicles> 176 – 179 mm

   <R.H. drive vehicles> 163 – 166 mm

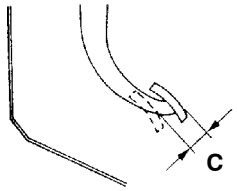
3. When the clutch pedal height does not meet the standard value, adjust as follows:
   (1) Disconnect the clutch switch connector.
   (2) Turn the clutch switch counter-clockwise about 1/4 time to loosen.
   (3) Adjust the clutch switch so that the clutch pedal height meets the standard value. Then, turn the clutch switch clockwise about 1/4 time to secure.
   (4) Connect the clutch switch connector.

4. Measure the clutch pedal play.

   Standard value (B): 1 – 3 mm
5. When the clutch pedal play does not meet the standard value, loosen the lock nut and move the push rod to adjust.

   Caution
   Do not push in the master cylinder push rod at this time.

Clutch pedal free play



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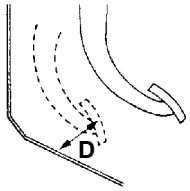
Distance between the clutch pedal and the toeboard when the clutch is disengaged



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6. 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.

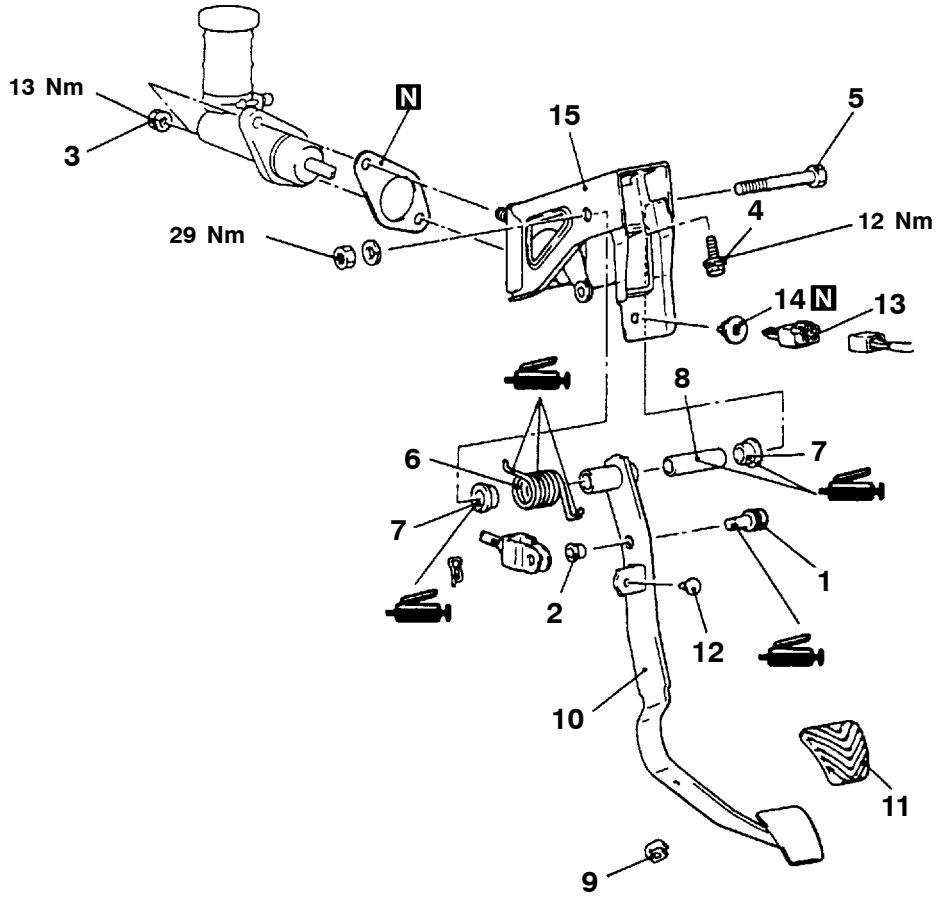
   Standard value (C): 6 – 13 mm
   Standard value (D): 125 mm or more

7. If the clutch pedal free play and the distance 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.
8. Turn back the carpet, etc.

CLUTCH PEDAL

REMOVAL AND INSTALLATION

Post-installation Operation
Clutch Pedal Adjustment (Refer to P.21-2)



Removal steps

1. Clevis pin assembly
2. Bushing
3. Nut
4. Bolt
5. Bolt
6. Clutch return spring
7. Clutch pedal bushing
8. Pipe
9. Stopper <R.H. drive vehicles>
10. Clutch pedal
11. Pedal pad
12. Stopper
13. Clutch switch
14. Clip
15. Master cylinder member assembly

INSPECTION

CLUTCH SWITCH CHECK

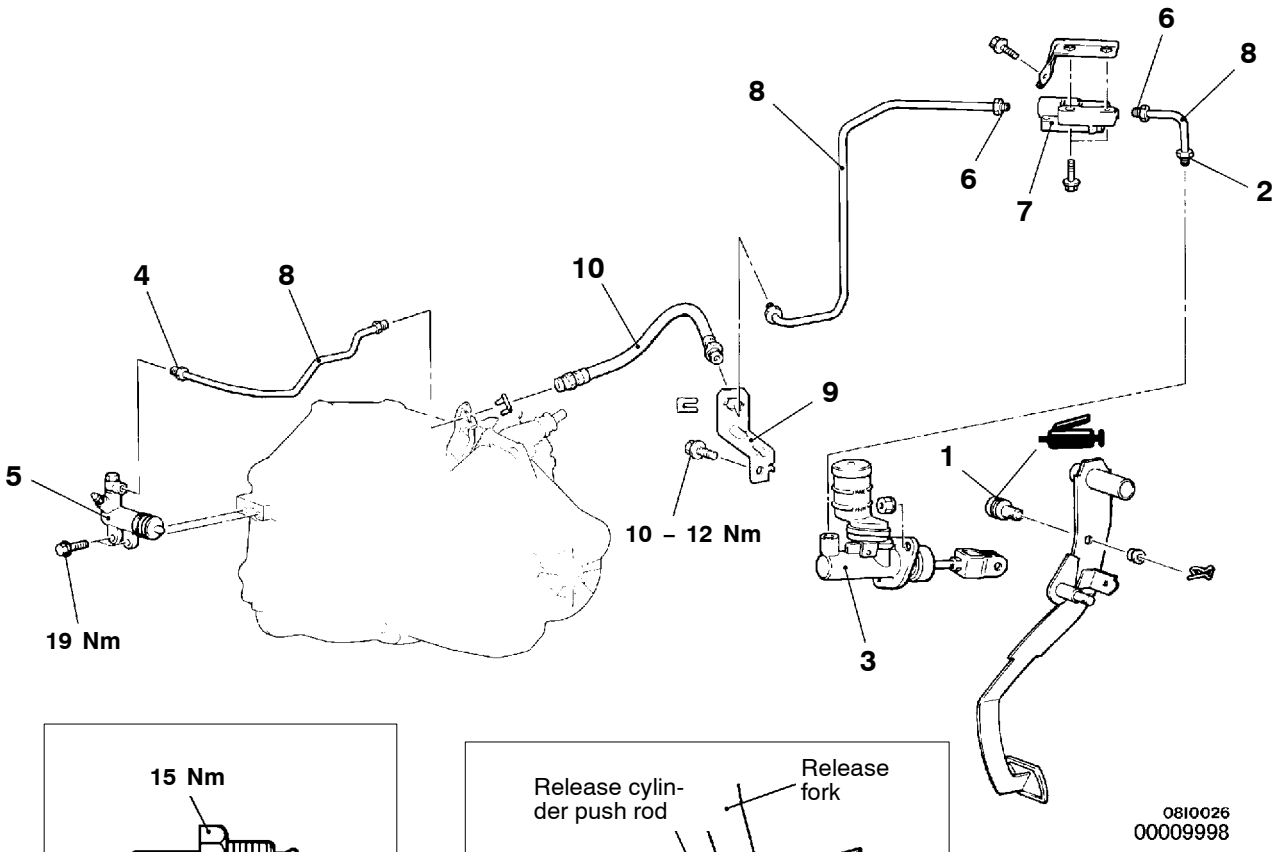
Refer to GROUP 13I – On-vehicle Service.

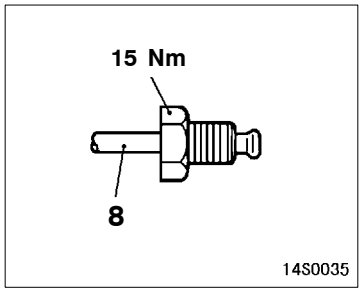
CLUTCH CONTROL <4G64 L.H. drive vehicles>

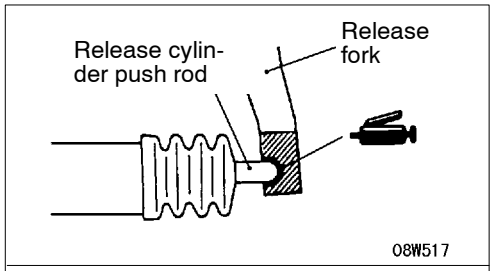
REMOVAL AND INSTALLATION

Pre-removal Operation
Clutch Fluid Draining

Post-installation Operation
- Clutch Fluid Supplying
- Clutch Line Bleeding
- Clutch Pedal Adjustment (Refer to P.21-2.)







Specified grease:
MITSUBISHI genuine grease
Part No. 0101011

Clutch master cylinder removal steps

1. Clevis pin assembly
2. Clutch pipe connection
3. Clutch master cylinder

Clutch release cylinder removal steps

4. Clutch pipe connection
5. Clutch release cylinder

Clutch fluid line damper removal steps

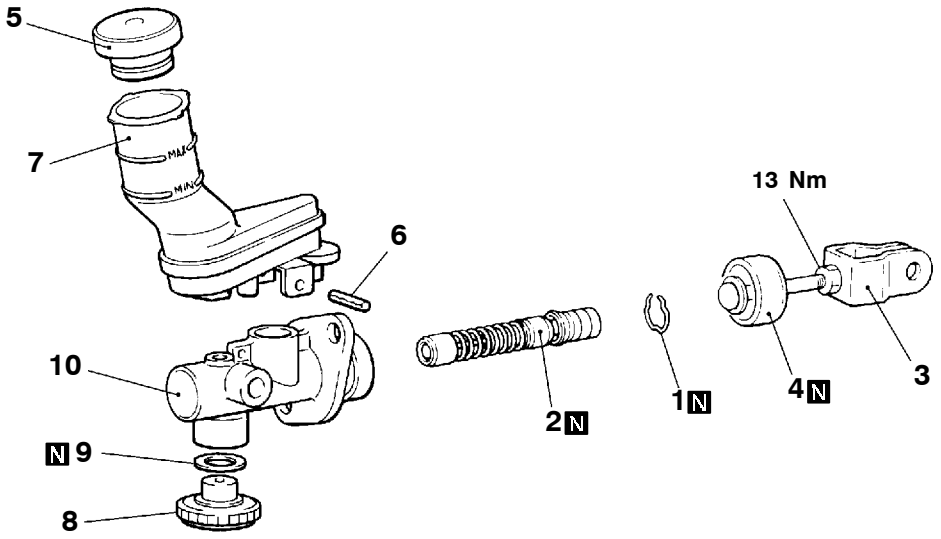
6. Clutch pipe connection
7. Clutch fluid line damper

Clutch line removal steps

8. Clutch pipe
9. Bracket
10. Clutch hose

CLUTCH CONTROL <4G64 R.H. drive vehicles>

CLUTCH MASTER CYLINDER
DISASSEMBLY AND REASSEMBLY



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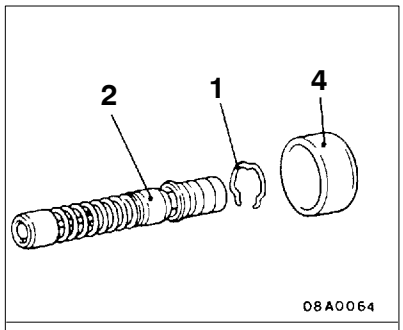
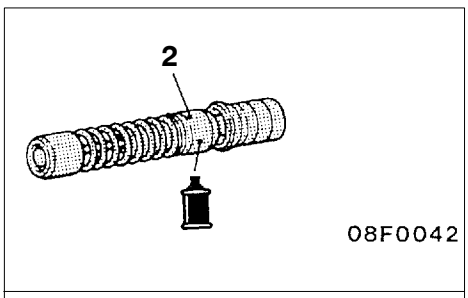
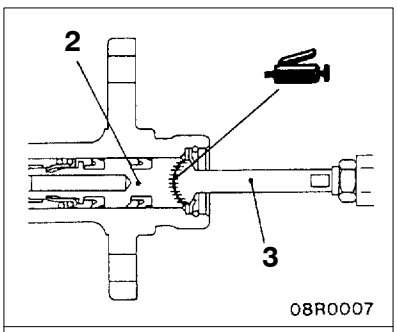


Piston repair kit



Clutch fluid:
Brake fluid DOT3 or DOT4

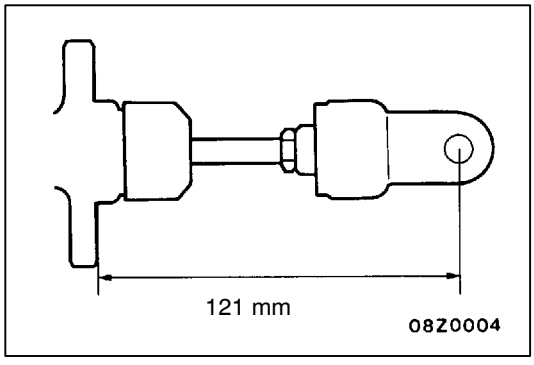


Grease: Rubber grease

Disassembly steps

1. Piston stopper ring
2. Piston assembly
▶A◀ 3. Push rod assembly
4. Boot
5. Reservoir cap
6. Spring pin
7. Reservoir tank
8. Damper assembly
9. Gasket
10. Clutch master cylinder assembly

Caution
Do not disassemble piston assembly.



INSTALLATION SERVICE POINT

▶A◀ PUSH ROD ASSEMBLY INSTALLATION

Set the length of the push rod assembly to the shown dimension to make the adjustment of clutch pedal easier.

AUTOMATIC TRANSMISSION

CONTENTS

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 driver and passenger (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.

NOTE

The SRS includes the following components: SRS-ECU, SRS warning lamp, air bag module, clock spring, side impact sensors 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 (*).

GENERAL

OUTLINE OF CHANGES

The following service procedures for items which are different from before have been established to correspond to the following changes:

- Addition of vehicles with Sports mode
- Abolition of the A/T-ECU idle position switch terminal
- Changes to the shift pattern
- Addition of A/T key interlock and shift lock mechanisms

TROUBLESHOOTING <A/T>

ROAD TEST

Check by the following procedure.

No.	State prior to test and operation	Test and operation	Judgement value	Check item	Diagnosis code No.	Inspection procedure page if there is an abnormality
1	Ignition switch: OFF	Ignition switch (1) ON	Data list No. 54 Battery voltage [V]	Control relay	54	A/T Control relay system (23-21)
2	Ignition switch: ON Engine: Stopped Selector lever position: P	Selector lever position (1) P, (2) R, (3) N, (4) D	Data list No. 61 (1) P, (2) R, (3)N, (4) D	Inhibitor switch	–	Inhibitor switch system (23-32)
		Selector lever position (1) D (1st gear) (2) Selector sports mode (1st gear) (3) Upshift and hold the selector lever (2nd gear) (4) Downshift and hold the selector lever (1st gear)	Data list No.67 No.68 No.69 (1) OFF OFF OFF (2) ON OFF OFF (3) ON ON OFF (4) ON OFF ON Shift indicator lamp (1) D and 1 illuminate (2) Only 1 illuminates (3) Only 2 illuminates (4) Only 1 illuminates	Select switch Upshift switch Downshift switch	–	Shift switch assembly system (23-33)
		Accelerator pedal (1) Released (2) Half depressed (3) Depressed	Data list No. 11 (1) 400 – 1,000 mV (2) Gradually rises from (1) (3) 4,500 – 5,000 mV	Throttle position sensor <6A13-Vehicles without TCL, 4G63> Accelerator pedal position sensor <6A13-Vehicles with TCL, 4G64>	11 12 14	Throttle position sensor system (23-10) Accelerator pedal position sensor system (23-10)
			Data list No. 25 (1) OFF (2) ON	Wide open throttle switch	25	Wide open throttle switch system (23-12)
		Brake pedal (1) Depressed (2) Released	Data list No. 26 (1) ON (2) OFF	Stop lamp switch	26	Stop lamp switch system (23-13)

No.	State prior to test and operation	Test and operation	Judgement value	Check item	Diagnosis code No.	Inspection procedure page if there is an abnormality
3	Ignition switch: ST Engine: Stopped	Starting test with lever P or N range	Starting should be possible	Starting possible or impossible	–	Starting impossible (23-24)
4	Warming up	Drive for 15 minutes or more so that the automatic fluid temperature becomes 70 – 90°C.	Data list No. 15 Gradually rises to 70 – 90°C	Oil temperature sensor	15	Oil temperature sensor system (23-10)
5	Engine: Idling Selector lever position: N	Brake pedal (Retest) (1) Depressed (2) Released	Data list No. 26 (1) ON (2) OFF	Stop lamp switch	26	Stop lamp switch system (23-13)
		A/C switch (1) ON (2) OFF	Data list No. 65 (1) ON (2) OFF	Dual pressure switch	–	Dual pressure switch system (23-33)
		Accelerator pedal (1) Released (2) Half depressed	Data list No. 21 (1) 550 – 850 r/min Gradually rises from (1)	Crank angle sensor	21	Crank angle sensor system (23-11)
			Data list No. 57 (2) Data changes	Communication with engine-ECU <Vehicles without TCL> Communication with TCL-ECU <Vehicles with TCL>	51	Serial communication system (23-20)
		Selector lever position (1) N → D (2) N → R	Should be no abnormal shifting shocks Time lag should be within 2 seconds	Malfunction when starting	–	Engine stalling during shifting (23-26)
					–	Shocks when changing from N to D and large time lag (23-26)
					–	Shocks when changing from N to R and large time lag (23-27)
					–	Shocks when changing from N to D,N to R and large time lag (23-28)
				Driving impossible	–	Does not move forward (23-24)
					–	Does not reverse (23-25)
					–	Does not move (forward or reverse) (23-25)

No.	State prior to test and operation	Test and operation	Judgement value	Check item	Diagnosis code No.	Inspection procedure page if there is an abnormality
6	Selector lever position: Sports mode (Carry out on a flat and straight road.)	Selector lever position and vehicle speed (1) Idling in 1st (Vehicle stopped) (2) Driving at constant speed of 10 km/h in 1st (3) Driving at constant speed of 30 km/h in 2nd (4) Driving at 50 km/h in 3rd with accelerator fully closed (5) Driving at constant speed of 50 km/h in 4th (Each condition should be maintained for 10 seconds or more.)	Data list No. 63 (2) 1st, (4) 3rd, (3) 2nd, (5) 4th	Shift condition	–	–
			Data list No. 31 (2) 0 %, (4) 100 %, (3) 100 %, (5) 100 %	Low and reverse solenoid valve	31	Low and reverse solenoid valve system (23-13)
			Data list No. 32 (2) 0 %, (4) 0 %, (3) 0 %, (5) 100 %	Underdrive solenoid valve	32	Underdrive solenoid valve system (23-13)
			Data list No. 33 (2)100 %, (4) 100 %, (3) 0 %, (5) 0 %	Second solenoid valve	33	Second solenoid valve system (23-13)
			Data list No. 34 (2) 100 %, (4) 0 %, (3) 100 %, (5) 0 %	Overdrive solenoid valve	34	Overdrive solenoid valve system (23-13)
			Data list No. 29 (1) 0 km/h (4) 50 km/h	Vehicle speed sensor	–	Vehicle speed sensor system (23-34)
			Data list No. 22 (4) 1,800 – 2,100 r/min	Input shaft speed sensor	22	Input shaft speed sensor system (23-11)
			Data list No. 23 (4) 1,800 – 2,100 r/min	Output shaft speed sensor	23	Output shaft speed sensor system (23-12)
7	Selector lever position: Sports mode (Carry out on a flat and straight road.)	Selector lever position and vehicle speed (1) Release the accelerator pedal fully while driving at 50 km/h in 3rd gear. (2) Driving at constant speed of 50 km/h in 3rd gear.	Data list No. 36 (1) 0 % (2) Approx. 70 – 90 %	Damper clutch control solenoid valve	36 52	Damper clutch control solenoid valve system (23-14)
			Data list No. 52 (1) Approx. 100 – 300 r/min (2) Approx. 0 – 10 r/min			

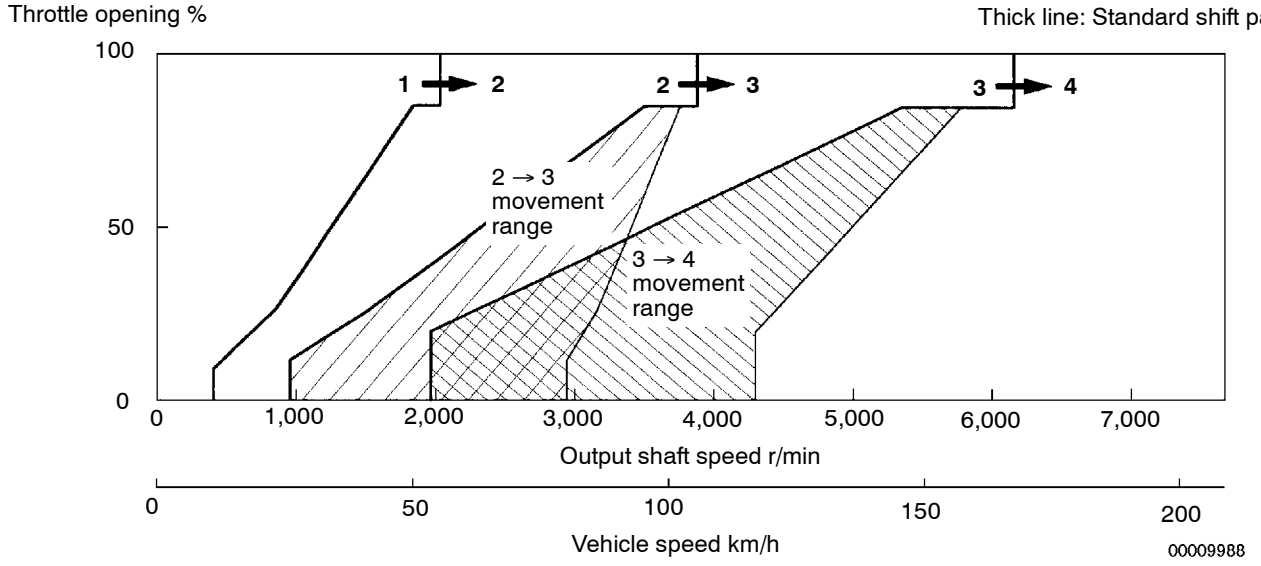
No.	State prior to test and operation	Test and operation	Judgement value	Check item	Diagnosis code No.	Inspection procedure page if there is an abnormality
8	Use the MUT-II to stop the INVECS-II function. Selector lever position: D (Carry out on a flat and straight road.)	Monitor data list No. 11, 23, and 63 with the MUT-II. (1) Accelerate to 4th gear at a throttle position sensor output of 1.5V (accelerator opening angle of 30 %). (2) Gently decelerate to a standstill. (3) Accelerate to 4th gear at a throttle position sensor output of 2.5 V (accelerator opening angle of 50%). (4) While driving at 60 km/h in 4th gear, shift down to 3rd (5) While driving at 40 km/h in 3rd gear, shift down to 2nd (6) While driving at 20 km/h in 2nd gear, shift down to 1st	For (1), (2) and (3), the reading should be the same as the specified output shaft speed and no abnormal shocks should occur. For (4), (5) and (6), downshifting should occur immediately after the shifting operation is made.	Malfunction when shifting	–	Shocks and running up (23-28)
				Displaced shifting points	–	All points (23-29)
					–	Some points (23-30)
				Does not shift	–	No diagnosis code (23-30)
					22	Input shaft speed sensor system (23-11)
					23	Output shaft speed sensor system (23-12)
				Does not shift from 1 to 2 or 2 to 1	31	Low and reverse solenoid valve system (23-13)
					33	Second solenoid valve system (23-13)
					41	1st gear ratio is not specified (23-15)
					42	2nd gear ratio is not specified (23-16)
				Does not shift from 2 to 3 or 3 to 2	33	Second solenoid valve system (23-13)
					34	Overdrive solenoid valve system (23-13)
					42	2nd gear ratio is not specified (23-16)
					43	3rd gear ratio is not specified (23-17)
				Does not shift from 3 to 4 or 4 to 3	32	Underdrive solenoid valve system (23-13)
					33	Second solenoid valve system (23-13)
					43	3rd gear ratio is not specified (23-17)
					44	4th gear ratio is not specified (23-18)

No.	State prior to test and operation	Test and operation	Judgement value	Check item	Diagnosis code No.	Inspection procedure page if there is an abnormality
9	Selector lever position: N (Carry out on a flat and straight road.)	Monitor data list No. 22 and No. 23 with the MUT-II. (1) Move selector lever to R range, drive at constant speed of 10 km/h.	The ratio between data list No. 22 and No. 23 should be the same as the gear ratio when reversing.	Does not shift	22	Input shaft speed sensor system (23-11)
					23	Output shaft speed sensor system (23-12)
					46	Reverse gear ratio is not specified (23-19)

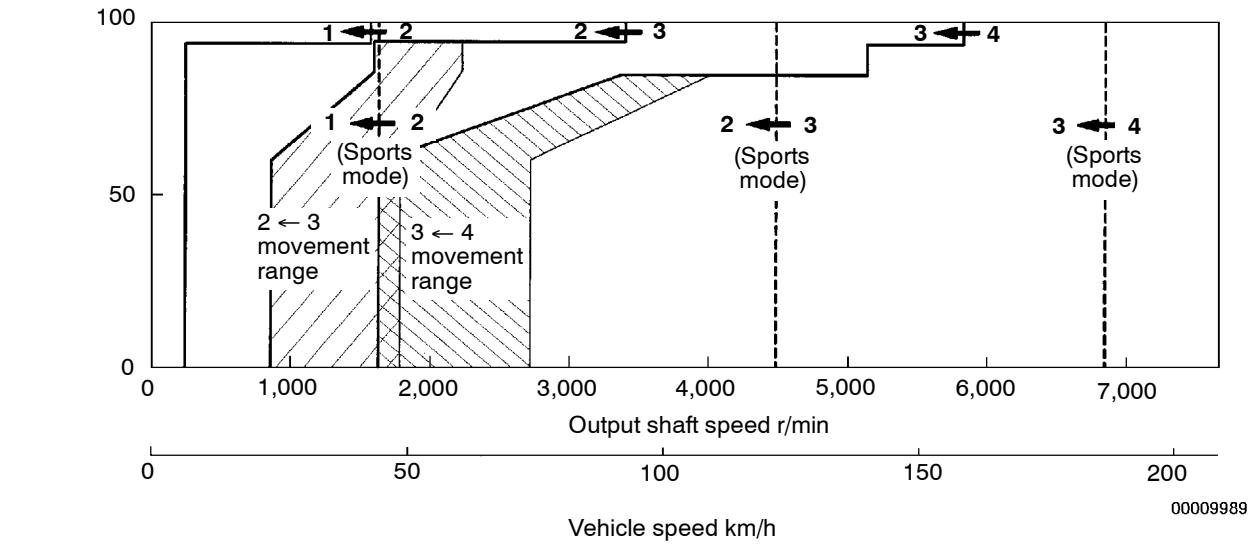
SHIFT PATTERN

<4G63 engine>

UPSHIFT PATTERN

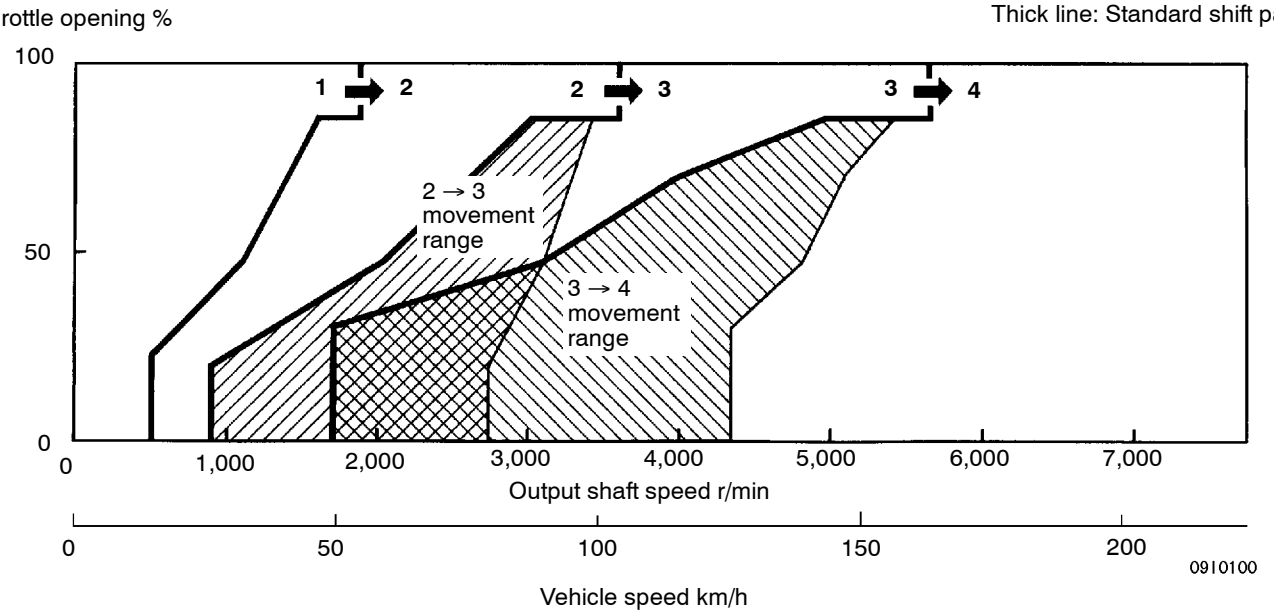


DOWNSHIFT PATTERN

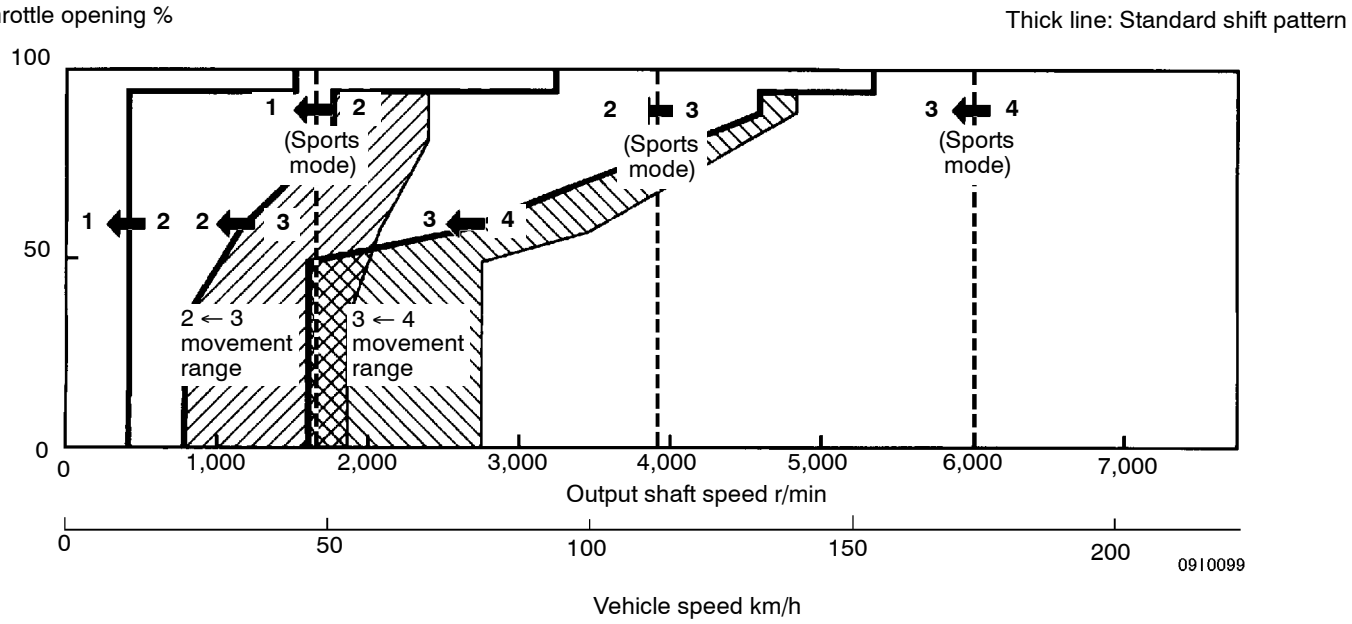


<4G64 engine>

UPSHIFT PATTERN

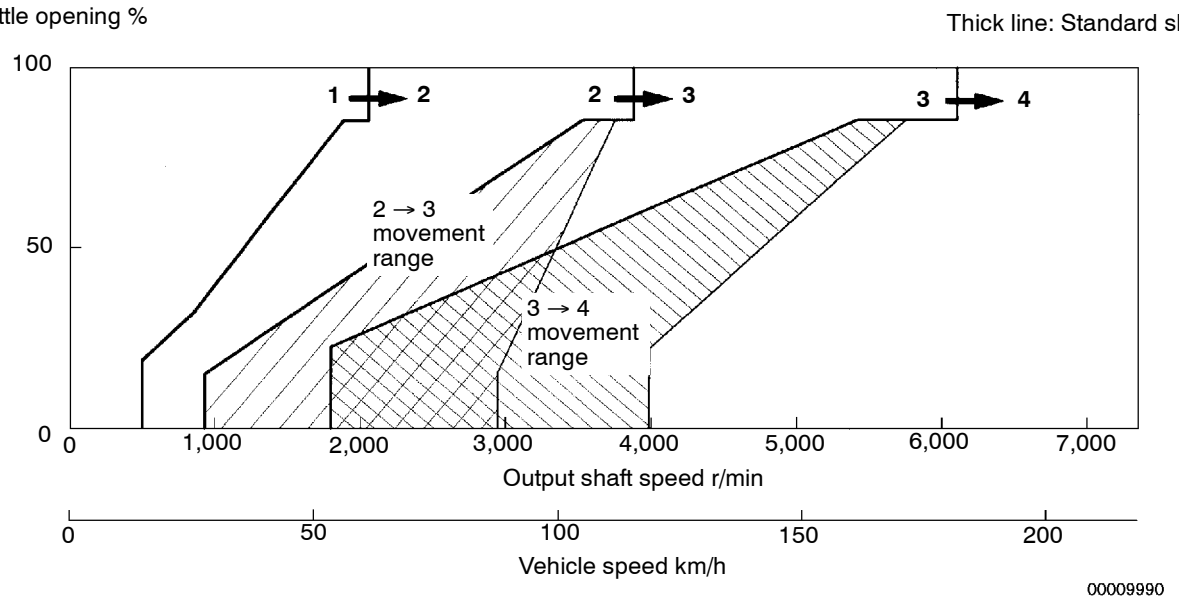


DOWNSHIFT PATTERN

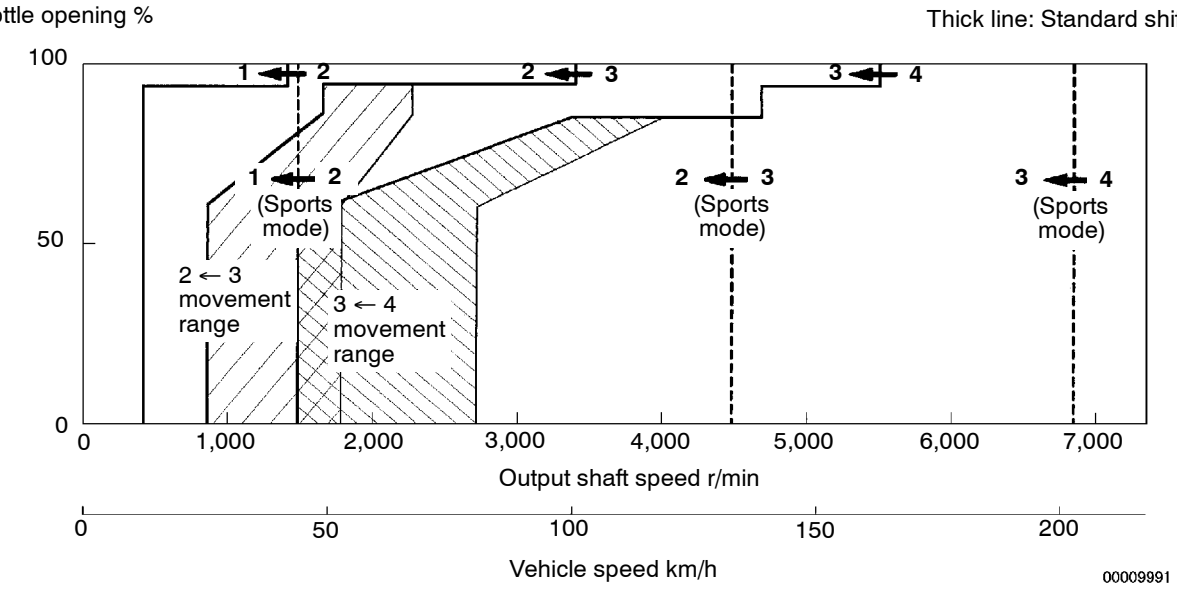


<6A13 engine>

UPSHIFT PATTERN



DOWNSHIFT PATTERN



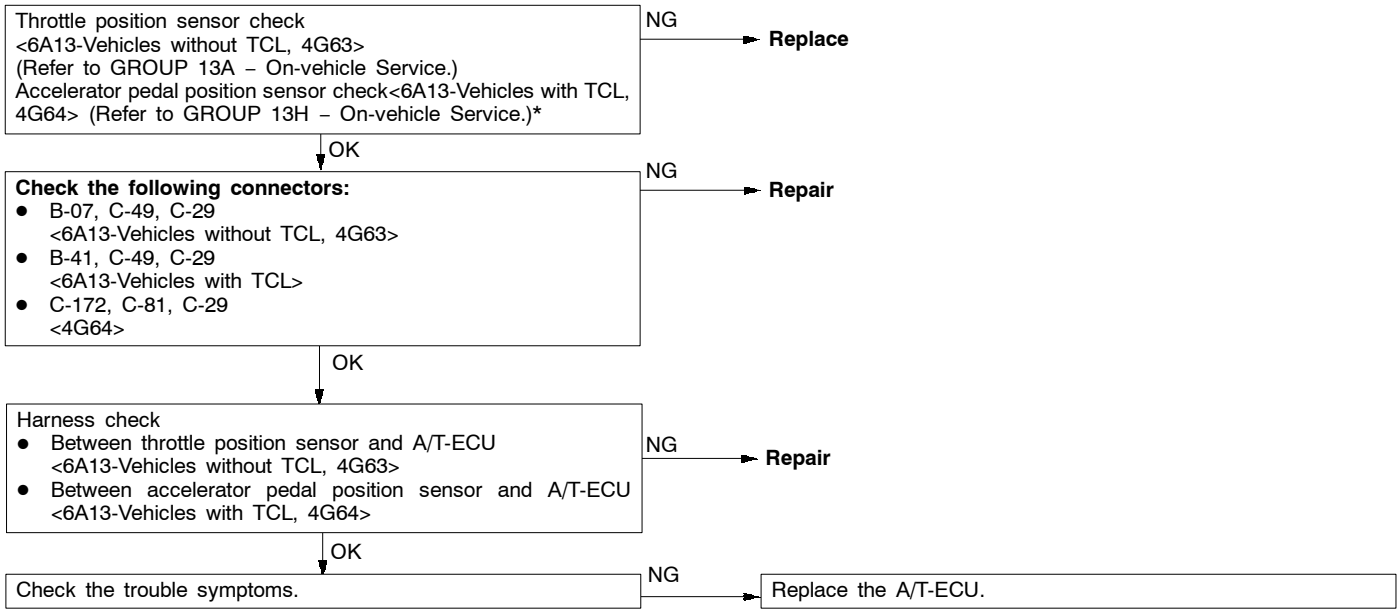
INSPECTION CHART FOR DIAGNOSIS CODE

Code	Diagnosis item		Reference page
11	Throttle position sensor system <6A13-Vehicles without TCL, 4G63> Accelerator pedal position sensor system <6A13-Vehicles with TCL, 4G64>	Short circuit	23-10
12		Open circuit	23-10
14		Sensor maladjustment	23-10
15	Oil temperature sensor system	Open circuit	23-10
21	Crank angle sensor system	Open circuit	23-11
22	Input shaft speed sensor system	Short circuit/open circuit	23-11
23	Output shaft speed sensor system	Short circuit/open circuit	23-12
25	Wide open throttle switch system	Short circuit	23-12
26	Stop lamp switch system	Short circuit/open circuit	23-13
31	Low and reverse solenoid valve system	Short circuit/open circuit	23-13
32	Underdrive solenoid valve system	Short circuit/open circuit	23-13
33	Second solenoid valve system	Short circuit/open circuit	23-13
34	Overdrive solenoid valve system	Short circuit/open circuit	23-13
36	Damper clutch control solenoid valve system	Short circuit/open circuit	23-14
41	1st gear ratio does not meet the specification		23-15
42	2st gear ratio does not meet the specification		23-16
43	3rd gear ratio does not meet the specification		23-17
44	4th gear ratio does not meet the specification		23-18
46	Reverse gear ratio does not meet the specification		23-19
51	Abnormal communication with engine-ECU <Vehicles without TCL> Abnormal communication with TCL-ECU <Vehicles with TCL>		23-20
52	Damper clutch control solenoid valve system	Defective system	23-14
54	A/T Control relay system	Short circuit to earth/ open circuit	23-21
56	N range lamp system	Short circuit to earth	23-22
71	Malfunction of A/T-ECU		23-22

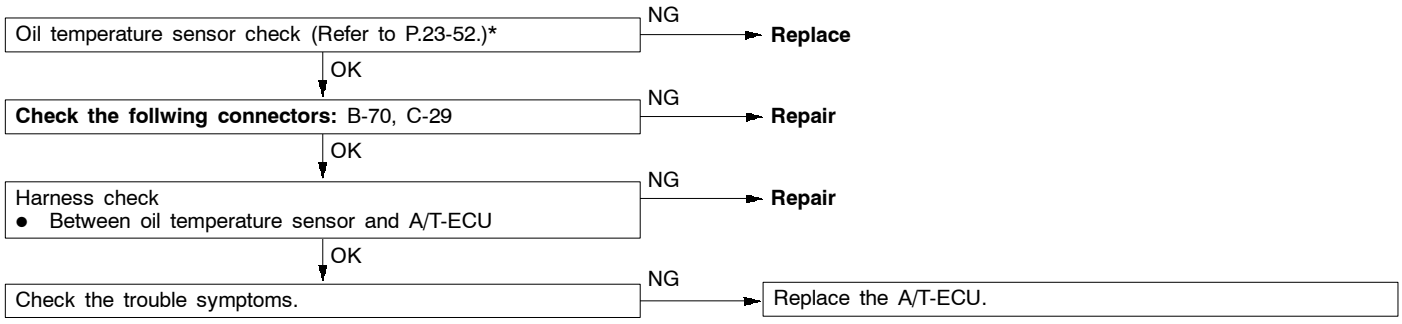
INSPECTION PROCEDURES FOR DIAGNOSIS CODES

NOTE
*: Refer to '97 GALANT Workshop Manual (Pub. No. PWDE9611).

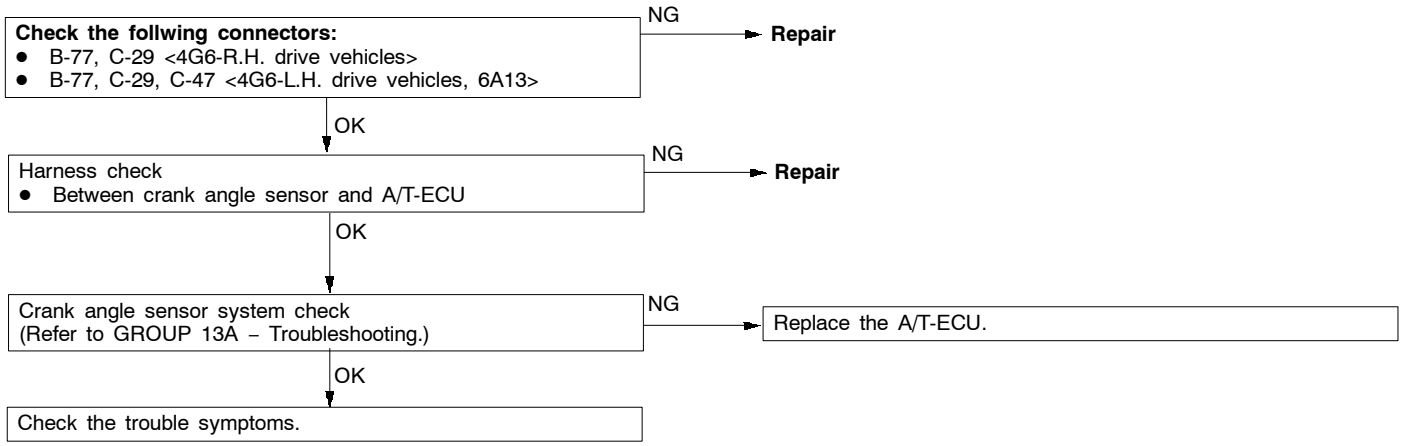
Code No. 11, 12, 14 Throttle position sensor system <6A13-Vehicles without TCL, 4G63>, accelerator pedal position sensor <6A13-Vehicles with TCL, 4G64>	Probable cause
If the TPS or APS output voltage is 4.8 V or higher when the engine is idling, the output is judged to be too high and diagnosis code No. 11 is output. Code No. 11 is also output if there is a problem with the APS and an APS fail-safe signal is received from the TCL-ECU. If the TPS or APS output voltage is 0.2 V or lower at times other than when the engine is idling, the output is judged to be too low and diagnosis code No. 12 is output. If the TPS or APS output voltage is 0.2 V or lower or if it is 1.2 V or higher when the engine is idling, the TPS or APS adjustment is judged to be incorrect and diagnosis code No. 14 is output.	• Malfunction of the throttle position sensor <6A13-Vehicles without TCL, 4G63> • Malfunction of the accelerator pedal position sensor <6A13-Vehicles with TCL, 4G64> • Malfunction of connector • Malfunction of the A/T-ECU



Code No. 15 Oil temperature sensor system	Probale cause
If the oil temperature sensor output voltage is 2.6 V or more even after driving for 10 minutes or more (if the oil temperature does not increase), it is judged that there is an open circuit in the oil temperature sensor and diagnosis code No. 15 is output.	• Malfunction of the oil temperature sensor • Malfunction of connector • Malfunction of the A/T-ECU

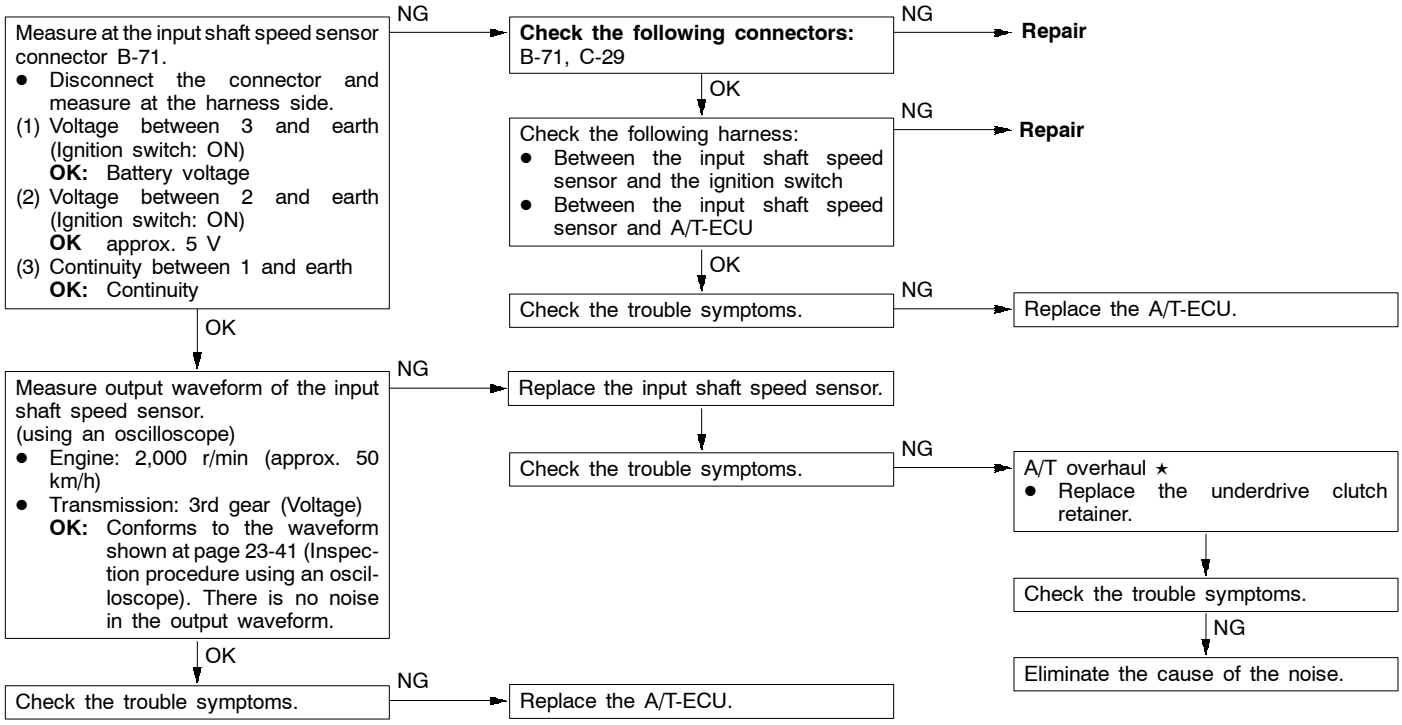


Code No. 21 Crank angle sensor system	Probable cause
If no output pulse is detected from the crank angle sensor for 5 seconds or more while driving at 25 km/h or more, it is judged that there is an open circuit in the crank angle sensor and diagnosis code No. 21 is output.	• Malfunction of the crank angle sensor • Malfunction of connector • Malfunction of the A/T-ECU



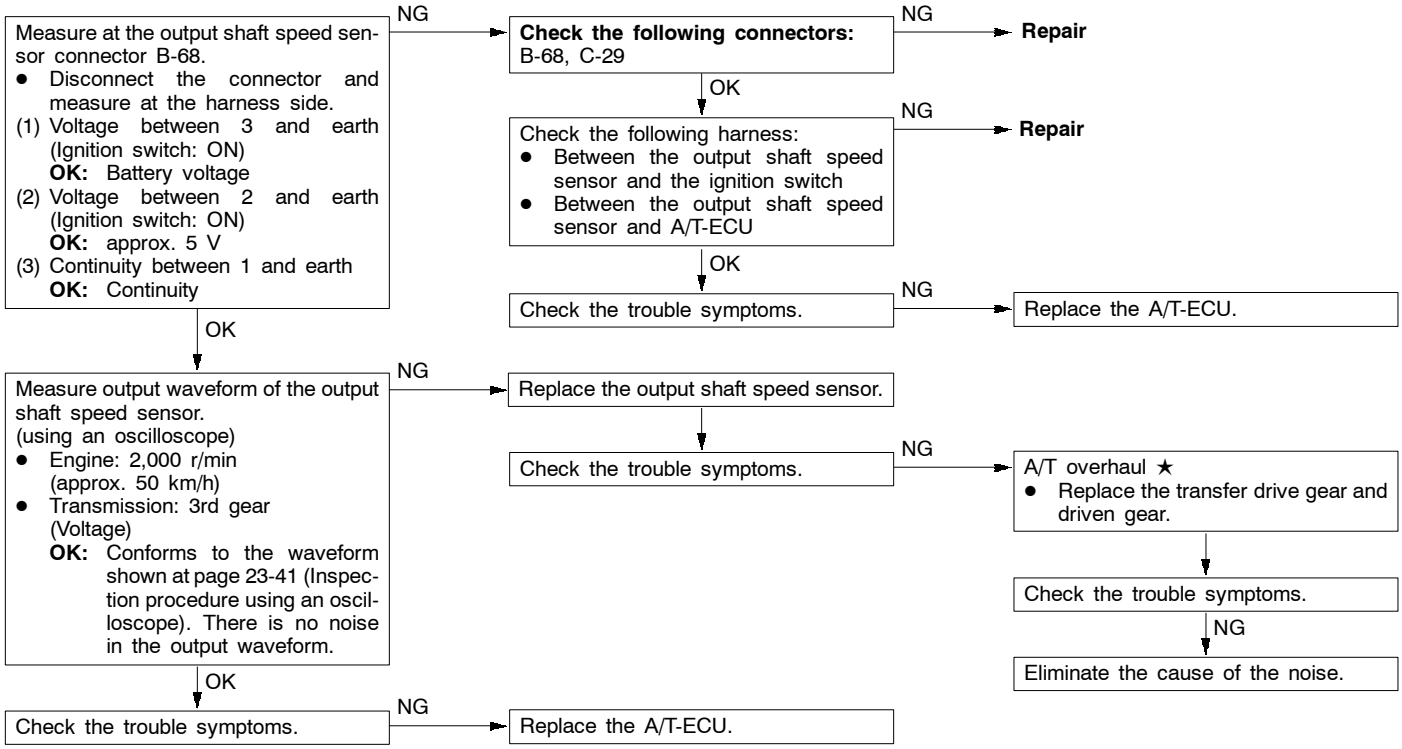
Code No. 22 Input shaft speed sensor system	Probable cause
If no output pulse is detected from the input shaft speed sensor for 1 second or more while driving in 3rd or 4th gear at a speed of 30 km/h or more, there is judged to be an open circuit or short-circuit in the input shaft speed sensor and diagnosis code No. 22 is output. If diagnosis code No. 22 is output four times, the transmission is locked into 3rd gear (D range) or 2nd gear (downshifting at Sports mode) as a fail-safe measure, and the N range lamp flashes at a frequency of 1 Hz.	• Malfunction of the input shaft speed sensor • Malfunction of the underdrive clutch retainer • Malfunction of connector • Malfunction of A/T-ECU

★: Refer to the Transmission Workshop Manual.

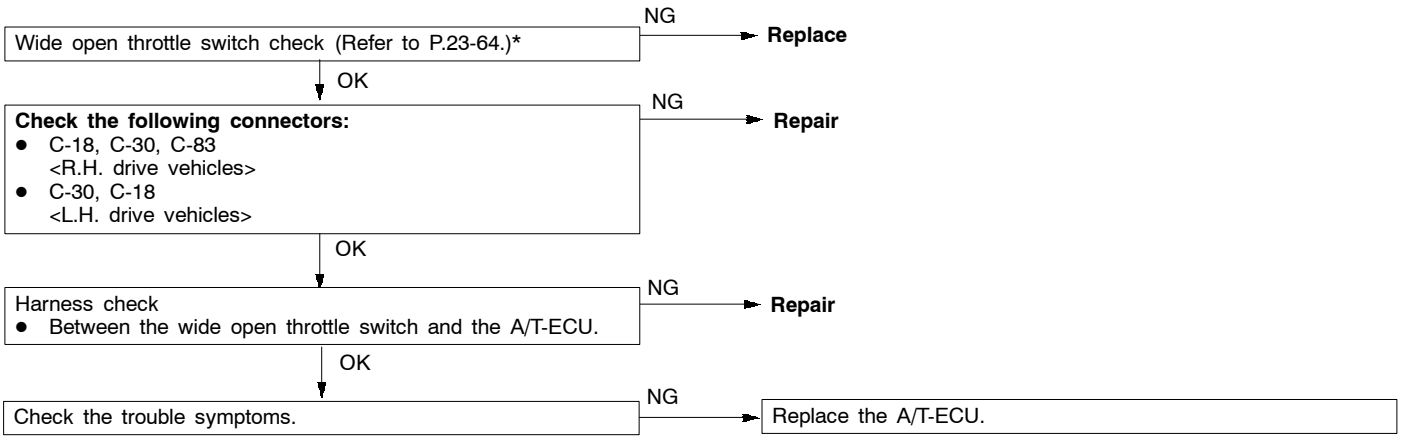


Code No. 23 Output shaft speed sensor system	Probable cause
If the output from the output shaft speed sensor is continuously 50% lower than the vehicle speed for 1 second or more while driving in 3rd or 4th gear at a speed of 30 km/h or more, there is judged to be an open circuit or short-circuit in the output shaft speed sensor and diagnosis code No. 23 is output. If diagnosis code No. 23 is output four times, the transmission is locked into 3rd gear (D range) or 2nd gear (downshifting at Sports mode) as a fail-safe measure, and the N range lamp flashes at a frequency of 1 Hz.	• Malfunction of the output shaft speed sensor • Malfunction of the transfer drive gear or driven gear • Malfunction of connector • Malfunction of the A/T-ECU

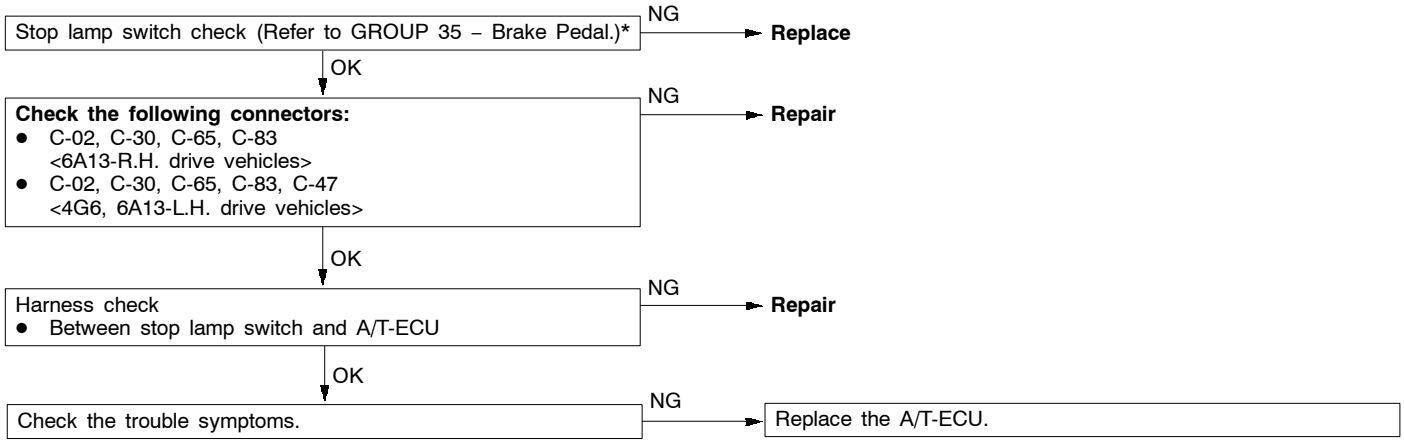
★: Refer to the Transmission Workshop Manual.



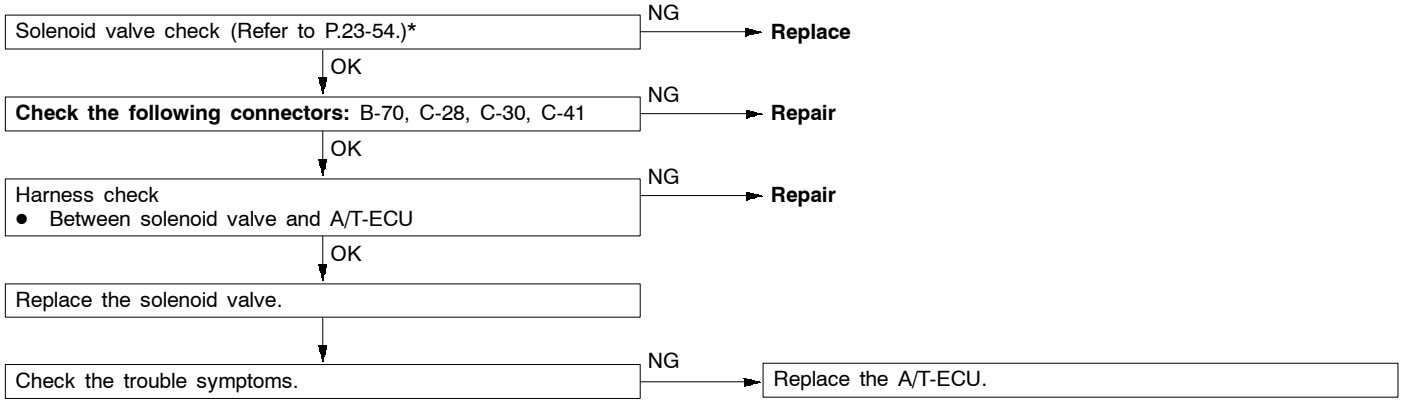
Code No. 25 Wide open throttle switch system	Probable cause
If the wide open throttle switch is on for 1 second or more with the throttle valve opening angle at 70% or less, it is judged that there is a short circuit in the wide open throttle switch and diagnosis code No. 25 is output.	• Malfunction of the wide open throttle switch • Malfunction of connector • Malfunction of A/T-ECU



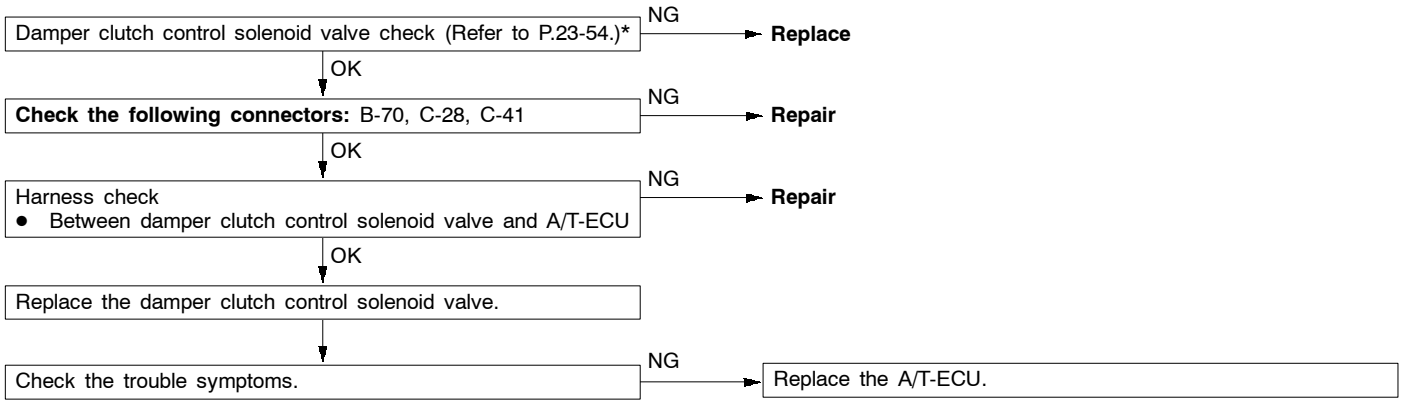
Code No. 26 Stop lamp switch system	Probable cause
If the stop lamp switch is on for 5 minutes or more while driving, it is judged that there is a short circuit in the stop lamp switch and diagnosis code No. 26 is output.	• Malfunction of the stop lamp switch • Malfunction of connector • Malfunction of the A/T-ECU



Code No. 31 Low and reverse solenoid valve system Code No. 32 Underdrive solenoid valve system Code No. 33 Second solenoid valve system Code No. 34 Overdrive solenoid valve system	Probable cause
If the resistance value for a solenoid valve is too large or too small, it is judged that there is a short-circuit or an open circuit in the solenoid valve and the respective diagnosis code is output. The transmission is locked into 3rd gear as a fail-safe measure, and the N range lamp flashes at a frequency of 1 Hz.	• Malfunction of solenoid valve • Malfunction of connector • Malfunction of the A/T-ECU



Code No. 36, 52 Damper clutch control solenoid valve system	Probable cause
If the resistance value for the damper clutch control solenoid valve is too large or too small, it is judged that there is a short-circuit or an open circuit in the damper clutch control solenoid valve and diagnosis code No. 36 is output. If the drive duty rate for the damper clutch control solenoid valve is 100 % for a continuous period of 4 seconds or more, it is judged that there is an abnormality in the damper clutch control system and diagnosis code No. 52 is output. When diagnosis code No. 36 is output, the transmission is locked into 3rd gear as a fail-safe measure, and the N range lamp flashes at a frequency of 1 Hz.	• Malfunction of the damper clutch control solenoid valve • Malfunction of connector • Malfunction of the A/T-ECU



Code No. 41 1st gear ratio does not meet the specification	Probable cause
If the output from the output shaft speed sensor multiplied by the 1st gear ratio is not the same as the output from the input shaft speed sensor after shifting to 1st gear has been completed, diagnosis code No. 41 is output. If diagnosis code No. 41 is output four times, the transmission is locked into 3rd gear as a fail-safe measure, and the N range lamp flashes at a frequency of 1 Hz.	● Malfunction of the input shaft speed sensor ● Malfunction of the output shaft speed sensor ● Malfunction of the underdrive clutch retainer ● Malfunction of the transfer drive gear or driven gear ● Malfunction of the low and reverse brake system ● Malfunction of the underdrive clutch system ● Noise generated

★: Refer to the Transmission Workshop Manual.

MUT-II Self-Diag code
Is the diagnosis code No. 22 output?
Yes → Code No. 22 Input shaft speed sensor system check (Refer to P.23-11.)
No ↓

MUT-II Self-Diag code
Is the diagnosis code No. 23 output?
Yes → Code No. 23 Output shaft speed sensor system check (Refer to P.23-12.)
No ↓

Measure output waveform from the input shaft speed sensor. (using an oscilloscope)
- Connect the connector B-71 and measure voltage between 31 and 43 at the A/T-ECU.
- Engine: 2,000 r/min (approx. 50 km/h)
- Selector lever position: D (3rd gear)

(Voltage)
OK: A waveform such as the one shown on P.23-41 (Inspection Procedure Using an Oscilloscope) is output (flalshing between 0 ←→ 5V) and there is no noise appearing in the waveform.

NG → Replace the input shaft speed sensor.
→ Check the trouble symptoms.
NG → A/T overhaul ★
- Replace the underdrive clutch retainer.

→ Check the trouble symptoms.
NG → Eliminate the cause of the noise.

OK ↓

Measure output waveform from the output shaft speed sensor. (using an oscilloscope)
- Connect the connector B-68 and measure voltage between 32 and 43 at the A/T-ECU.
- Engine: 2,000 r/min (approx. 50 km/h)
- Selector lever position: D (3rd gear)

(Voltage)
OK: A waveform such as the one shown on P.23-41 (Inspection Procedure Using an Oscilloscope) is output (flalshing between 0 ←→ 5V) and there is no noise appearing in the waveform.

NG → Replace the output shaft speed sensor.
→ Check the trouble symptoms.
NG → A/T overhaul ★
- Replace the transfer drive gear and driven gear.

→ Check the trouble symptoms.
NG → Eliminate the cause of the noise.

OK ↓

A/T overhaul ★
- Underdrive clutch system check (No. 42, No. 43, or no diagnosis code is output).
- Low and reverse brake system check (No. 46 or no diagnosis code is output).

Code No. 42 2nd gear ratio does not meet the specification	Probable cause
If the output from the output shaft speed sensor multiplied by the 2nd gear ratio is not the same as the output from the input shaft speed sensor after shifting to 2nd gear has been completed, diagnosis code No. 42 is output. If diagnosis code No. 42 is output four times, the transmission is locked into 3rd gear as a fail-safe measure, and the N range lamp flashes at a frequency of 1 Hz.	● Malfunction of the input shaft speed sensor ● Malfunction of the output shaft speed sensor ● Malfunction of the underdrive clutch retainer ● Malfunction of the transfer drive gear or driven gear ● Malfunction of the second brake system ● Malfunction of the underdrive clutch system ● Noise generated

★: Refer to the Transmission Workshop Manual.

MUT-II Self-Diag code
Is the diagnosis code No. 22 output?
Yes → Code No. 22 Input shaft speed sensor system check (Refer to P.23-11.)
No ↓

MUT-II Self-Diag code
Is the diagnosis code No. 23 output?
Yes → Code No. 23 Output shaft speed sensor system check (Refer to P.23-12.)
No ↓

Measure output waveform from the input shaft speed sensor. (using an oscilloscope)
- Connect the connector B-71 and measure voltage between 31 and 43 at the A/T-ECU.
- Engine: 2,000 r/min (approx. 50 km/h)
- Selector lever position: D (3rd gear)

(Voltage)
OK: A waveform such as the one shown on P.23-41 (Inspection Procedure Using an Oscilloscope) is output (flalshing between 0 ←→ 5V) and there is no noise appearing in the waveform.

NG → Replace the input shaft speed sensor.
→ Check the trouble symptoms.
NG → A/T overhaul ★
- Replace the underdrive clutch retainer.

→ Check the trouble symptoms.
NG → Eliminate the cause of the noise.

OK ↓

Measure output waveform from the output shaft speed sensor. (using an oscilloscope)
- Connect the connector B-68 and measure voltage between 32 and 43 at the A/T-ECU.
- Engine: 2,000 r/min (approx. 50 km/h)
- Selector lever position: D (3rd gear)

(Voltage)
OK: A waveform such as the one shown on P.23-41 (Inspection Procedure Using an Oscilloscope) is output (flalshing between 0 ←→ 5V) and there is no noise appearing in the waveform.

NG → Replace the output shaft speed sensor.
→ Check the trouble symptoms.
NG → A/T overhaul ★
- Replace the transfer drive gear and driven gear.

→ Check the trouble symptoms.
NG → Eliminate the cause of the noise.

OK ↓

A/T overhaul ★
- Underdrive clutch system check (No. 41, No. 43, or no diagnosis code is output).
- Second brake system check (No. 44 or no diagnosis code is output).

Code No. 43 3rd gear ratio does not meet the specification	Probable cause
If the output from the output shaft speed sensor multiplied by the 3rd gear ratio is not the same as the output from the input shaft speed sensor after shifting to 3rd gear has been completed, diagnosis code No. 43 is output. If diagnosis code No. 43 is output four times, the transmission is locked into 3rd gear as a fail-safe measure, and the N range lamp flashes at a frequency of 1 Hz.	● Malfunction of the input shaft speed sensor ● Malfunction of the output shaft speed sensor ● Malfunction of the underdrive clutch retainer ● Malfunciton of the transfer drive gear or driven gear ● Malfunction of the underdrive clutch system ● Malfunction of the overdrive clutch system ● Noise generated

★: Refer to the Transmission Workshop Manual.

MUT-II Self-Diag code
Is the diagnosis code No. 22 output?
Yes → Code No. 22 Input shaft speed sensor system check (Refer to P.23-11.)
No ↓

MUT-II Self-Diag code
Is the diagnosis code No. 23 output?
Yes → Code No. 23 Output shaft speed sensor system check (Refer to P.23-12.)
No ↓

Measure output waveform from the input shaft speed sensor. (using an oscilloscope)
- Connect the connector B-71 and measure voltage between 31 and 43 at the A/T-ECU.
- Engine: 2,000 r/min (approx. 50 km/h)
- Selector lever position: D (3rd gear)

(Voltage)
OK: A waveform such as the one shown on P.23-41 (Inspection Procedure Using an Oscilloscope) is output (flalshing between 0 ←→ 5V) and there is no noise appearing in the waveform.

NG → Replace the input shaft speed sensor.
→ Check the trouble symptoms.
NG → A/T overhaul ★
- Replace the underdrive clutch retainer.

→ Check the trouble symptoms.
NG → Eliminate the cause of the noise.

OK ↓

Measure output waveform from the output shaft speed sensor. (using an oscilloscope)
- Connect the connector B-68 and measure voltage between 32 and 43 at the A/T-ECU.
- Engine: 2,000 r/min (approx. 50 km/h)
- Selector lever position: D (3rd gear)

(Voltage)
OK: A waveform such as the one shown on P.23-41 (Inspection Procedure Using an Oscilloscope) is output (flalshing between 0 ←→ 5V) and there is no noise appearing in the waveform.

NG → Replace the output shaft speed sensor.
→ Check the trouble symptoms.
NG → A/T overhaul ★
- Replace the transfer drive gear and driven gear.

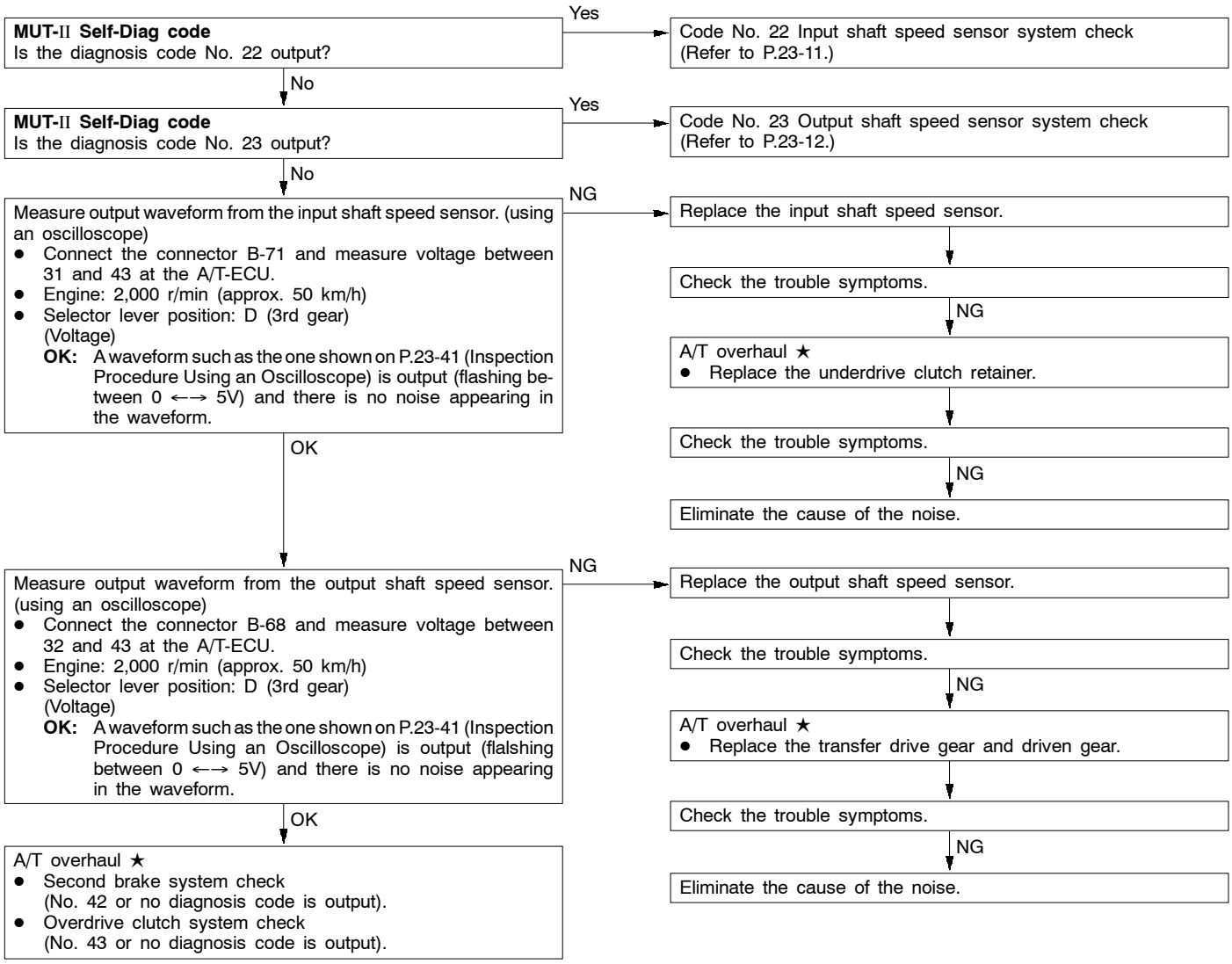
→ Check the trouble symptoms.
NG → Eliminate the cause of the noise.

OK ↓

A/T overhaul ★
- Underdrive clutch system check (No. 41, No. 42, or no diagnosis code is output).
- Overdrive clutch system check (No. 44 or no diagnosis code is output).

Code No. 44 4th gear ratio does not meet the specification	Probable cause
If the output from the output shaft speed sensor multiplied by the 4th gear ratio is not the same as the output from the input shaft speed sensor after shifting to 4th gear has been completed, diagnosis code No. 44 is output. If diagnosis code No. 44 is output four times, the transmission is locked into 3rd gear as a fail-safe measure, and the N range lamp flashes at a frequency of 1 Hz.	● Malfunction of the input shaft speed sensor ● Malfunction of the output shaft speed sensor ● Malfunction of the underdrive clutch retainer ● Malfunction of the transfer drive gear or driven gear ● Malfunction of the second brake system ● Malfunction of the overdrive clutch system ● Noise generated

★: Refer to the Transmission Workshop Manual.



Code No. 46 Reverse gear ratio does not meet the specification	Probable cause
If the output from the output shaft speed sensor multiplied by the reverse gear ratio is not the same as the output from the input shaft speed sensor after shifting to reverse gear has been completed, diagnosis code No. 46 is output. If diagnosis code No. 46 is output four times, the transmission is locked into 3rd gear as a fail-safe measure, and the N range lamp flashes at a frequency of 1 Hz.	● Malfunction of the input shaft speed sensor ● Malfunction of the output shaft speed sensor ● Malfunction of the underdrive clutch retainer ● Malfunciton of the transfer drive gear or driven gear ● Malfunction of the low and reverse brake system ● Malfunction of the reverse clutch system ● Noise generated

★: Refer to the Transmission Workshop Manual.

MUT-II Self-Diag code
Is the diagnosis code No. 22 output?
Yes → Code No. 22 Input shaft speed sensor system check (Refer to P.23-11.)
No ↓

MUT-II Self-Diag code
Is the diagnosis code No. 23 output?
Yes → Code No. 23 Output shaft speed sensor system check (Refer to P.23-12.)
No ↓

Measure output waveform from the input shaft speed sensor. (using an oscilloscope)
- Connect the connector B-71 and measure voltage between 31 and 43 at the A/T-ECU.
- Engine: 2,000 r/min (approx. 50 km/h)
- Selector lever position: D (3rd gear)

(Voltage)
OK: A waveform such as the one shown on P.23-41 (Inspection Procedure Using an Oscilloscope) is output (flalshing between 0 ←→ 5V) and there is no noise appearing in the waveform.

NG → Replace the input shaft speed sensor.
→ Check the trouble symptoms.
NG → A/T overhaul ★
- Replace the underdrive clutch retainer.

→ Check the trouble symptoms.
NG → Eliminate the cause of the noise.

OK ↓

Measure output waveform from the output shaft speed sensor. (using an oscilloscope)
- Connect the connector B-68 and measure voltage between 32 and 43 at the A/T-ECU.
- Engine: 2,000 r/min (approx. 50 km/h)
- Selector lever position: D (3rd gear)

(Voltage)
OK: A waveform such as the one shown on P.23-41 (Inspection Procedure Using an Oscilloscope) is output (flalshing between 0 ←→ 5V) and there is no noise appearing in the waveform.

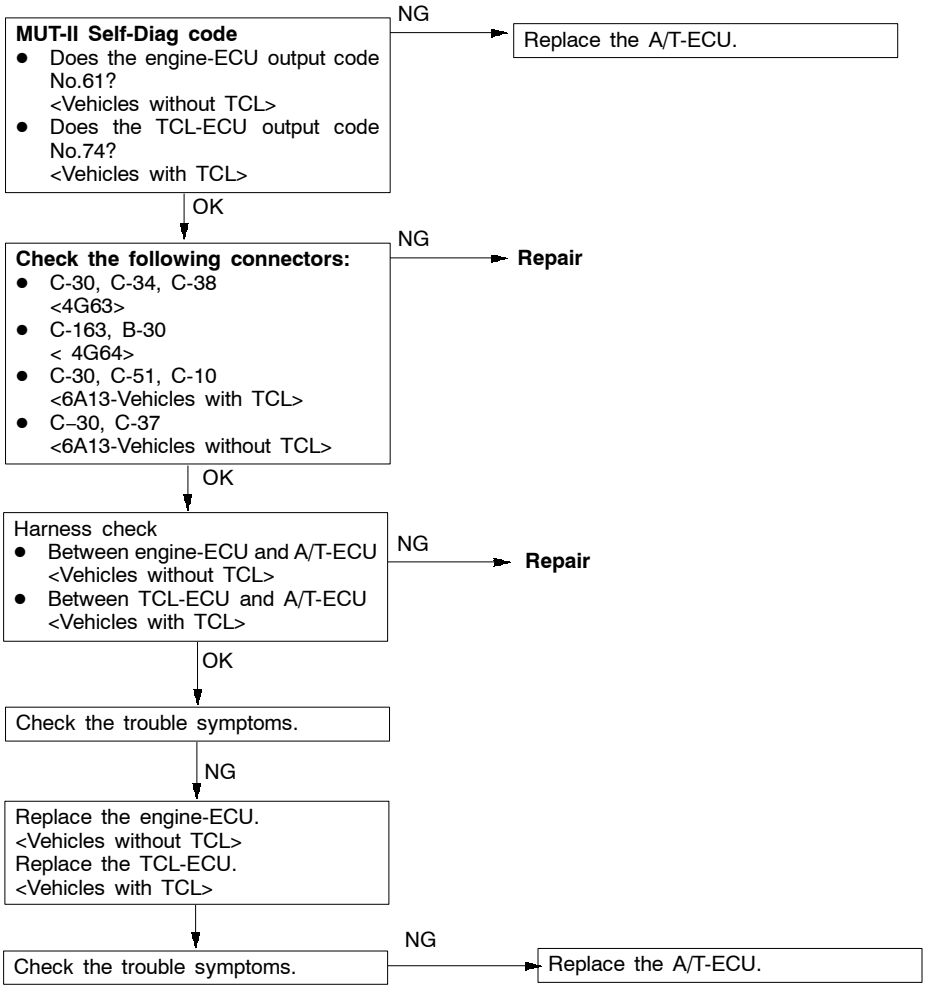
NG → Replace the output shaft speed sensor.
→ Check the trouble symptoms.
NG → A/T overhaul ★
- Replace the transfer drive gear and driven gear.

→ Check the trouble symptoms.
NG → Eliminate the cause of the noise.

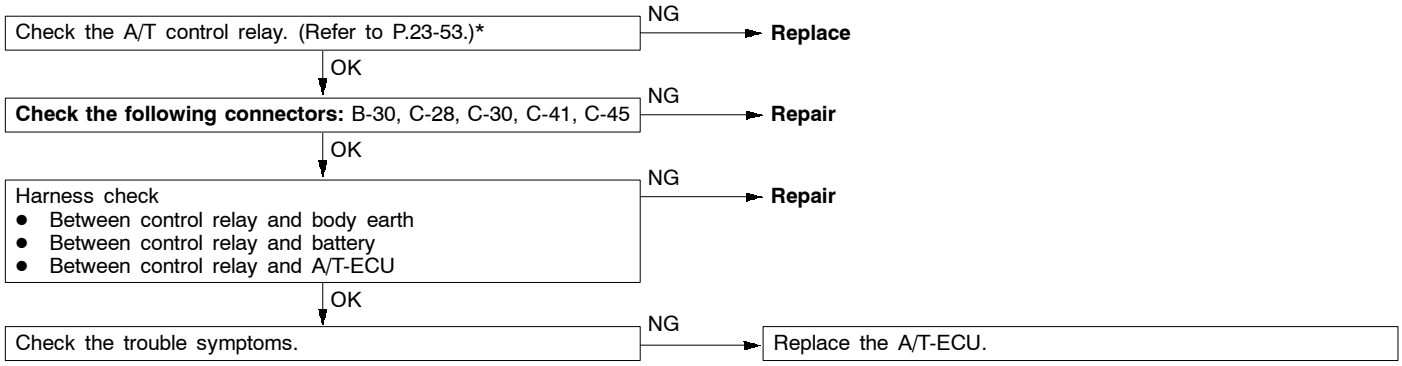
OK ↓

A/T overhaul ★
- Low and reverse brake system check (No. 41 or no diagnosis code is output).
- Reverse clutch system check (No diagnosis code is output).

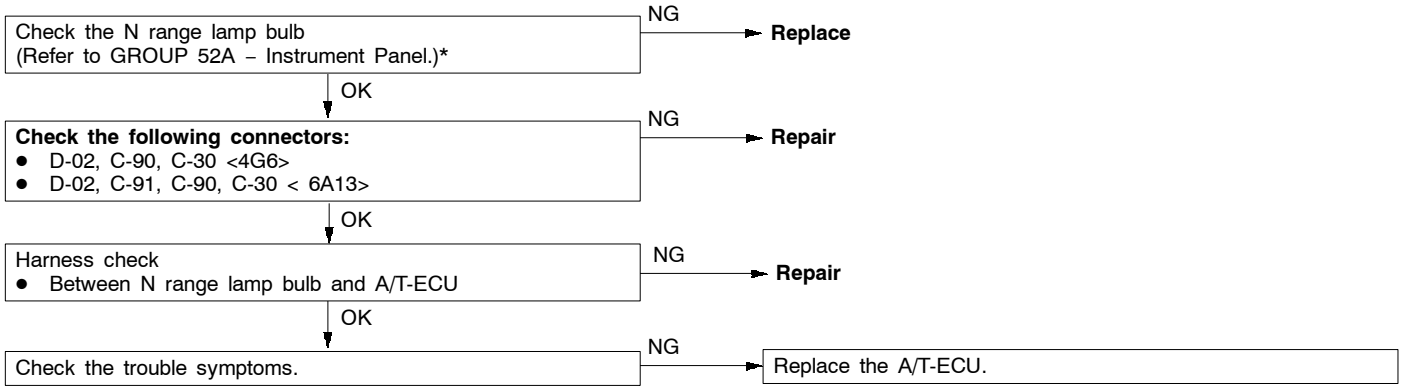
Code No. 51 Abnormal communication with engine-ECU <Vehicles without TCL> Abnormal communication with TCL-ECU <Vehicles with TCL>	Probable cause
If normal communication is not possible for a continuous period of 1 second or more when the ignition switch is at the ON position, the battery voltage is 10 V or more and the engine speed is 450 r/min or more, diagnosis code No. 51 is output. Diagnosis code No. 51 is also output if the data being received is abnormal for a continuous period of 4 seconds under the same conditions.	• Malfunction of connector • Malfunction of the engine-ECU <Vehicles without TCL> • Malfunction of the TCL-ECU <Vehicles with TCL> • Malfunction of the A/T-ECU



Code No. 54 A/T control relay system	Probable cause
If the A/T control relay voltage is less than 7 V after the ignition switch has been turned ON, it is judged that there is an open circuit or a short-circuit in the A/T control relay earth and diagnosis code No. 54 is output. Then the transmission is locked into 3rd gear as a fail-safe measure, and the N range lamp flashes at a frequency of 1 Hz.	● Malfunction of the A/T control relay ● Malfunction of connector ● Malfunction of the A/T-ECU



Code No. 56 N range lamp system	Probable cause
If the N range signal is off after an N range lamp illumination instruction (ON instruction) has been given, it is judged that there is a short-circuit in the N range lamp earth and diagnosis code No. 56 is output.	• Malfunction of the N range lamp bulb • Malfunction of connector • Malfunction of the A/T-ECU



Code No. 71 Malfunction of A/T-ECU	Probale cause
There is an abnormality in the A/T-ECU. The transmission is locked into 3rd gear as a fail-safe measure.	• Malfunction of the A/T-ECU

Replace the A/T-ECU.

INSPECTION CHART FOR TROUBLE SYMPTOMS

23100800267

Trouble symptom		Inspection procedure No.	Reference page
Communication with MUT-II is not possible		1	23-23
Driving impossible	Starting impossible	2	23-24
	Does not move forward	3	23-24
	Does not reverse	4	23-25
	Does not move (forward or reverse)	5	23-25
Malfunction when starting	Engine stalling when shifting	6	23-26
	Shocks when changing from N to D and large time lag	7	23-26
	Shocks when changing from N to R and large time lag	8	23-27
	Shocks when changing from N to D, N to R and large time lag	9	23-28
Malfunction when shifting	Shocks and running up	10	23-28

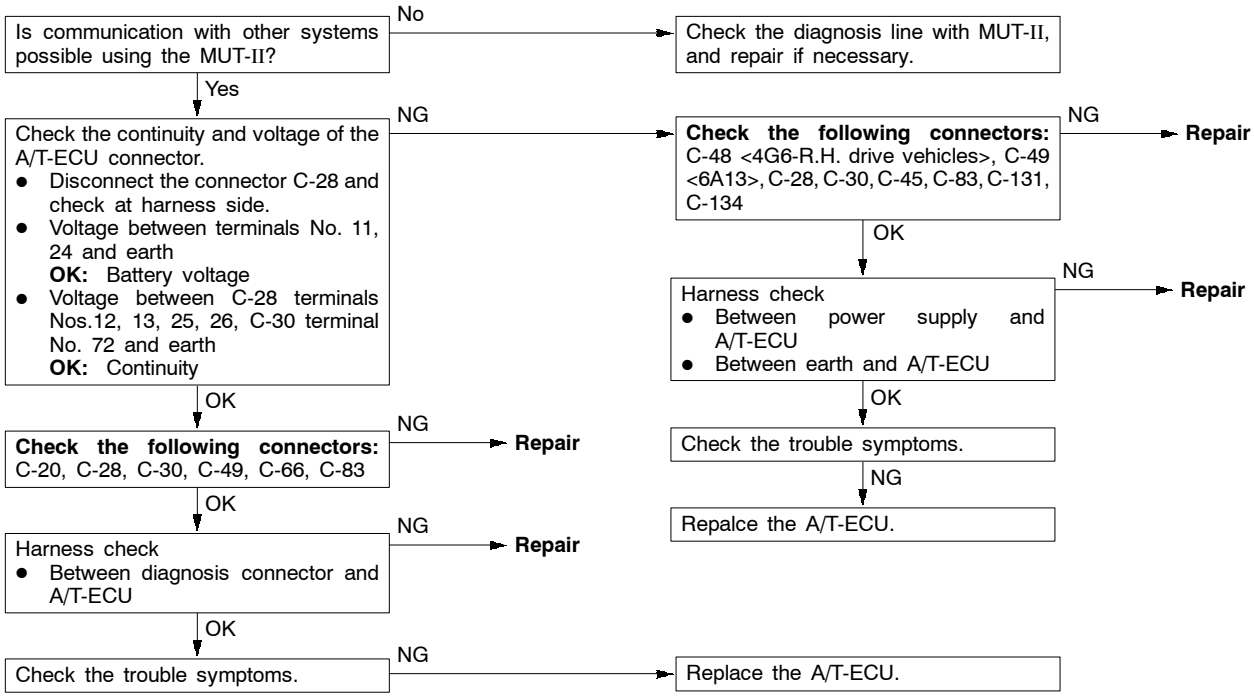
Trouble symptom		Inspection procedure No.	Reference page
Displaced shifting points	All points	11	23-29
	Some points	12	23-30
Does not shift	No diagnosis codes	13	23-30
Malfunction while driving	Poor acceleration	14	23-31
	Vibration	15	23-31
Inhibitor switch system		16	23-32
Shift switch assembly system		17	23-33
Dual pressure switch system		18	23-33
Vehicle speed sensor system		19	23-34
Auto-cruse-ECU signal system <MPI>		20	23-34

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

NOTE
*: Refer to '97 GALANT Workshop Manual (Pub. No. PWDE9611).

INSPECTION PROCEDURE 1

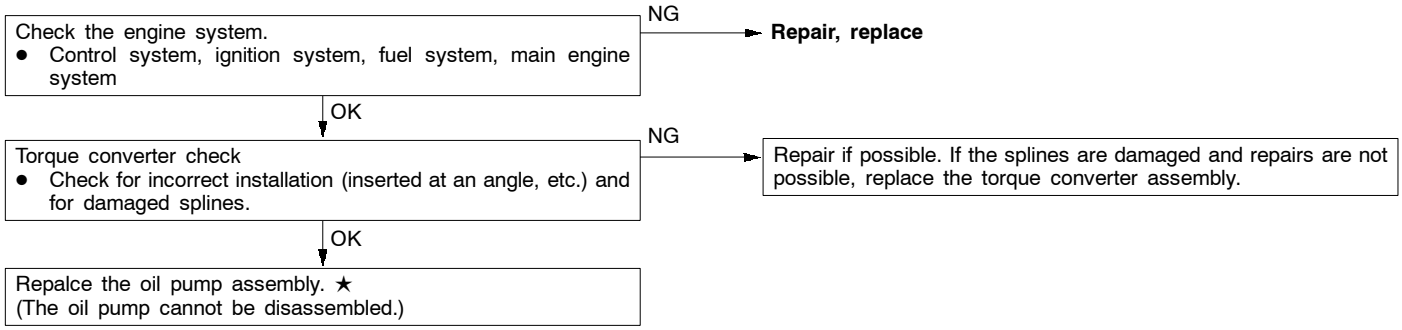
Communication with MUT-II is not possible	**Probable cause**
If communication with the MUT-II is not possible, the cause is probably a defective diagnosis line or the A/T-ECU is not functioning.	• Malfunction of diagnosis line • Malfunction of connector • Malfunction of the A/T-ECU



INSPECTION PROCEDURE 2

Starting impossible	Probable cause
Starting is not possible when the selector lever is in P or N range.In such cases, the cause is probably a defective engine system, torque converter or oil pump.	• Malfunction of the engine system • Malfunction of the torque converter • Malfunction of the oil pump

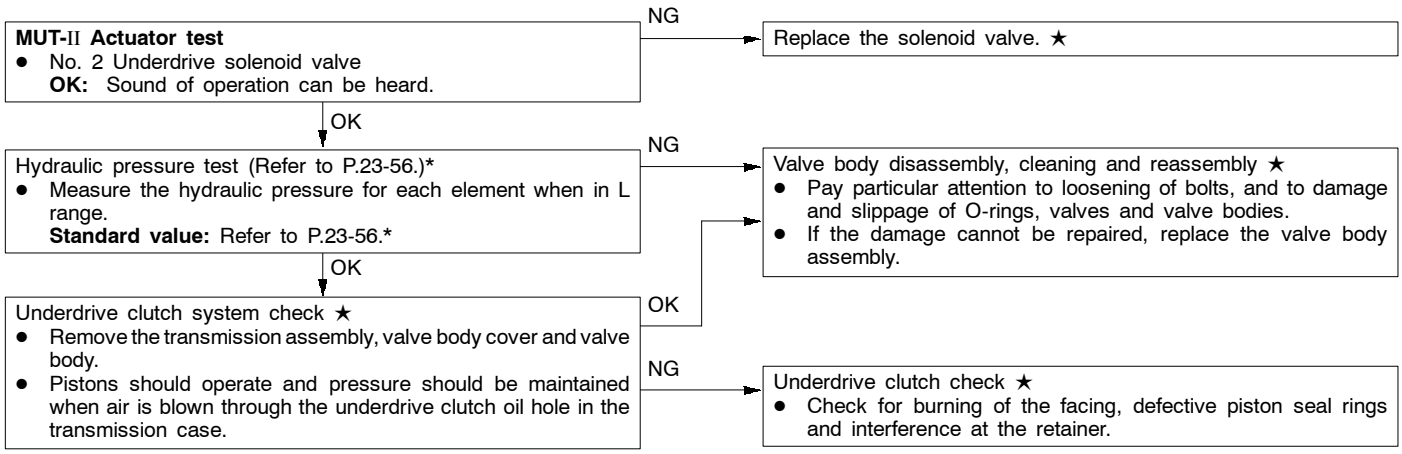
★: Refer to the Transmission Workshop Manual.



INSPECTION PROCEDURE 3

Does not move (forward)	Probable cause
If the vehicle does not move forward when the selector lever is shifted from N to D, Sports mode 1st or 2nd range while the engine is idling, the cause is probably abnormal line pressure or a malfunction of the underdrive clutch or valve body.	• Abnormal line pressure • Malfunction of the underdrive solenoid valve • Malfunction of the underdrive clutch • Malfunction of the valve body

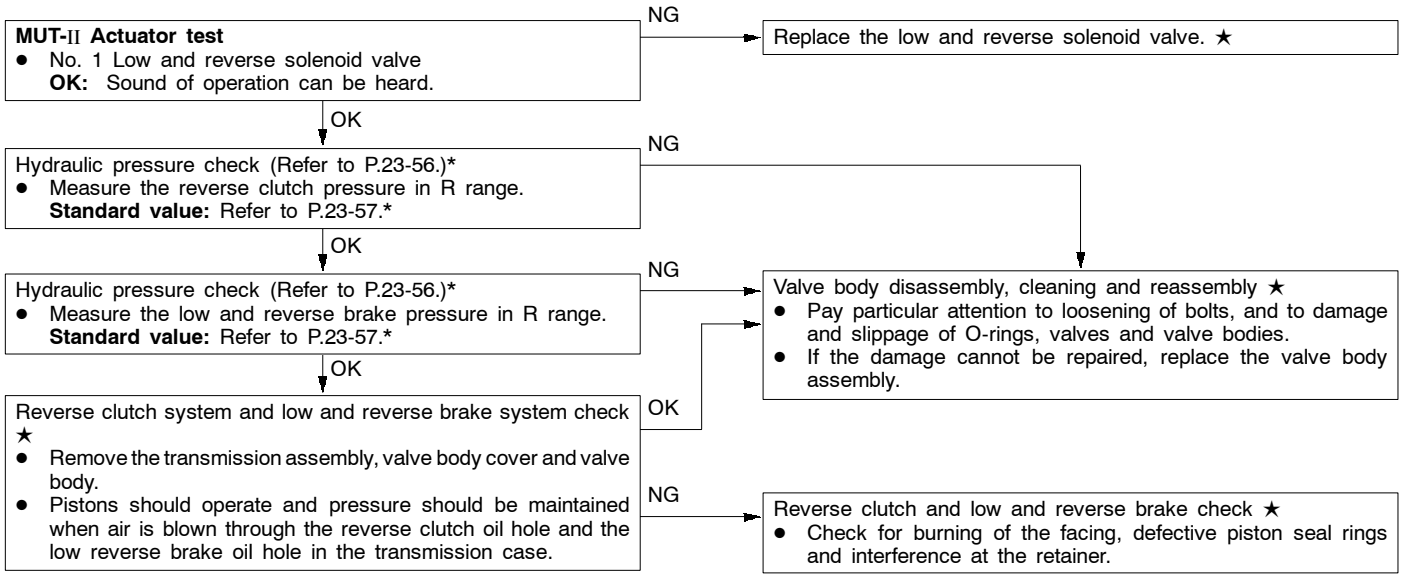
★: Refer to the Transmission Workshop Manual.



INSPECTION PROCEDURE 4

Does not reverse	Probable cause
If the vehicle does not reverse when the selector lever is shifted from N to R range while the engine is idling, the cause is probably abnormal pressure in the reverse clutch or low and reverse brake or a malfunction of the reverse clutch, low and reverse brake or valve body.	• Abnormal reverse clutch pressure • Abnormal low and reverse brake pressure • Malfunction of the low and reverse solenoid valve • Malfunction of the reverse clutch • Malfunction of the low and reverse brake • Malfunction of the valve body

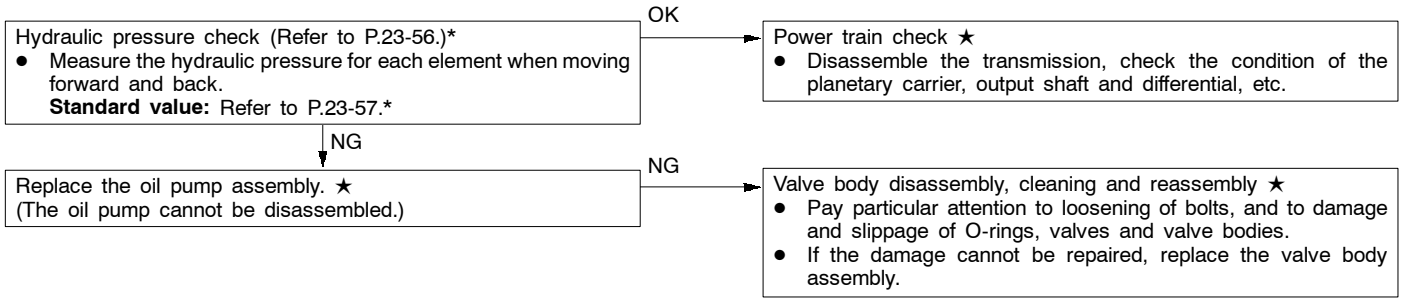
★: Refer to the Transmission Workshop Manual.



INSPECTION PROCEDURE 5

Does not move (forward or reverse)	Probable cause
If the vehicle does not move forward or reverse when the selector lever is shifted to any position while the engine is idling, the cause is probably abnormal line pressure, or a malfunction of the power train, oil pump or valve body.	• Abnormal line pressure • Malfunction of power train • Malfunction of the oil pump • Malfunction of the valve body

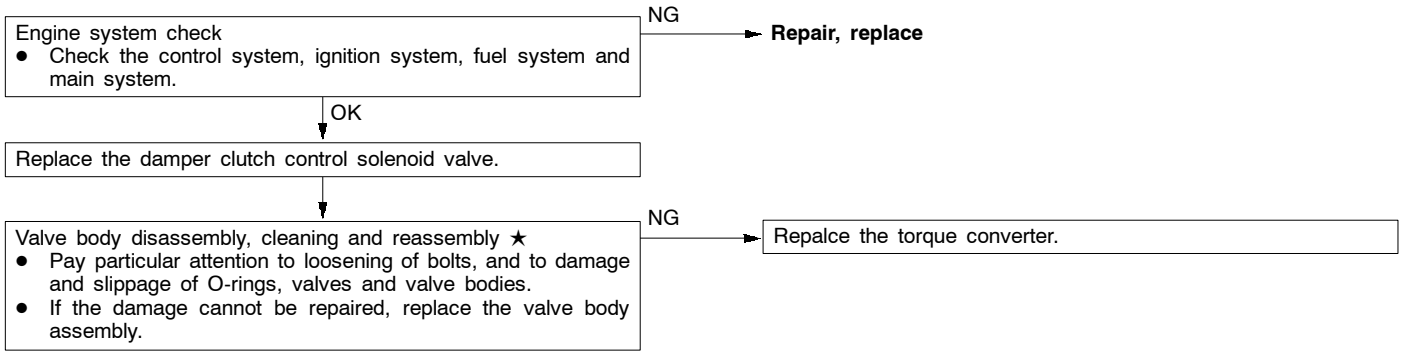
★: Refer to the Transmission Workshop Manual.



INSPECTION PROCEDURE 6

Engine stalling when shifting	Probable cause
If the engine stalls when the selector lever is shifted from N to D or R range while the engine is idling, the cause is probably a malfunction of the engine system, damper clutch solenoid valve, valve body or torque converter (damper clutch malfunction).	• Malfunction of the engine system • Malfunction of the damper clutch control solenoid valve • Malfunction of the valve body • Malfunction of the torque converter (Malfuction of the damper clutch)

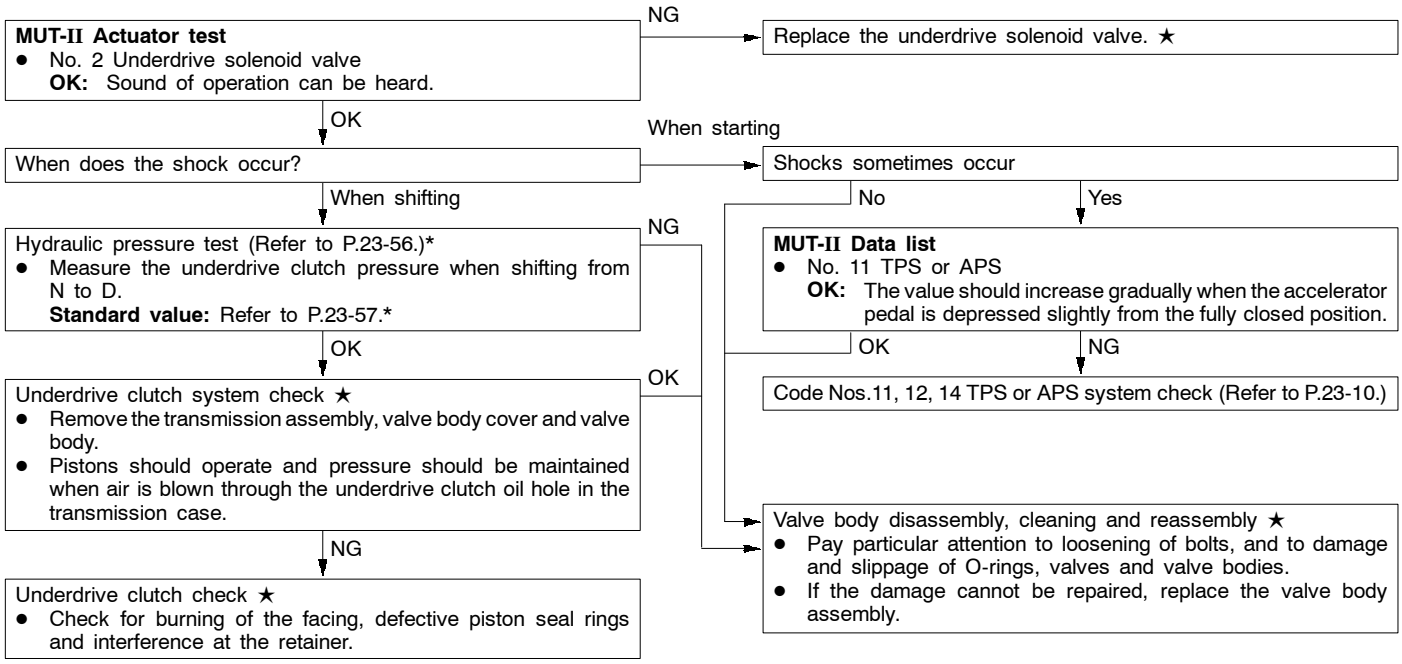
★: Refer to the Transmission Workshop Manual.



INSPECTION PROCEDURE 7

Shocks when changing from N to D and large time lag	Probable cause
If abnormal shocks or a time lag of 2 seconds or more occur when the selector lever is shifted from N to D range while the engine is idling, the cause is probably abnormal underdrive clutch pressure or a malfunction of the underdrive clutch, valve body, APS or TPS.	• Abnormal underdrive clutch pressure • Malfunction of the underdrive solenoid valve • Malfunction of the underdrive clutch • Malfunction of the valve body • Malfunction of the TPS or APS

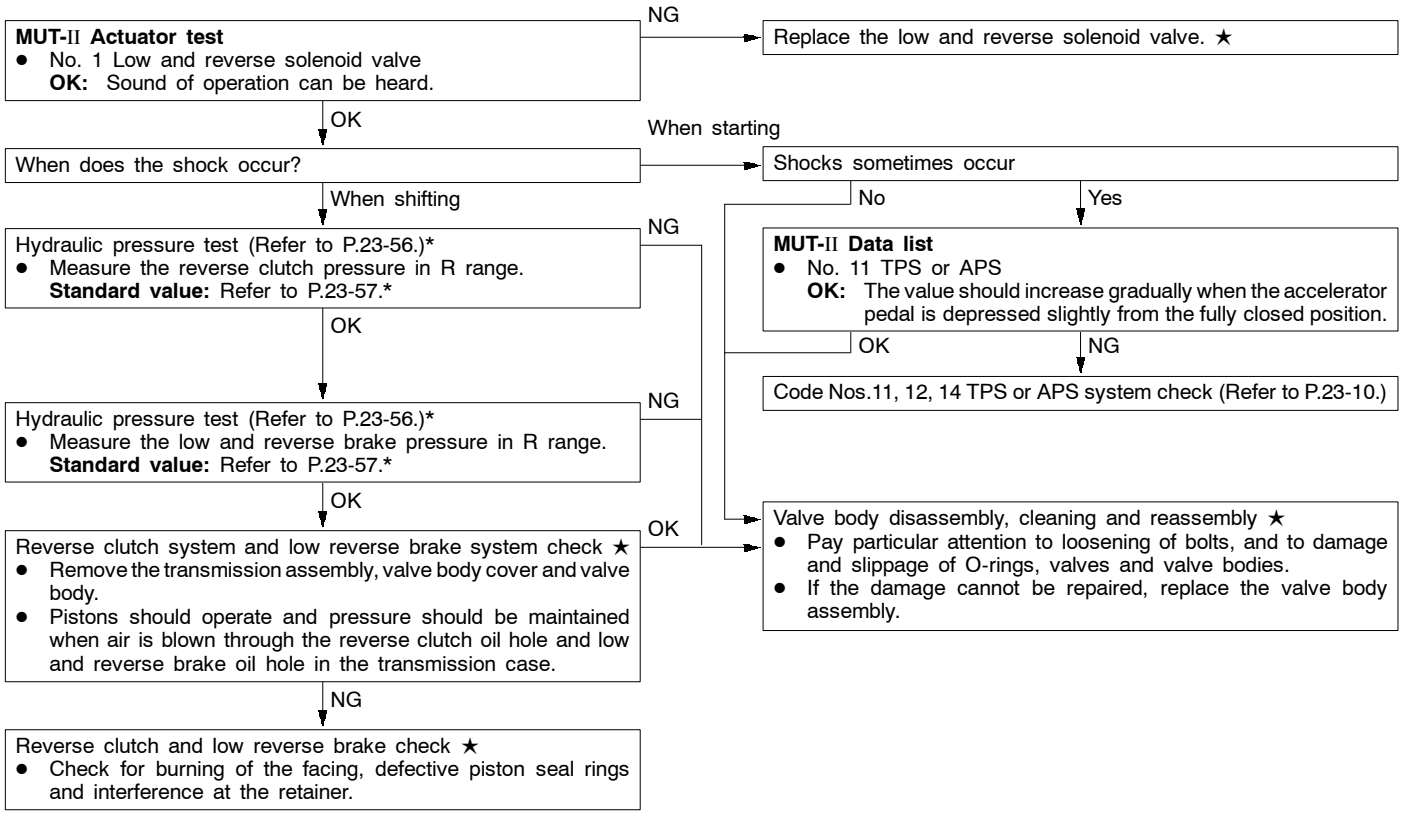
★: Refer to the Transmission Workshop Manual.



INSPECTION PROCEDURE 8

Shocks when changing from N to R and large time lag	Probable cause
If abnormal shocks or a time lag of 2 seconds or more occurs when the selector lever is shifted from N to R range while the engine is idling, the cause is probably abnormal reverse clutch pressure or low and reverse brake pressure, or a malfunction of the reverse clutch, low and reverse brake, valve body, TPS or APS.	• Abnormal reverse clutch pressure • Abnormal low and reverse brake pressure • Malfunction of the low and reverse solenoid valve • Malfunction of the reverse clutch • Malfunction of the low and reverse brake • Malfunction of the valve body • Malfunction of the TPS or APS

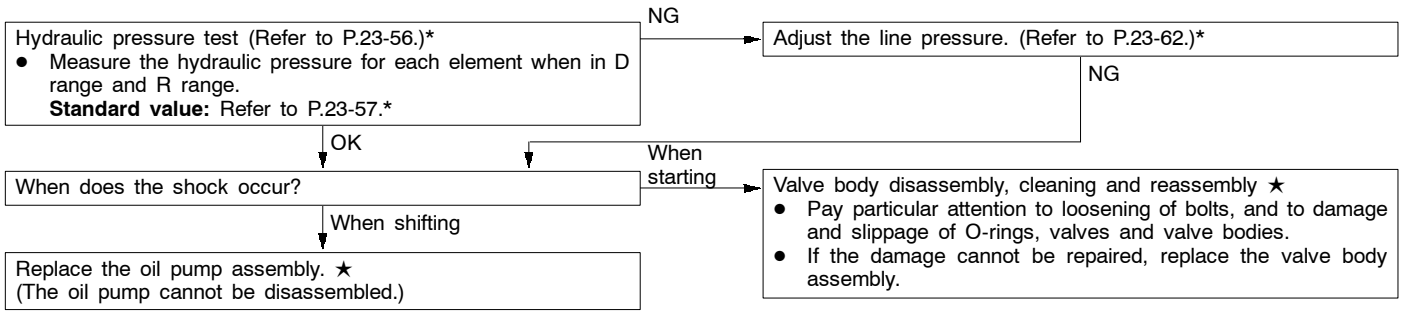
★: Refer to the Transmission Workshop Manual.



INSPECTION PROCEDURE 9

Shocks when changing from N to D, N to R and large time lag	Probable cause
If abnormal shocks or a time lag of 2 seconds or more occur when the selector lever is shifted from N to D range and from N to R range while the engine is idling, the cause is probably abnormal line pressure or a malfunction of the oil pump or valve body.	• Abnormal line pressure • Malfunction of the oil pump • Malfunction of the valve body

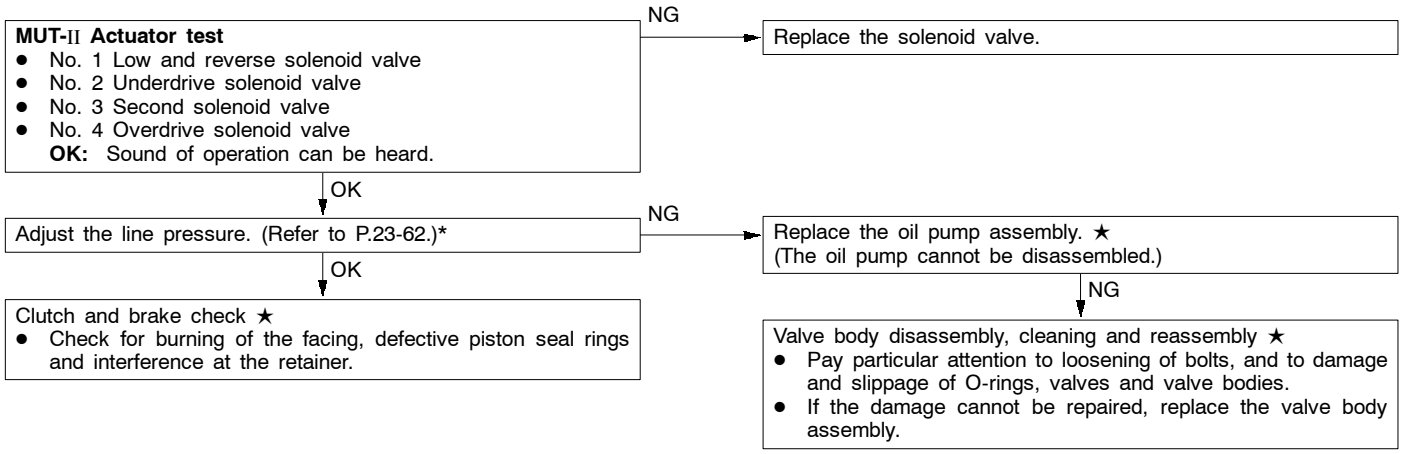
★: Refer to the Transmission Workshop Manual.



INSPECTION PROCEDURE 10

Shocks and running up	Probable cause
If shocks occur when driving due to upshifting or downshifting and the transmission speed becomes higher than the engine speed, the cause is probably abnormal line pressure or a malfunction of a solenoid valve, oil pump, valve body or of a brake or clutch.	• Abnormal line pressure • Malfunction of each solenoid valve • Malfunction of the oil pump • Malfunction of the valve body • Malfunction of each brake or each clutch

★: Refer to the Transmission Workshop Manual.



INSPECTION PROCEDURE 11

All points (Displaced shifting points)	Probable cause
If all shift points are displaced while driving, the cause is probably a malfunction of the output shaft speed sensor, TPS or APS of a solenoid valve.	• Malfunction of the output shaft speed sensor • Malfunction of the TPS or APS • Malfunction of each solenoid valve • Abnormal line pressure • Malfunction of the valve body • Malfunction of the A/T-ECU

★: Refer to the Transmission Workshop Manual.

MUT-II Data list
- No. 23 Output shaft speed sensor
  OK: Increases in proportion to vehicle speed.

NG → Code No. 23 – Output shaft speed sensor system (Refer to P.23-12.)

OK ↓

MUT-II Data list
- No. 11 TPS/APS
  OK: Increases in proportion to accelerator pedal opening angle

NG → Code No. 11, 12, 14 TPS/APS system check (Refer to P.23-10.)

OK ↓

MUT-II Data list
- No. 31 Low and reverse solenoid valve duty %
- No. 32 Underdrive solenoid valve duty %
- No. 33 Second solenoid valve duty %
- No. 34 Overdrive solenoid valve duty %
  OK: Refer to the table below.

NG → Replace the solenoid valve. ★

NG ↓ Repalce the A/T-ECU.

OK ↓

Adjust the line pressure. (Refer to P.23-62.)*

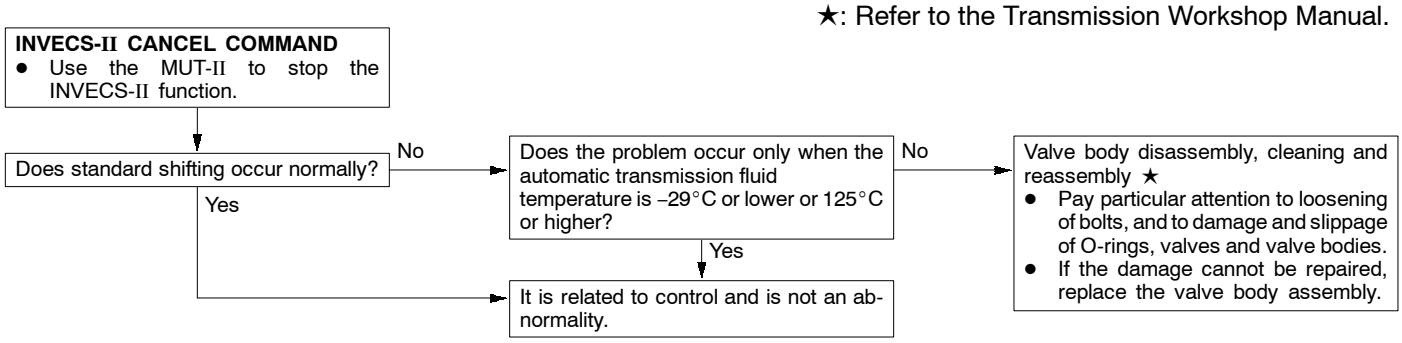
NG → Valve body disassembly, cleaning and reassembly ★
- Pay particular attention to loosening of bolts, and to damage and slippage of O-rings, valves and valve bodies.
- If the damage cannot be repaired, replace the valve body assembly.

	No. 31	No. 32	No. 33	No. 34
Driving at constant speed in 1st gear	0 %	0 %	100 %	100 %
Driving at constant speed in 2nd gear	100 %	0 %	0 %	100 %
Driving at constant speed in 3rd gear	100 %	0 %	100 %	0 %
Driving at constant speed in 4th gear	100 %	100 %	0 %	0 %

INSPECTION PROCEDURE 12

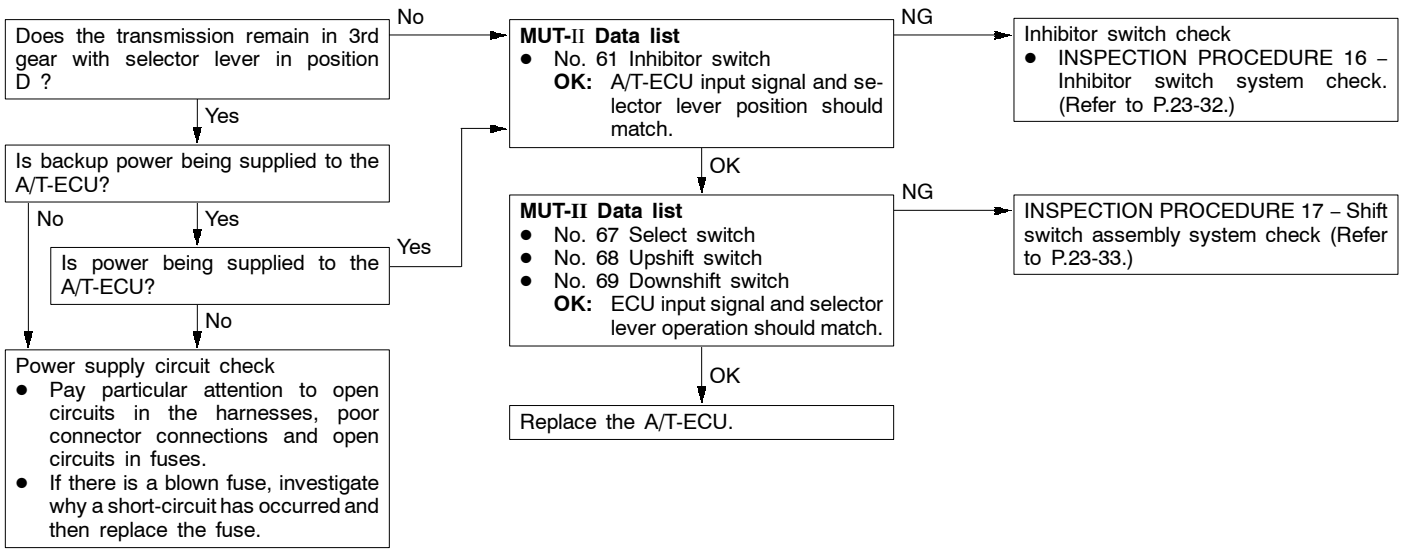
Some points (Displaced shifting points)	Probable cause
If some of the shift points are displaced while driving, the cause is probably a malfunction of the valve body, or it is related to control and is not an abnormality.	• Malfunction of the valve body

★: Refer to the Transmission Workshop Manual.



INSPECTION PROCEDURE 13

No diagnosis codes (Does not shift)	Probable cause
If shifting does not occur while driving and no diagnosis codes are output, the cause is probably a malfunction of the inhibitor switch, or A/T-ECU.	• Malfunction of the inhibitor switch • Malfunction of shift switch assembly • Malfunction of the A/T-ECU



INSPECTION PROCEDURE 14

Poor acceleration	Probable cause
If acceleration is poor even if downshifting occurs while driving, the cause is probably a malfunction of the engine system or of a brake or clutch.	• Malfunction of the engine system • Malfunction of the brake or clutch

★: Refer to the Transmission Workshop Manual.

Engine system check
- Check the control system, ignition system, fuel system and main system.

NG → **Replace, repair**

OK ↓

Brake or clutch check ★
- Check for burning of the facing, defective piston seal rings and interference at the retainer.

INSPECTION PROCEDURE 15

Vibration	Probable cause
If vibration occurs when driving at constant speed or when accelerating and deceleration in top range, the cause is probably abnormal damper clutch pressure or a malfunction of the engine system, damper clutch control solenoid valve, torque converter or valve body.	• Abnormal damper clutch pressure • Malfunction of the engine system • Malfunction of the damper clutch control solenoid valve • Malfunction of the torque converter • Malfunction of the valve body

★: Refer to the Transmission Workshop Manual.

MUT-II Actuator test
- No. 6 Damper clutch control solenoid valve
  OK: Sound of operation can be heard.

NG → Replace the damper clutch control solenoid valve. ★

OK ↓

Does the problem occur even when the oil temperature sensor connector is disconnected?

Yes → Engine system check
- Check the control system, ignition system, fuel system and main system.

No ↓

Hydraulic pressure test (Refer to P.23-56.)*
- Measure the damper clutch pressure.
  Standard value: Refer to P.23-57.*

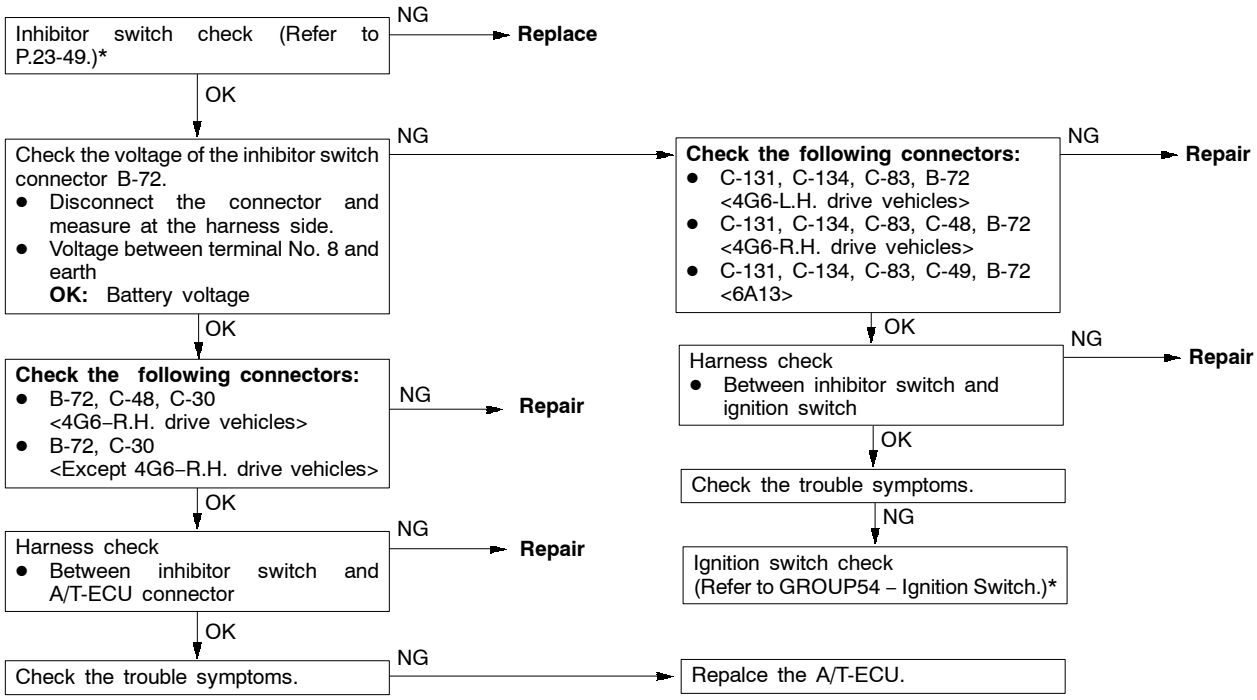
NG → Valve body disassembly, cleaning and reassembly ★
- Pay particular attention to loosening of bolts, and to damage and slippage of O-rings, valves and valve bodies.
- If the damage cannot be repaired, replace the valve body assembly.

OK ↓

Replace the torque converter assembly.

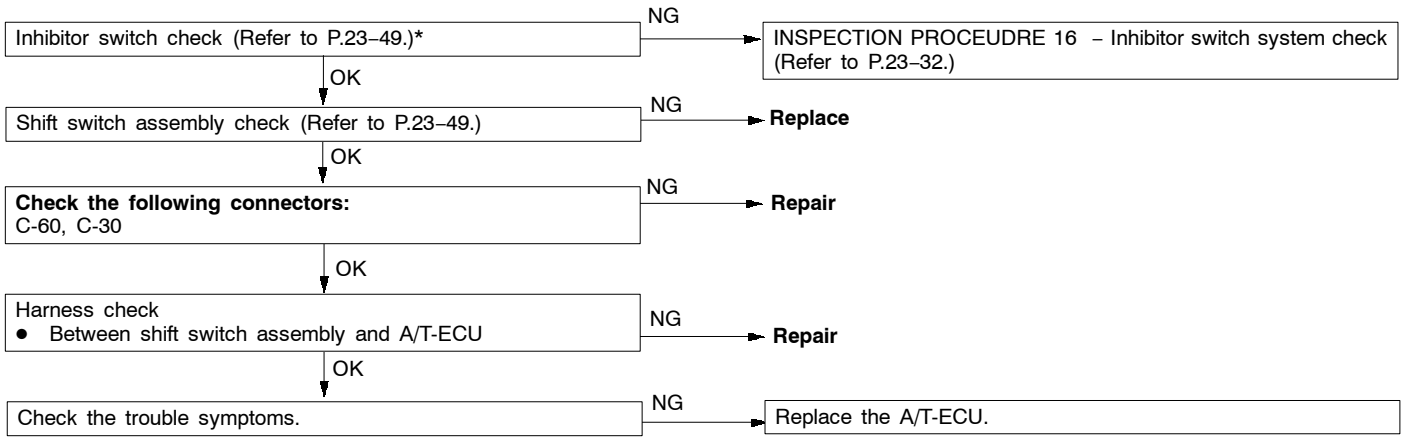
INSPECTION PROCEDURE 16

Inhibitor switch system	Probable cause
The cause is probably a malfunction of the inhibitor switch circuit, ignition switch circuit or a defective A/T-ECU.	• Malfunction of the inhibitor switch • Malfunction of the ignition switch • Malfunction of connector • Malfunction of the A/T-ECU



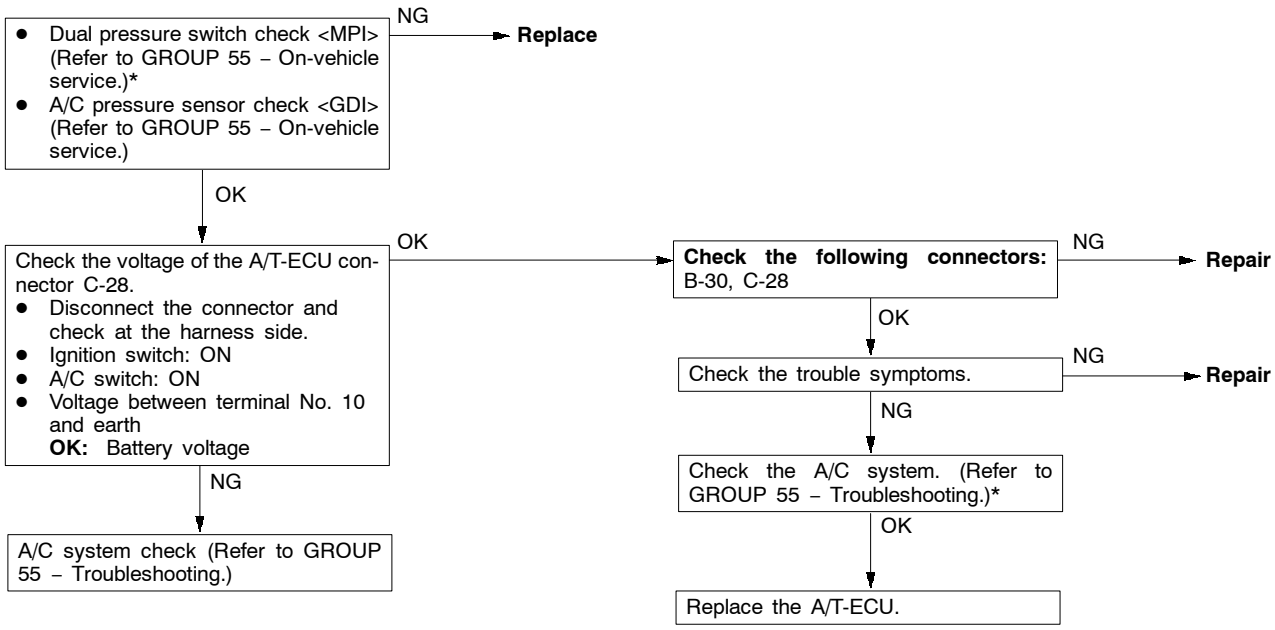
INSPECTION PROCEDURE 17

Shift switch assembly system	Probable cause
The cause is probably a malfunction of the inhibitor switch circuit, shift switch assembly circuit or a A/T-ECU.	• Malfunction of the inhibitor switch • Malfunction of the shift switch assembly • Malfunction of connector • Malfunction of the A/T-ECU



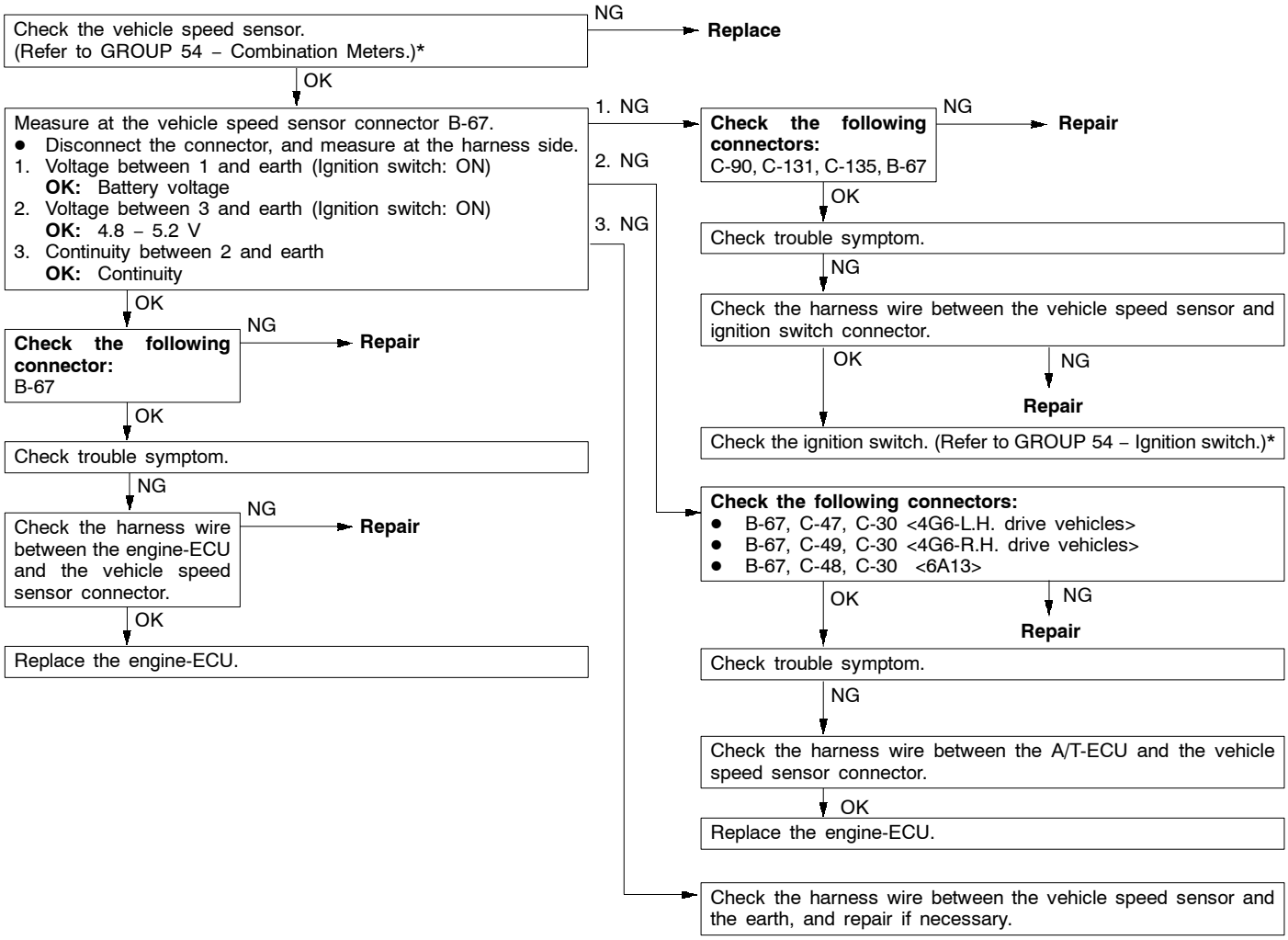
INSPECTION PROCEDURE 18

Dual pressure switch <MPI>, A/C pressure sensor <GDI> system	Probable cause
The cause is probably a defective dual pressure switch circuit or a defective A/T-ECU.	• Malfunction of the dual pressure switch • Malfunction of connector • Malfunction of A/C system • Malfunction of the A/T-ECU



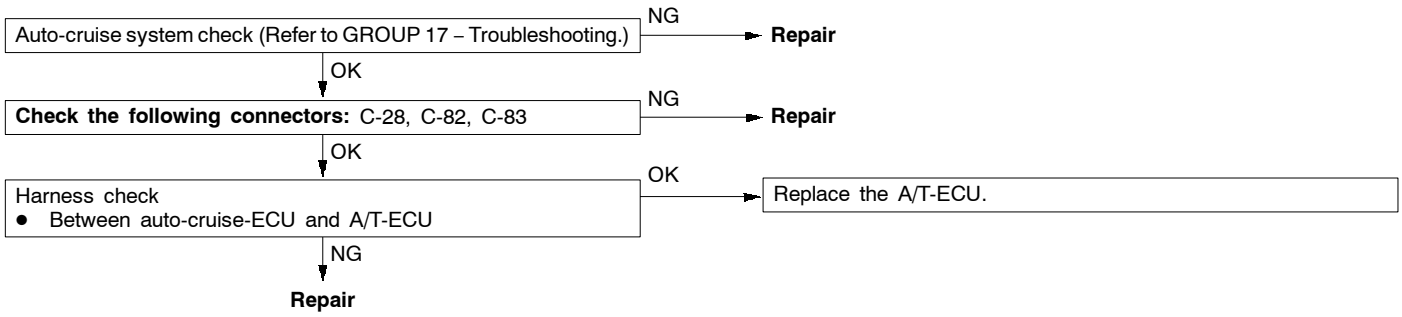
INSPECTION PROCEDURE 19

Vehicle speed sensor system	Probable cause
The cause is probably a defective vehicle speed sensor circuit or a defective A/T-ECU.	• Malfunction of the vehicle speed sensor • Malfunction of connector • Malfunction of the A/T-ECU



INSPECTION PROCEDURE 20

Auto-cruise-ECU signal system <MPI>	Probable cause
The cause is probably a defective auto-cruise signal line circuit or a defective A/T-ECU.	• Malfunction of connector • Malfunction of the A/T-ECU • Malfunction of the auto-cruise-ECU



DATA LIST REFERENCE TABLE

Item No.	Check item	Check requirement		Normal value
11	Throttle position sensor <6A13–Vehicles without TCL, 4G63> Accelerator pedal position sensor <6A13–Vehicles with TCL,4G64>	Engine: Stopped Selector lever position: P	Accelerator pedal: Released	400 – 1,000 mV
			Accelerator pedal: Halfly depressed	Gradually rises from the above value
			Accelerator pedal: Depressed	4,500 – 5,000 mV
15	Oil temperature sensor	Warming up	Drive for 15 minutes or more so that the automatic transmission fluid temperature becomes 70 – 90 °C.	Gradually rises to 70 – 90 °C
21	Crank angle sensor	Engine: Idling Selector lever position: P	Accelerator pedal: Released	550 – 900 r/min
			Accelerator pedal: Halfly depressed	Gradually rises from the above value
22	Input shaft speed sensor	Selector lever position: Sports mode	Driving at constant speed of 50 km/h in 3rd gear	1,800 – 2,100 r/min
23	Output shaft speed sensor	Selector lever position: Sports mode	Driving at constant speed of 50 km/h in 3rd gear	1,800 – 2,100 r/min
25	Wide open throttle switch	Accelerator pedal position	Released	OFF
			Depressed	ON
26	Stop lamp switch	Ignition switch: ON Engine: Stopped	Brake pedal: Depressed	ON
			Brake pedal: Released	OFF
29	Vehicle speed sensor	Selector lever position: Sports mode	Idling with 1st gear (Vehicle stopped)	0 km/h
			Driving at constant speed of 50 km/h in 3rd gear	50 km/h
31	Low and reverse solenoid valve duty %	Selector lever position: Sports mode	10 km/h in 1st gear	No. 31: 0 %, No. 32: 0 %, No. 33: 100 %, No. 34: 100%
32	Underdrive solenoid valve duty %		30 km/h in 2nd gear	No. 31: 100 %, No. 32: 0 %, No. 33: 0 %, No. 34: 100%
33	Second solenoid valve duty %		50 km/h in 3rd gear	No. 31: 100 %, No. 32: 0 %, No. 33: 100 %, No. 34: 0%
34	Overdrive solenoid valve duty %		70 km/h in 4th gear	No. 31: 100 %, No. 32: 100 %, No. 33: 0 %, No. 34: 0%

Item No.	Check item	Check requirement		Normal value
36	Damper clutch control solenoid valve duty %	Selector lever position: Sports mode	Driving at 50 km/h in 3rd gear with accelerator released	0 %
			Driving at constant speed of 70 km/h in 3rd gear	Approx. 70 – 90 %
52	Amount of damper clutch slippage	Selector lever position: Sports mode	Driving at 50 km/h in 3rd gear with accelerator fully closed	Approx. 100 – 300 r/min
			Driving at constant speed of 70 km/h in 3rd gear	Approx. 0 – 10 r/min
54	Control relay output voltage	Ignition switch : OFF	Ignition switch: ON → OFF	Battery voltage (mV) → 0 mV
57	Engine volumetric efficiency <MPI>	Selector lever position: N	N range with accelerator pedal released → depressed.	Data changes
61	Inhibitor switch	Ignition switch: ON Engine: Stopped	Selector lever position: P	P
			Selector lever position: R	R
			Selector lever position: N	N
			Selector lever position: D	D
63	Shift position	Selector lever position: Sports mode	Driving at constant speed of 10 km/h in 1st gear	1st
			Driving at constant speed of 30 km/h in 2nd gear	2nd
			Driving at constant speed of 50 km/h in 3rd gear	3rd
			Driving at constant speed of 70 km/h in 4th gear	4th
65	Dual pressure switch	Engine: Idling Selector lever position: N	A/C switch: ON	ON
			A/C switch: OFF	OFF
66	Auto-cruse-ECU signal <MPI>	While auto-cruise operating	Plain road	OFF
			Sloping road	ON

Item No.	Check item	Check requirement		Normal value
67	Select switch	Ignition switch: ON Engine: Stopped		Selector lever position: D Data list No.67: OFF, Data list No.68: OFF, Data list No.69: OFF Selector lever operation: Select sports mode Data list No.67: ON, Data list No.68: OFF, Data list No.69: OFF Selector lever operation: Upshift and hold the selector lever Data list No.67: ON, Data list No.68: ON, Data list No.69: OFF Selector lever operation: Downshift and hold the selector lever Data list No.67: ON, Data list No.68: OFF, Data list No.69: ON
68	Upshift switch			
69	Downshift switch			
73	Engine target effective pressure <GDI>	Selector lever position: N	N range with accelerator pedal released to depressed	Data changes

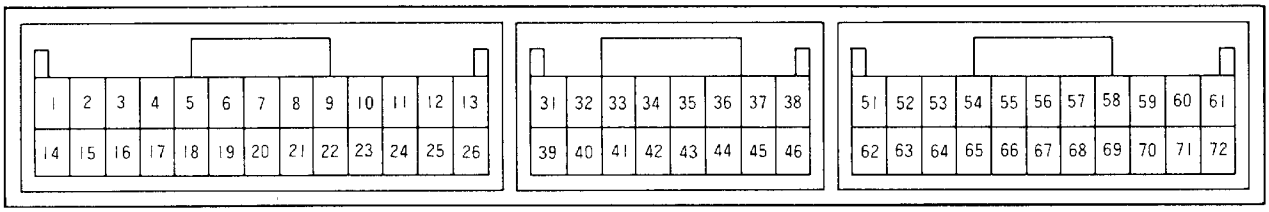
ACTUATOR TEST JUDGEMENT VALUE

Item No.	Check item	Test content	Check requirement	Normal value
1	Low reverse solenoid valve	Drive the solenoid valve specified by the MUT-II at 50 % duty for 5 seconds. No other solenoid valve should be energised.	Ignition switch: ON Selector lever position: P Engine: 0 r/min Vehicle speed: 0 km/h (Vehicle stopped) Throttle (Accelerator) opening voltage: Less than 0 V	The operation sound should be audible when the solenoid valve is driven.
2	Underdrive solenoid valve			
3	Second solenoid valve			
4	Overdrive solenoid valve			
6	Damper clutch control solenoid valve			
7	1st indicator lamp	Illuminate each indicator lamp for three seconds according to the signal from the MUT-II.		Shift indicator lamp illuminates.
8	2nd indicator lamp			
9	3rd indicator lamp			
10	4th indicator lamp			
12	A/T control relay	Control relay is OFF for 3 seconds.		Data list No. 54 (1) During test: 0 mV (2) Normal: Battery voltage [mV]

INVECS-II CANCEL COMMAND

Item No.	Item	Content	Remarks
14	INVECS-II	Stop the INVECS-II control and change gears according to the standard shift pattern.	Use this function when carrying out procedure 8 in the road tests.

CHECK AT A/T-ECU TERMINALS



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Terminal No.	Check item	Check requirement	Standard value
1	Underdrive solenoid valve	Selector lever position: Sports mode (1st gear)	Battery voltage
		Selector lever position: P	Approx.7 – 9 V
2	Solenoid valve power supply	Ignition switch: OFF	0 V
		Ignition switch: ON	Battery voltage
3	Solenoid valve power supply	Ignition switch: OFF	0 V
		Ignition switch: ON	Battery voltage
4	1st gear shift indicator lamp	Gear: 1st gear	Battery voltage
		Gear: Other than above	0 V
5	3rd gear shift indicator lamp	Gear: 3rd gear	Battery voltage
		Gear: Other than above	0 V
8	Auto-cruse control unit (MPI)	No OD-OFF request	Battery voltage
		OD-OFF request	0 V
10	A/C compressor load signal	A/C switch: OFF	0 V
		A/C switch: ON	Battery voltage
11	Power supply	Ignition switch: OFF	0 V
		Ignition switch: ON	Battery voltage
12	Earth	Always	0 V
13	Earth	Always	0 V

Terminal No.	Check item	Check requirement	Standard value
14	Overdrive solenoid valve	Selector lever position: Sports mode (3rd gear)	Battery voltage
		Selector lever position: P	Approx. 7 – 9 V
15	Damper clutch control solenoid valve	Selector lever position: Sports mode (1st gear)	Battery voltage
		Selector lever position: Sports mode (50 km/h in 3rd gear)	Other than battery voltage
16	Second solenoid valve	Selector lever position: Sports mode (2nd gear)	Battery voltage
		Selector lever position: P	Approx. 7 – 9 V
17	2nd gear shift indicator lamp	Gear: 2nd gear	Battery voltage
		Gear: Other than above	0 V
18	4th gear shift indicator lamp	Gear: 4th gear	Battery voltage
		Gear: Other than above	0 V
21	Engine-ECU torque reduction request signal <Vehicles with TCL>	Ignition switch: ON (except during shifting)	4 – 5 V
23	Diagnosis control	–	–
24	Power supply	Ignition switch: OFF	0 V
		Ignition switch: ON	Battery voltage
25	Earth	Always	0 V
26	Earth	Always	0 V
31	Input shaft speed sensor	Measure between terminal No. 31 and No. 43 by an oscilloscope. Engine: 2,000 r/min Selector lever position: Sports mode (3rd gear)	Refer to P.23-41, Oscilloscope inspection procedure.
32	Output shaft speed sensor	Measure between terminal No. 32 and No. 43 by an oscilloscope. Engine: 2,000 r/min Selector lever position: Sports mode (3rd gear)	Refer to P.23-41, Oscilloscope inspection procedure.
33	Crank angle sensor	Engine: Idling	2.0 – 2.4 V
38	Back up power suuply	Ignition switch: OFF	Battery voltage
43	Sensor earth	Always	0 V
44	Oil temperature sensor	ATF temperature: 25 °C	3.8 – 4.0 V
		ATF temperature: 80 °C	2.3 – 2.5 V
45	Throttle position sensor (TPS) <6A13–Vehicles without TCL, 4G63> Accelerator pedal position sensor (APS) <6A13–Vehicles with TCL, 4G64>	Accelerator pedal: Released (Engine stopped)	0.5 – 1.0 V
		Accelerator pedal: Depressed (Engine stopped)	4.5 – 5.0 V

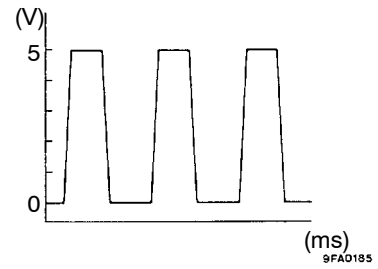
Terminal No.	Check item	Check requirement	Standard value
53	Communication with engine-ECU <Vehicles without TCL> Communication with TCL-ECU <Vehicles with TCL>	Engine: Idling Selector lever position: D	Other than 0 V
54	Communication with engine-ECU <Vehicles without TCL> Communication with TCL-ECU <Vehicles with TCL>	Engine: Idling Selector lever position: D	Other than 0 V
55	Inhibitor switch P	Selector lever position: P	Battery voltage
		Selector lever position: Other than above	0 V
56	Inhibitor switch N	Selector lever position: N	Battery voltage
		Selector lever position: Other than above	0 V
57	Select switch	Selector lever position: Sports mode	Battery voltage
		Selector lever position: Other than above	0 V
58	Down shift switch	Selector lever position: Downshift and lever held	Battery voltage
		Selector lever position: Other than above	0 V
59	Stop lamp switch	Brake pedal: Depressed	Battery voltage
		Brake pedal: Released	0 V
62	Low and reverse solenoid valve	Selector lever position: D (1st gear)	Battery voltage
		Selector lever position: D (2nd gear)	Approx. 7 – 9 V
63	Diagnosis output	Normal (No diagnosis code output)	0 → 5 V flashing
65	Wide open throttle switch	Accelerator pedal: Released	4.5 – 5.5 V
		Accelerator pedal: Depressed	Less than 0.4 V
66	Inhibitor switch R	Selector lever position: R	Battery voltage
		Selector lever position: Other than above	0 V
67	Inhibitor switch D	Selector lever position: D	Battery voltage
		Selector lever position: Other than above	0 V
68	Upshift switch	Selector lever position: Upshift and lever held	Battery voltage
		Selector lever position: Other than above	0 V
69	Vehicle speed sensor	When stopped	0 V
		Move forward slowly	0 → 5 V flashing
71	A/T control relay	Ignition switch: OFF	0 V
		Ignition switch: ON	Battery voltage
72	Earth	Ignition switch: ON	0 V

OSCILLOSCOPE INSPECTION PROCEDURE

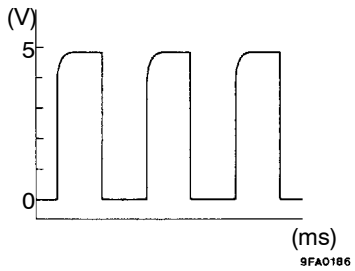
Check item	Check requirement		Normal condition (Waveform sample)
Crank angle sensor	Selector lever position: N	Idling (Vehicle stopped)	Waveform A
Input shaft speed sensor	Selector lever position: Sports mode	Driving at constant speed of 50 km/h in 3rd gear (Engine: 1,800 – 2,100 r/min)	Waveform B
Output shaft speed sensor			
Vehicle speed sensor			
Low reverse solenoid valve	Ignition switch: ON Selector lever position: P Engine: 0 r/min Vehicle speed: 0 km/h (Vehicle stopped) Throttle (Accelerator) opening angle: Less than 1 V	Force drive each solenoid valve (Actuator test)	Waveform C
Underdrive solenoid valve			
Second solenoid valve			
Overdrive solenoid valve			
Damper clutch control solenoid valve			

Waveform sample

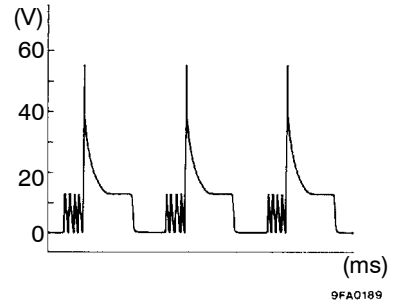
Waveform A



Waveform B



Waveform C



TROUBLESHOOTING <A/T KEY INTERLOCK AND SHIFT LOCK MECHANISMS>

TROUBLE SYMPTOM TABLE

Symptom	Inspection procedure No.	Reference page
Can move selector lever from P to R without depressing brake pedal when ignition key is at positions other than LOCK	1	23-42
Cannot move selector lever from P to R with brake pedal depressed when ignition key is at positions other than LOCK	2	23-42
Can move selector lever from P to R with brake pedal depressed when ignition key is at LOCK	3	23-43
Cannot move selector lever from P to R smoothly	4	23-43
Cannot move selector lever from R to P	5	23-43
Cannot turn ignition key to LOCK when selector lever is at P	6	23-43
Can turn ignition key to LOCK when selector lever is at positions other than P	7	23-43

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

INSPECTION PROCEDURE 1

Can shift selector lever from P to R without depressing brake pedal when ignition key is at positions other than LOCK	**Probable cause**
Lock cam or lock cable is suspected to be faulty.	• Malfunction of lock cam • Defective shift lock cable

Check the following as parts related to the shift lock are suspected to be faulty:
- Lock cam
- Shift lock cable

INSPECTION PROCEDURE 2

Cannot shift selector lever from P to R with brake pedal depressed when ignition key is at positions other than LOCK	**Probable cause**
Selector lever assembly, shift lock cable, key interlock cable transmission control cable or lock cam is suspected to be faulty.	• Malfunction of selector lever assembly • Malfunction of shift lock cable • Defective key interlock cable • Defective transmission control cable • Malfunction of lock cam

Check the following as parts related to the selector lever are suspected to be faulty:
- Selector lever assembly
- Shift lock cable
- Key interlock cable
- Transmission control cable
- Lock cam

INSPECTION PROCEDURE 3

Can move selector lever from P to R with brake pedal depressed when ignition key is at LOCK	Probable cause
Lock cam or key interlock cable is suspected to be faulty.	• Malfunction of lock cam • Defective key interlock cable

Check the following as parts related to the key interlock are suspected to be faulty:
- Key interlock cable
- Lock cam

INSPECTION PROCEDURE 4

Cannot move selector lever from P to R smoothly	Probable cause
Key interlock cable, shift lock cable, lock cam or selector lever assembly is suspected to be faulty.	• Defective key interlock cable • Defective shift lock cable • Malfunction of lock cam • Malfunction of selector lever assembly

Check the following as parts related to the key interlock are suspected to be faulty:
- Key interlock cable
- Shift lock cable
- Lock cam
- Selector lever assembly

INSPECTION PROCEDURE 5

Cannot move selector lever from R to P	Probable cause
Selector lever assembly or transmission control cable is suspected to be faulty.	• Malfunction of selector lever assembly • Defective transmission control cable

Check the following as parts related to the selector lever are suspected to be faulty:
- Selector lever assembly
- Transmission control cable

INSPECTION PROCEDURE 6

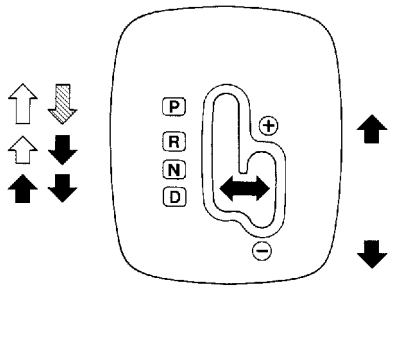
Cannot turn ignition key to LOCK when selector lever is at P	Probable cause
Lock cam key interlock cable or key cylinder slider is suspected to be faulty.	• Malfunction of lock cam • Defective key interlock cable • Malfunction of slider

Check the following as parts related to the key interlock are suspected to be faulty:
- Lock cam
- Key interlock cable
- Slider

INSPECTION PROCEDURE 7

Can turn ignition key to LOCK when selector lever is at positions other than P	Probable cause
Lock cam, key cylinder cover or key interlock cable is suspected to be faulty.	• Malfunction of lock cam • Defective cover • Malfunction of key inter lock cable

Check the following as parts related to the key interlock are suspected to be faulty:
- Lock cam
- Key cylinder cover
- Key interlock cable



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Turn the ignition switch to any position other than "LOCK", and operate the selector lever with the brake pedal depressed and the push button pushed.

Operate the selector lever without pushing the push button.

Operate the selector lever with the push button pushed.

ON-VEHICLE SERVICE

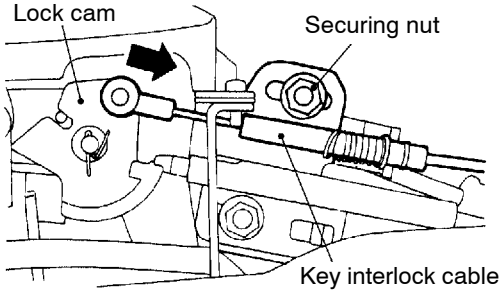
SELECTOR LEVER OPERATION CHECK

1. Apply parking brake. Shift the selector lever to every range to check that the movement is smooth.
2. Check that the engine starts with the selector lever at N or P and does not start at the other positions.
3. Start the engine and release the parking brake. Check that the vehicle moves forwards when the selector lever is at D or 1st (or 2nd) range in Sports Mode, and also reverses at R.

KEY INTERLOCK MECHANISM CHECK

1. Carry out the following inspection:

Inspection procedure	Requirements		When normal
1	Brake pedal: Depressed	Ignition key: LOCK or removed	Cannot push selector lever push button, so cannot shift the lever from P to other positions
2		Ignition key: ACC	Can shift the lever from P to other positions with push button pushed
3	Brake pedal: Not depressed	Selector lever: Other than P	Cannot turn ignition key to LOCK
4		Selector lever: P	Can turn ignition key to LOCK smoothly



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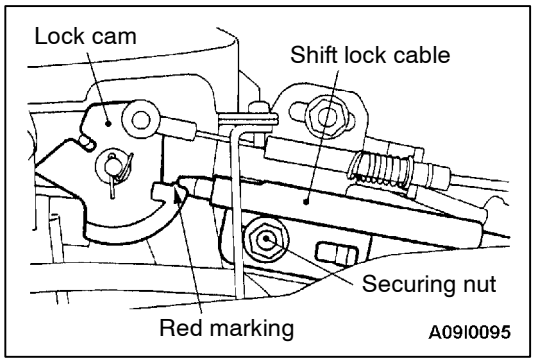
2. If problem is present in the above operation, adjust the key interlock cable as follows:
   (1) Remove the floor console box.
   (2) Shift the selector lever to P.
   (3) Turn the ignition key to LOCK.
   (4) Loosen the key interlock cable securing nut.
   (5) While lightly pushing the cable connected to the lock cam towards the arrow, tighten the securing nut.
   (6) Install the floor console box.

SHIFT LOCK MECHANISMS INSPECTION

Inspection procedure	Requirements		When normal
1	Brake pedal: Not depressed	Ignition key: ACC	Cannot push selector lever bush button, so cannot shift the lever from P to other positions
2	Brake pedal: Depressed		Can shift the lever from P to other positions smoothly with selector lever push button pushed
3	Brake pedal: Not depressed		Can shift the lever from R to P smoothly with selector lever push button pushed



2. If problem is present in the above operation, adjust the shift lock cable as follows:
   (1) Remove the floor console box.
   (2) Shift the selector lever to P.
   (4) Loosen the shift lock cable securing nut.
   (5) Tighten the securing nut when the shift lock cable end reaches the red marking on the lock cam.
   (5) Install the floor console box.

TRANSMISSION CONTROL

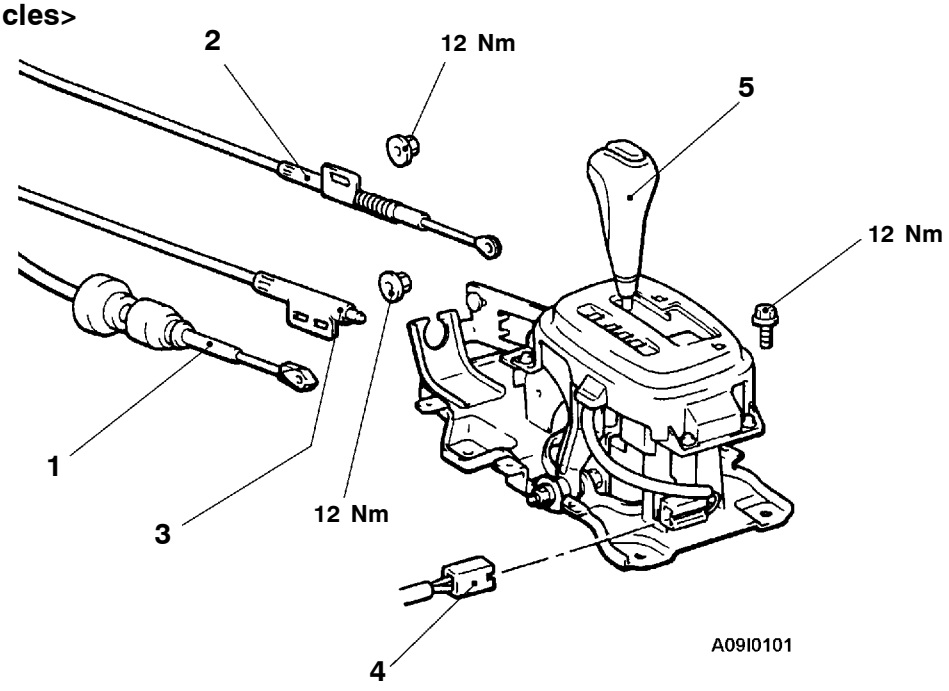
Sport Mode 4A/T and A/T key interlock and shift lock mechanisms have been newly used. Accordingly, service procedures have been added for the selector lever assembly. Still, the other service procedures are the same as before.

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Lower Cover and Side Cover Removal and Installation
- Floor Console Box Removal and Installation
- Selector Lever Operation Check <Post-Installation only> (Refer to P.23-44)

Caution: SRS
Be careful not to give any impact to the SRS-ECU when removing or installing the selector lever.

<L.H. drive vehicles>



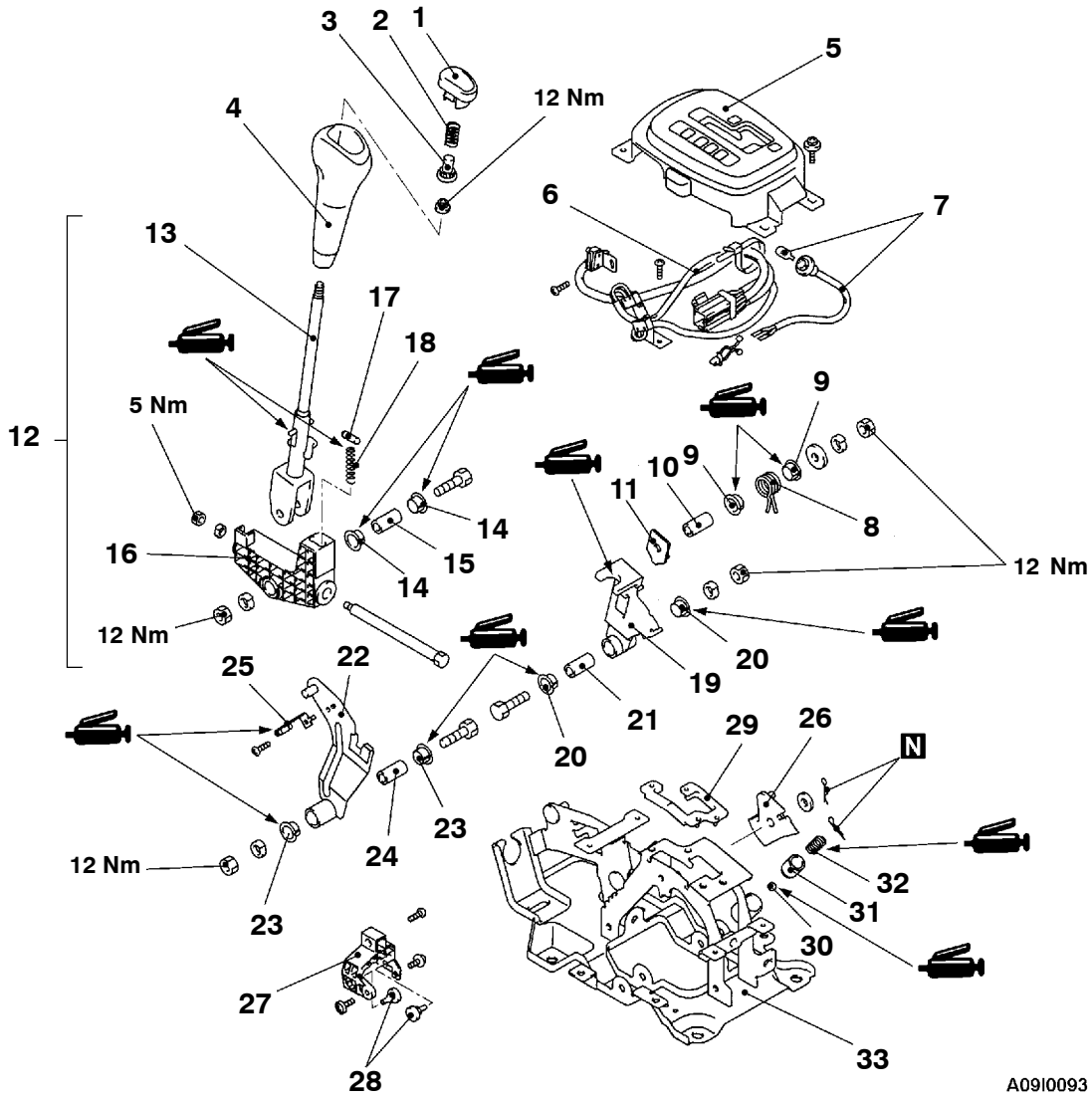
Selector lever assembly removal steps

1. Transmission control cable connection
2. Key interlock cable connection
3. Shift lock cable connection
4. Wiring harness connector
5. Selector lever assembly

SELECTOR LEVER ASSEMBLY

DISASSEMBLY AND REASSEMBLY

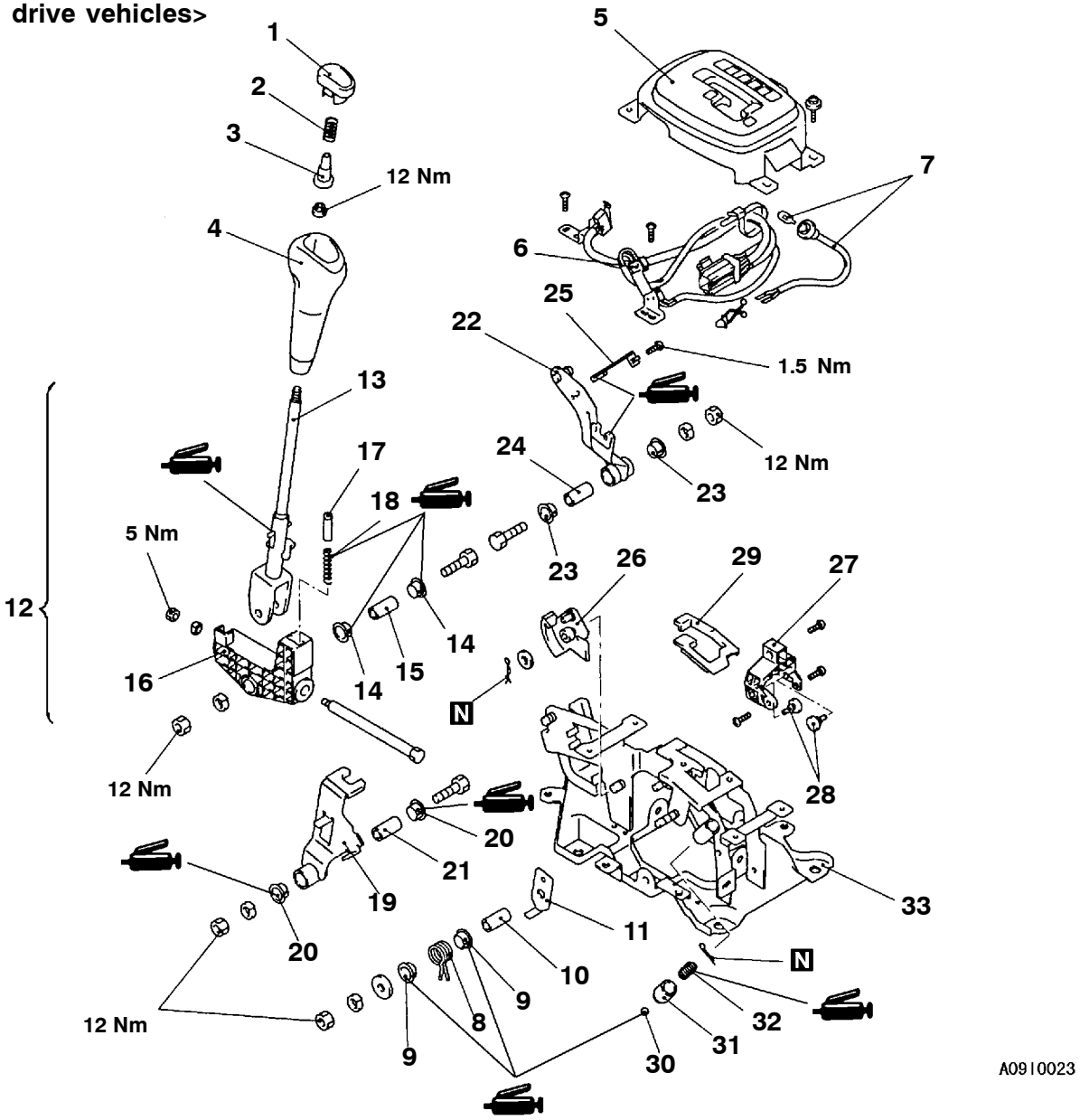
<L.H. drive vehicles>



Disassembly steps

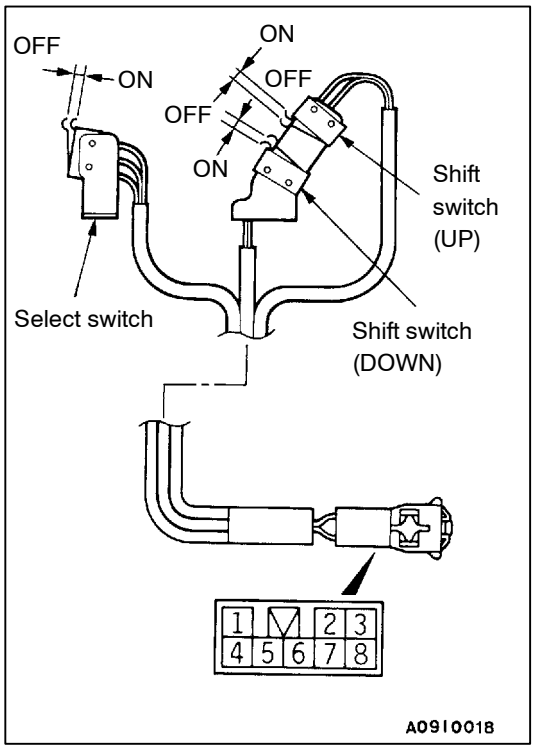
1. Push button
2. Spring
3. Adjuster
4. Shift knob
5. Indicator panel assembly
6. Shift switch assembly
7. Position indicator lamp
8. Return spring
9. Bushing
10. Pipe
11. Bracket
12. Lever assembly
13. Lever
14. Shift bushing
15. Pipe
16. Select lever
17. Roller
18. Spring
19. Manual lever
20. Shift bushing
21. Pipe
22. Cable lever
23. Shift bushing
24. Pipe
25. Detent spring asssembly
26. Lock cam
27. Guide block
28. Rubber stopper
29. Cushion
30. Steel ball
31. Ball support
32. Spring
33. Bracket assembly

<R.H. drive vehicles>



Disassembly steps

1. Push button
2. Spring
3. Adjuster
4. Shift knob
5. Indicator panel assembly
6. Shift switch assembly
7. Position indicator lamp assembly
8. Return spring
9. Bushing
10. Pipe
11. Bracket
12. Lever assembly
13. Lever
14. Shift bushing
15. Pipe
16. Select lever
17. Roller
18. Spring
19. Manual lever
20. Shift bushing
21. Pipe
22. Cable lever
23. Shift bushing
24. Pipe
25. Detent spring asssembly
26. Lock cam
27. Guide block
28. Rubber stopper
29. Cushion
30. Steel ball
31. Ball support
32. Spring
33. Bracket assembly



INSPECTION

SHIFT SWITCH ASSEMBLY CONTINUITY CHECK

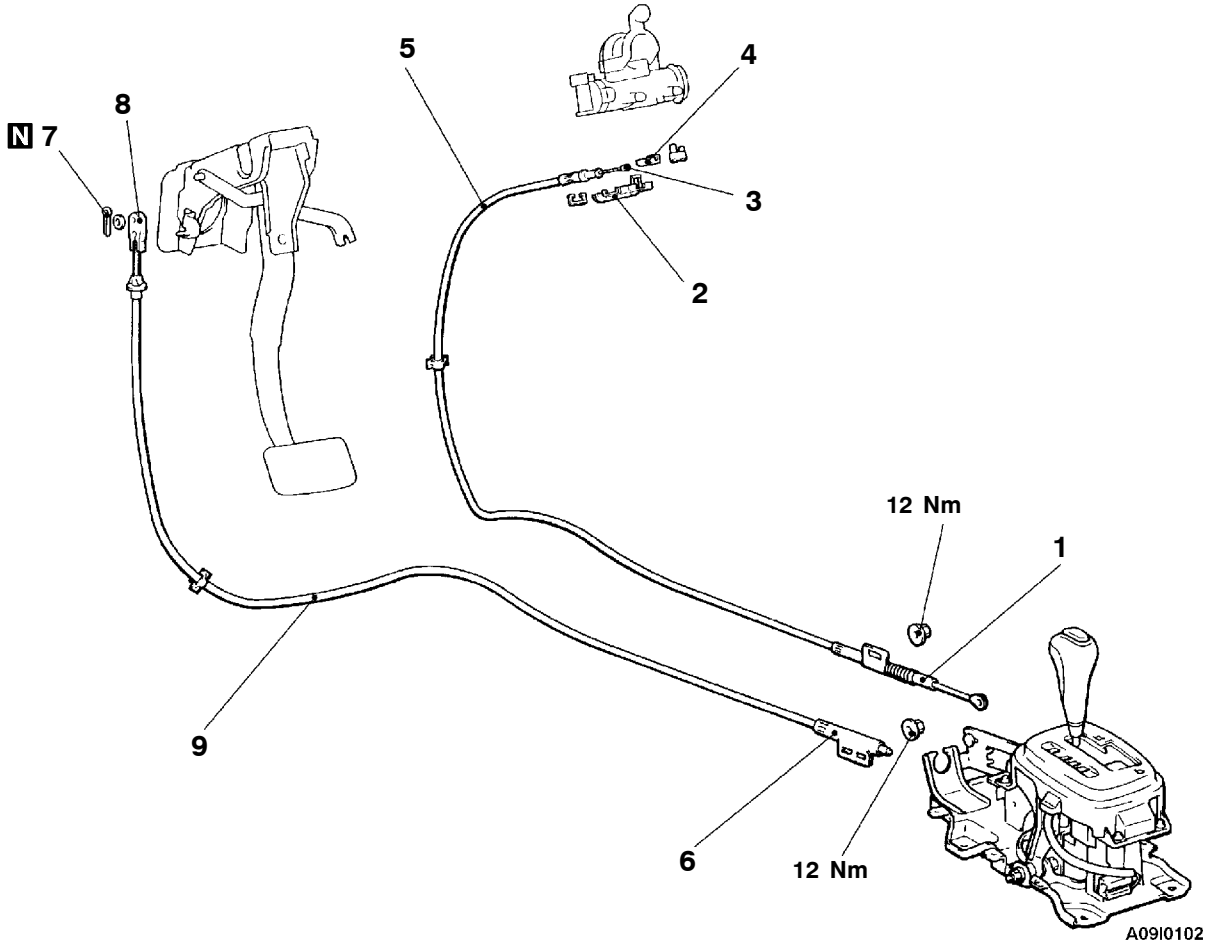
Switch position		Terminal number					
		3	4	5	6	7	8
Shift switch (UP)	ON			○	○		
	OFF						
Shift switch (DOWN)	ON		○	○			
	OFF						
Select switch	ON	○					○
	OFF	○				○	

A/T KEY INTERLOCK AND SHIFT LOCK MECHANISMS

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Lower Cover and Side Cover Removal and Installation
- Floor Cable Box Removal and Installation
- Selector Lever Operation Check <Post-Installation only> (Refer to P.23-44)

Caution: SRS
Be careful not to give any impact to the SRS-ECU when removing or installing the key interlock cable and shift lock cable.



Key interlock cable removal steps
1. Key interlock cable connection (Selector lever side)
● Lower column lever
2. Cover
3. Key interlock cable connection (Steering lock cylinder side)
4. Slider
5. Key interlock cable

Shift lock cable removal steps
6. Shift lock cable connection (Selector lever side)
7. Split pin
8. Shift lock cable connection (Brake pedal side)
9. Shift lock cable

BASIC BRAKE SYSTEM

CONTENTS

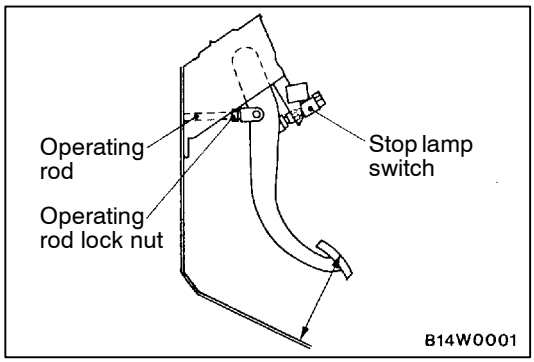
GENERAL

OUTLINE OF CHANGES

- A/T key interlock and shift lock mechanisms have been newly used. Accordingly, service procedures for the brake pedal have been added. <A/T>
- A vacuum sensor has been newly used. Accordingly, the service procedures for the brake booster have been revised. <4G64>
- The specifications of the proportioning valve have been modified. Accordingly, the inspection procedures for the proportioning valve have been revised. <4G64, 6A13>

SERVICE SPECIFICATIONS <4G64, 6A13>

Items			Standard value	Limit
Proportioning valve	Split point MPa	Sedan	3.43 ± 0.25	–
		Wagon	3.92 ± 0.25	–
	Output fluid pressure (Input fluid pressure) MPa	Sedan	5.80 ± 0.39 (9.81)	–
		Wagon	6.10 ± 0.39 (9.81)	–
	Output fluid pressure difference between left and right MPa		–	0.39



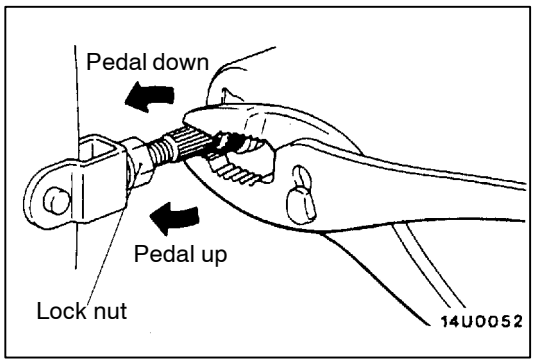
ON-VEHICLE SERVICE

BRAKE PEDAL CHECK AND ADJUSTMENT

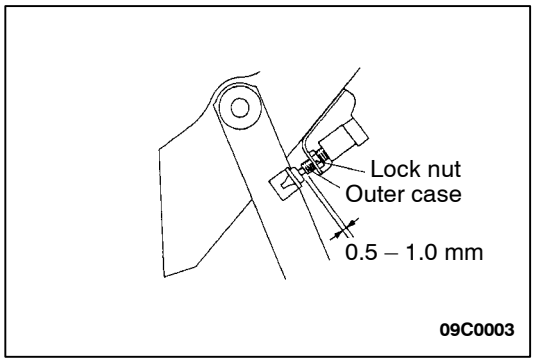
BRAKE PEDAL HEIGHT <A/T>

1. Turn up the carpet and so on under the brake pedal.
2. Measure the brake pedal height as illustrated. If the brake pedal height is not within the standard value, follow the procedure below.

   Standard value: 162.8 – 165.8 mm



   (1) Disconnect the stop lamp switch connector.
   (2) Adjust the brake pedal height by turning the operating rod with pliers (with the operating rod lock nut loosened), until the correct brake pedal height is obtained.
   (3) Secure by tightening the lock nut of the operating rod.



   (4) Push the stop lamp switch in the direction of the pedal stroke until it stops. (The switch will slide if it is pushed firmly.)
   (5) Lift up the pedal until the operating rod is fully extended, and then slide the stop lamp switch back to the required position. Adjust the position of the switch by turning it until the distance shown in the illustration is correct.
   (6) Connect the connector of the stop lamp switch.
   (7) Check that the stop lamp is not illuminated with the brake pedal unpressed.
3. Check the key interlock and shift lock mechanisms. (Refer to GROUP 23 – On-vehicle Service.)
4. Return the carpet and so on.

PROPORTIONING VALVE FUNCTION TEST <4G64, 6A13>

Standard values have been set as follows. The inspection procedure is the same as before.

Standard value:

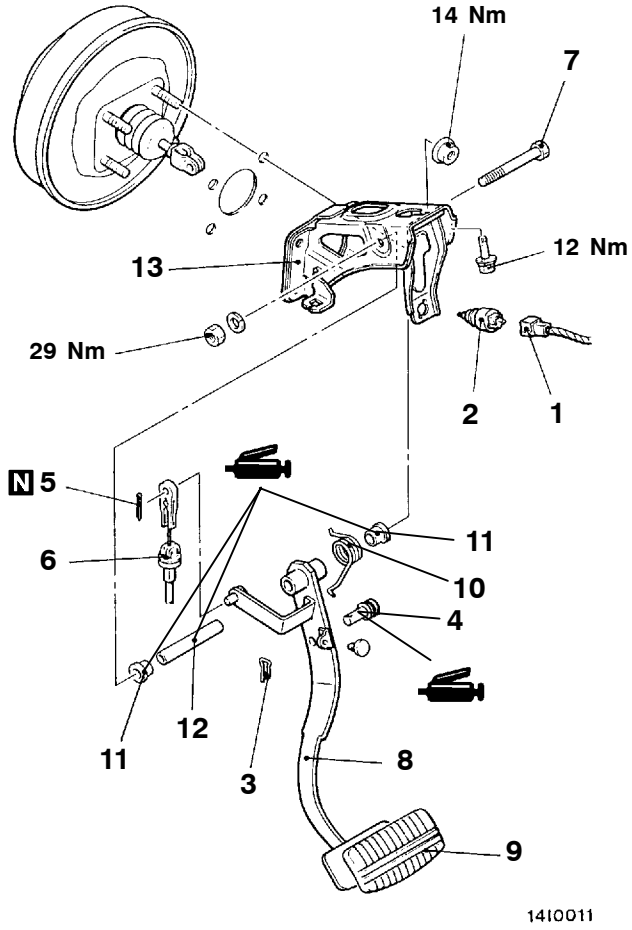
MPa

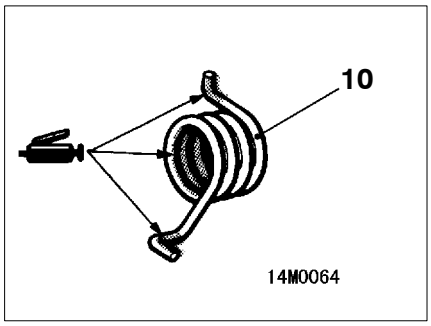
	Sedan	Wagon
Split point	3.43 ± 0.25	3.92 ± 0.25
Output fluid pressure (Input fluid pressure)	3.43 ± 0.39 (9.81)	6.10 ± 0.39 (9.81)

BRAKE PEDAL <A/T>

REMOVAL AND INSTALLATION

Post-installation Operation
Brake Pedal Adjustment (Refer to P.35A-3.)





Removal steps

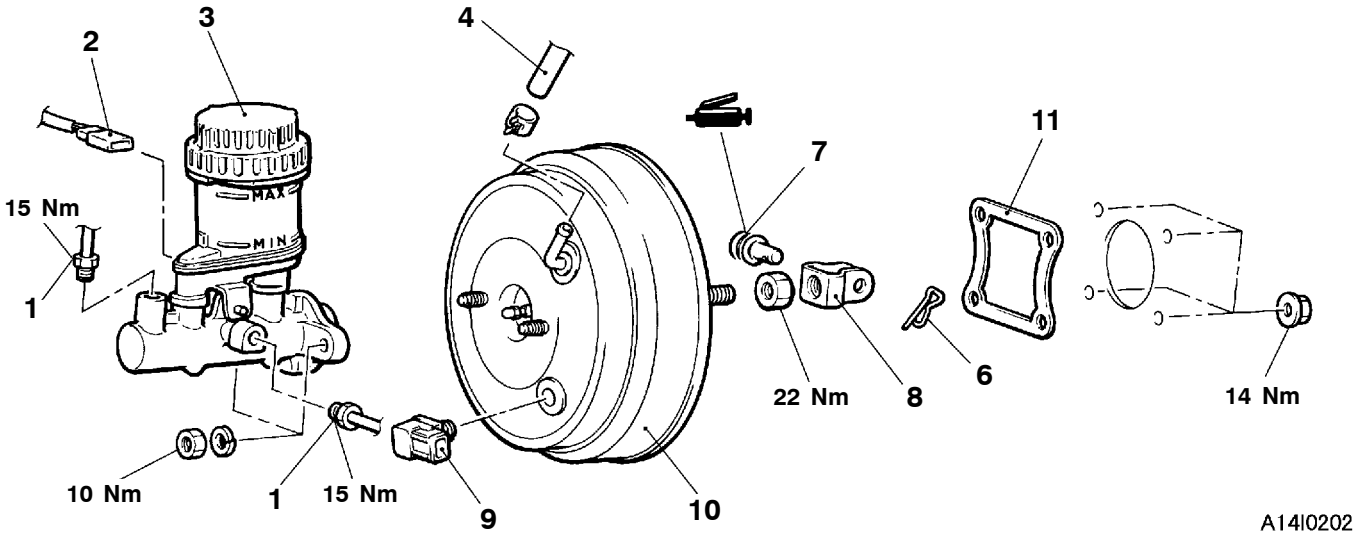
1. Stop lamp switch connector
2. Stop lamp switch
3. Snap pin
4. Pin assembly
5. Split pin
6. Shift lock cable
7. Brake pedal shaft bolt
8. Brake pedal
9. Brake pedal pad
10. Brake pedal return spring
11. Bushing
12. Pipe
13. Pedal support member

MASTER CYLINDER AND BRAKE BOOSTER<4G64>

REMOVAL AND INSTALLATION

Pre-removal Operation
Brake Fluid Draining

Post-installation Operation
- Brake Fluid Supplying
- Brake Line Bleeding
- Brake Pedal Adjustment (Refer to P.35A-3.)



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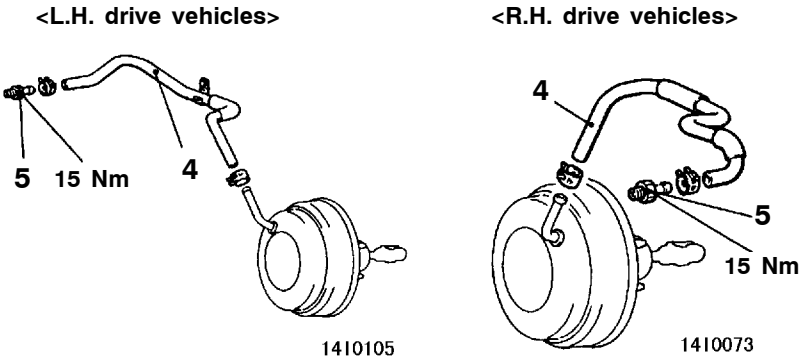
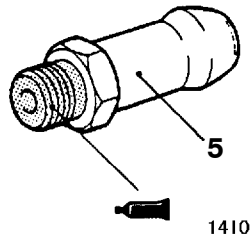




Sealant: 3M ATD Part No.8661 or equivalent

Removal steps

1. Brake pipe connection
2. Brake fluid level sensor connector
3. Master cylinder assembly
- ▶B◀ • Push rod protruding length check and adjustment
- ▶A◀ 4. Vacuum hose
5. Fitting
6. Snap pin
7. Pin assembly
8. Clevis
9. Vacuum sensor
10. Brake booster
11. Sealer

NOTE
For service points, refer to the Basic Manual.

INSPECTION

VACUUM SENSOR CHECK

Refer to GROUP 13 – Troubleshooting.

NOTE
The engine-ECU monitors the vacuum sensor. If it is defective, a diagnosis code will be displayed on the MUT-II.

STEERING

CONTENTS

GENERAL

OUTLINE OF CHANGES

- Vehicles with a 4G64 engine have been lined up and the power steering pump modified. Accordingly, the following service procedures have been revised <Petrol-powered vehicles>:

  (1) STEERING ANGLE CHECK <4G64>
  (2) OIL PUMP PRESSURE TEST <4G63, 4G64>
  (3) POWER STEERING OIL PUMP REMOVAL AND INSTALLATION
  (4) POWER STEERING OIL PUMP DISASSEMBLY AND ASSEMBLY
  (5) POWER STEERING HOSE REMOVAL AND INSTALLATION

SERVICE SPECIFICATIONS

Items		Standard value	Limit
Steering angle <4G64>	Inner wheel	38°00' ± 2° <L.H. drive vehicles> 39°00' ± 2° < R.H. drive vehicles>	–
	Outer wheel	30°30'	–
Oil pump pressure <4G63, 4G64> MPa	Oil pump relief pressure	9.3 – 9.8	–
	Pressure under no-load conditions	0.8 – 1.0	–
	Steering gear retention hydraulic pressure	9.3 – 9.8	–

ON-VEHICLE SERVICE

STEERING ANGLE CHECK <4G64>

Standard values have been set as follows. Still, inspection procedures are the same as before.

Standard value:
Inner wheel
38°00' ± 2° <L.H. drive vehicles>
39°00' ± 2° <R.H. drive vehicles>
Outer wheel 30°30'

OIL PUMP PRESSURE TEST <4G63, 4G64>

Standard values have been set as follows. Still, inspection procedure is the same as before.

Standard value:
Oil pump relief pressure 9.3 – 9.8 MPa
Unladen condition pressure 0.8 – 1.0 MPa
Steering gear holding pressure 9.3 – 9.8 MPa

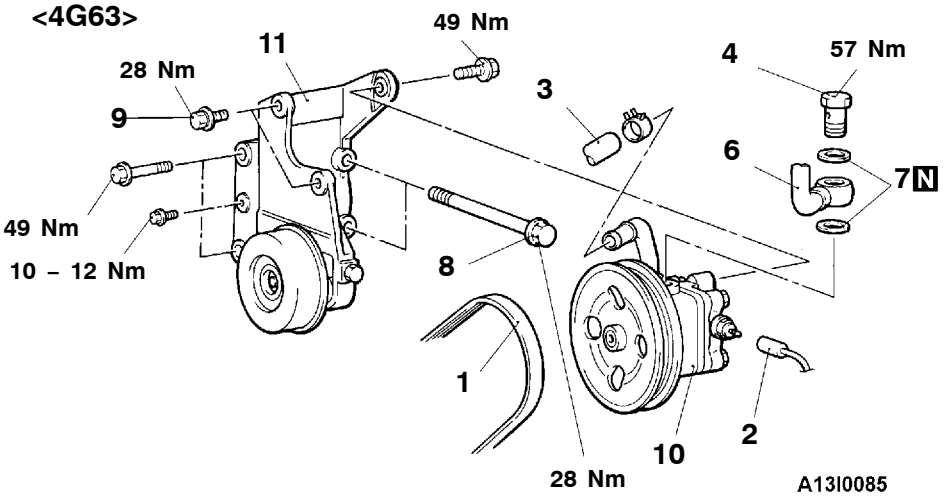
POWER STEERING OIL PUMP <Petrol-powered vehicles>

REMOVAL AND INSTALLATION

Pre-removal Operation
- Power Steering Fluid Draining
- Condenser Fan Motor Assembly Removal <6A1>

Post-installation Operation
- Condenser Fan Motor Assembly Installation <6A1>
- Power Steering Fluid Supplying
- Drive Belt Tension Adjusting (Refer to GROUP 11 – On-vehicle Service.)
- Power Steering Fluid Line Bleeding
- Oil Pump Pressure Check (Refer to P.37A-2.)

<4G63>



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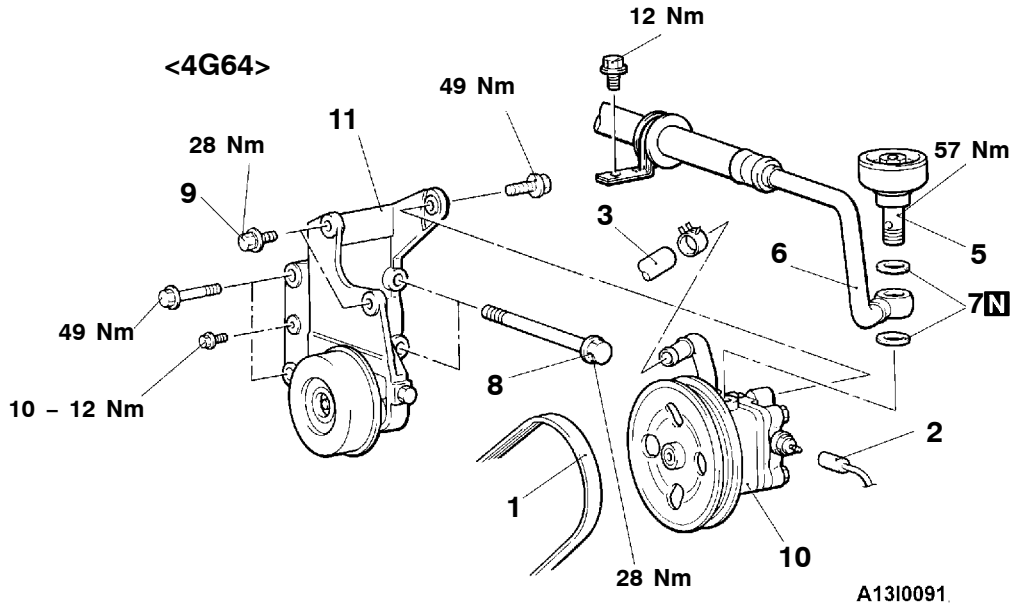
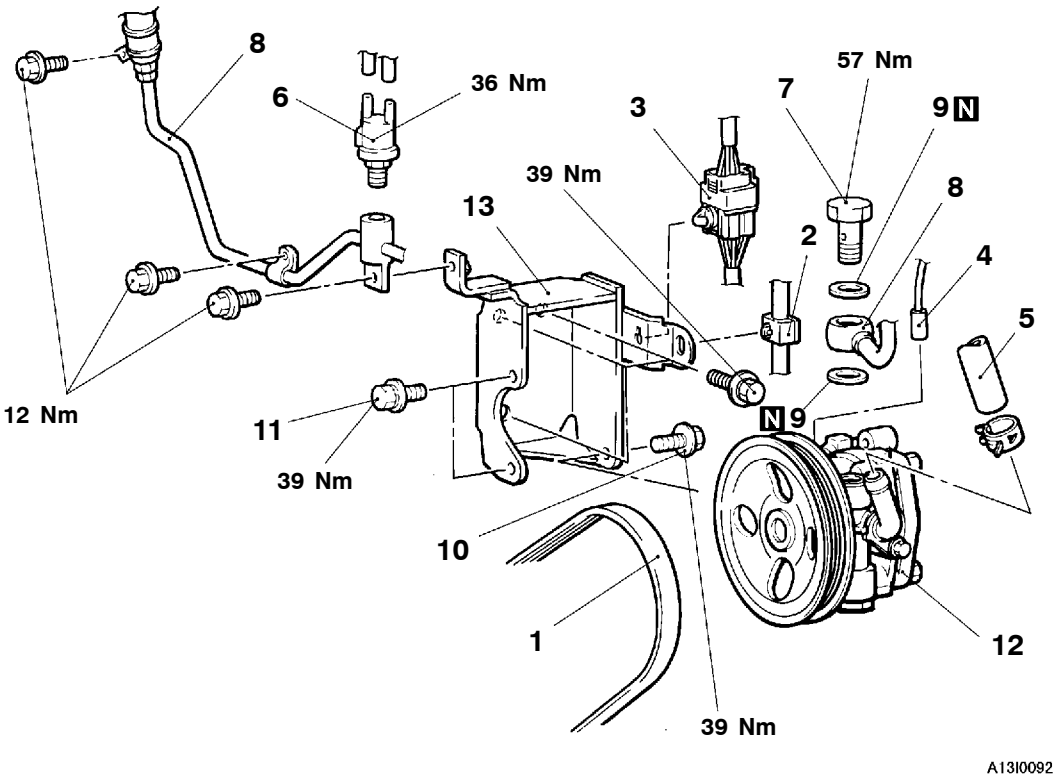


Removal steps

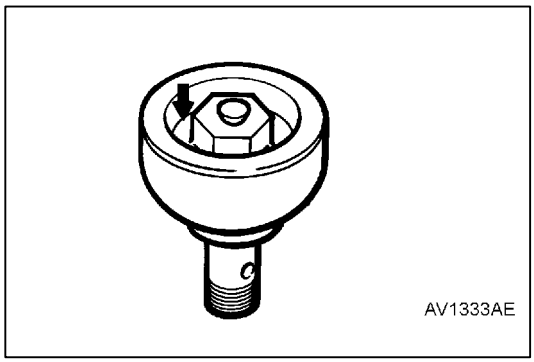
1. Drive belt
2. Pressure switch connector
3. Suction hose
4. Eye bolt
◀A▶ 5. Accumulator
6. Pressure hose
7. Gasket
8. Bolt
9. Bolt
10. Oil pump
11. Oil pump bracket

<6A13>



Removal steps

1. Drive belt
2. Power steering oil pressure switch connector harness clip
3. Harness clip
4. Pressure switch connector
5. Suction hose
6. Air control valve
7. Eye bolt
8. Pressure hose
9. Gasket
10. Bolt
11. Bolt
12. Oil pump
13. Oil pump bracket



REMOVAL SERVICE POINT

◀A▶ ACCUMULATOR REMOVAL

Be sure to drill a hole in the position shown to discharge the packed gas when the accumulator is discarded.

Caution

1. **Never handle the accumulator in such ways as putting into fire, disassembling, pressing or welding as high-pressure gas is packed inside.**
2. **When drilling a hole in the accumulator, wear safety glasses against the possible scattering of metal particles by the gas.**

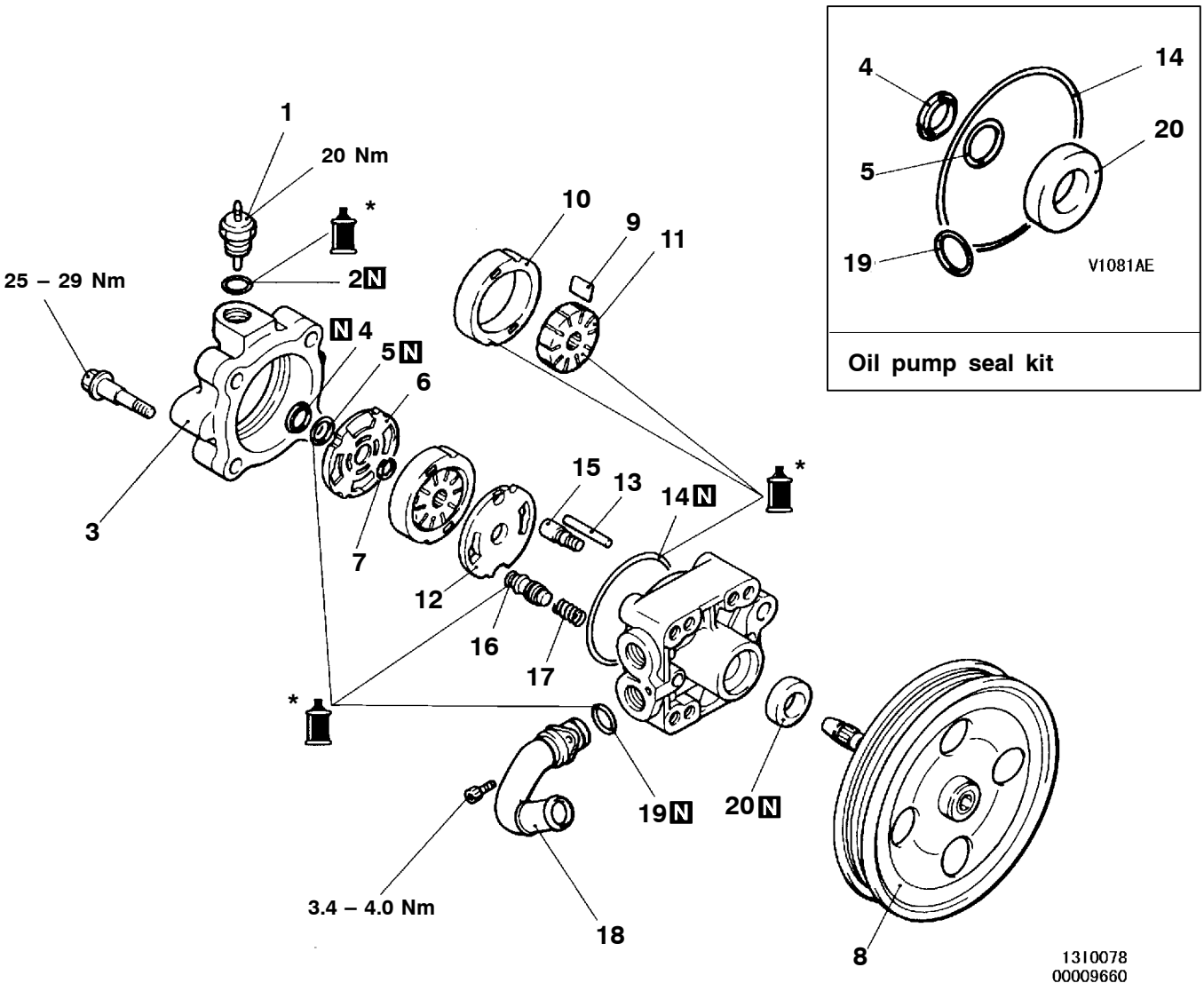
INSPECTION

37200530104

- Check the drive belt for cracks.
- Check the pulley assembly for uneven rotation.
- Check the accumulator for cracks and damage.

DISASSEMBLY AND REASSEMBLY

<4G63, 4G64>



Oil pump seal kit

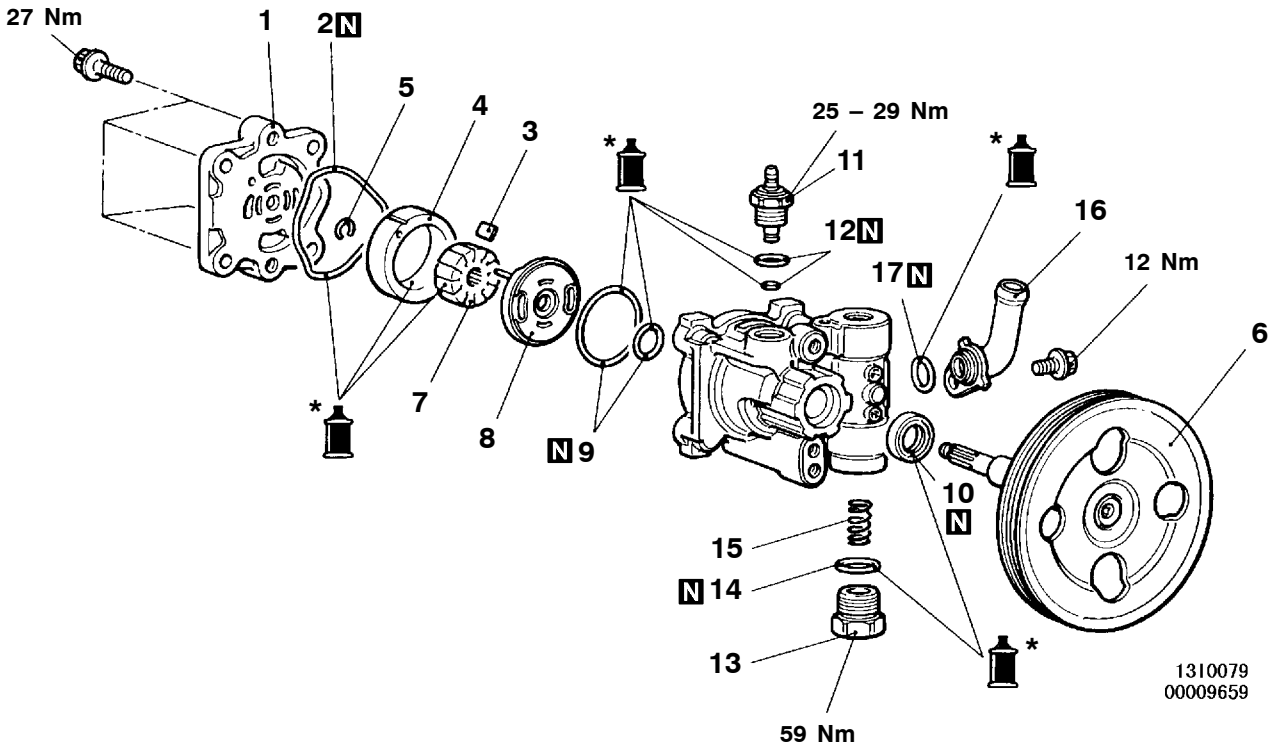
NOTE
*: Automatic transmission fluid DEXRON or DEXRON II

Disassembly steps

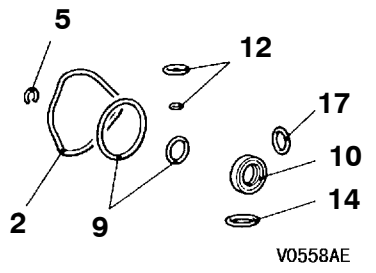
1. Terminal assembly
2. O-ring
3. Rear cover
4. Back-up ring
▶A◀ 5. O-ring
6. Side plate (Rear)
7. Snap ring
8. Pulley and shaft
▶E◀ 9. Vane
▶D◀ 10. Cam ring
▶C◀ 11. Rotor
12. Side plate (Front)
13. Lock pin
14. O-ring
15. Valve sub-assembly
16. Spool assembly
17. Spring
18. Suction connector
▶A◀ 19. O-ring
▶B◀ 20. Oil seal

Caution
Do not disassemble the terminal assembly and valve sub assembly which cannot be reassembled.

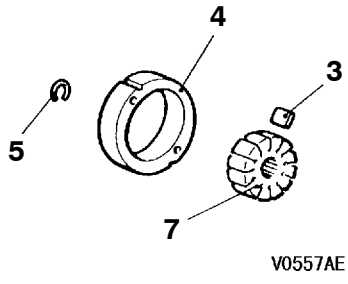
<6A13>



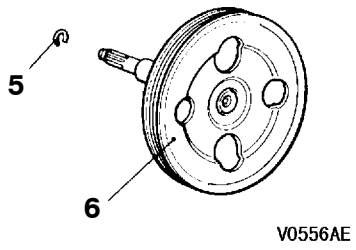
NOTE
*: Automatic transmission fluid DEXRON or DEXRON II



Oil pump seal kit



Oil pump cartridge kit



Oil pump pulley and shaft kit

Disassembly steps

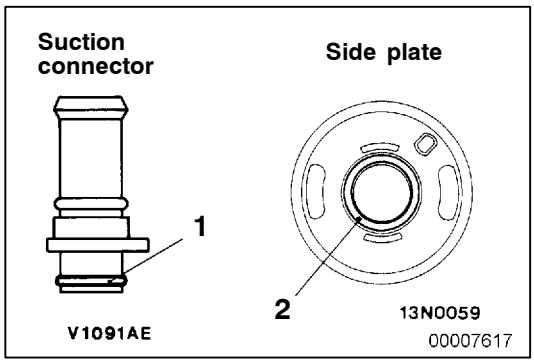
1. Pump cover
2. O-ring
- ▶E◀ 3. Vane
- ▶D◀ 4. Cam ring
5. Snap ring
6. Pulley and shaft
- ▶C◀ 7. Rotor
8. Side plate
- ▶A◀ 9. O-ring
- ▶B◀ 10. Oil seal
11. Terminal assembly
- ▶A◀ 12. O-ring
13. Inner ring
- ▶A◀ 14. O-ring
15. Flow control spring
16. Suction connector
- ▶A◀ 17. O-ring

Caution
Do not disassemble the terminal assembly which cannot be reassembled.

REASSEMBLY SERVICE POINTS

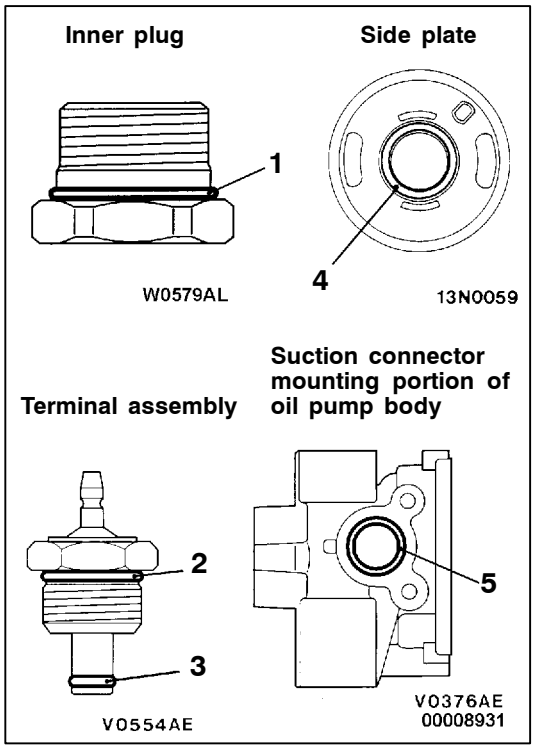
Reassemble in the same way as before other than the listed below.

▶A◀ O-RING INSTALLATION



<4G63, 4G64>

No.	ID × Width mm
1	13.3 × 1.6
2	15.0 × 2.0



<6A13>

No.	ID × Width mm
1	19.8 × 2.4
2	14.8 × 1.9
3	3.8 × 1.9
4	14.8 × 2.4
5	15.8 × 2.4

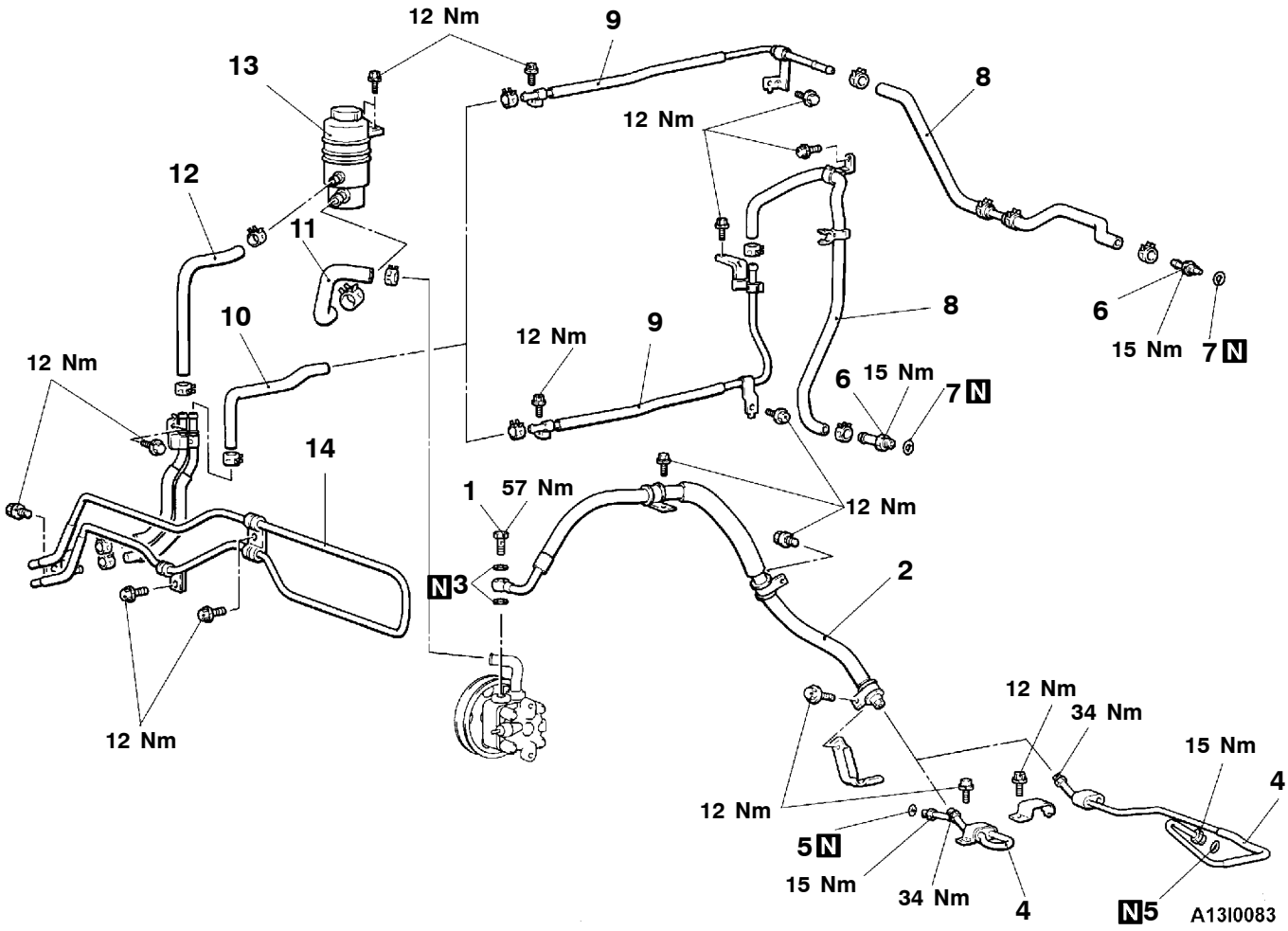
POWER STEERING HOSES <Petrol-powered Vehicles>

REMOVAL AND INSTALLATION

Pre-removal Operation
- Power Steering Fluid Draining
- Front Bumper Removal (Refer to GROUP 51.)

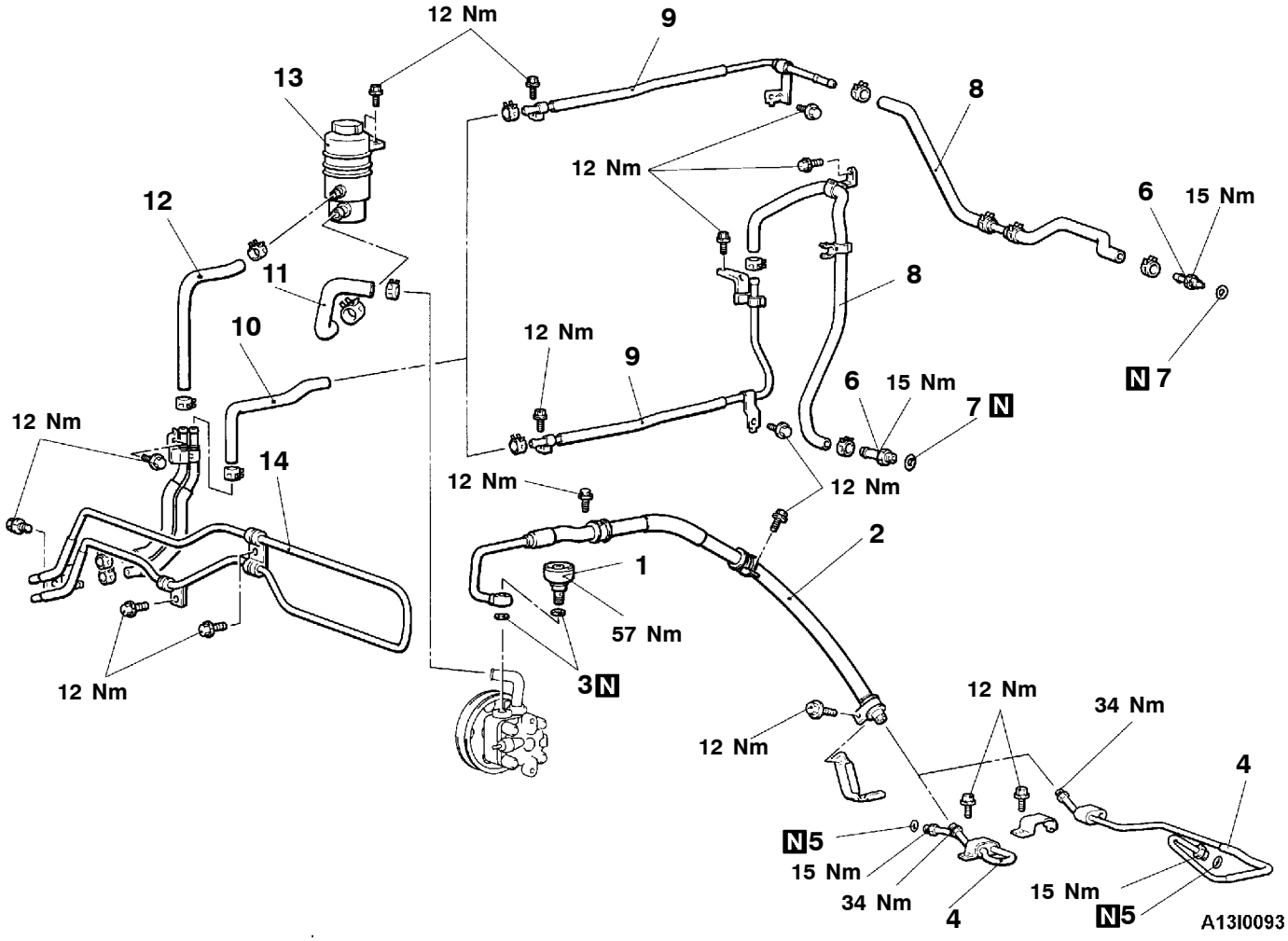
Post-installation Operation
- Front Bumper Installation (Refer to GROUP 51.)
- Power Steering Fluid Supplying
- Power Steering Fluid Line Bleeding

<4G63>



1. Eye bolt
▶A◀ 2. Pressure hose
3. Gasket
4. Pressure tube
5. O-ring
6. Return tube
7. O-ring
8. Return hose
9. Return tube
10. Return hose
11. Suction hose
12. Return hose
13. Oil reservoir
14. Cooler tube

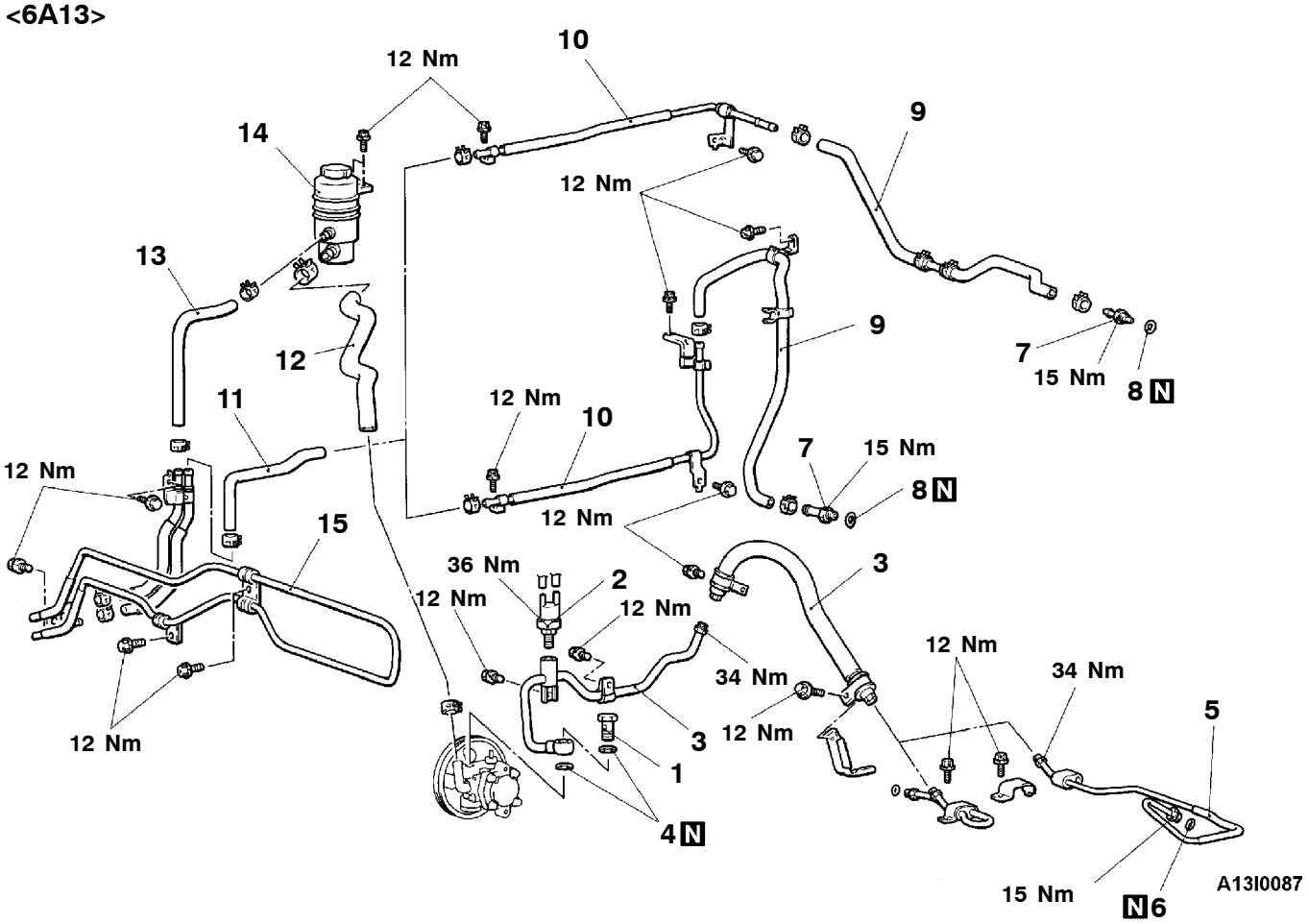
<4G64>



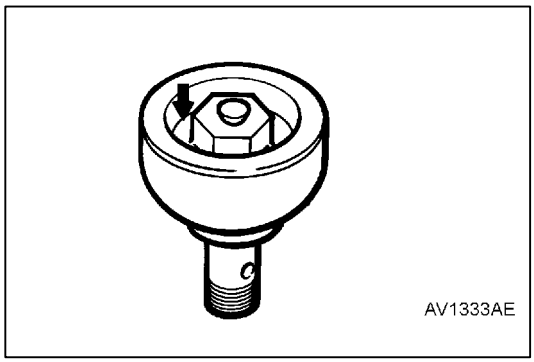
◀A▶ ▶A◀

1. Accumulator
2. Pressure hose
3. Gasket
4. Pressure tube
5. O-ring
6. Return tube
7. O-ring
8. Return hose
9. Return tube
10. Return hose
11. Suction hose
12. Return hose
13. Oil reservoir
14. Cooler tube

<6A13>



1. Eye bolt
2. Air control valve
▶A◀ 3. Pressure hose
4. Gasket
5. Pressure tube
6. O-ring
7. Return tube
8. O-ring
9. Return hose
10. Return tube
11. Return hose
12. Suction hose
13. Return hose
14. Oil reservoir
15. Cooler tube



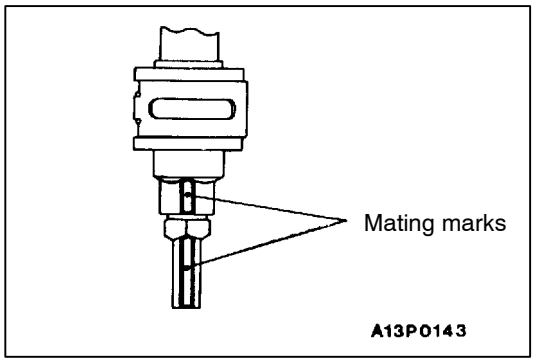
REMOVAL SERVICE POINT

◀A▶ ACCUMULATOR REMOVAL

Be sure to drill a hole in the position shown to discharge the packed gas when the accumulator is discarded.

Caution

1. **Never handle the accumulator in such ways as putting into fire, disassembling, pressing or welding as high-pressure gas is packed inside.**
2. **When drilling a hole in the accumulator, wear safety glasses against the possible scattering of metal particles by the gas.**



INSTALLATION SERVICE POINT

◀A▶ PRESSURE HOSE INSTALLATION

Align the marks on the pressure hose and pressure pipe, and install the pressure hose.

GROUP 42
BODY

GENERAL

OUTLINE OF CHANGES

- Troubleshooting for the keyless entry system has been changed.
- Due to the change of the transmitter and receiver, “how to replace a battery of the transmitter” and “secret code registration method” have been changed.

KEYLESS ENTRY SYSTEM

TROUBLESHOOTING

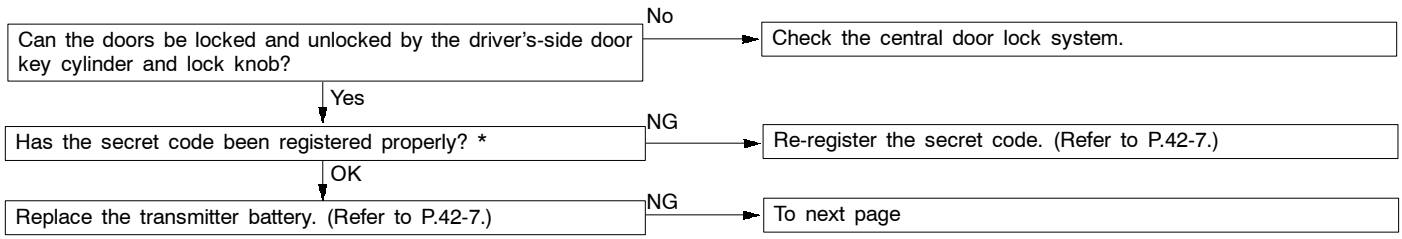
INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble symptom	Inspection procedure No.	Reference page
None of the doors can be locked or unlocked using the transmitter.	1	42-1
All of the doors can be locked and unlocked using the transmitter, but the room lamp or turn-signal lamp does not flash or illuminate. (However, the room lamp operates normally when the doors are opened and closed.)	2	42-3
All doors can be locked and unlocked by the transmitter when a door is opened.	3	42-4
All doors can be locked and unlocked by the transmitter when the ignition key is inserted.	4	42-4
Secret codes cannot be registered.	5	42-5

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

INSPECTION PROCEDURE 1

None of the doors can be locked or unlocked using the transmitter.	**Probable cause**
The cause may be a malfunction of the transmitter, a malfunction of the receiver or the lock and unlock signals are not being sent to the ETACS-ECU. It is also likely that the keyless entry system is disabled due to abnormal key reminder switch or door switch input signals.	• Malfunction of transmitter • Malfunction of receiver • Malfunction of ETACS-ECU • Malfunction of wiring harness or connector • Malfunction of key reminder switch • Malfunction of door switch



NOTE
*: This should be done if a transmitter or receiver has been replaced, and if a secret code has not been registered properly.

From previous page

Measure at the receiver connector C-80.
- Remove the ignition key.
- Disconnect the connector, and measure at the harness side.

(1) Voltage between 1 and body earth
OK: Battery voltage
(2) Voltage between 2 and body earth
OK: 0V

(1) NG → **Check the following connectors:**
<L.H.D> C-141, C-132, C-63, C-80
<R.H.D> C-20, C-62, C-80
OK → Check trouble symptoms.
NG → **Repair**
NG → Check the harness wire, and repair if necessary.
- Between fusible link No.2 and receiver

(2) NG → Check the harness wire, and repair if necessary.
- Between the ignition switch (ACC) and receiver.

OK

Measure at receiver connector C-80.
- Disconnect the connector, and measure at the harness side.
- Continuity between 4 and body earth

OK: Continuity

NG → **Check the following connectors:**
<L.H.D.> C-62, C-80, <R.H.D.> C-64, C-80
OK → Check trouble symptoms.
NG → **Repair**
NG → Check the harness wire between the receiver and earth, and repair if necessary.

OK

Measure at receiver connector C-80.
- Disconnect the connector, and measure at the harness side.
- Continuity between 4 and body earth

OK: 5V

NG → **Check the following connectors:**
C-80, C-138
OK → Check trouble symptoms.
NG → **Repair**
NG → Check the harness wire between the ETACS-ECU and the receiver.
OK → Replace the ETACS-ECU.
NG → **Repair**

OK

Measure at the ETACS-ECU connector C-144.
- Disconnect the connector, and measure at the harness side.
- Continuity between 20 and body earth
- Continuity between 23 and body earth

OK: Continuity exists.

NG → Door switch continuity check.
OK → **Check the following connectors:**
<L.H.D>
C-144, C-143, E-19, G-16, C-119, C-123, E-08, G-09, G-28, G-32
<R.H.D>
C-144, C-143, E-08, G-09, G-28, G-32, C-123, C-119, E-19, G-16
OK → Check trouble symptoms.
NG → **Repair**
NG → Check the harness wire, and repair if necessary.
- Between ETACS-ECU and door switch

NG → **Replace**

OK

Key reminder switch continuity check

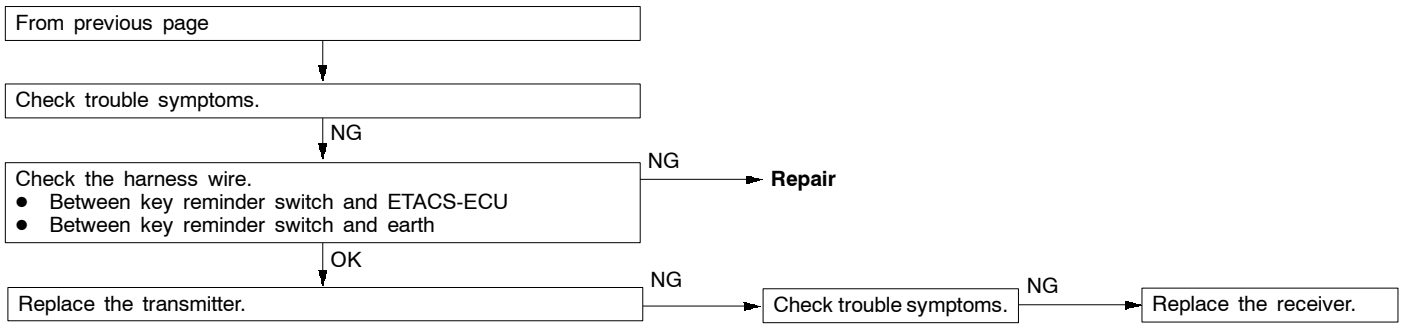
OK

Check the following connectors:
C-80, C-109, C-134, C-144

NG → **Repair**

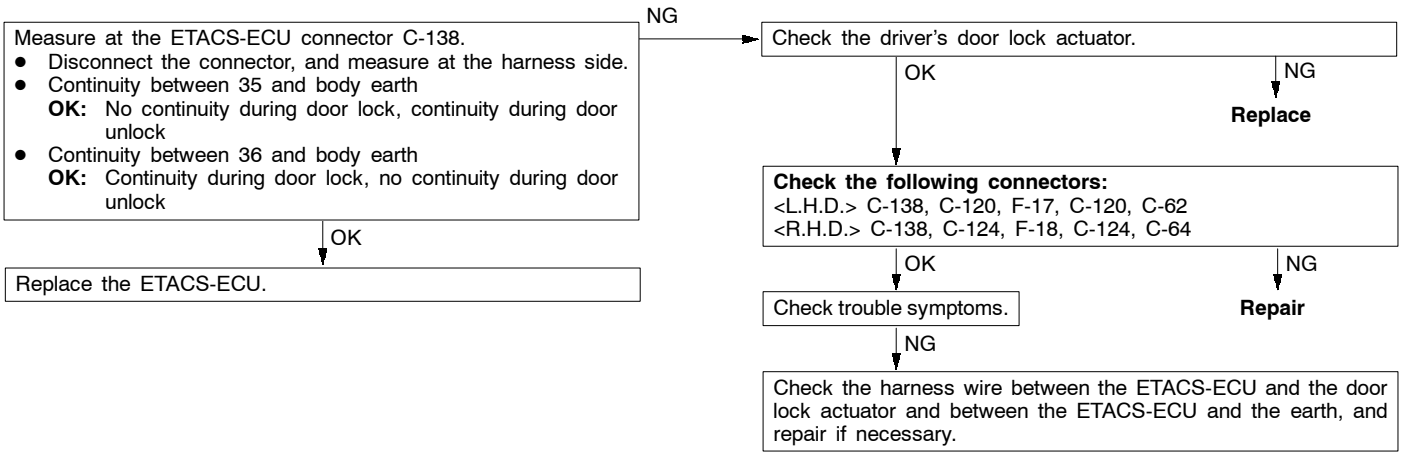
OK

To next page



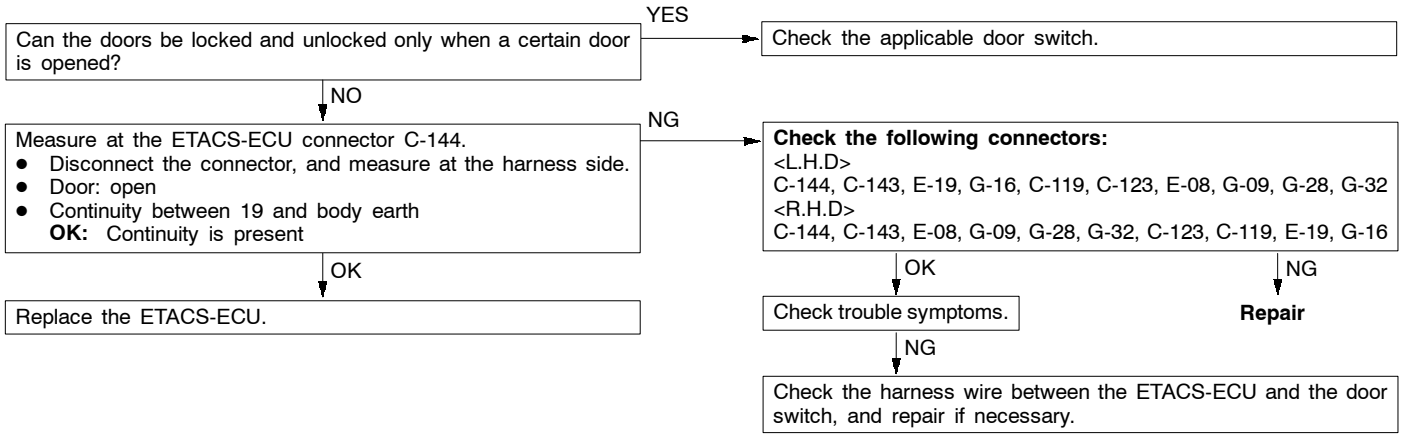
INSPECTION PROCEDURE 2

All of the doors can be locked and unlocked using the transmitter, but the room lamp or turn-signal lamp does not flash or illuminate. (However, the room lamp operates normally when the doors are opened and closed.)	Probable cause
If the room lamp operates normally when the doors are opened and closed, the cause of the problem may be a malfunction of the ETACS-ECU or a malfunction of the driver's-side door lock actuator.	● Malfunction of ETACS-ECU ● Malfunction of driver's door lock actuator ● Malfunction of connector or wiring harness



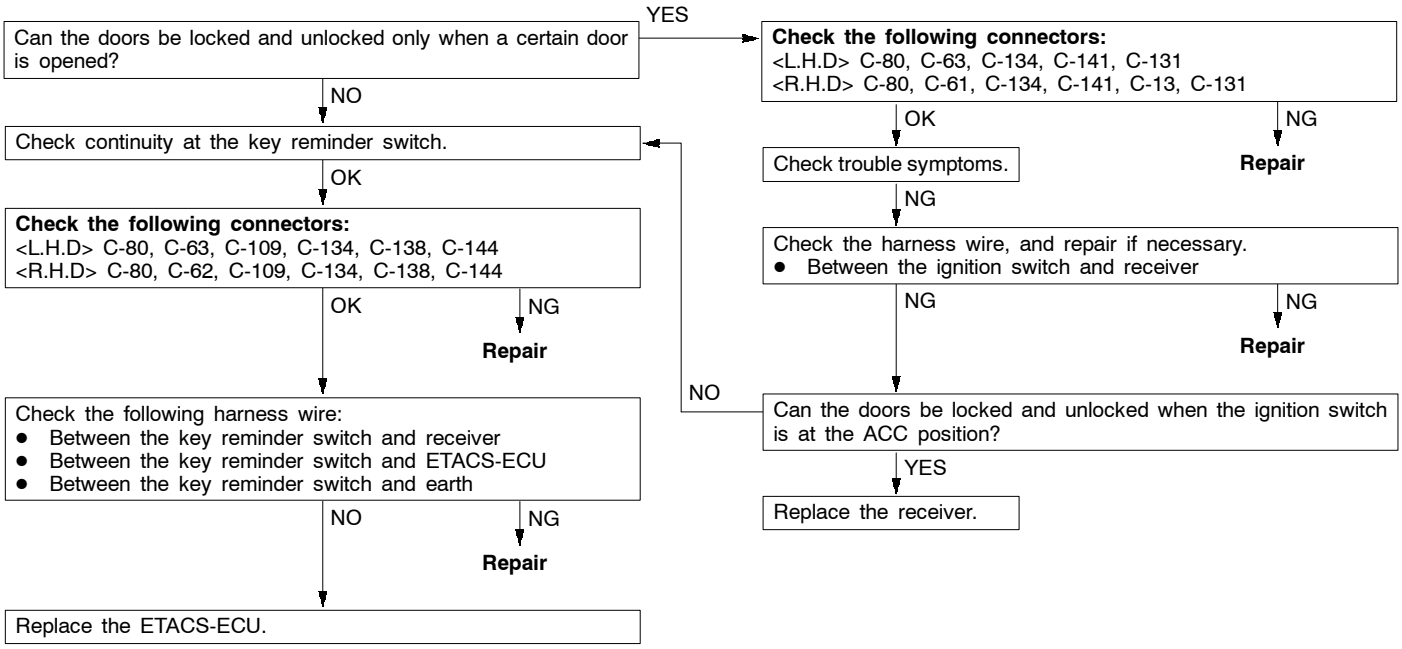
INSPECTION PROCEDURE 3

All door can be locked and unlocked by the transmitter when a door is opened.	Probable cause
The ETACS-ECU should disable a door lock and unlock by the transmitter when a door is opened (door switch: ON). If all doors can be locked and unlocked by the transmitter when a door is opened, there may be a malfunction of the door switch or a problem on the door switch input circuit at the ETACS-ECU.	• Malfunction of ETACS-ECU • Malfunction of connector or wiring harness • Malfunction of door switch



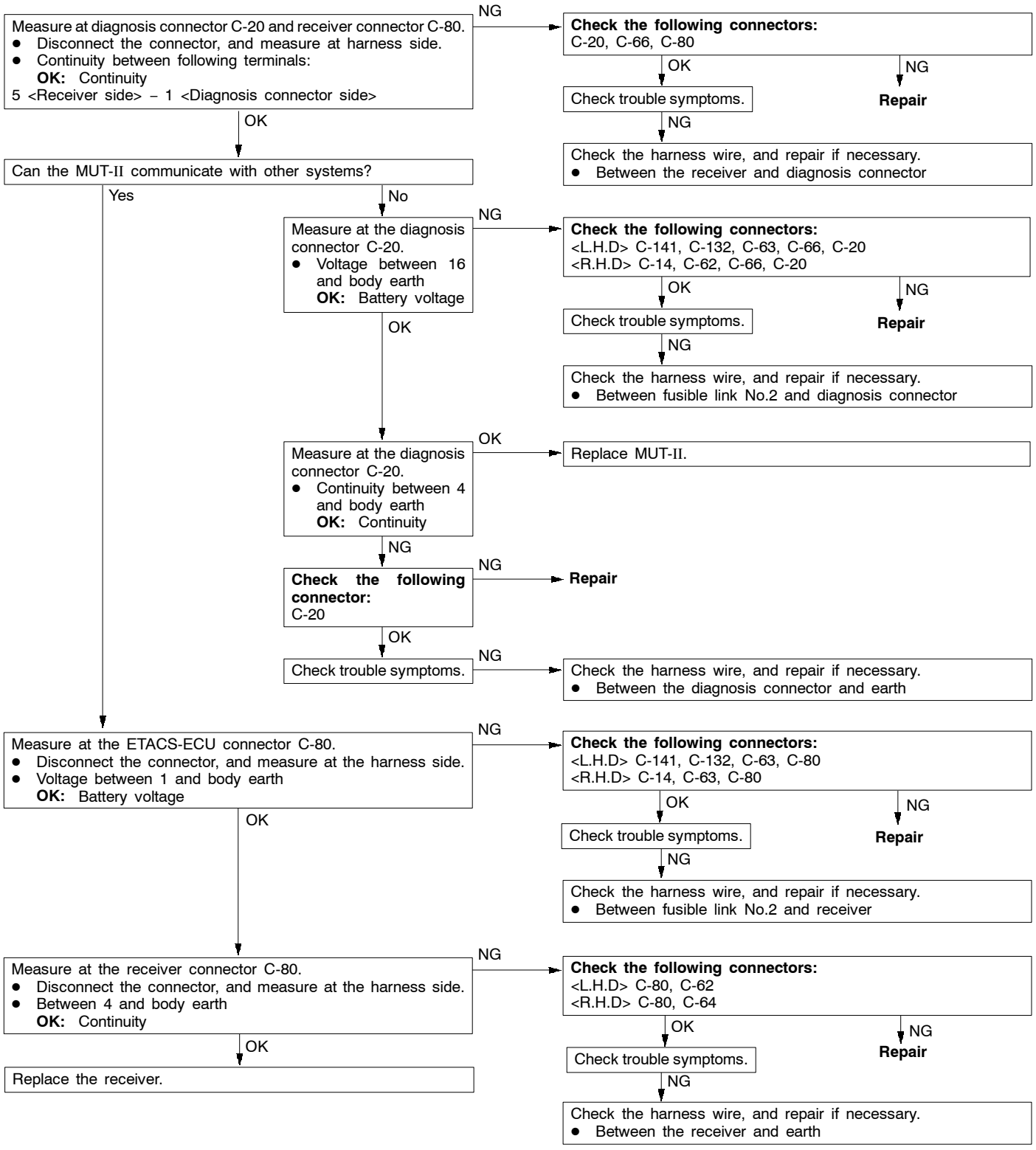
INSPECTION PROCEDURE 4

All door can be locked and unlocked by the transmitter when the ignition key is inserted.	Probable cause
The ETACS-ECU should disable a door lock and unlock by the transmitter when the ignition key is inserted (key reminder switch: OFF). Besides that, the receiver monitors power supply at ignition switch ACC position, and disables a door lock and unlock by the transmitter when the power supply reaches battery voltage. If all doors can be locked and unlocked by the transmitter when the ignition key is inserted, there may be a malfunction of the key reminder switch, a problem on the reminder switch input circuit at the ETACS-ECU, or the ignition switch (ACC position) input circuit at the receiver.	• Malfunction of ETACS-ECU • Malfunction of connector or wiring harness • Malfunction of key reminder switch • Malfunction of receiver



INSPECTION PROCEDURE 5

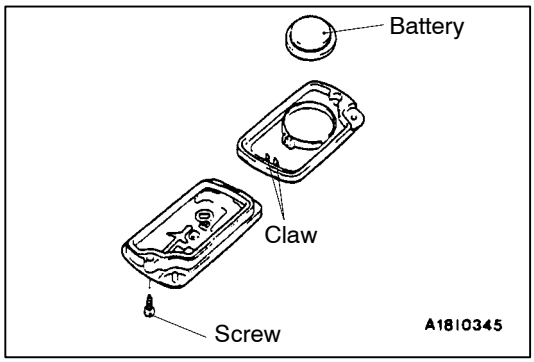
Secret codes cannot be registered.	Probable cause
The cause may be a malfunction of the diagnosis connector,a malfunction of the ETACS-ECU or a malfunction of the diagnosis output circuit.	• Malfunction of MUT-II • Malfunction of connector or wiring harness • Malfunction of receiver



MEASUREMENT AT THE RECEIVER TERMINALS

1410065

Terminal	Signal	Requirement	Terminal voltage
1	Receiver power supply	Always	Battery voltage
2	Ignition switch (ACC) signal	Ignition switch: ACC or ON	Battery voltage
		Ignition switch: OFF	0V
4	Earth	Always	0V
5	Diagnosis switching input	Connect the MUT-II	0V
		Disconnect the MUT-II	Battery voltage
6	Multiplex communication	Always	5V



ON-VEHICLE SERVICE

HOW TO REPLACE A BATTERY OF THE TRANSMITTER

1. Remove the set screw to remove the battery from the transmitter.
2. Install a battery with its (+) side face-down.

   Battery required for replacement:
   Coin type battery CR2032

3. Insert the claw, and then assemble the transmitter.

   Caution
   Do not let water or dust stick to the inside of the transmitter when it is open. Also, do not touch the precision electronic device.

4. Check to see if the keyless entry system operates.

SECRET CODE REGISTRATION METHOD

Each individual secret code is registered inside the transmitter, and so it is necessary to register these codes with the EEPROM inside the ETACS-ECU in the following cases.

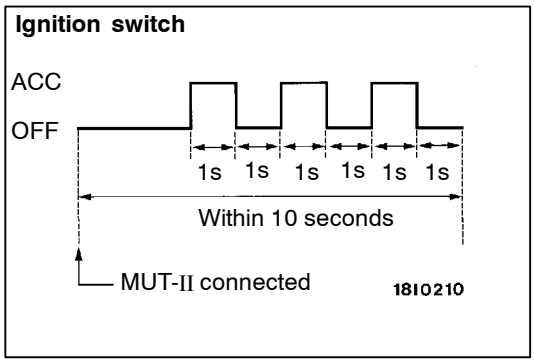
- When either the transmitter or ETACS-ECU is replaced;
- If a second transmitter is to be used;
- If it appears that a problem is occurring because of faulty registration of a code.

A maximum of four different codes can be stored in the memory area of the EEPROM (four different transmitters can be used). When the code for the first transmitter is registered, the previously-registered codes for four transmitters are cleared. Therefore, if you are using more than two transmitters or are adding a second transmitter, the codes for all the transmitters must be registered at the same time.

1. Check that the doors lock normally when the key is used.
2. Connect the MUT-II to the diagnosis connector.

   NOTE
   This will connect terminal (1) of the diagnosis connector to earth, and the system will be in secret code registration standby mode.

   Caution
   Always turn the ignition switch to OFF before connecting and disconnecting the MUT-II.



3. Within 10 seconds after connecting the MUT-II, turn the ignition switch to ACC ON for 1 second and then to OFF for 1 second; repeat this procedure three times.

   NOTE
   The doors will lock and unlock once at this time and the system will switch to registration mode.
4. Press the lock switch or unlock switch of the transmitter switch, and then press it two times within 10 seconds of the first press. This will register the code.
5. After registration is completed, the doors will be automatically locked and unlocked once.
6. If you are using more than two transmitters or have added a second transmitter, the same registration procedure should be carried out for the remaining transmitters, and it should be carried out within one minute after registration of the code for the first transmitter has been completed. The registration procedure are all the same for all transmitters.
7. Registration mode will be terminated under the following conditions.
   - When the secret codes for four transmitters have been registered;
   - When one minute has passed after registration mode started;
   - If the MUT-II is disconnected (earth is released);
   - If the ignition switch is turned to ON;
8. After registration mode has been completed, carry out the followings to make sure that the keyless entry system operates.
   - Pull the ignition key out.
   - Close the all windows.

GROUP 51
EXTERIOR

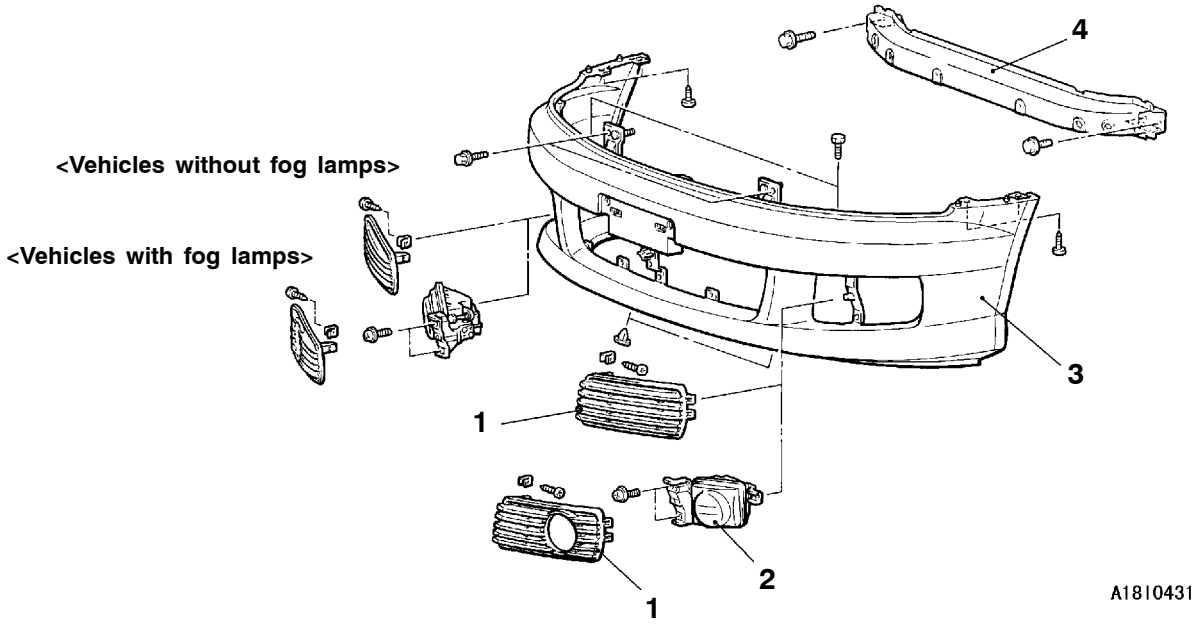
GENERAL

OUTLINE OF CHANGES

- Service procedures have been changed due to the modification in the front bumper.
- Service procedures have been changed as “Mitsubishi” mark is changed into Three Diamond mark.
- GHI mark is added to correspond to the addition of the GDI engine models.

FRONT BUMPER

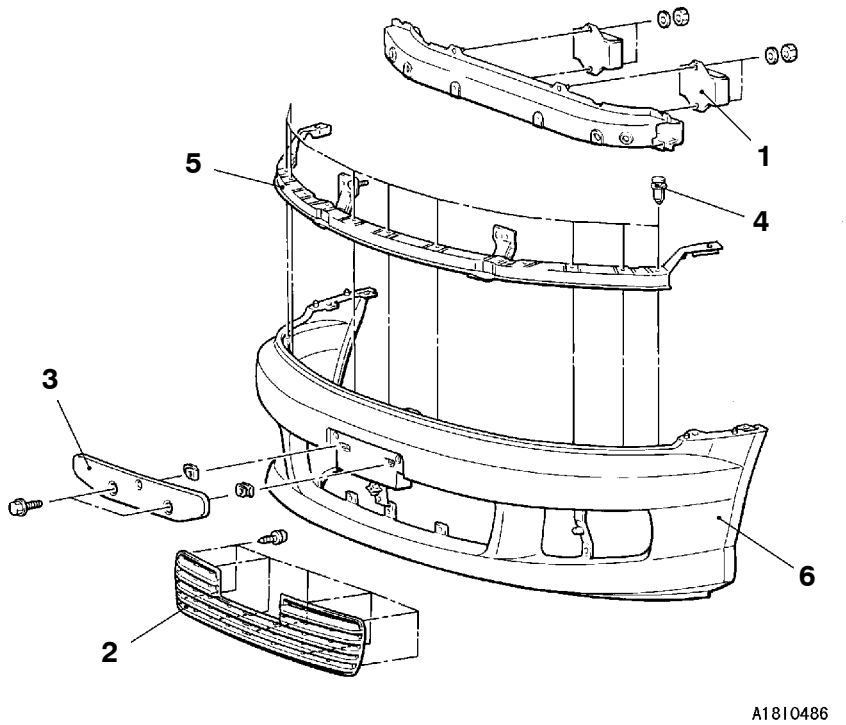
REMOVAL AND INSTALLATION



Removal Steps

1. Fog lamp bezel
2. Fog lamp
3. Front bumper assembly
4. Front bumper reinforcement assembly

DISASSEMBLY AND REASSEMBLY

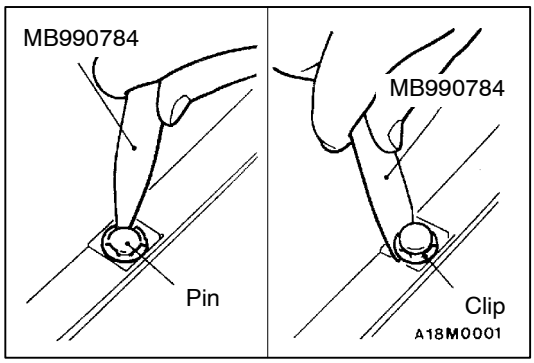


Disassembly Steps

1. Dynamic damper assembly <Vehicles with 4G63 engine>
2. Under grille
3. Licence plate bracket

◀A▶

4. Clip
5. Front bumper upper reinforcement
6. Front bumper face



DISASSEMBLY SERVICE POINT

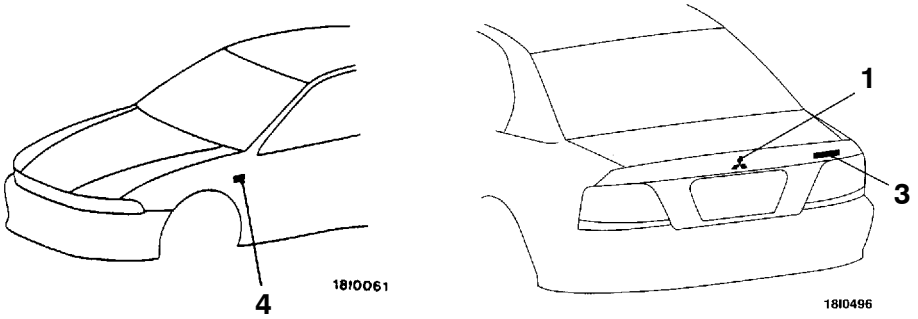
◀A▶ CLIP REMOVAL

1. Use the special tool to pull up the center pin in the clop.
2. Remove the clip.

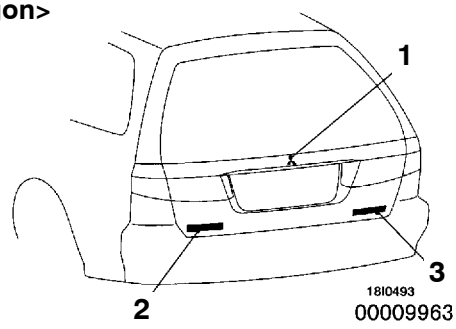
MARKS

REMOVAL AND INSTALLATION

<Sedan>



<Wagon>



▶A◀ 1. Three Diamond mark
▶A◀ 2. "GALANT" mark <Wagon>
▶A◀ 3. Grade mark
▶A◀ 4. GDI mark

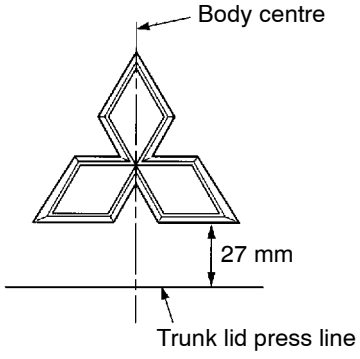
INSTALLATION SERVICE POINT

▶A◀ INSTALLATION OF MARKS

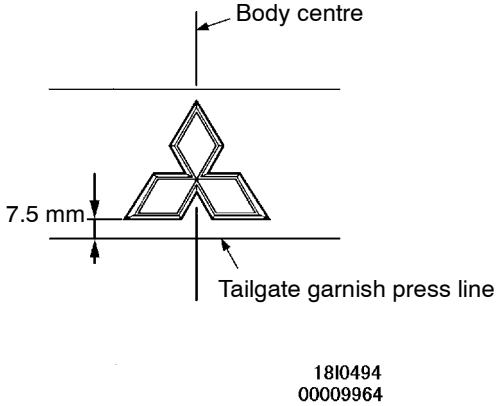
1. APPLICATION POSITION

(1) Three Diamond mark

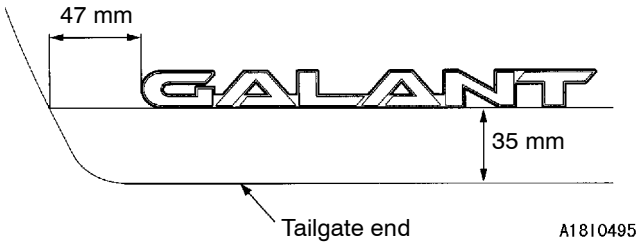
<Sedan>



<Wagon>



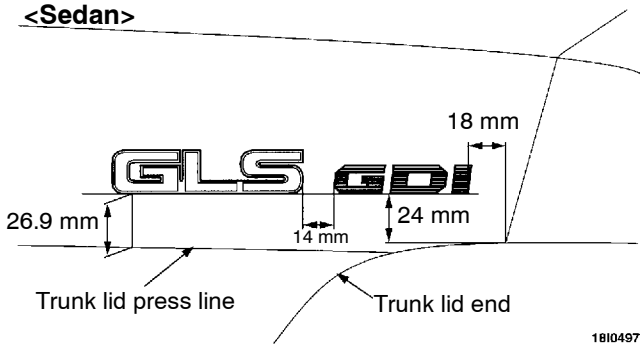
(2) "GALANT" mark <Wagon>



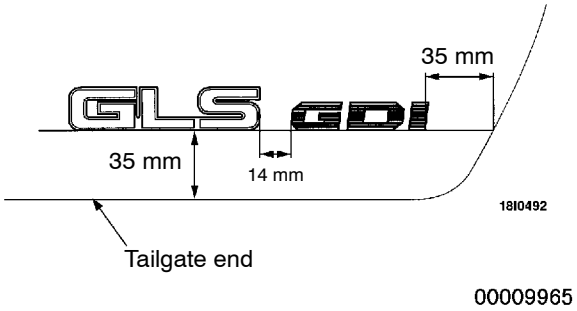
(3) Grade mark

GLS (GDI)

<Sedan>

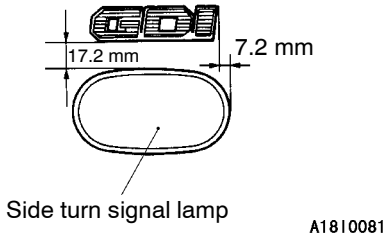


<Wagon>



00009965

(4) GDI mark



2. INSTALLATION PROCEDURE

(1) Clean the mark installation surfaces on the body with unleaded petrol.

(2) Peel off the backing paper from the reverse side of the marks, and then attach the marks to the vehicle body so that they fit properly into position.

Caution

When attaching the marks, the surrounding temperature should be 20–38°C and the air should be completely free from dust.

If the surrounding temperature is lower than 20°C, the marks and the places on the body where the marks are to be attached should be heated to 20–38°C.

GROUP 52A
INTERIOR

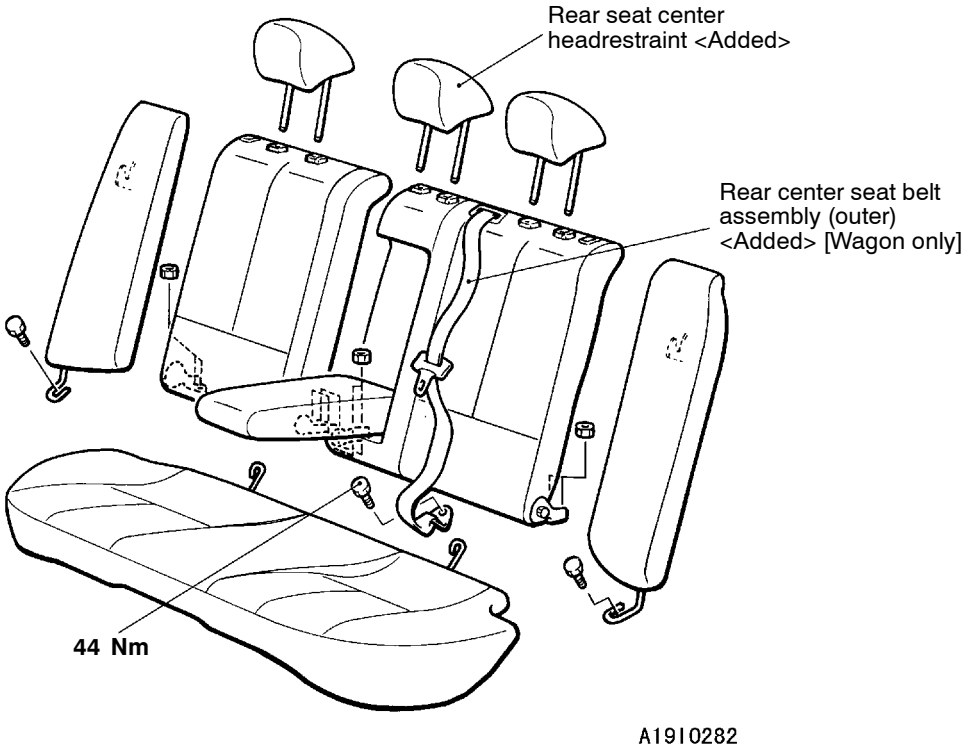
GENERAL

OUTLINE OF CHANGES

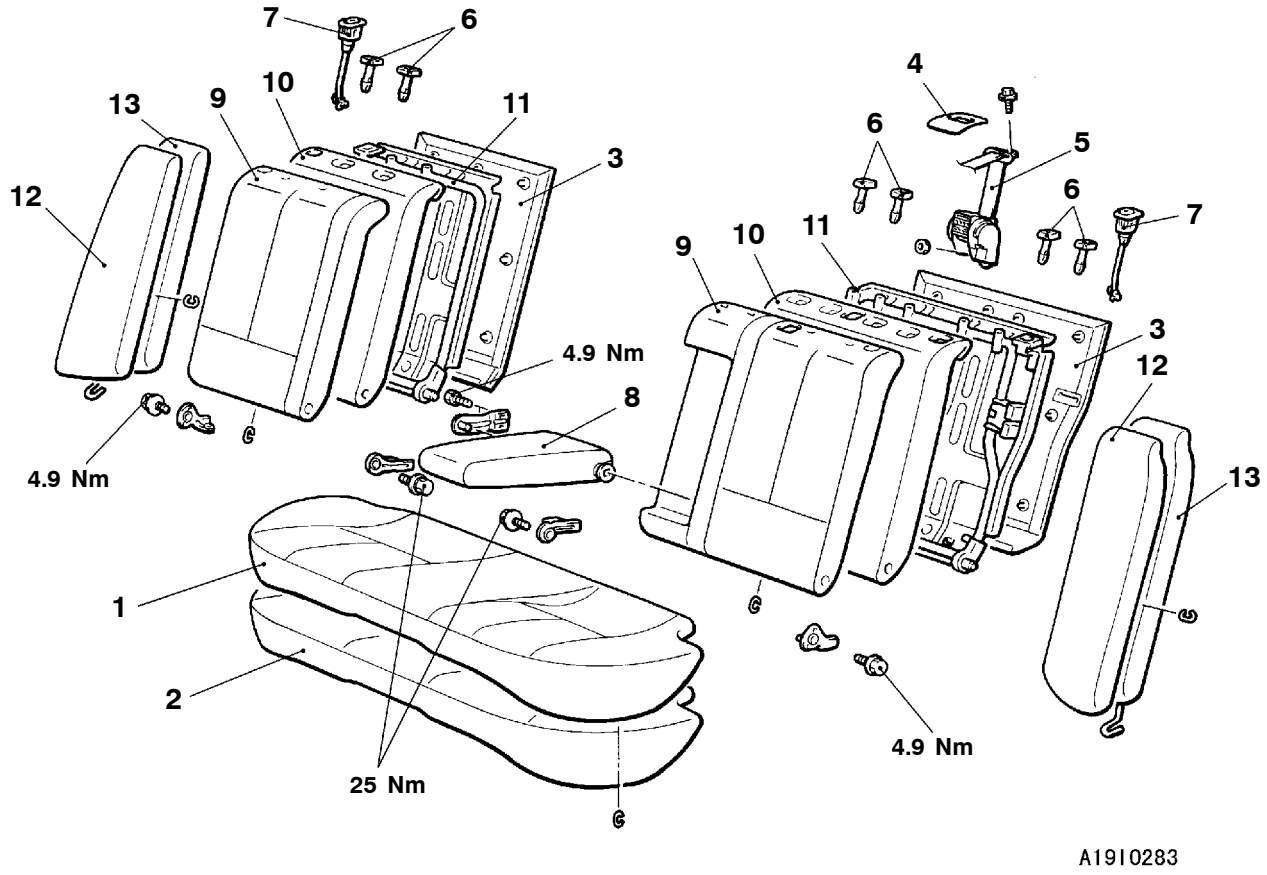
- Rear seat center headrestraint has been added.
- Service procedures have been changed due to the addition of the rear center seat belt (incorporated in the rear seat) <Wagon>.

REAR SEAT

REMOVAL AND INSTALLATION



DISASSEMBLY AND REASSEMBLY

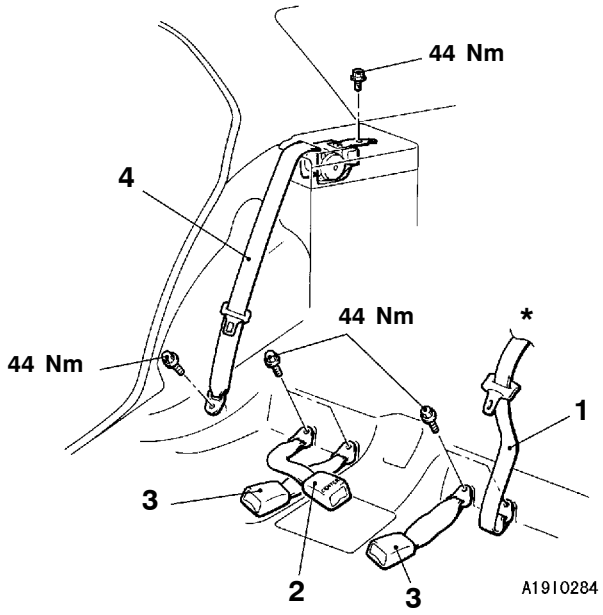


Disassembly steps

1. Seat cushion cover
2. Seat cushion pad
3. Seatback panel
4. Garnish <Wagon>
5. Rear center seat belt assembly (outer) <Wagon>
6. Headrestraint guide
7. Unlock knob
8. Armrest
9. Seatback cover
10. Seatback pad
11. Seatback frame
12. Side seatback cover
13. Side seatback pad

REAR SEAT BELT <Wagon>

REMOVAL AND INSTALLATION



Removal steps

- Rear seat (Refer to P.52A-1.)
1. Rear centre seat belt assembly (outer)
2. Rear centre seat belt assembly (inner)
3. Rear seat belt assembly (inner)
- Retractor trim
4. Rear seat belt assembly (outer)

NOTE
*: Refer to rear seat disassembly and reassembly procedures (P.52A-2) for the retractor removal and installation of the rear centre seat belt assembly (outer).

NOTES

CHASSIS ELECTRICAL

CONTENTS

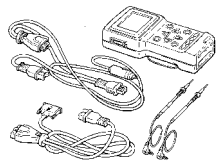
IGNITION SWITCH AND IMMOBILIZER SYSTEM

GENERAL

OUTLINE OF CHANGES

The following service procedures have been added as the immobilizer control has been changed from the ID code type to the encrypted code type.

SPECIAL TOOL

Tool	Number	Name	Use
	MB991502	MUT-II sub assembly	• Immobilizer system check (Diagnosis display using the MUT-II) • Registration of the encrypted code

TROUBLESHOOTING

Caution
The encrypted code should always be re-registered when replacing the immobilizer-ECU.

STANDARD FLOW OF DIAGNOSIS TROUBLESHOOTING

Refer to basic manual.

DIAGNOSIS FUNCTION

DIAGNOSIS CODES CHECK

Refer to basic manual.

ERASING DIAGNOSIS CODES

Refer to basic manual.

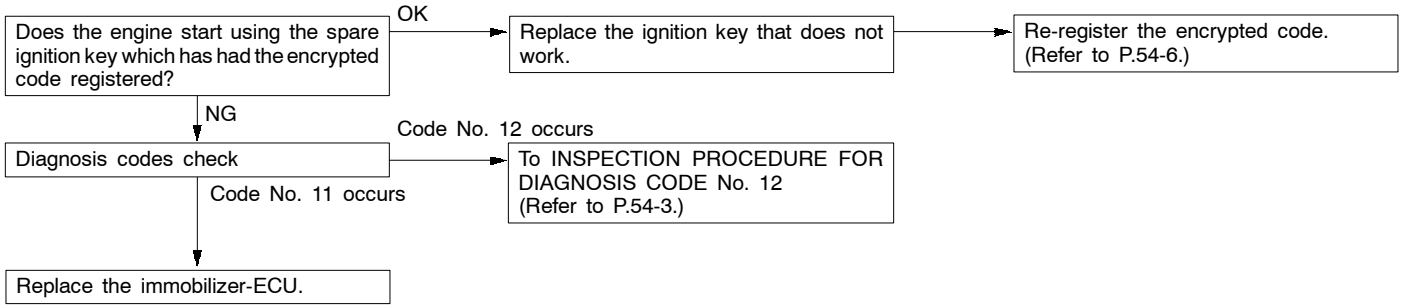
Caution
The diagnosis codes which result from disconnecting the battery cables cannot be erased.

INSPECTION CHART FOR DIAGNOSIS CODES

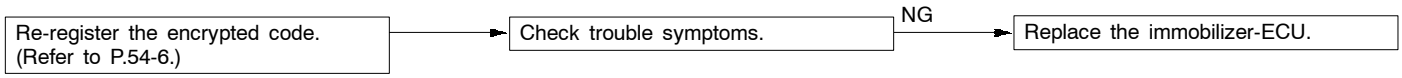
Diagnosis code No.	Inspection items	Reference page
11	Transponder communication system	54-3
12	Encrypted code are not the same or are not registered	54-3

INSPECTION PROCEDURE FOR DIAGNOSIS CODES

Code No. 11 Transponder communication system	Probable cause
The encrypted code of the transponder is not sent to the immobilizer-ECU immediately after the ignition switch is turned to the ON position.	• Malfunction of the transponder • Malfunction of the ignition key ring antenna • Malfunction of the immobilizer-ECU



Code No. 12 Encrypted code are not the same or are not registered	Probable cause
The encrypted code which is sent from the transponder is not the same as the encrypted code which is registered in the immobilizer-ECU.	• The encrypted code in the ignition key being used has not been properly registered. • Malfunction of the immobilizer-ECU



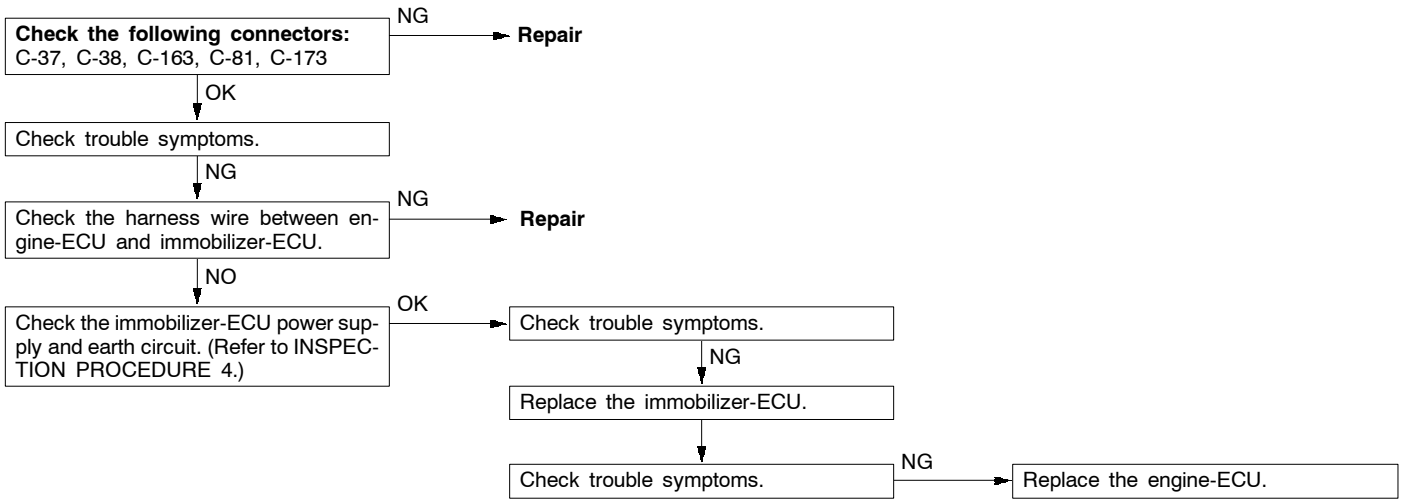
INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble symptom	Inspection procedure No.	Reference page
Communication with MUT-II is impossible.	–	GROUP 13A – Troubleshooting
Diagnosis code No. 54 has been generated by the engine-ECU.	1	54-4
Encrypted code cannot be registered using the MUT-II.	2	54-4
Engine does not start (Cranking but no initial combustion).	3	54-5
Malfunction of the immobilizer-ECU power supply and earth circuit	4	54-5

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

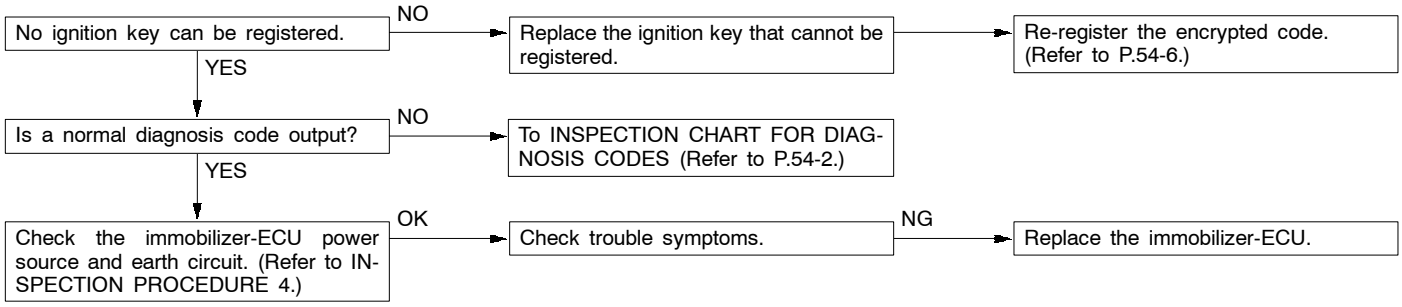
Inspection Procedure 1

Diagnosis code No. 54 has been generated by the engine-ECU.	Probable cause
There is a problem with communication between the engine-ECU and the immobilizer-ECU.	• Malfunction of harness or connector • Malfunction of the immobilizer-ECU • Malfunction of the engine-ECU



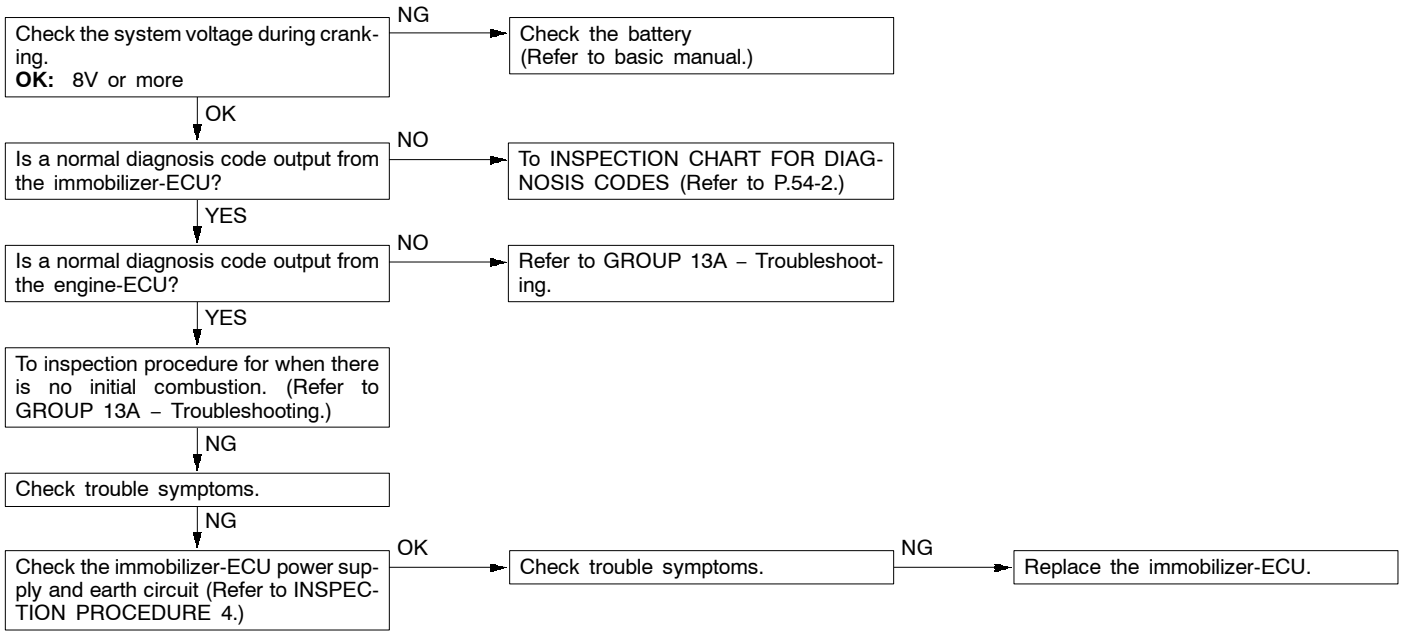
Inspection Procedure 2

Encrypted code cannot be registered using the MUT-II.	Probable cause
The cause is probably that there is no encrypted code registered in the immobilizer-ECU, or there is a malfunction of the immobilizer-ECU.	• Malfunction of the transponder • Malfunction of the ignition key ring antenna • Malfunction of harness or connector • Malfunction of the immobilizer-ECU



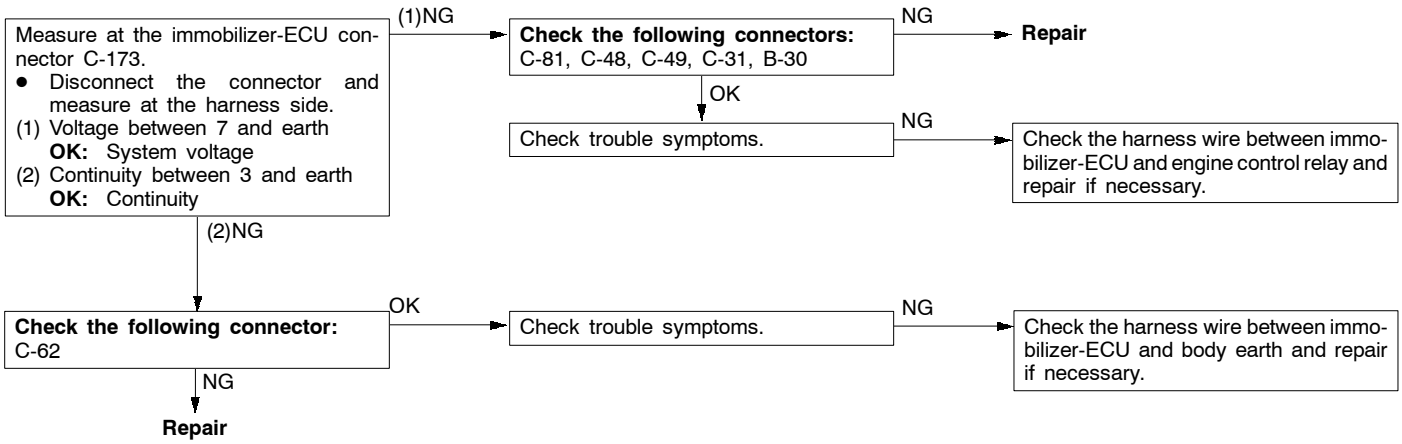
Inspection Procedure 3

Engine does not start (cranking but no initial combustion).	Probable cause
If the fuel injectors are not operating, there might be a problem with the GDI system in addition to a malfunction of the immobilizer system. It is normal for this to occur if an attempt is made to start the engine using a key that has not been properly registered.	• Malfunction of the GDI system • Malfunction of the immobilizer-ECU



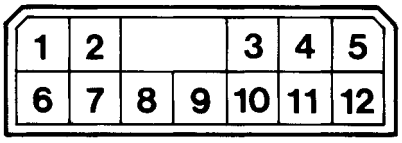
Inspection Procedure 4

Malfunction of the immobilizer-ECU power supply and earth circuit



CHECK AT IMMOBILIZER-ECU

TERMINAL VOLTAGE CHECK CHART



1610641

Terminal No.	Signal	Checking requirements	Terminal voltage
1, 2	–	–	–
3	Immobilizer-ECU earth	Always	0 V
4	–	–	–
5	Engine-ECU	–	–
6	–	–	–
7	Immobilizer-ECU power supply	Ignition switch: ON	System voltage
8, 9	–	–	–
10	Ignition key ring antenna	–	–
11	Ignition key ring antenna	–	–
12	–	–	–

IGNITION SWITCH AND IMMOBILIZER SYSTEM

ENCRYPTED CODE REGISTRATION METHOD AND RESETTING THE CODE TO THE FACTORY SETTING

Register the encrypted code in the immobilizer-ECU and then reset the code to the factory setting after parts have been replaced.

Replacement part	Encrypted code
Ignition key	Necessary
Ignition key ring antenna and immobilizer-ECU	Necessary
Engine-ECU*	Necessary

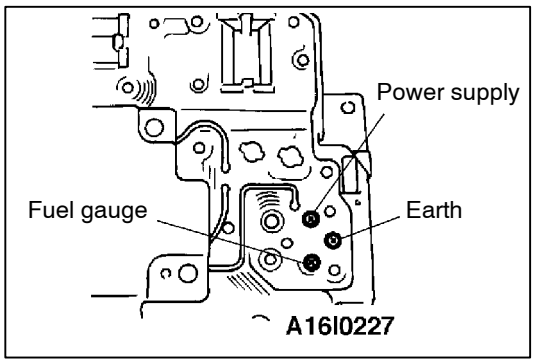
NOTE
*: If the engine-ECU is replaced, the ignition key ring antenna and immobilizer-ECU and ignition key should be replaced together with it.
Each engine-ECU has an individual information for immobilizer-ECU, and the individual information is registered in the immobilizer-ECU.

COMBINATION METERS

GENERAL

OUTLINE OF CHANGES

The following service procedures have been added to correspond to the introduction of the high-contrast meter.



COMBINATION METERS

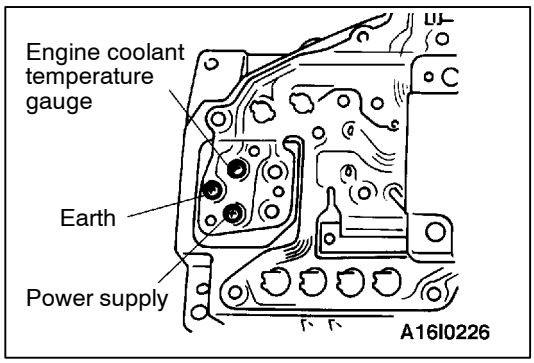
INSPECTION

FUEL GAUGE RESISTANCE CHECK

1. Remove the power supply tightening screw.
2. Use an ohmmeter to measure the resistance value between the terminals.

Standard value:
Power supply – Earth: 97.5 Ω
Power supply – Fuel gauge: 54.5 Ω
Fuel gauge – Ground: 93.5 Ω

Caution
When inserting the testing probe into the power supply terminal, be careful not to touch the printed board.



ENGINE COOLANT TEMPERATURE GAUGE RESISTANCE CHECK

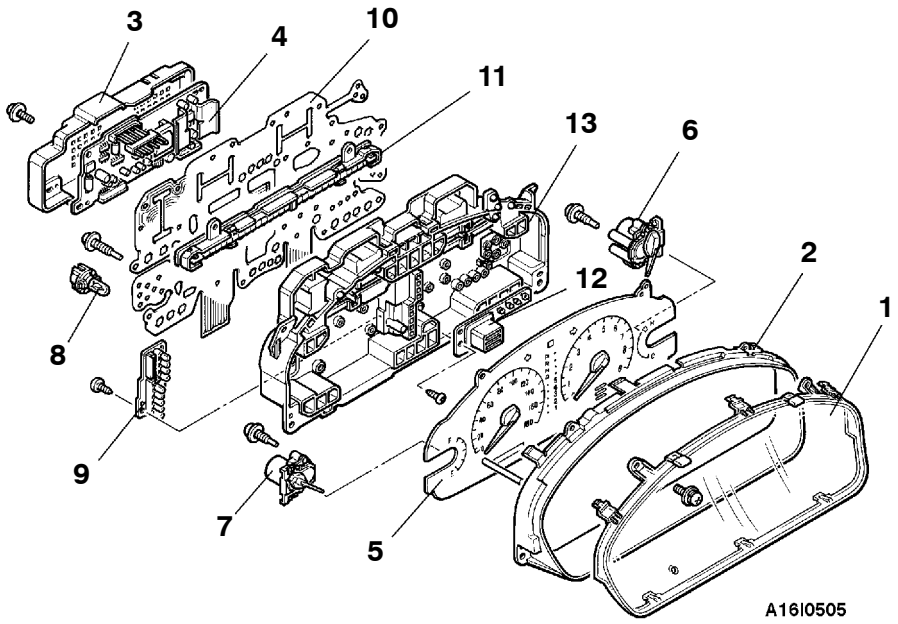
1. Remove the power supply tightening screw.
2. Use an ohmmeter to measure the resistance value between the terminals.

Standard value:
Power supply – Earth: 97.5 Ω
Power supply – Engine coolant temperature gauge: 54.0 Ω
Engine coolant temperature gauge – Earth: 150.8 Ω

Caution
When inserting the testing probe into the power supply terminal, be careful not to touch the printed board.

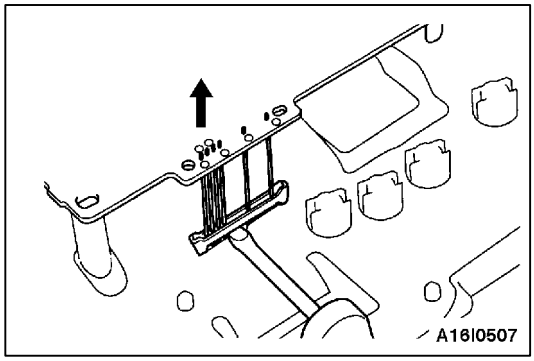
COMBINATION METERS

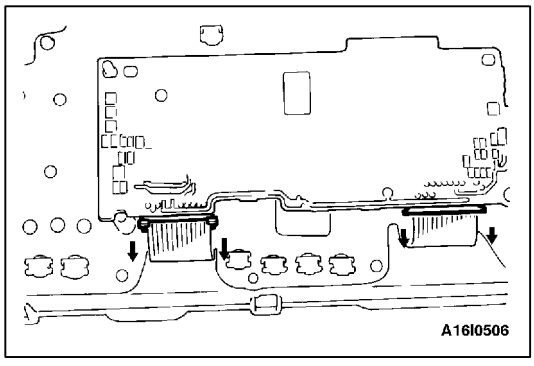
DISASSEMBLY AND REASSEMBLY



Disassembly steps

1. Combination meter glass
2. Combination meter window plate
3. Combination meter case
◀A▶ 4. Printed circuit board
5. Combination meter assembly
6. Water temperature gauge
7. Fuel gauge
◀B▶ 8. Bulb
9. Printed circuit board
10. Printed circuit board
11. Printed circuit board
12. Printed circuit board
13. Combination meter case

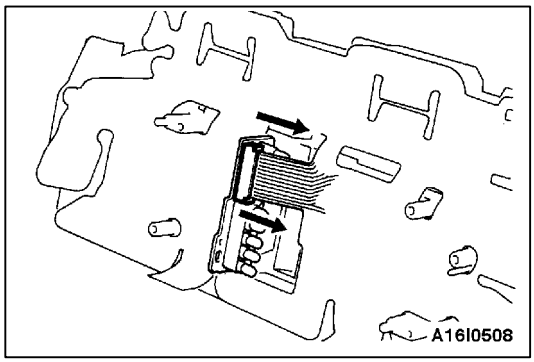




DISASSEMBLY SERVICE POINTS

◀A▶ PRINTED CIRCUIT BOARD REMOVAL

1. Wrap the end of a thin flat-tipped screwdriver by plastic tape, and then use it to unlock the connector at the top of the printed circuit board.
2. Unlock the connector at the bottom of the printed circuit board.
3. Remove the printed circuit board.



◀B▶ PRINTED CIRCUIT BOARD REMOVAL

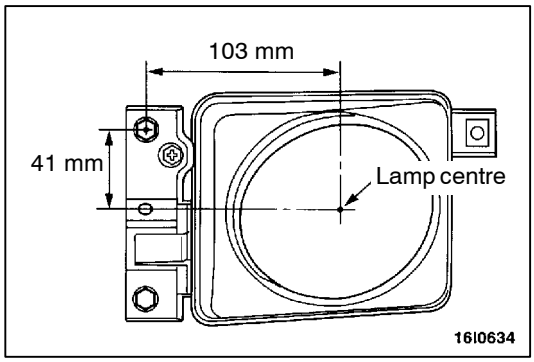
1. Remove the retaining screws, and then withdraw the printed circuit board.
2. Unlock the printed circuit board connector.
3. Remove the printed circuit board.

FRONT FOG LAMP

GENERAL

OUTLINE OF CHANGES

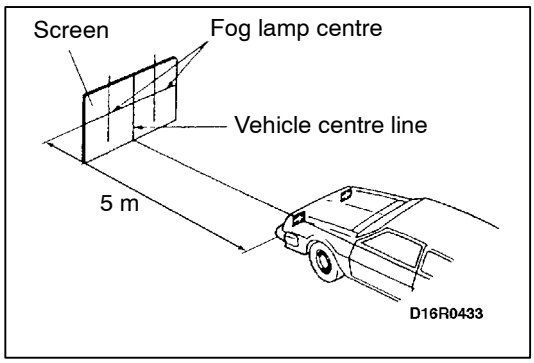
The following service procedures have been changed to the modification on the fog lamp.



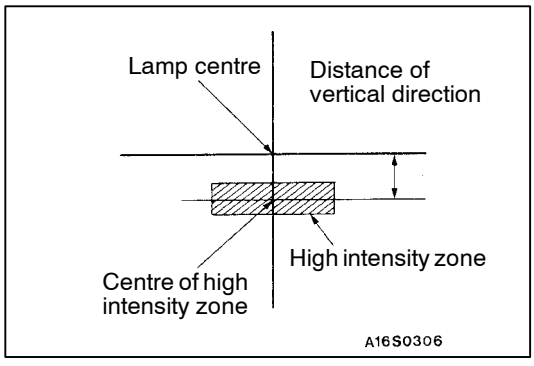
ON-VEHICLE SERVICE

FRONT FOG LAMP AIMING

1. Measure the centre of the fog lamps, as shown in the illustration.

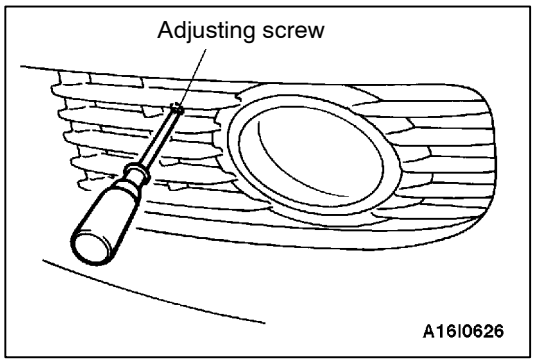


2. Set the distance between the screen and the centre of the fog lamps as shown in the illustration.
3. Inflate the tyres to the specified pressures and there should be no other load in the vehicles other than driver or substituted weight of approximately 75 kg placed in the driver's position.
4. With the engine running at 2,000 r/min, aim the fog lamp.



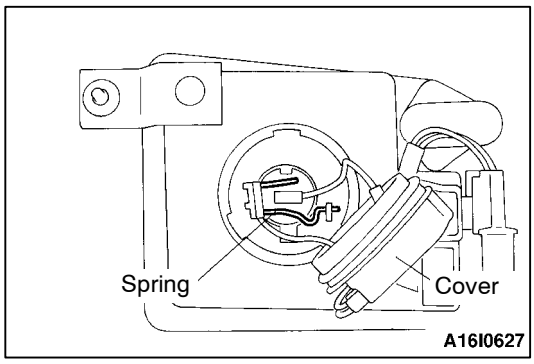
5. Check if the beam shining onto the screen is at the standard value.

Standard value:
(Vertical direction)
100 mm below horizontal (H)
(Horizontal direction)
Parallel to direction of vehicle travel



NOTE
The horizontal direction is non-adjustable. If the deviation of the light beam axis exceeds the standard value, check to be sure that the mounting location or some other point is not defective.

Caution
When making the aiming adjustment, be sure to mask those lamps which are not being adjusted.



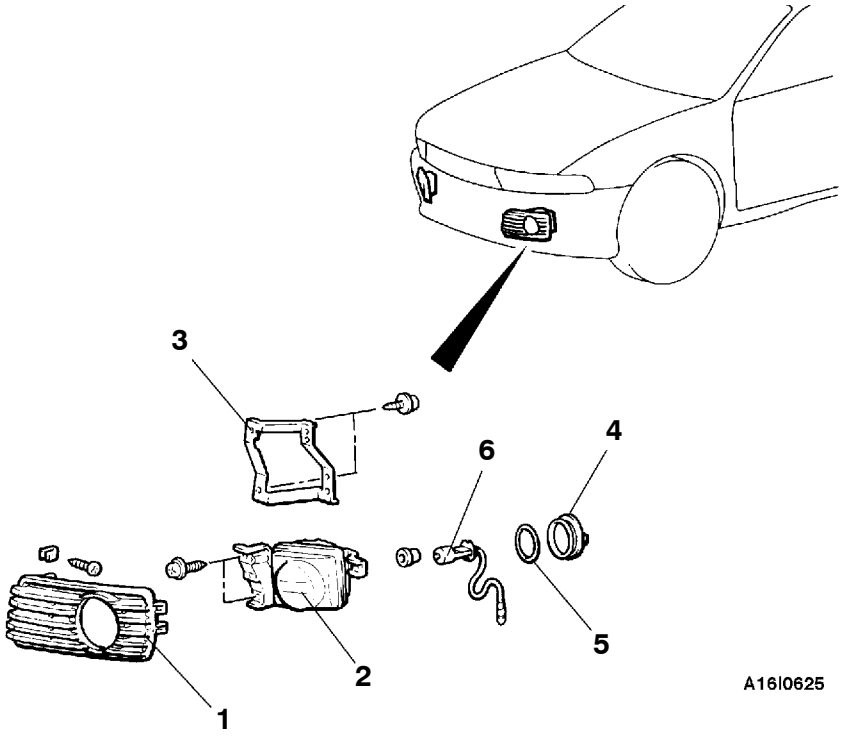
BULB REPLACEMENT

1. Remove the fog lamp bezel.
2. Remove the fog lamp unit.
3. Undo the fog lamp cover.
4. Unhook the spring which secure the bulb and then remove the bulb.

Caution
Do not touch the surface of the bulb with hands or dirty gloves. If the surface does become dirty, clean it with alcohol or thinner, and let it dry thoroughly before installing.

FRONT FOG LAMP

REMOVAL AND INSTALLATION



Removal steps

1. Fog lamp bezel
2. Fog lamp
3. Fog lamp bracket
4. Cover
5. Packing
6. Fog lamp bulb

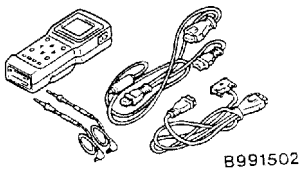
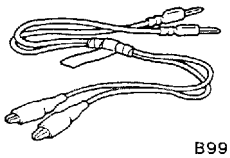
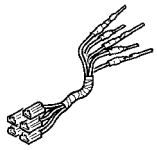
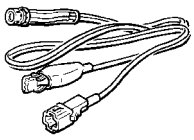
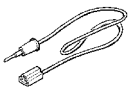
ROOM LAMP

GENERAL

OUTLINE OF CHANGES

The following service procedures have been added as the room lamp dimming function has been added to the ETACS functions.

SPECIAL TOOLS

Tool	Number	Name	Use
 B991502	MB991502	MUT-II sub assembly	ETACS-ECU input check
 B991529	MB991529	Diagnosis code check harness	ETACS-ECU input check
A  B  C  D  C991223	MB991223 A: MB991219 B: MB991220 C: MB991221 D: MB991222	Harness set A: Test harness B: LED harness C: LED harness adapter D: Probe	ETACS-ECU terminal voltage measurement A: Connector pin contact pressure inspection B: Power circuit inspection C: Power circuit inspection D: Commercial tester connection

TROUBLESHOOTING

DIAGNOSIS FUNCTION

INPUT SIGNAL INSPECTION PROCEDURE

1. Connect the MUT-II or a voltmeter to the diagnosis connector to check input signal.
2. The following input signals can be checked:
   - Door switch
   - Ignition switch
   - Key reminder switch
   - Keyless entry transmitter (LOCK, UNLOCK)

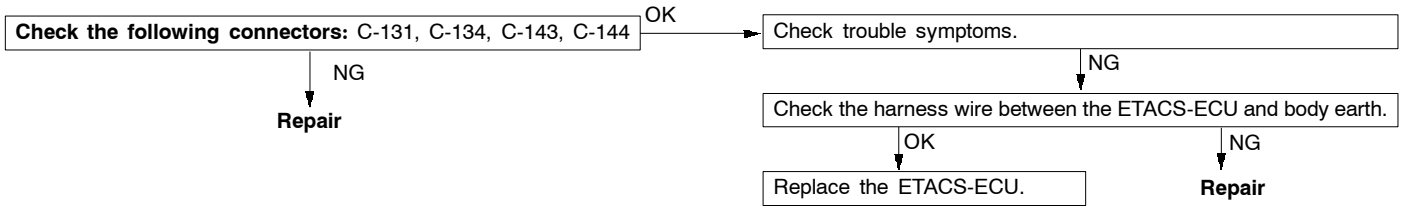
   NOTE
   If all the input signals cannot be check by using the MUT-II, the diagnosis circuit may be defective.

INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble symptoms	Inspection procedure	Reference page
When all the doors is closed, the room lamp is switched off immediately, but does not fade out.	1	54-13
When a door is opened with the room lamp switch in the DOOR position, the room lamp does not illuminate.	2	54-14
When the ignition switch is turned to the ON position while the room lamp is fading out, the room lamp is not switched off (However, the room lamp will be switched off after fading out).	3	54-14
The room lamp can not be switched off (However, it is switched off when the room lamp switch is set to the OFF position).	4	54-15

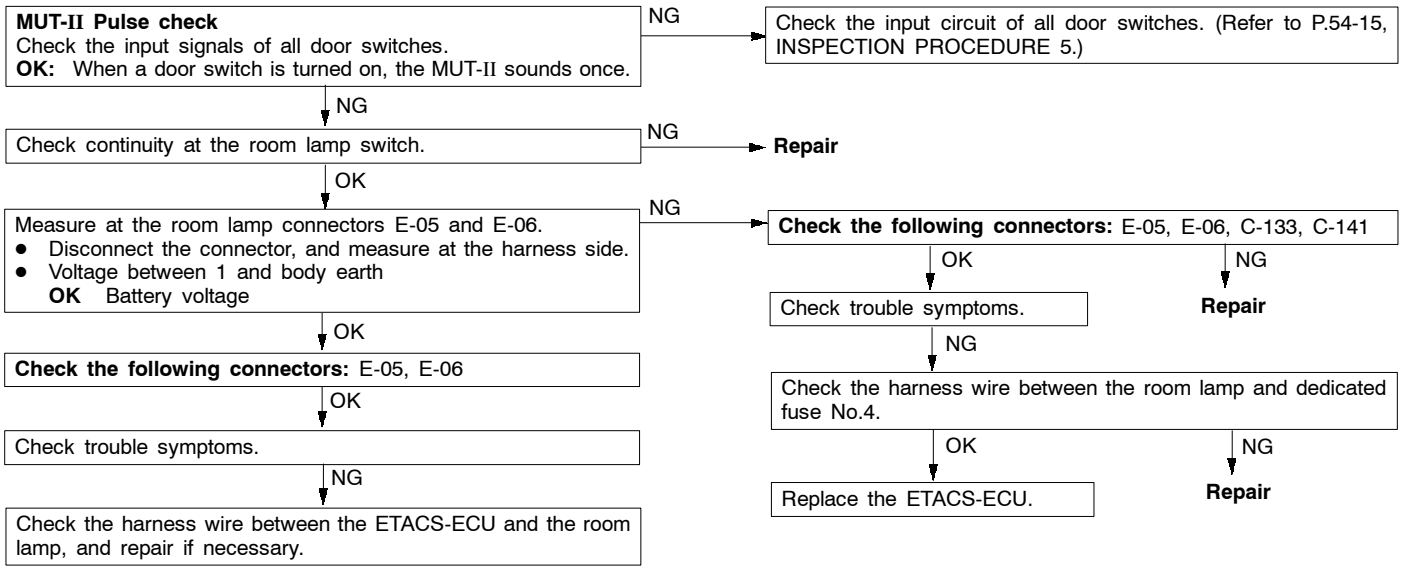
INSPECTION PROCEDURE 1

When all the doors is closed, the room lamp is switched off immediately, but does not fade out.	**Probable cause**
The harness wire in the earth circuit or the ETACS-ECU can be defective.	• Malfunction of harness or connector • Malfunction of ETACS-ECU



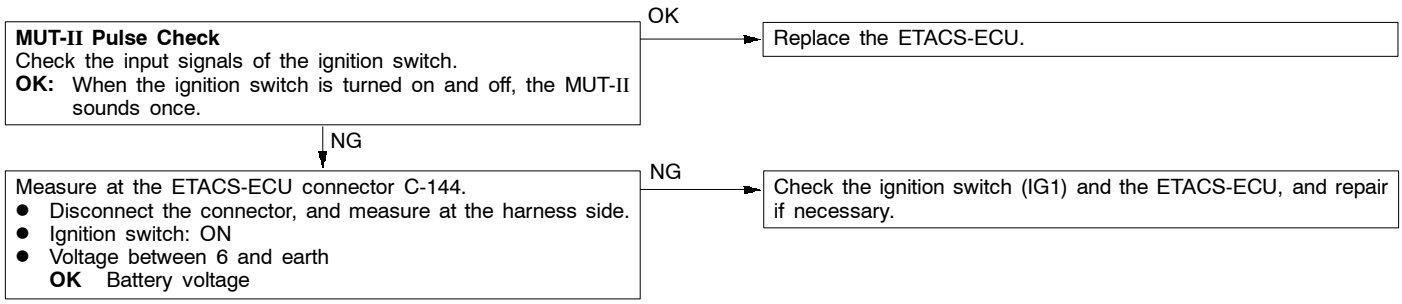
INSPECTION PROCEDURE 2

When a door is opened with the room lamp switch in the DOOR position, the room lamp does not illuminate.	Probable cause
The door switch circuit of all doors or the room lamp illumination circuit can be defective.	• Malfunction of room lamp • Malfunction of harness or connector • Malfunction of ETACS-ECU



INSPECTION PROCEDURE 3

When the ignition switch is turned to the ON position while the room lamp is fading out, the room lamp is not switched off (However, the room lamp will be switched off after fading out).	Probable cause
The ignition circuit or the ETACS-ECU can be defective. In addition, a defective fuse can cause a malfunction in the indicator lamp in the combination meter or a short in the harness wire.,	• Malfunction of fuse • Malfunction of connector • Malfunction of harness • Malfunction of ETACS-ECU



INSPECTION PROCEDURE 4

The room lamp can not be switched off (However, it is switched off when the room lamp switch is set to the OFF position.	Probable cause
A short in the harness wire can be present, or a door switch can be defective.	• Malfunction of door switch • Malfunction of harness

Measure at J/B connector C-143.
- Disconnect the connector, and measure at the harness side.
- Ignition switch: ON
- Door switch: ON (door open)
- Continuity between 1 and earth

OK Continuity

OK → When the connector of a door switch is disconnected, does the room lamp illuminate?
- NO → Check the harness wire between the J/B and the door switch, and repair if necessary.
- YES → **Replace the door switch.**

NG → Check the harness wire between the J/B and the room lamp, and repair if necessary.

INSPECTION PROCEDURE 5

Check the input circuit of all door switches.

MUT-II Pulse Check
Check the input signals of all door switches.
OK: When a closed door is opened, the MUT-II sounds once.

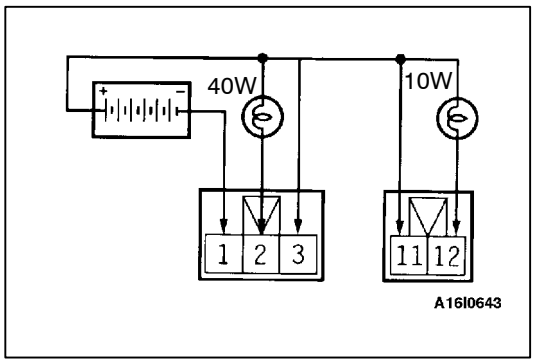
NG → **Check the following connectors:**
E-08, E-19, G-09, G-16, G-28, G-32, C-119, C-123, C-143, C-144
- OK → Check trouble symptoms.
  - NG → Check the ETACS-ECU and each door harness wire.
    - OK → Check trouble symptoms.
      - NG → Replace the ETACS-ECU.
      - OK → **Repair**
    - NG → **Repair**
- NG → **Repair**

RHEOSTAT

GENERAL

OUTLINE OF CHANGES

The following inspection procedure has been added to correspond to the change on the rheostat <Vehicles with high-contrast meter>.



RHEOSTAT

INSPECTION

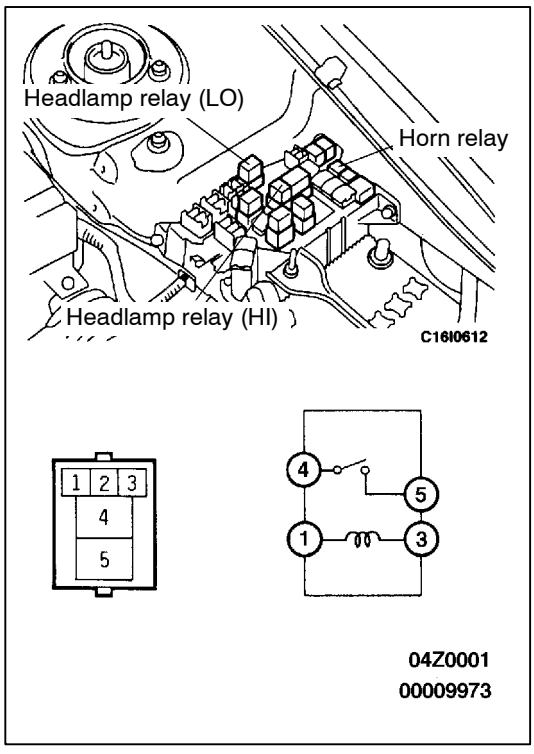
1. Connect the battery and the test bulbs (40W and 10W) as shown in the illustration.
2. Operate the rheostat, and if the brightness changes smoothly without switching off, then the rheostat function is normal.

RELAY

GENERAL

OUTLINE OF CHANGES

The following inspection procedure has been added to correspond to the relocation of the horn relay and the addition of the headlamp relays (LO and HI).



RELAY

INSPECTION

HEADLAMP RELAY (LO), (HI) AND HORN RELAY CHECK

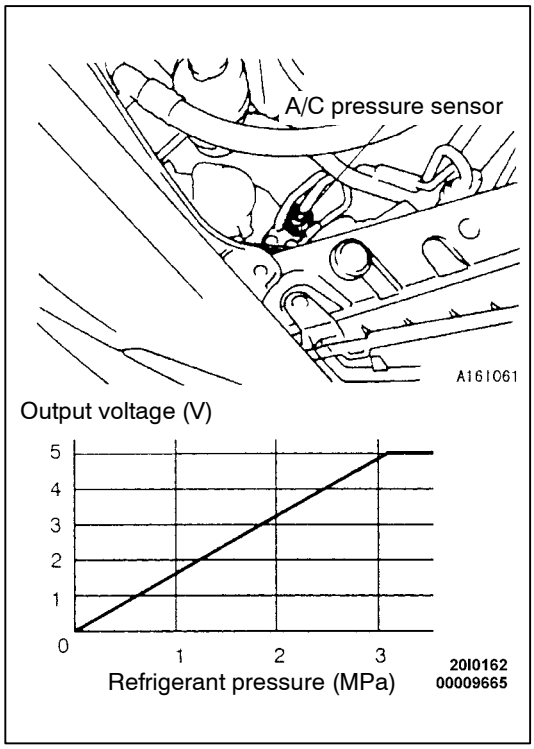
Battery voltage	Terminal No.			
	1	3	4	5
Supplied	⊕	⊖	○	○
Not supplied	○	○		

GROUP 55
HEATER, AIR CONDITIONER AND VENTILATION

GENERAL

OUTLINE OF CHANGE

The following service procedures have been added to correspond to the addition of the GDI engine models.



ON-VEHICLE SERVICE <GDI>

A/C PRESSURE SENSOR CHECK

1. Install a vacuum gauge to the high-pressure service valve.
2. Start the engine, and turn on the A/C switch.
3. Confirm that the relationship between the A/C pressure sensor output voltage and the refrigerant pressure meets the graph.

   NOTE
   Permissible range should be ±10%.

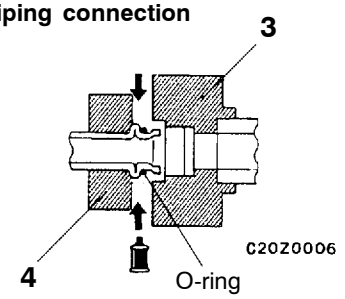
COMPRESSOR AND TENSION PULLEY <GDI>

REMOVAL AND INSTALLATION

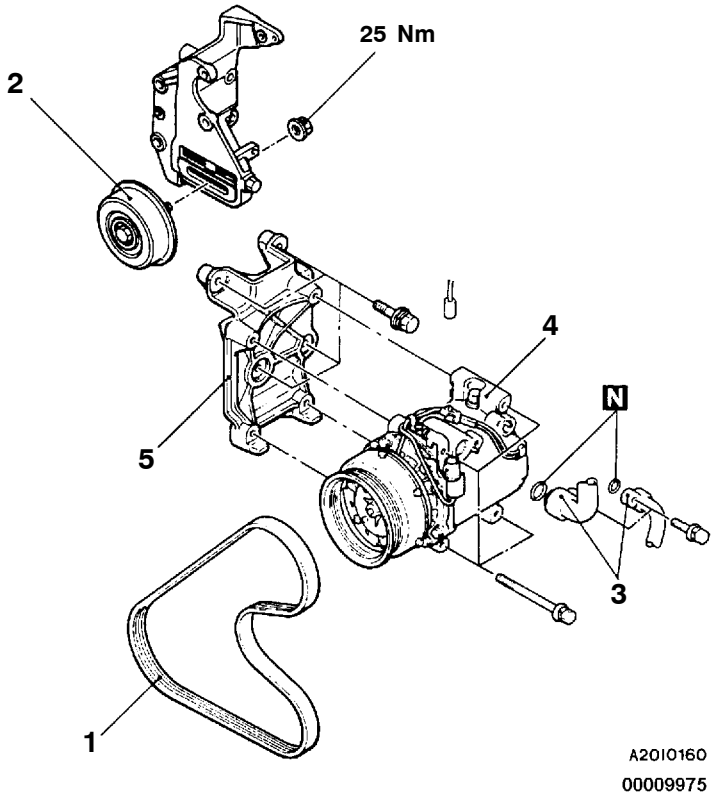
Pre-removal Operation
- Discharging of Refrigerant

Post-installation Operation
- Drive Belt Tension Adjustment
- Changing of Refrigerant

Piping connection



Compressor oil: SUN PAG 56



Removal steps

- Under cover
- Condenser fan motor

◀A▶ 1. Drive belt
2. Tension pulley
◀B▶ 3. Hose connections
◀C▶ ▶A◀ 4. Compressor
5. Compressor bracket

NOTE
The service points are the same as before.