MITSUBISHI MOTORS

1998

MONTERO

SERVICE MANUAL

VOLUME 1

Service Manual

MONTERO

1998
Volume 1

FOREWORD

This Service Manual has been prepared with the latest service information available at the time of publication. It is subdivided into various group categories and each section contains diagnosis, disassembly, repair, and installation procedures along with complete specifications and tightening references. Use of this manual will aid in properly performing any servicing necessary to maintain or restore the high levels of performance and reliability designed into these outstanding vehicles.

GROUP INDEX

00109001196

NOTE:
For information on all service manual groups not listed above, please refer to Volume 2.

MITSUBISHI MOTOR SALES OF AMERICA, Inc.

Printed in U.S.A.

WARNINGS REGARDING SERVICING OF SUPPLEMENTAL RESTRAINT SYSTEM (SRS) EQUIPPED VEHICLES

WARNING!

(1) **Improper service or maintenance of any component of the SRS, or any SRS-related component, can lead to personal injury or death to service personnel (from inadvertent firing of the air bag) or to the driver and passenger (from rendering the SRS inoperative).**

(2) **If it is possible that the SRS components are subjected to heat over 93°C (200°F) in baking or in drying after painting, remove the SRS components (air bag module, SRS diagnosis unit, front impact sensors) beforehand.**

(3) **Service or maintenance of any SRS component or SRS-related component must be performed only at an authorized MITSUBISHI dealer.**

(4) **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

Section titles with the asterisks (*) in the table of contents in each group indicate operations requiring warnings.

GENERAL

CONTENTS

00109000904

GENERAL
<BODY AND CHASSIS>

CONTENTS

00109001202

HOW TO USE THIS MANUAL

00100010364

MAINTENANCE, REPAIR AND SERVICING EXPLANATIONS

This manual provides explanations, etc. concerning procedures for the inspection, maintenance, repair and servicing of the subject model. Unless otherwise specified, each service procedure covers all models. Procedures covering specific models are identified by the model codes, or similar designation (engine type, transaxle type, etc.). A description of these designations is covered in this manual under "VEHICLE IDENTIFICATION".

SERVICE ADJUSTMENT PROCEDURES

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

SERVICE PROCEDURES

The service steps are arranged in numerical order. Attention must to be paid in performing vehicle service are described in detail in SERVICE POINTS.

TERMS DEFINITION

STANDARD VALUE

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

LIMIT

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

REFERENCE VALUE

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

CAUTION

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

TIGHTENING TORQUE INDICATION

The tightening torque shown in this manual is a basic value with a tolerance of ± 10% except the following cases when the upper and lower limits of tightening torque are given.

(1) The tolerance of the basic value is within ± 10%.
(2) Special bolts or the like are in use.
(3) Special tightening methods are used.

SPECIAL TOOL NOTE

Only MMC special tool part numbers are called out in the repair sections of this manual. Please refer to the special tool cross reference chart, which is located in the service manual at the beginning of each group, for a cross reference from the MMC special tool number to the special tool number that is available in your market.

MODEL INDICATIONS

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

A/T: Indicates automatic transmission, or models equipped with automatic transmission.
MFI: Indicates multiport fuel injection, or engines equipped with multiport fuel injection.
A/C: Indicates air conditioning.
3.5L Engine: Indicates the 3.5 dm^3 (213.4 cu.in.) <6G74> engine, or a model equipped with such an engine.

EXPLANATION OF MANUAL CONTENTS

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

Component Diagram

A diagram of the component parts is provided near the front of each section in order to give the reader a better understanding of the installed condition of component parts.

Indicates (by symbols) where lubrication is necessary.

Maintenance and Servicing Procedures

The numbers provided within the diagram indicate the sequence for maintenance and servicing procedures.

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

Classifications of Major Maintenance / Service points

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

◀A▶ : Indicates that there are essential points for removal or disassembly.

▶A◀ : Indicates that there are essential points for installation or reassembly.

Symbols for Lubrication, Sealants and Adhesives

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

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

 : Sealant or adhesive

 : Brake fluid or automatic transmission fluid

 : Engine oil, gear oil or air conditioner compressor oil

 : Adhesive tape or butyl rubber tape

TSB Revision

Indicates the group title.

Indicates the section title.

Indicates the group number.

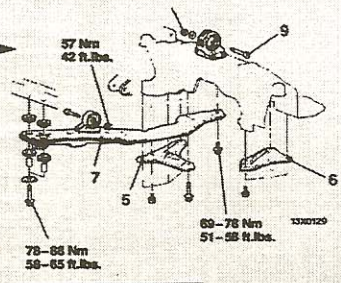
Indicates the page number.

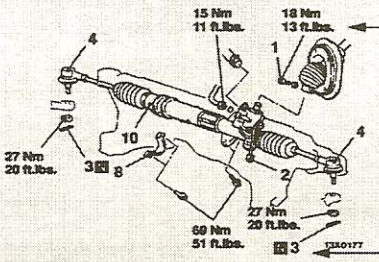
STEERING – Power Steering Gear Box 37A-23

POWER STEERING GEAR BOX

REMOVAL AND INSTALLATION

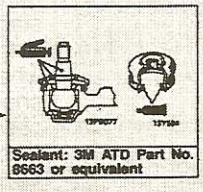
Pre-removal Operation
- Power Steering Fluid Draining (Refer to P.37A-15.)
- Stabilizer Bar Removal (Refer to GROUP 33A – Stabilizer Bar)





Denotes tightening torque.

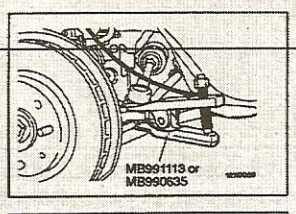
Denotes non-reusable part.


Sealant: 3M ATD Part No. 8663 or equivalent


Steering gear seal kit

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

Removal steps
1. Joint assembly and gear box connecting bolt
2. Solenoid valve connector <Vehicles with EPS>
3. Cotter pin
4. Connection for tie-rod end and knuckle
5. Stay (L.H.)
6. Stay (R.H.)
7. Center member assembly
8. Clamp
9. Bolt
10. Gear box assembly

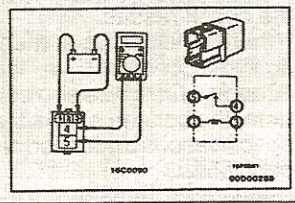


REMOVAL SERVICE POINTS

◀A▶ TIE-ROD END DISCONNECTION

Caution
1. Be sure to tie the cord of the special tool to the nearby part.
2. Loosen the nut but do not remove it.

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



FOG LIGHT RELAY CONTINUITY CHECK

Battery voltage	Terminal			
	1	3	4	5
Power is not supplied	○	○		
Power is supplied	⊕	⊖	○	○

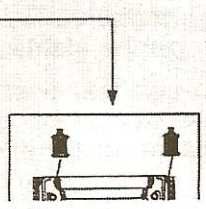
○—○ indicates that there is continuity between the terminals.
⊕—⊖ indicates terminals to which battery voltage is applied.

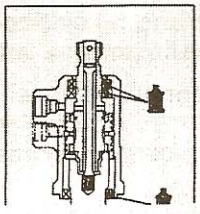
37A-28 STEERING – Power Steering Gear Box

LUBRICATION AND SEALING POINTS

<Conventional power steering gear box>

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

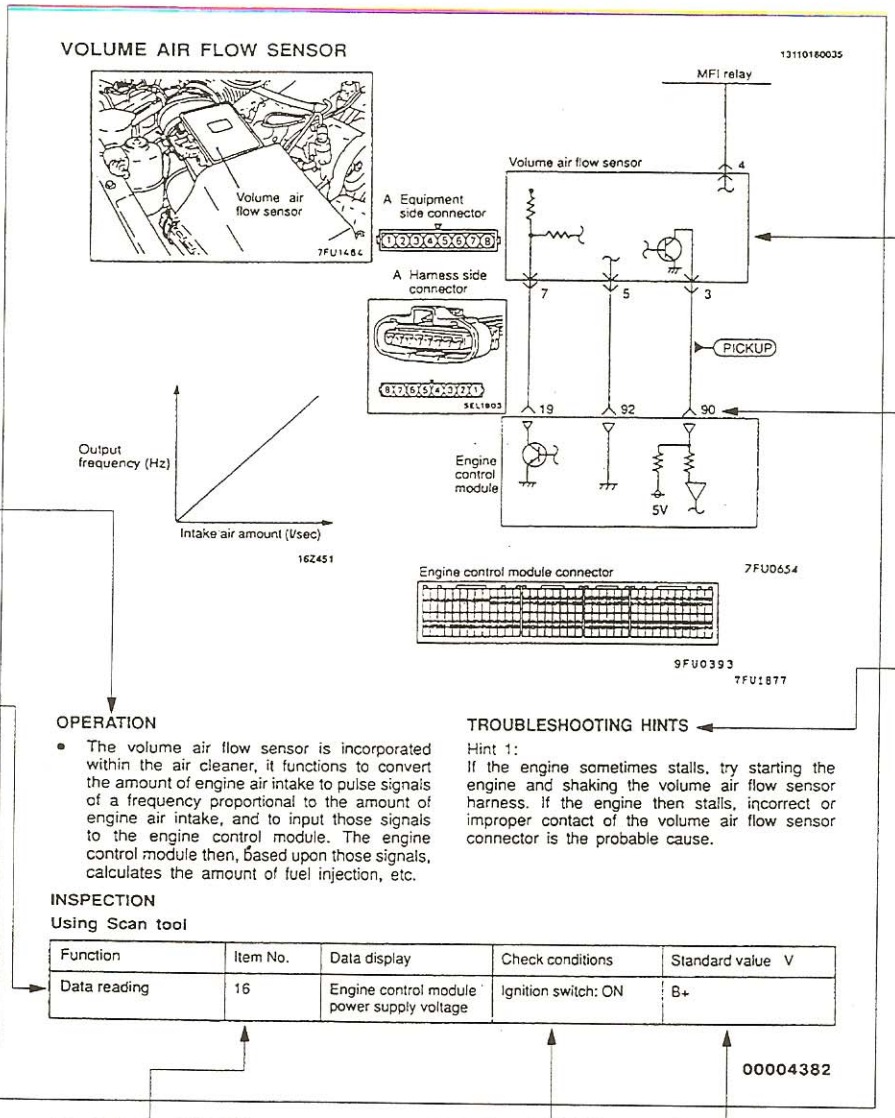





Fluid: Automatic transmission fluid "DEXRON II"

TSB Revision

EXPLANATION OF THE TROUBLESHOOTING GUIDE



Indicates the circuit diagram for checking.

Indicates a connector terminal number.

Provides the necessary description of circuit operation for basic understanding.

Provides hints (including standards for judgement) when troubleshooting procedures are followed.

Indicates the check to be made.

OPERATION

- The volume air flow sensor is incorporated within the air cleaner, it functions to convert the amount of engine air intake to pulse signals of a frequency proportional to the amount of engine air intake, and to input those signals to the engine control module. The engine control module then, based upon those signals, calculates the amount of fuel injection, etc.

TROUBLESHOOTING HINTS

Hint 1:
If the engine sometimes stalls, try starting the engine and shaking the volume air flow sensor harness. If the engine then stalls, incorrect or improper contact of the volume air flow sensor connector is the probable cause.

INSPECTION

Using Scan tool

Function	Item No.	Data display	Check conditions	Standard value V
Data reading	16	Engine control module power supply voltage	Ignition switch: ON	B+

00004382

Indicates the item to be checked.

Indicates the conditions under which the check should be made.

Indicates the specification to be used for judgement of the check results.
If there is no particular mention of conditions in the "Check Conditions" column, the column shows the specifications under normal conditions.

TSB Revision

HOW TO USE TROUBLESHOOTING/INSPECTION SERVICE POINTS

00100020053

Troubleshooting of electronic control systems for which the scan tool can be used follows the basic outline described below. Furthermore, even in systems for which the scan tool cannot be used, part of these systems still follow this outline.

TROUBLESHOOTING CONTENTS

1. **STANDARD FLOW OF DIAGNOSTIC TROUBLESHOOTING**

   The main procedures for diagnostic troubleshooting are shown.

2. **SYSTEM OPERATION AND SYMPTOM VERIFICATION TESTS**

   If verification of the trouble symptoms is difficult, procedures for checking operation and verifying trouble symptoms are shown.

3. **DIAGNOSTIC FUNCTION**

   The following diagnostic functions are shown.
   - Method of reading diagnostic trouble codes
   - Method of erasing diagnostic trouble codes
   - Input inspection service points

4. **INSPECTION CHART FOR DIAGNOSTIC TROUBLE CODES**

5. **INSPECTION PROCEDURE FOR DIAGNOSTIC TROUBLE CODES**

   Indicates the inspection procedures corresponding to each diagnostic trouble code. (Refer to P.00-9.)

6. **INSPECTION CHART FOR TROUBLE SYMPTOMS**

   If there are trouble symptoms, even though the results of inspection using the scan tool show that all diagnostic trouble codes are normal, inspection procedures for each trouble symptom will be found by means of this chart.

7. **INSPECTION PROCEDURE FOR DIAGNOSTIC SYMPTOM**

   Indicates the inspection procedures corresponding to each trouble symptoms classified in the Inspection Chart for Trouble Symptoms. (Refer to P.00-9.)

8. **SERVICE DATA REFERENCE TABLE**

   Inspection items and normal judgement values have been provided in this chart as reference information.

9. **CHECK AT ECU TERMINALS**

   Terminal numbers for the ECU connectors, inspection items and standard values have been provided in this chart as reference information.

   Terminal Voltage Checks

   1. Connect a needle-nosed wire probe to a voltmeter probe.
   2. Insert the needle-nosed wire probe into each of the ECU connector terminals from the wire side, and measure the voltage while referring to the check chart.

      NOTE
      1. Measure voltage with the ECU connectors connected.
      2. You may find it convenient to pull out the ECU to make it easier to reach the connector terminals.
      3. Checks don't have to be carried out in the order given in the chart.

      Caution
      Short-circuiting the positive (+) probe between a connector terminal and ground could damage the vehicle wiring, the sensor, the ECU, or all three. Use care to prevent this !

   3. If voltage readings differ from Normal Condition values, check related sensors, actuators, and wiring, then replace or repair.
   4. After repair or replacement, recheck with the voltmeter to confirm that the repair has corrected the problem.

Terminal Resistance and Continuity Checks

1. Turn the ignition switch to off.
2. Disconnect the ECU connector.

   CAUTION: If resistance and continuity check are performed on the wrong terminals, damage to the vehicle wiring, sensors, ECU, and/or ohmmeter may occur. Use care to prevent this!

3. Measure the resistance and check for continuity between the terminals of the ECU harness-side connector while referring to the check chart.

   NOTE
   Checks don't have to be carried out in the order given in the chart.

   Caution
   If resistance and continuity checks are performed on the wrong terminals, damage to the vehicle wiring, sensors, ECU, and/or ohmmeter may occur. Use care to prevent this!

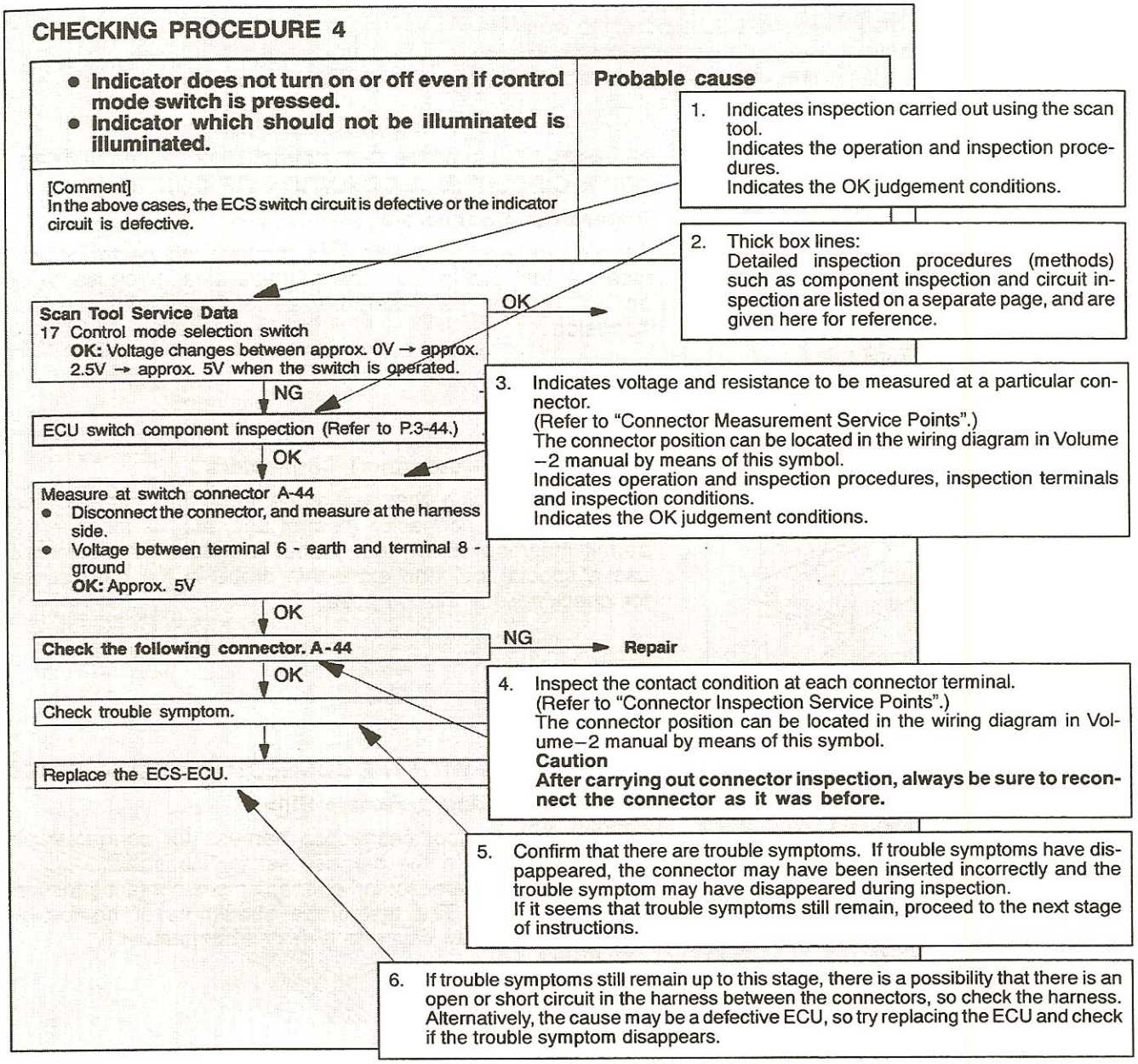
4. If the ohmmeter shows any deviation from the Normal Condition value, check the corresponding sensor, actuator and related electrical wiring, then repair or replace.
5. After repair or replacement, recheck with the ohmmeter to confirm that the repair has corrected the problem.

10. INSPECTION PROCEDURES USING AN OSCILLOSCOPE

When there are inspection procedures using an oscilloscope, these are listed here.

HOW TO USE THE INSPECTION PROCEDURES

The causes of a high frequency of problems occurring in electronic circuitry are generally the connectors, components, the ECU and the harnesses between connectors, in that order. These inspection procedures follow this order, and they first try to discover a problem with a connector or a defective component.



HARNESS INSPECTION

Check for an open or short circuit in the harness between the terminals which were defective according to the connector measurements. Carry out this inspection while referring to Volume 2 Electrical manual. Here, "Check harness between power supply and terminal xx" also includes checking for blown fuses. For inspection service points when there is a blown fuse, refer to "Inspection Service Points for a Blown Fuse."

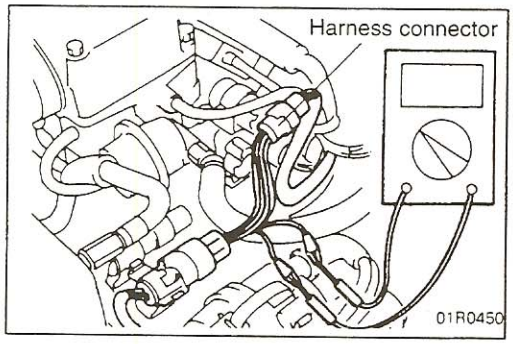
MEASURES TO TAKE AFTER REPLACING THE ECU

If the trouble symptoms have not disappeared even after replacing the ECU, repeat the inspection procedure from the beginning.

TSB Revision

CONNECTOR MEASUREMENT SERVICE POINTS

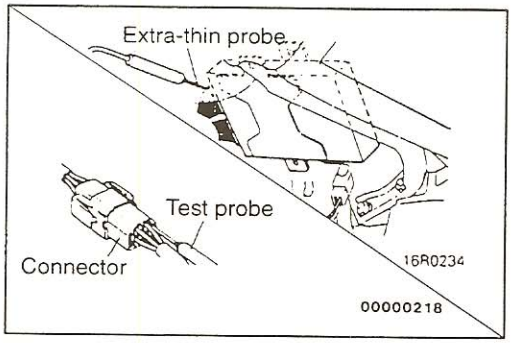
Turn the ignition switch to OFF when connecting disconnecting the connectors. Turn the ignition switch to ON when measuring if there are no instructions to the contrary.



IF INSPECTING WITH THE CONNECTOR CONNECTED (WITH CIRCUIT IN A CONDITION OF CONTINUITY)

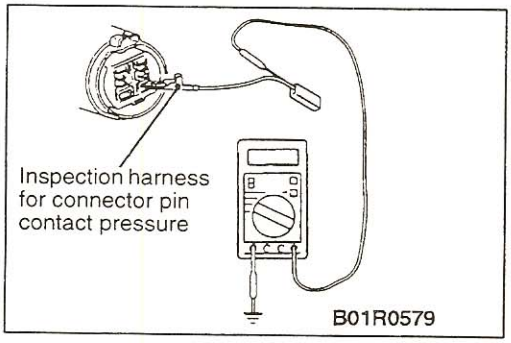
Waterproof Connectors

Be sure to use the special tool (harness connector). Never insert a test probe from the harness side, as this so will reduce the waterproof performance and result in corrosion.



Ordinary (non-waterproof) Connectors

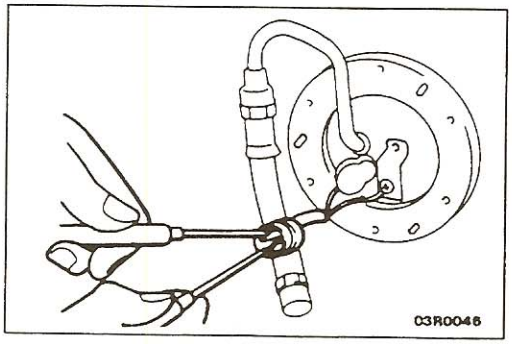
Check by inserting the test probe from the harness side. Note that if the connector (control unit, etc.) is too small to permit insertion of the test probe, it should not be forc use a special tool (the extra–thin probe in the harness for checking) for this purpose.



IF INSPECTING WITH THE CONNECTOR DISCONNECTED

<When Inspecting a Female Pin>

Use the special tool (inspection harness for connector pin contact pressure in the harness set for inspection).
The inspection harness for connector pin contact pressure should be used. The test probe should never be forcibly inserted, as it may cause a defective contact.



<When Inspecting a Male Pin>

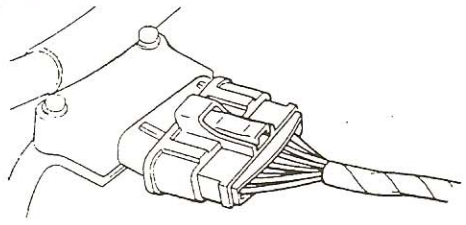
Touch the pin directly with the test bar.

Caution

At this time, be careful not to short the connector pins with the test probes. To do so may damage the circuits inside the ECU.

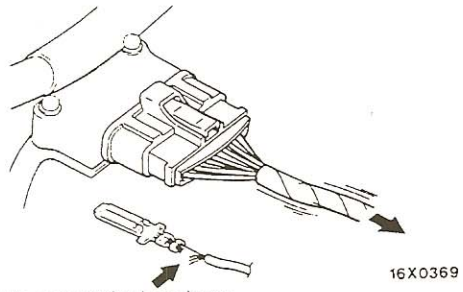
TSB Revision

Connector disconnected or improperly connected



16S0256

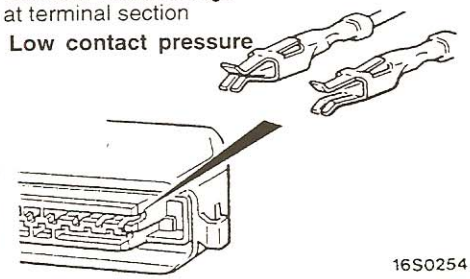
Defective connector contact



16X0369

Harness wire breakage at terminal section

Low contact pressure



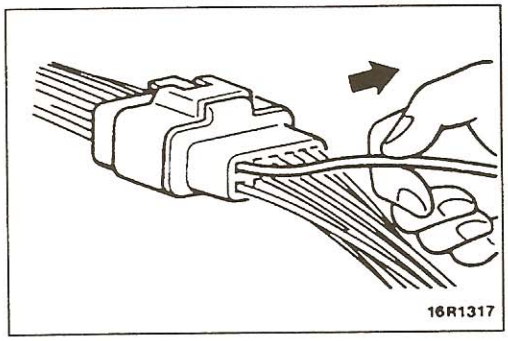
16S0254

00004381

CONNECTOR INSPECTION SERVICE POINTS

VISUAL INSPECTION

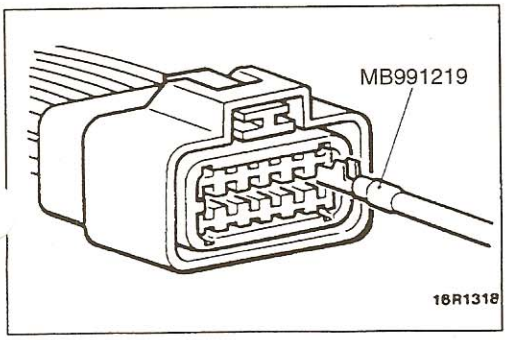
- Connector is disconnected or improperly connected
- Connector pins are pulled out
- Due to harness tension at terminal section
- Low contact pressure between male and female terminals
- Low connection pressure due to rusted terminals or foreign matter lodged in terminals



16R1317

CONNECTOR PIN INSPECTION

If the connector pin stopper is damaged, the terminal connections (male and female pins) will not be perfect even when the connector body is connected, because the pins may pull out of the back side of the connector. Therefore, gently pull the wires one by one to make sure that no pins pull out of the connector.



16R1318

CONNECTOR ENGAGEMENT INSPECTION

Use the special tool (connector pin connection pressure inspection harness of the inspection harness set) to inspect the engagement of the male pins and female pins. [Pin drawing force : 1 N (.2 lbs.) or more]

TSB Revision

HOW TO COPE WITH INTERMITTENT MALFUNCTIONS

Most intermittent malfunctions occur under certain conditions. If those conditions can be identified, cause will be easier to find.

TO COPE WITH INTERMITTENT MALFUNCTION;

1. **Ask the customer about the malfunction**

   Ask what it feels like, what it sounds like, etc. Then ask about driving conditions, weather, frequency of occurrence, and so on.

2. **Determine the conditions from the customer's responses**

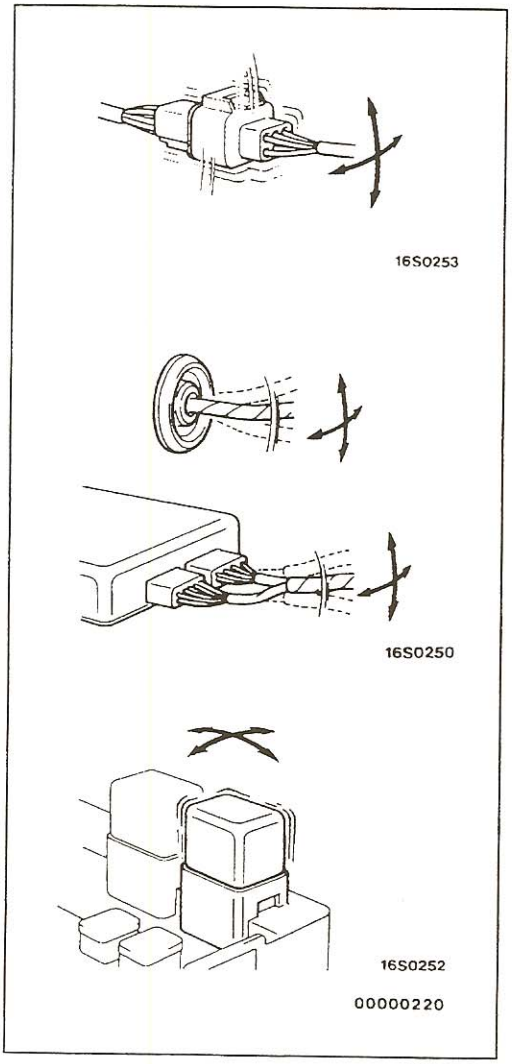
   Typically, almost all intermittent malfunctions occur from conditions like vibration, temperature and/or moisture change, poor connections. From the customer's replies, it should be reasoned which condition is influenced.

3. **Use simulation test**

   In the cases of vibration or poor connections, use the simulation tests below to attempt to duplicate the customer's complaint. Determine the most likely circuit(s) and perform the simulation tests on the connectors and parts of that circuit(s). Be sure to use the inspection procedures provided for diagnostic trouble codes and trouble symptoms.
   For temperature and/or moisture conditions related intermittent malfunctions, using common sense, try to change the conditions of the suspected circuit components, then use the simulation tests below.

4. **Verify the intermittent malfunction is eliminated**

   Repair the malfunctioning part and try to duplicate the condition(s) again to verify the intermittent malfunction has been eliminated.



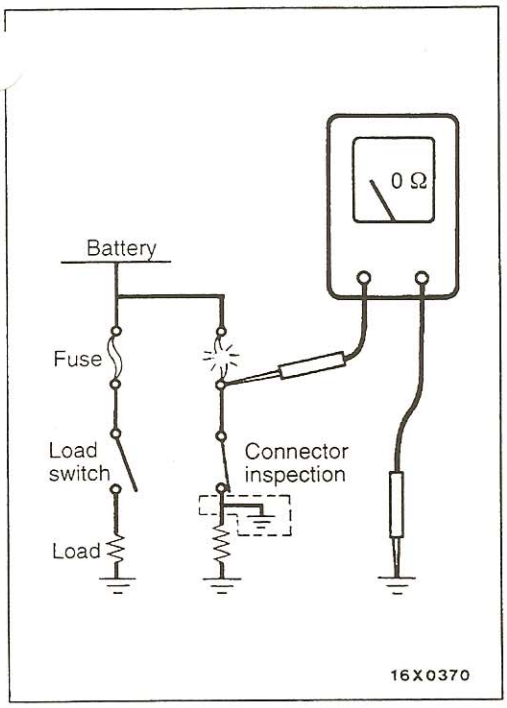
SIMULATION TESTS

For these simulation tests, shake, then gently bend, pull, and twist the wiring of each of these examples to duplicate the intermittent malfunction.

- Shake the connector up-and-down, and right-and-left.
- Shake the wiring harness up-and-down, and right-and-left.
- Vibrate the part or sensor.

NOTE
In case of difficulty in finding the cause of the intermittent malfunction, the data recorder function in the scan tool is effective.

TSB Revision

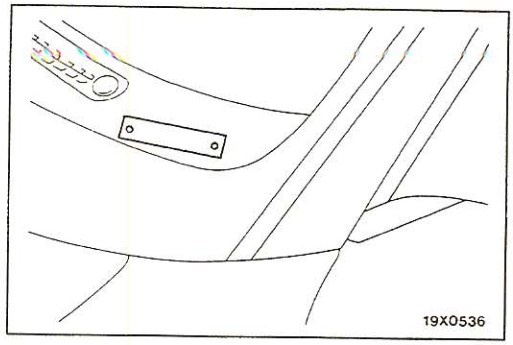


INSPECTION SERVICE POINTS FOR A BLOWN FUSE

Remove the fuse and measure the resistance between the load side of the fuse and ground. Set the switches of all circuits which are connected to this fuse to a condition of continuity. If the resistance is almost 0 Ω at this time, there is a short somewhere between these switches and the load. If the resistance is not 0 Ω, there is no short at the present time, but a momentary short has probably caused the fuse to blow.

The main causes of a short circuit are the following.

- Harness being clamped by the vehicle body
- Damage to the outer casing of the harness due to wear or heat
- Water getting into the connector or circuitry
- Human error (mistakenly shorting a circuit, etc.)

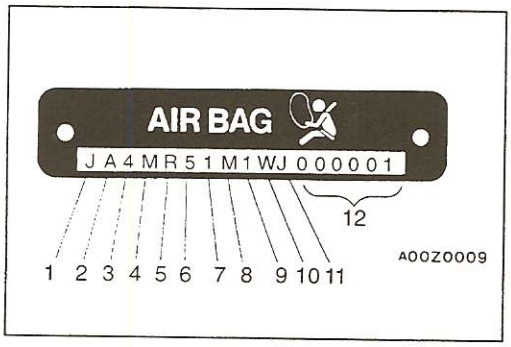


VEHICLE IDENTIFICATION

001000[illegible]2

VEHICLE IDENTIFICATION NUMBER LOCATION

The vehicle identification number (V.I.N.) is located on a plate attached to the left top side of the instrument panel.



VEHICLE IDENTIFICATION CODE CHART PLATE

All vehicle identification numbers contain 17 digits. The vehicle number is a code which tells country, make, vehicle type, etc.

No.	Items	Contents
1	Country	J; Japan
2	Make	A; Mitsubishi
3	Vehicle type	4; Multi-purpose vehicle
4	Others	M: 5001 – 6000lbs. and with hydraulic brakes
5	Line	R; MONTERO
6	Price class	5; Premium
7	Body	1; 5-door wagon
8	Engine	M; 3.5dm^3 (213.4 cu.in.)
9	Check digits *	0, 1, 2, 3, · · · · · 9, X
10	Model year	W; 1998 year
11	Plant	J; Nagoya – 3
12	Serial number	000001 to 999999

NOTE

* Check digit means a singls number or letter X used to verify the accuracy of transcription of vehicle identification number.

VEHICLE IDENTIFICATION NUMBER LIST

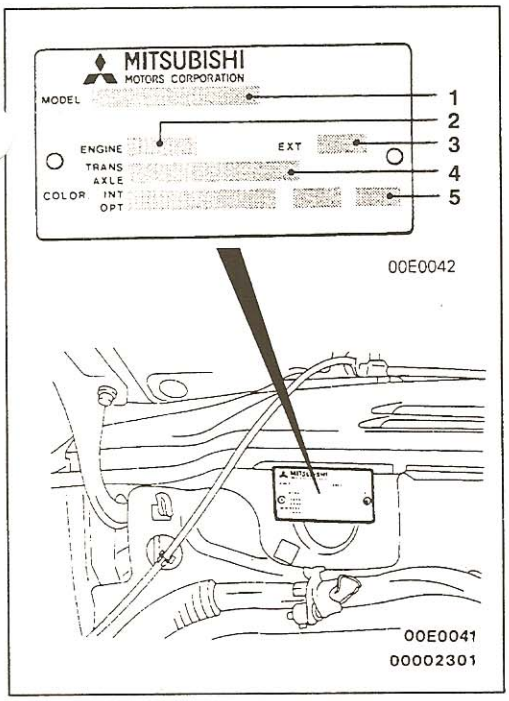
00100550118

EDERAL

V.I.N. (except sequence number)	Brand	Engine displacement	Model code
JA4MR51R_WJ	MITSUBISHI MONTERO	3,497 cm^3 (213.4 cu.in.)	V45WGRXVL2M

CALIFORNIA

V.I.N.(except sequence number)	Brand	Engine displacement	Model code
JA4MR51R_WJ	MITSUBISHI MONTERO	3,497 cm^3 (213.4 cu.in.)	V45WGRXVL7M



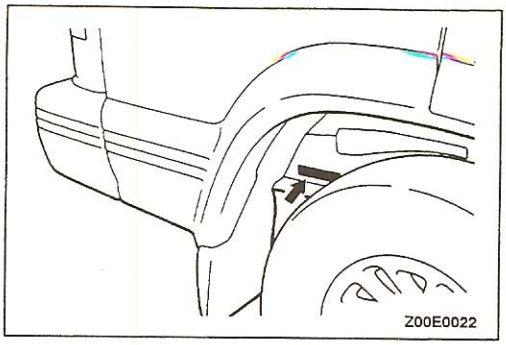
VEHICLE INFORMATION CODE PLATE

The vehicle information code plate is riveted onto the cowl top outer panel in the engine compartment.
The plate shows model code, engine model, transmission model and body color code.

No.	Items	Contents	
1	MODEL	V43WG RXEL2M	V43WG; Vehicle model
			RXEL2M; Model series
2	ENGINE	6G74	Engine model
3	EXT	CA6A	Exterior code
4	TRANS AXLE	V4AW3 4272	V4AW3; Transmission model
			4272; Rear differential reduction
5	COLOR, INT OPT	R25 87V 03V	R25; Body color code
			87V; Interior code
			03V; Equipment code

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

TSB Revision



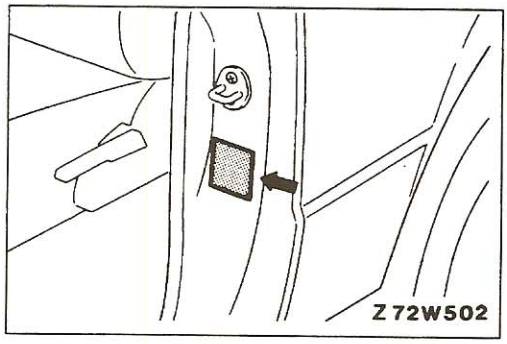
CHASSIS NUMBER

STAMPING LOCATION

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

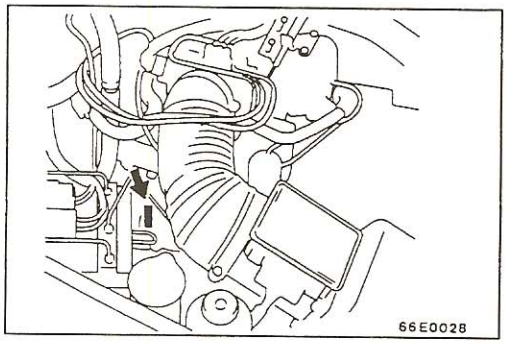
CHASSIS NUMBER CODE CHART

Chassis number code	Contents	
V45W NJ000001	V45; Vehicle line	V45; MONTERO (3.5dm^3 Engine)
	W; Body type	W; Wagon
	NJ000001; Refer to 10th thru 17th digits of V.I.N. plate	



VEHICLE SAFETY CERTIFICATION LABEL

The vehicle safety certification label is attached to the face of the left door pillar.
This label indicates the month and year of manufacture, Gr Vehicle Weight Rating (G.V.W.R.), front and rear Gross A... Weight Rating (G.A.W.R.), and Vehicle Identification Number (V.I.N.).



ENGINE MODEL STAMPING

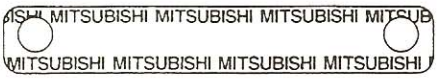
The engine model is stamped at the right rear of the top of the cylinder block.
These engine model numbers are as shown as follows.

Engine model	Engine displacement
6G74	3,497 cm^3 (213.4 cu.in.) <3.5L engine>

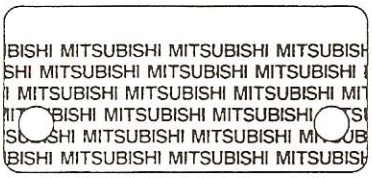
The engine serial number is stamped near the engine model number.

Theft protection plate (VIN plate)

For engine



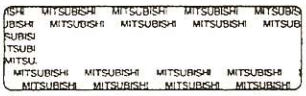
For transmission



Theft protection label

For main outer panels

[For original parts]



[For replacement parts]

00E0087

THEFT PROTECTION

In order to protect against theft, a Vehicle Identification Number (VIN) is attached as a plate or label to the following major parts of the engine and transmission, as well as main outer panels:

Engine cylinder block, Transmission housing. Fender, Doors, Quarter panel, Hood, Bumpers

In addition, a theft-protection label is attached to replacement parts for the body outer panel main components, and the same data are stamped into replacement parts for the engine and the transmission.

Cautions regarding panel repairs:

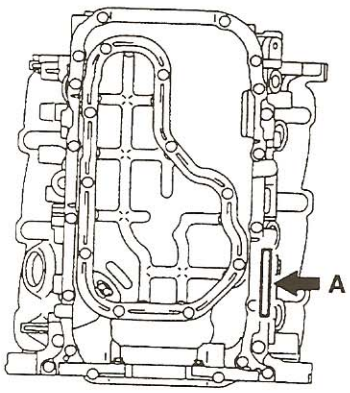
1. **When repainting original parts, do so after first masking the theft-protection label, and, after painting, be sure to peel off the masking tape.**
2. **The theft-protection label for replacement parts is covered by masking tape, so such parts can be painted as is. The masking tape should be removed after painting is finished.**
3. **The theft-protection label should not be removed from original parts or replacement parts.**

TSB Revision

LOCATIONS

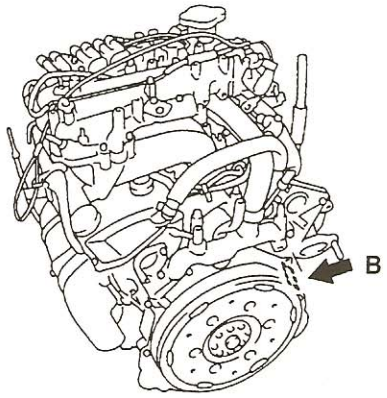
Target area (A: for original equipment parts, B: for replacement parts)

Engine



00E0095

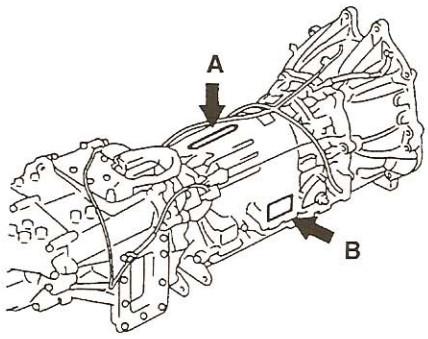
Engine underside



00E0096

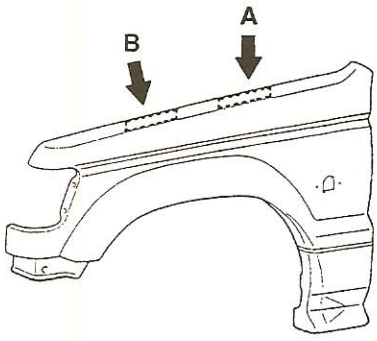
00005532

Automatic transmission



A00E0093

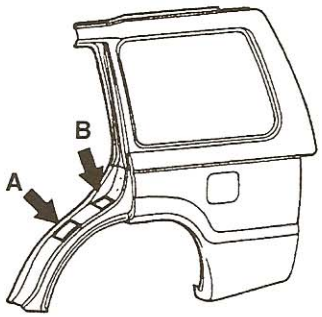
Fender



A00E0089

The illustration indicates left hand side, outer.
Right hand side is symmetrically opposite.

Quarter panel



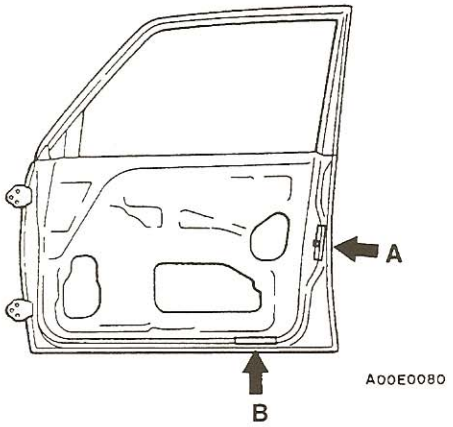
A00E0088

The illustration indicates left hand side, outer.
Right hand side is symmetrically opposite.

TSB Revision

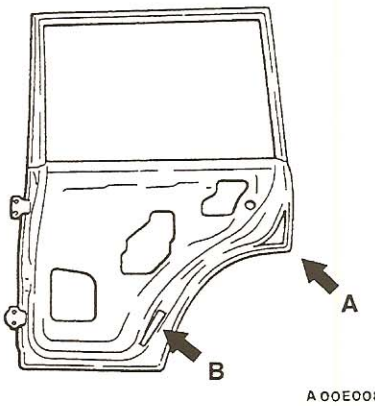
Target area (A: for original equipment parts, B: for replacement parts)

Front door



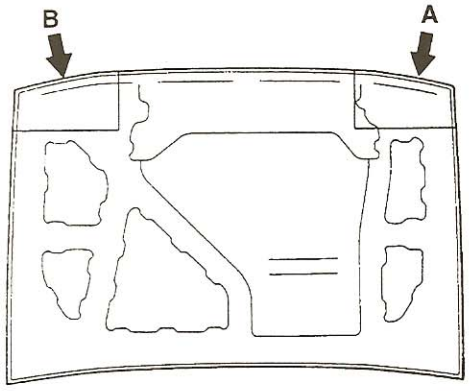
The illustration indicates right hand side, outer.
Left hand side is symmetrically opposite.

Rear door

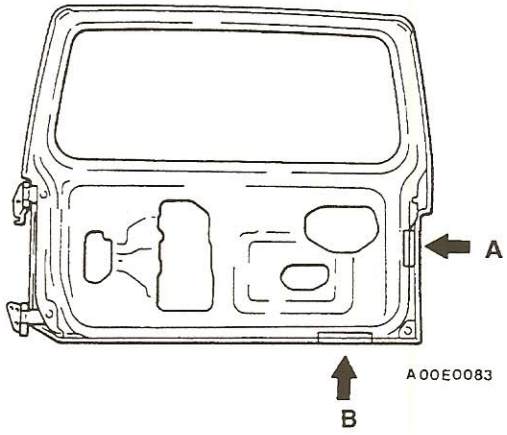


The illustration indicates right hand side, outer.
Left hand side is symmetrically opposite.

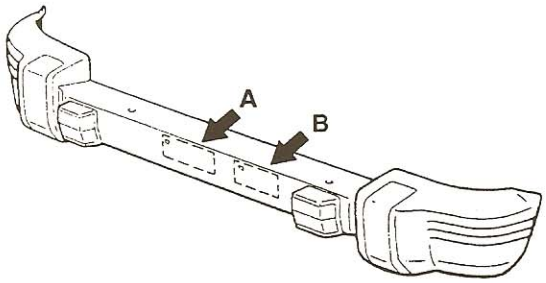
Hood



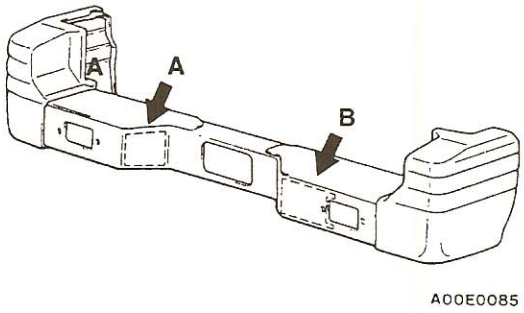
Back door



Front bumper



Rear bumper



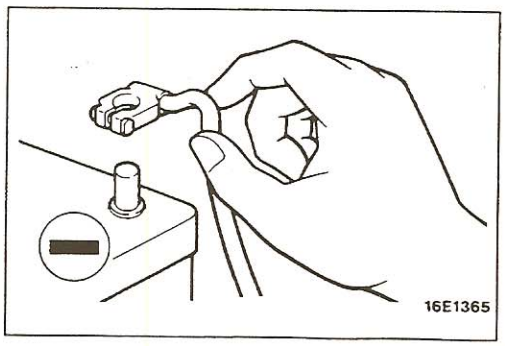
TSB Revision

PRECAUTIONS BEFORE SERVICE

0010005[illegible]

SUPPLEMENTAL RESTRAINT SYSTEM (SRS)

1. Items to follow when servicing SRS
   (1) Be sure to read GROUP 52B – Supplemental Restraint System (SRS). For safe operation, please follow the directions and heed all warnings.
   (2) Always use the designated special tools and test equipment.
   (3) Wait at least 60 seconds after disconnecting the battery cable before doing any further work. The SRS system is designed to retain enough voltage to deploy the air bag even after the battery has been disconnected. Serious injury may result from unintended air bag deployment if work is done on the SRS system immediately after the battery cable is disconnected.
   (4) Never attempt to disassemble or repair the SRS components (SRS diagnosis unit, air bag module and clock spring). If there is a defect, replace the defective part.
   (5) Warning labels must be heeded when servicing or handling SRS components. Warning labels can be found in the following locations.
      - Hood
      - Sun visor
      - Glove box
      - SRS diagnosis unit
      - Steering wheel
      - Air bag module
      - Clock spring
      - Front impact sensor
      - Frame on side of steering gear box
   (6) Store components removed from the SRS in a clean and dry place. The air bag module should be stored on a flat surface and placed so that the pad surface is facing upward.
   (7) Be sure to deploy the air bag before disposing of the air bag module or disposing of a vehicle equipped with an air bag. (Refer to GROUP 52B – Air Bag Module Disposal Procedures.)
   (8) Whenever you finish servicing the SRS, check the SRS warning light operation to make sure that the system functions properly.
2. Observe the following when carrying out operations on places where SRS components are installed, including operations not directly related to the SRS air bag.
   (1) When removing or installing parts, do not allow any impact or shock to the SRS components.
   (2) SRS components should not be subjected to temperatures of over 93°C (200°F), so remove the SRS components before drying or baking the vehicle after painting. After re-installing them, check the SRS warning light operation to make sure that the system functions properly.



SERVICING ELECTRICAL SYSTEM

1. Note the following before proceeding with work on the electrical system.
   Note that the following must never be done:
   Unauthorized modifications of any electrical device or wiring. Because such modifications might lead to a vehicle malfunction, over-capacity or short-circuit that could result in a fire in the vehicle.
2. When servicing the electrical system, disconnect the negative cable terminal from the battery.

TSB Revision

Caution

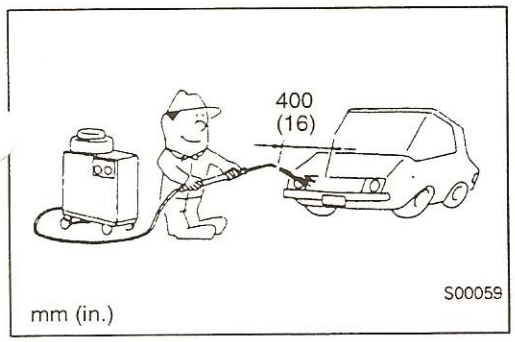
1. **Before connecting or disconnecting the negative cable, be sure to turn off the ignition switch and the lighting switch.**
   (If this is not done, there is the possibility of semiconductor parts being damaged.)
2. **After completion of the work steps (when the negative battery terminal is connected), warm up the engine and allow it to idle for approximately 15 minutes under the conditions described below in order to stabilize engine control conditions, and then check to be sure that the idling is satisfactory.**

   Engine coolant temperature:
   85°–95°C (185–203°F)

   Lights and all accessories: OFF

   Transmission:
   neutral position (Automatic transmission models: N or P)

   Steering wheel: straight–forward position

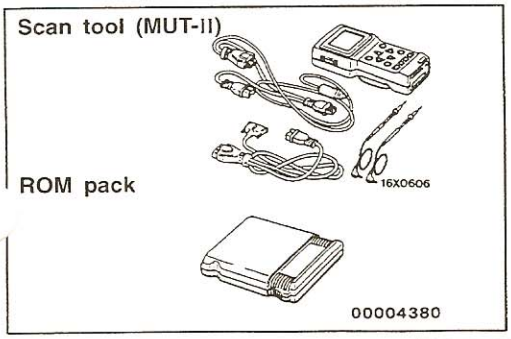


VEHICLE WASHING

If high-pressure car-washing equipment or steam car-washing equipment is used to wash the vehicle, be sure to maintain the spray nozzle at a distance of at least 400 mm (16 in.) from any plastic parts and all opening parts (doors, luggage compartment, etc).

APPLYING ANTI-CORROSION AGENT OR OTHER UNDERCOAT AGENTS

Be careful not to adhere oil or grease to the heated oxygen sensor. If adhered, the sensor may malfunction.
Protect the heated oxygen sensor with a cover before applying anti-corrosion agent, etc.



SCAN TOOL (MUT-II)

To operate the scan tool, refer to "MUT-II Operating Instructions."

Caution
Connection and disconnection of the scan tool should always be carried out with the ignition switch in the OFF position.

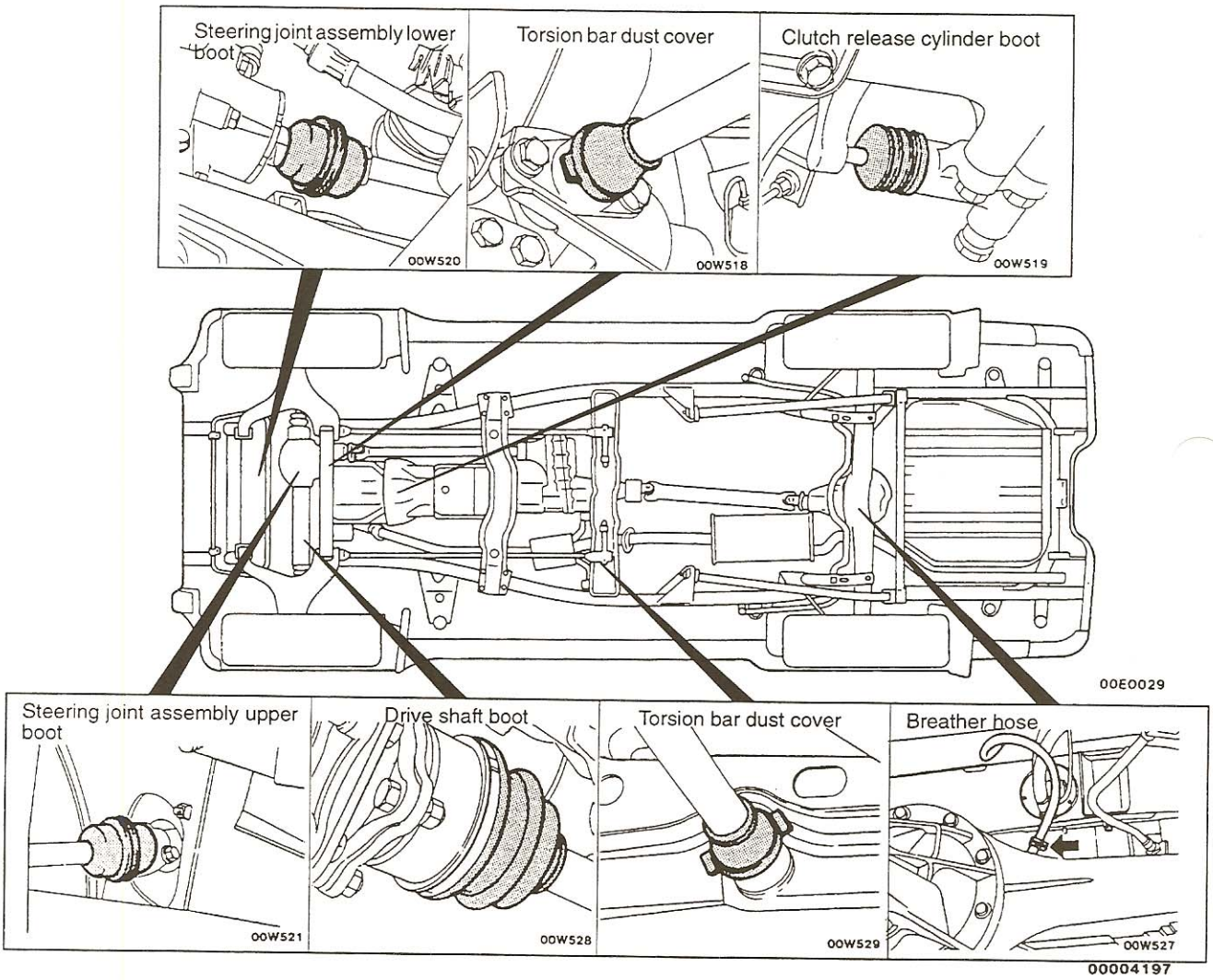
TSB Revision

TREATMENT BEFORE/AFTER THE FORDING OF A STREAM 00100L

INSPECTION AND SERVICE BEFORE FORDING A STREAM

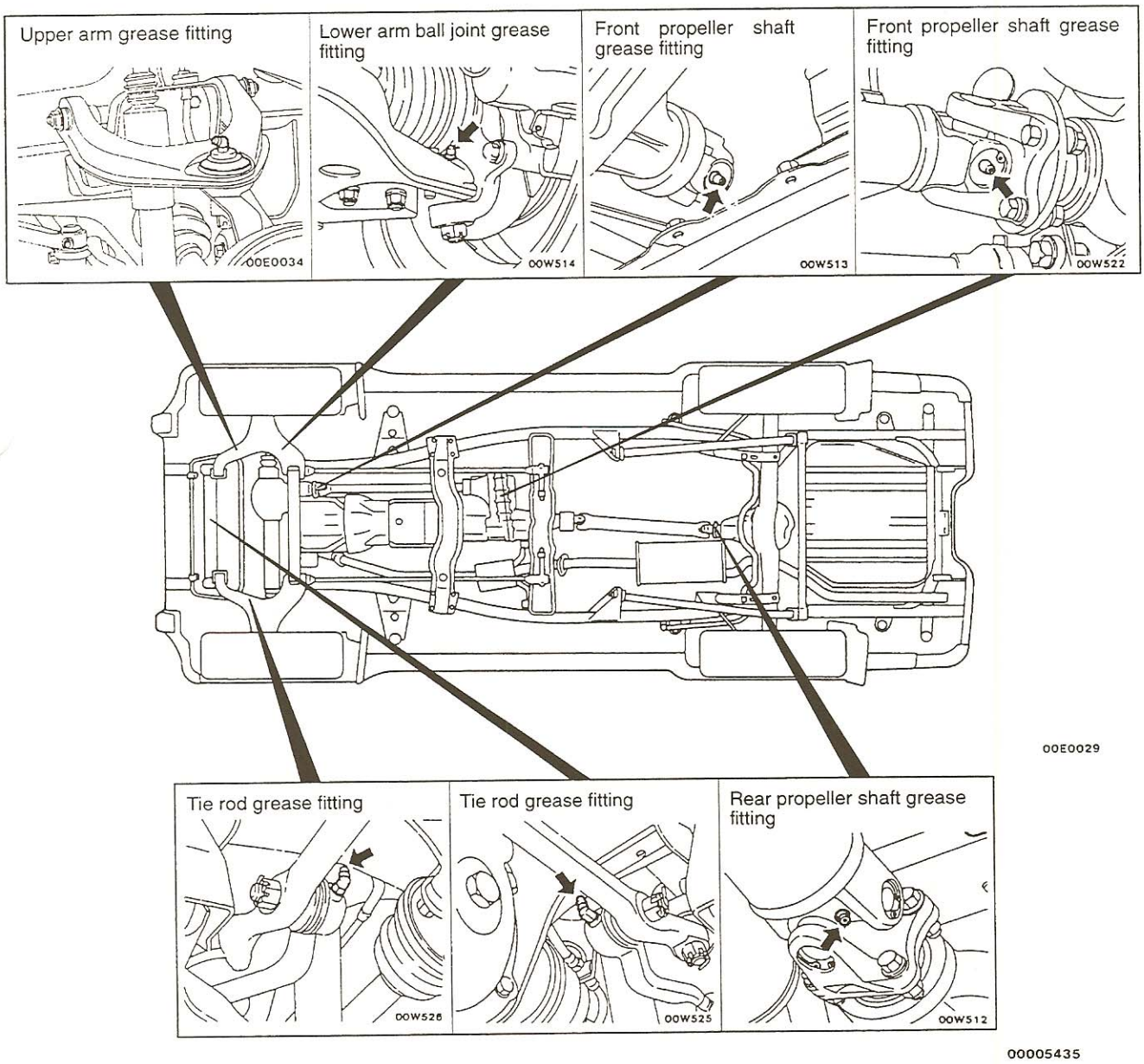
Vehicles which are driven through water, or which may possibly be driven through water, should be subjected to the following inspections and maintenance procedures in advance.

- Inspect the dust boots and breather hose for cracks or damage, and replace them if cracks of damage are found.



TSB Revision

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



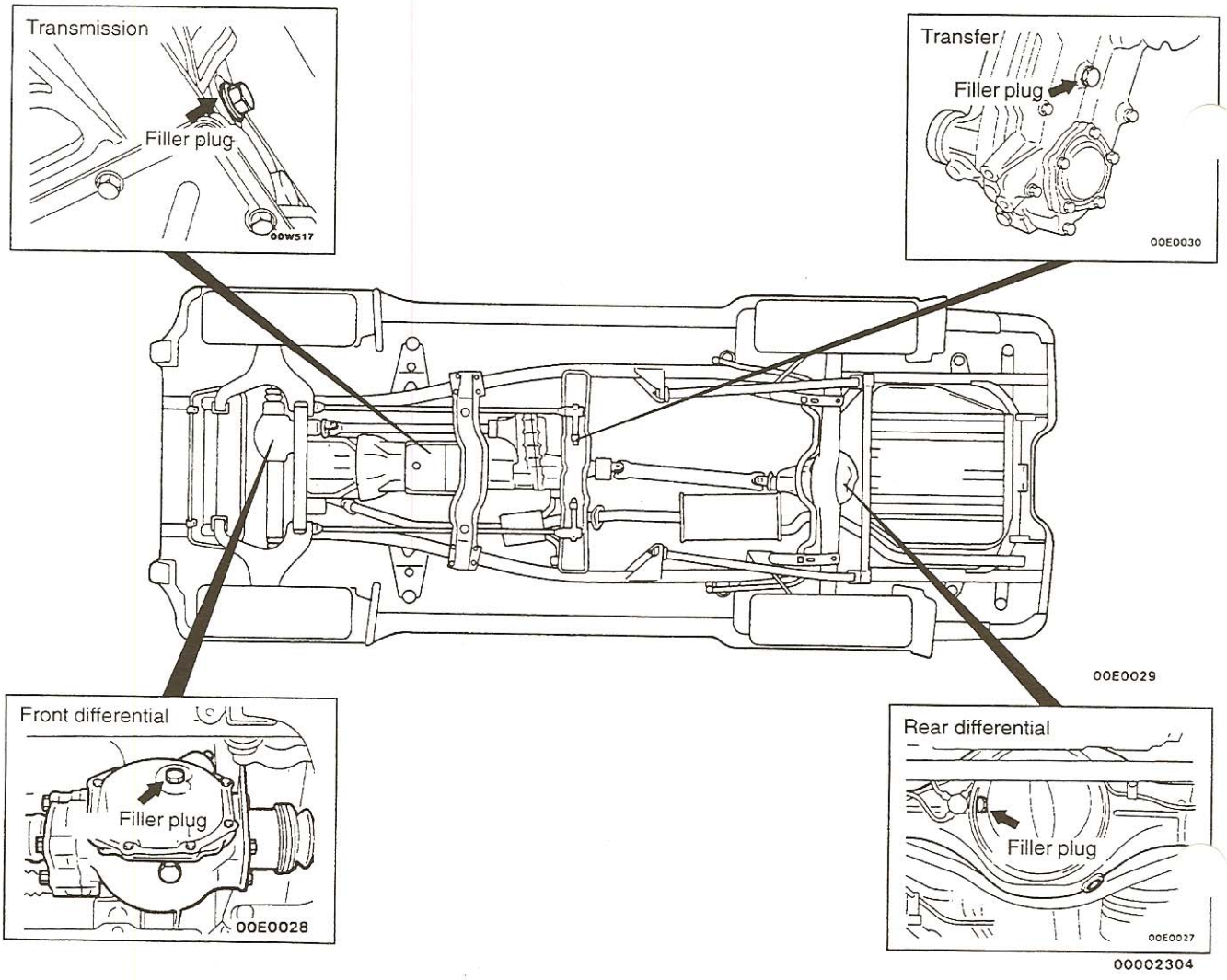
TSB Revision

INSPECTION AND SERVICE AFTER FORDING A STREAM

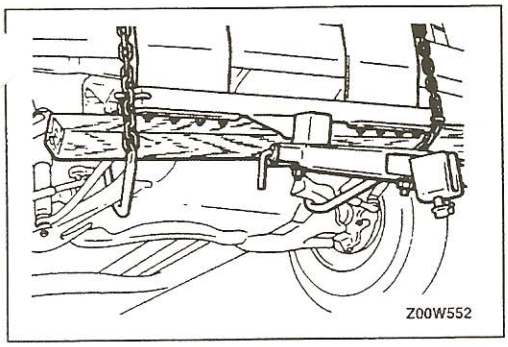
After fording a stream, check the following points. If an abnormal condition is evident, clean, replace or lubricate.

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

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



TSB Revision



TOWING AND HOISTING

00100080051

This vehicle can only be towed from the front with conventional sling-type equipment and tow chain with grab hooks.
If the vehicle is towed from the rear, use a tow dolly.
A lumber spacer (4" × 4" × 55" wood beam) should be placed forward of the under guard and under the towing hook/shipping tie down hook.
Then, attach a J-hook to the lower arm.
A safety chain system must be used. This system must be completely independent of the primary lifting and towing attachment. Care must be taken in the installation of safety' chains to insure they do not cause damage to the bumper, painted surfaces or lights.

LIFTING-GROUND CLEARANCE

The towed vehicle should be raised until the wheels are a minimum of 10 cm (4 in.) from the ground. Make sure that there is adequate ground clearance at the opposite end of the vehicle, especially when towing over rough terrain or when crossing sharp rises such as curbs. If necessary, the ground clearance can be increased by removing the wheels from the lifted end of the disabled vehicle and carrying the lifted end closer to the ground. A 20 cm (8 in.) ground clearance must be maintained between the brake discs and the ground.

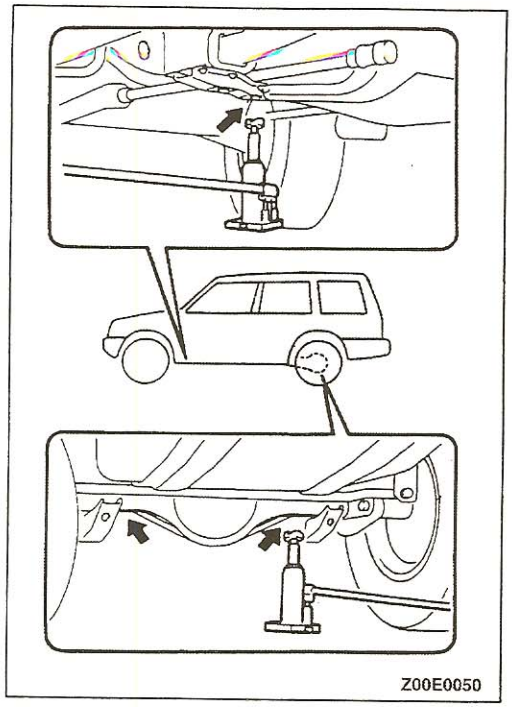
FRONT TOWING PICK-UP

The vehicle may be towed on its rear wheels for extended distances, provided the parking brake is released.
Make sure that the transmission remains in the N position.

SAFETY PRECAUTION

The following precautions should be taken when towing the vehicle.

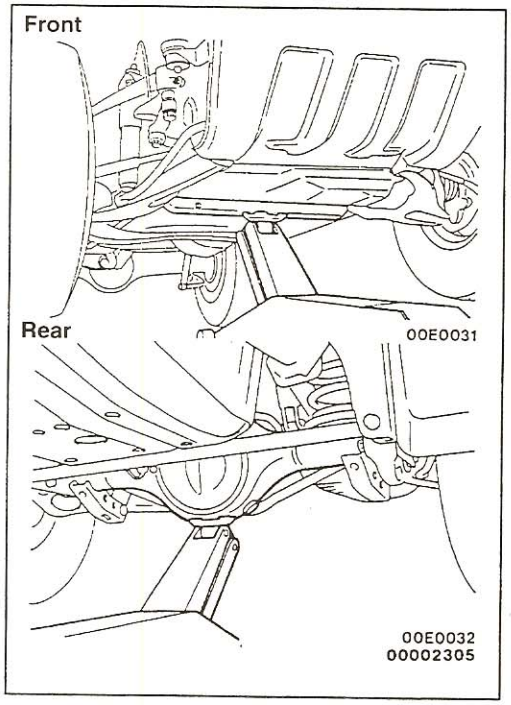
1. Remove exhaust tips and any other optional equipment that interface with the towing sling. Padding (heavy shop towel or carpeting) should be placed between the towing sling cross bar and any painted surfaces and bumper surfaces.
2. A safety chain system completely independent of the primary lifting and towing attachment must be used
3. Any loose or protruding parts of damaged vehicle such as hoods, doors, fenders, trim, etc., should be secured prior to moving the vehicle.
4. The operator should refrain from getting underneath a vehicle unless the vehicle is adequately supported by safety stands.
5. Never allow passengers to ride in a towed vehicle.
6. State and local rules and regulations must be followed when towing a vehicle.



HOISTING

EMERGENCY JACKING

Jack receptacles are located at the No. 2 crossmember and rear axle housing to accept the jack supplied with the vehicle for emergency road service. Always block the opposite wheels and jack only on a level surface.



FLOOR JACK

A regular floor jack may be used under the front crossmember or rear axle housing.

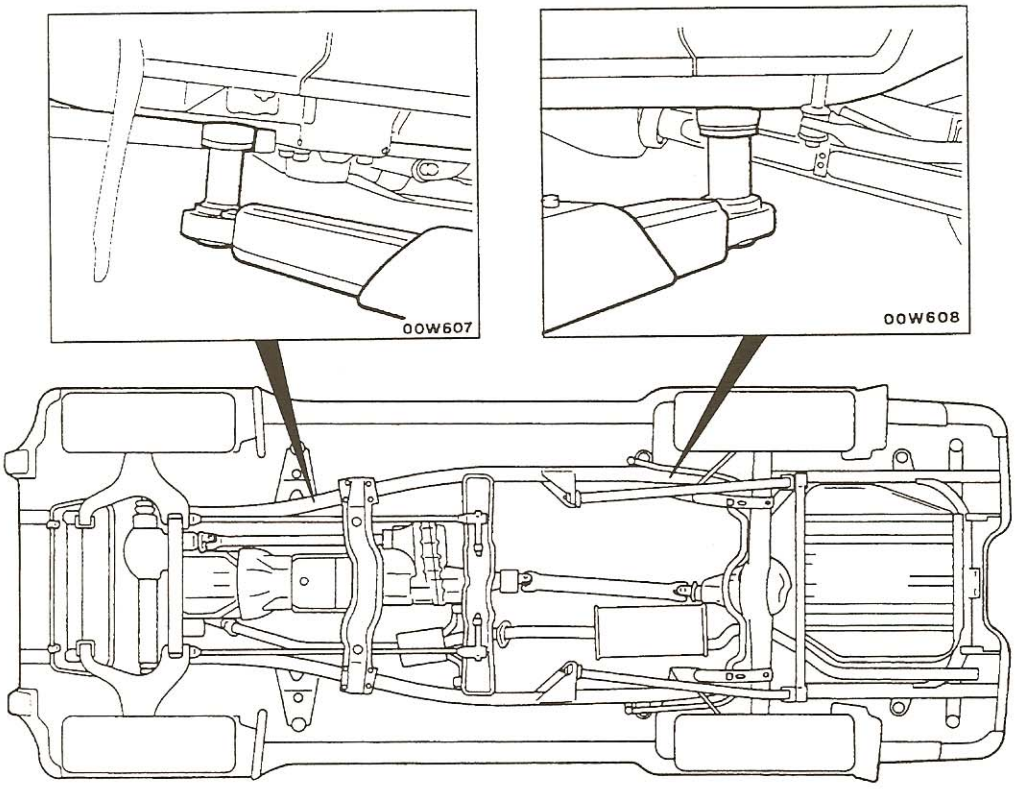
Caution

1. **A floor jack must never be used on any part of the underbody.**
2. **Do not attempt to raise one entire side of the vehicle by placing a jack midway between front and rear wheels.**
   This practice may result in permanent damage to the body.

POST TYPE

Special care should be taken when raising the vehicle on a frame contact type hoist. The hoist must be equipped with the proper adapters in order to support the vehicle at the proper locations shown in the illustration.
Conventional hydraulic hoists may be used after determining that the adapter plates will make firm contact with the side frame.

Caution
When service procedures require removal of the rear suspension, the fuel tank or the spare tire, place additional weight on the rear end of the vehicle or anchor the vehicle to a hoist to prevent center of gravity changes.



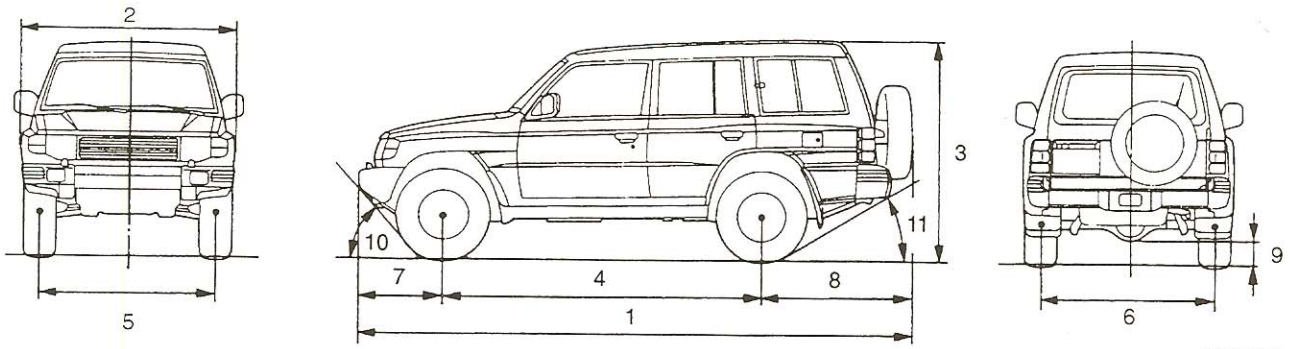
00E0029

00002306

TSB Revision

GENERAL DATA AND SPECIFICATIONS

00100090206



00E0102

Items		V45WGRXVL2M V45WGRXVL7M
Vehicle dimensions mm (in.)	1. Overall length	4,740 (186.6)
	2. Overall width	1,775 (69.9)
	3. Overall height	1,900 (74.8), 1,910 (75.2)**
	4. Wheelbase	2,725 (107.3)
	5. Tread – front	1,465 (57.7)
	6. Tread – rear	1,480 (58.3)
	7. Overhang – front	720 (28.3)
	8. Overhang – rear	1,295 (51.0)
	9. Minimum running ground clearance	205 (8.1)
	10. Angle of approach degrees	42.0
	11. Angle of departure degrees	27.5
Vehicle weights kg (lbs.)	Curb weight	2,010 (4,435)
	Gross vehicle weight rating	2,650 (5,840)
	Gross axle weight rating – front	1,200 (2,645)
	Gross axle weight rating – Rear	1,780 (3,925)
Seating capacity		5 (or 7*)
Engine	Piston displacemen cm^3 (cu.in.)	3,497 (213.4)
Transmission & transfer	Model No. & Type	A/T: V4AW3 4-speed automatic
Fuel system	Fuel supply system	MFI

NOTE
*: Vehicles with optional third seat
**: Vehicles with 16-inch wheels

TSB Revision

TIGHTENING TORQUE

00100110040

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

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

Standard bolt and nut tightening torque

Thread size		Torque Nm (ft.lbs.)		
Nominal bolt diameter (mm)	Pitch (mm)	Head mark "4"	Head mark "7"	Head mark "8"
M5	0.8	2.5 (1.8)	4.9 (3.6)	5.9 (4.3)
M6	1.0	4.9 (3.6)	8.8 (6.5)	9.8 (7.2)
M8	1.25	12 (8.7)	22 (16)	25 (18)
M10	1.25	24 (17)	44 (33)	52 (38)
M12	1.25	41 (30)	81 (60)	96 (71)
M14	1.5	72 (53)	137 (101)	157 (116)
M16	1.5	111 (82)	206 (152)	235 (174)
M18	1.5	167 (123)	304 (224)	343 (253)
M20	1.5	226 (166)	412 (304)	481 (354)
M22	1.5	304 (224)	559 (412)	647 (477)
M24	1.5	392 (289)	735 (542)	853 (629)

Flange bolt and nut tightening torque

Thread size		Torque Nm (ft.lbs.)		
Nominal bolt diameter (mm)	Pitch (mm)	Head mark "4"	Head mark "7"	Head mark "8"
M6	1.0	4.9 (3.6)	9.8 (7.2)	12 (8.7)
M8	1.25	13 (9.4)	24 (17)	28 (20)
M10	1.25	26 (19)	49 (36)	57 (42)
M10	1.5	24 (17)	44 (33)	54 (40)
M12	1.25	46 (34)	93 (69)	103 (76)
M12	1.75	42 (31)	81 (60)	96 (71)

TSB Revision

LUBRICATION AND MAINTENANCE

0010010173

Maintenance and lubrication service recommendations have been compiled to provide maximum protection for the vehicle owner's investment against all reasonable types of driving conditions. Since these conditions vary with the individual vehicle owner's driving habits, the area in which the vehicle is operated and the type of driving to which the vehicle is subjected, it is necessary to prescribe lubrication and maintenance service on a time frequency as well as mileage interval basis. Oils, lubricants and greases are classified and graded according to standards recommended by the Society of Automotive Engineers (SAE), the American Petroleum Institute (API) and the National Lubricating Grease Institute (NLGI).

MAINTENANCE SCHEDULES

Information for service maintenance is provided in the "SCHEDULED MAINTENANCE TABLE". Three schedules are provided; one for "Required Maintenance". one for "General Maintenance" and one for "Severe Usage Service."
The item numbers in "SCHEDULED MAINTENANCE TABLE" correspond to the section numbers in "MAINTENANCE SERVICE."

SEVERE SERVICE

Vehicles operating under severe service conditions will require more frequent service.
Component service information is included in appropriate units for vehicles operating under one or more of the following conditions:

1. Trailer towing or police, taxi or commercial type operation.
2. Operation of Vehicle
   (1) Short-trip operation at freezing temperature (engine not thoroughly warmed up)
   (2) More than 50% operation in heavy city traffic during hot weather above 32°C (90°F)
   (3) Extensive idling
   (4) Driving in sandy areas
   (5) Driving in salty areas
   (6) Driving in dusty conditions
   (7) Driving on off-road

ENGINE OIL

Either of the following engine oils should be used:
(1) Engine oil displaying EOLCS certification mark.
(2) Engine oil conforming to the API classification SJ ECII or SJ/CD ECII.

For further details, refer to "LUBRICANTS SELECTION" section.

Caution
Test results submitted to EPA have shown that laboratory animals develop skin cancer after prolonged contact with used engine oil. Accordingly, the potential exists for humans to develop a number of skin disorders, including cancer, from such exposure to used engine oil. Care should be taken, therefore, when changing engine oil, to minimize the amount and length of exposure time to used engine oil on your skin. Protective clothing and gloves, that cannot be penetrated by oil, should be worn. The skin should be thoroughly washed with soap and water, or use waterless hand cleaner, to remove any used engine oil. Do not use gasoline, thinners, or solvents.

LUBRICANTS AND GREASES

Semi-solid lubricants bear the NLGI designation and are further classified as grades 0, 1, 2, 3, etc. Whenever "Chassis Lubricant" is specified, Multi-Purpose Grease, NLGI grade No. 2, should be used.

FUEL USAGE STATEMENT

Your vehicle must be unleaded gasoline only. This vehicle has a fuel filler tube which is especially designed to accept only the smaller-diameter unleaded gasoline dispensing nozzle.

CAUTION
Using leaded gasoline in your car will damage the catalytic converters and oxygen sensors, and affect the warranty coverage validity.

Your car is designed to operate on unleaded gasoline having a minimum octane rating of 87 [(MON + RON)/2], or 91 RON.
MON: Motor Octane Number
RON: Research Octane Number

GASOLINES CONTAINING ALCOHOL

Some gasolines sold at service stations contain alcohol although they may not be so identified. Using fuels containing alcohol is not recommended unless the nature of the blend can be determined as being satisfactory.
Gasohol: A mixture of 10% ethanol (grain alcohol) and 90% unleaded gasoline may be used in your vehicle. If drivability problems are experienced as a result of using gasohol, it is recommended that the vehicle be operated on gasoline.
Methanol: **Do not use gasolines containing methanol (wood alcohol)**. Using this type of alcohol can result in vehicle performance deterioration and damage critical parts in the fuel system components. Fuel system damage and performance problems resulting from the use of gasolines containing methanol may not be covered by the new vehicle warranty.

GASOLINES CONTAINING MTBE (METHY TERTIARY BUTYL ETHER)

Unleaded gasoline containing 15% or less MTBE may be used in your vehicle. (Fuel containing MTBE over 15% vol. may cause reduced engine performance and produce vapor lock or hard starting.

MATERIALS ADDED TO FUEL

Indiscriminate use of fuel system cleaning agents should be avoided. Many of these materials intended for gum and varnish removal may contain highly active solvents or similar ingredients that can be harmful to gasket and diaphragm materials used in fuel system component parts.

RECOMMENDED LUBRICANTS AND LUBRICANT CAPACITIES TABLE

00100

RECOMMENDED LUBRICANTS

Parts		Specifications	Remarks
Engine oil		Engine oil displaying EOLCS certification mark or conforming the API classification SJ ECII or SJ/CD ECII	For further details, refer to "LUBRICANTS SELECTION" section.
Automatic transmission		ATF DEXRON II or equivalent	–
Transfer		API classification GL-4	SAE grade number: SAE 75W-90 or 75W/85W
Front axle		API classification GL-5 or higher	For further details, refer to "LUBRICANTS SELECTION" section.
Rear axle	Conventional differential	API classification GL-5 or higher	For further details, refer to "LUBRICANTS SELECTION" section.
	Limited-slip differential	–	Mitsubishi Genuine Gear Oil Part No. 8149630EX or equivalent
Power steering		Automatic Transmission Fluid DEXRON II	–
Brakes and clutch		Conforming to DOT 3 or DOT 4	
Engine coolant		–	HIGH QUALITY ETHYLENE GLYCOL ANTIFREEZE COOLANT
Door hinges, back door hinges		Engine oil	–

LUBRICANT CAPACITIES TABLE

Description		Specifications
Engine oil dm^3 (qts.)	Crankcase (except for oil filter and oil cooler)	4.3 (4-1/2)
	Oil filter	0.3 (1/2)
	Oil cooler	0.3 (1/2)
Cooling system (including front heater and coolant reserve tank) dm^3 (qts.)		9.5 (10.0)
Automatic transmission dm^3 (qts.)		9.8 (10.4)
Transfer dm^3 (qts.)		2.5 (2.6)
Front axle dm^3 (qts.)		1.15 (1.22)
Rear axle dm^3 (qts.)		3.2 (3.3)
Power steering dm^3 (qts.)		1.06 (1.12)
Fuel tank dm^3 (gals.)		92 (24.3)

EOLCS certification mark

M03A015

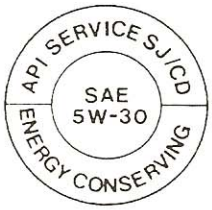
LUBRICANTS SELECTION

ENGINE OIL

Caution
Never use nondetergent or straight mineral oil.

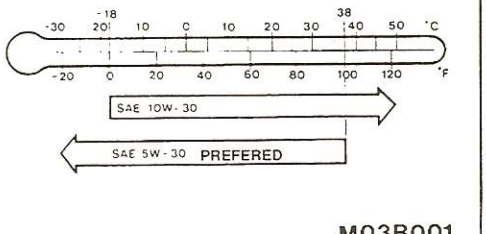
Oil Identification Symbol

Use only engine oils displaying the EOLCS certification mark on the container.



M03A041A

If these oils are not available, an API classification SJ ECII or SJ/CD ECII can be used.



M03B001

Oil Viscosity

The SAE grade number indicates the viscosity of the oil. A proper SAE grade number should be selected according to ambient temperature.

TSB Revision

FRONT AXLE/REAR AXLE (CONVENTIONAL DIFFERENTIAL)

Lubricant	API classification GL-5 or higher
Expected temperature range	Viscosity range
Above –23°C (–10°F)	SAE 90, SAE 85W-90 or SAE 80W-90
–20°C to –34°C (–10°F to –30°F)	SAE 80W or SAE 80W-90
Below –34°C (–30°F)	SAE 75W

REAR AXLE (LIMITED SLIP DIFFERENTIAL)

Refer to GROUP 27 – Specifications.

SELECTION OF COOLANT

COOLANT

Relationship between Coolant Concentration and Specific Gravity

Coolant temperature °C (°F) and specific gravity					Freezing temperature	Safe operating temperature	Coolant concentration (Specific volume)
10 (50)	20 (68)	30 (86)	40 (104)	50 (122)	°C (°F)	°C (°F)	%
1.054	1.050	1.046	1.042	1.036	–16 (3.2)	–11 (12.2)	30
1.063	1.058	1.054	1.049	1.044	–20 (–4)	–15 (5)	35
1.071	1.067	1.062	1.057	1.052	–25 (–13)	–20 (–4)	40
1.079	1.074	1.069	1.064	1.058	–30 (–22)	–25 (–13)	45
1.087	1.082	1.076	1.070	1.064	–36 (–32.8)	–31 (–23.8)	50
1.095	1.090	1.084	1.077	1.070	–42 (–44)	–37 (–35)	55
1.103	1.098	1.092	1.084	1.076	–50 (–58)	–45 (–49)	60

Example
The safe operating temperature is –15°C (5°F) when the measured specific gravity is 1.058 at the coolant temperature of 20°C (68°F)

Caution

1. **If the concentration of the coolant is below 30%, the anti-corrosion property will be adversely affected. In addition, if the concentration is above 60%, both the anti-freeze and engine cooling properties will decrease, affecting the engine adversely. For these reasons, be sure to maintain the concentration level within the specified range.**
2. **Do not use a mixture of different brands of anti-freeze.**

TSB Revision

SCHEDULED MAINTENANCE TABLE

00100140247

SCHEDULED MAINTENANCE SERVICE FOR EMISSION CONTROL AND PROPER VEHICLE PERFORMANCE

Inspection and service should be performed any time a malfunction is observed or suspected. Retain receipts for all vehicle emission services to protect your emission warranty.

No.	Emission Control System Maintenance	Service Intervals										
		Kilometers in Thousands	24	48	72	96	120	144	160	168	192
		Mileage in Thousands	15	30	45	60	75	90	100	105	120
1	Fuel System (Tank, Pipe Line and Connection, and Fuel Tank Filler Tube Cap)	Check for Leaks Every 5 Years or				X					X
2	Fuel Hoses	Check Condition Every 2 Years or		X		X		X			X
3	Air Cleaner Element	Replace at		X		X		X			X
4	Evaporative Emission Control System* (Except for Canister)	Check for Leaks and Clogging Every 5 Years or				X					X
5	Spark Plugs	Replace Platinum Plugs Only at				X					X
6	Ignition Cables	Replace Every 5 Years or				X					X

TSB Revision

GENERAL MAINTENANCE SERVICE FOR PROPER VEHICLE PERFORMANCE

No.	General Maintenance	Service Intervals	Kilometers in Thousands	24	48	72	96	120	144	160	168	192
			Mileage in Thousands	15	30	45	60	75	90	100	105	120
7	Timing Belt	Replace at					X*3			X*4		X*3
8	Drive Belt (for Generator, Water Pump, Power Steering Pump)	Check Condition at			X		X		X			X
9	Engine Oil	Change Oil Every 12 Months or		Every 12,000 km (7,500 miles)								
10	Engine Oil Filter	Replace Every 12 Months or*5		X	X	X	X	X	X		X	X
11	Automatic Transmission Fluid	Check Fluid Level Every 12 Months or		X	X	X	X	X	X		X	X
12	Automatic Transmission Fluid	Change Fluid at			X		X		X			X
13	Transfer oil	Check oil level			X		X		X			X
14	Engine Coolant	Change Coolant Every 2 Years or			X		X		X			X
15	Disc Brake Pads	Inspect for Wear Every 12 Months or		X	X	X	X	X	X		X	X
16	Brake Hoses	Check for Deterioration or Leaks Every 12 Months or		X	X	X	X	X	X		X	
17	Ball Joint and Steering Linkage Seals	Inspect for Grease Leaks and Damage Every 2 Years or			X		X		X			X
18	Drive Shaft Boots	Inspect for Grease Leaks and Damage Every 12 Months or		X	X	X	X	X	X		X	X
19	Ball Joints With Grease Fitting	Lubricate with Grease Every 2 Years or			X		X		X		X	X
20	Front Axle and Rear Axle	With LSD*1	Change Oil at		X		X		X		X	X
		Without LSD*1	Inspect Oil Level at		X		X		X		X	X
21	Propeller Shaft Joints	Lubricate with Grease Every 2 Years or			X		X		X		X	X
22	Exhaust System Connection Portion of Muffler, Piping and Converter Heat Shields	Check and Service as Required Every 2 Years or			X		X		X		X	X
23	SRS*2 air bag	Inspect the SRS System at		10 years								

NOTE
*1: LSD: Limited-slip differential
*2: SRS: Supplemental Restraint System
*3: For California, Massachusetts and Connecticut, this maintenance is recommended but not required
*4: Not required if belt was previously changed
*5: If the mileage is less than 12,000 km (7,500 miles) each year, the oil filter should be replaced at every oil change

TSB Revision

SCHEDULED MAINTENANCE UNDER SEVERE USAGE CONDITIONS

Maintenance should be carried out according to the following table:

No.	Maintenance Item	Service to be Performed	Mileage Intervals Kilometers in Thousands (Miles in Thousands)	24 (15)	48 (30)	72 (45)	96 (60)	Severe Usage Conditions
3	Air Cleaner Element	Replace at		X	X	X	X	A and E
5	Spark Plugs	Replace at		X	X	X	X	B and D
9	Engine Oil	Change Every 3 Months or		Every 4,800 km (3,000 miles)				A, B, C, D and G
10	Engine Oil Filter	Replace Every 6 Months or		Every 9,600 km (6,000 miles)				A, B, C, D and G
13	Transfer oil	Change Oil at			X		X	B, G and H
15	Disc Brake Pads (Front)	Inspect for Wear at		Every 9,600 km (6,000 miles) or 6 months				A and F

Severe usage conditions
A – Driving in dusty conditions
B – Trailer towing, or police, taxi or commercial type operation
C – Extensive idling
D – Short-trip operation at freezing temperatures (engine not thoroughly warmed up)
E – Driving in sandy areas
F – Driving in salty areas
G – More than 50% operation in heavy city traffic during hot weather above 32°C (90°F)
H – Driving off-road

MAINTENANCE SERVICE

00100160038

1. FUEL SYSTEM (Check for leaks)

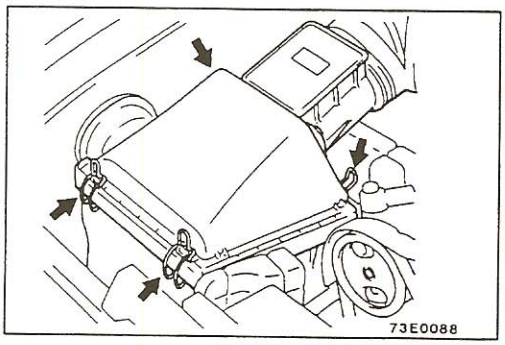
TANK, PIPE LINE AND CONNECTIONS, AND FUEL TANK FILLER TUBE CAP

1. Check for damage or leakage in the fuel lines and connections.
2. Inspect the surface of fuel hoses for heat and mechanical damage. Hard and brittle rubber, cracking, checking, tears, cuts, abrasions and excessive swelling indicate deterioration of the rubber.
3. If the fabric casing of the rubber hose is exposed by cracks and abrasions in the fuel system, the hoses should be replaced.

2. FUEL HOSES (Check)

00100170031

Make sure that the hoses do not come in contact with any heat source or moving component which might cause heat damage or mechanical wear.



3. AIR CLEANER ELEMENT (Replace)

00100180096

The air cleaner element will become dirty and loaded with dust during use, and the filtering effect will be substantially reduced. Replace it with a new one.

REPLACEMENT OF AIR CLEANER ELEMENT

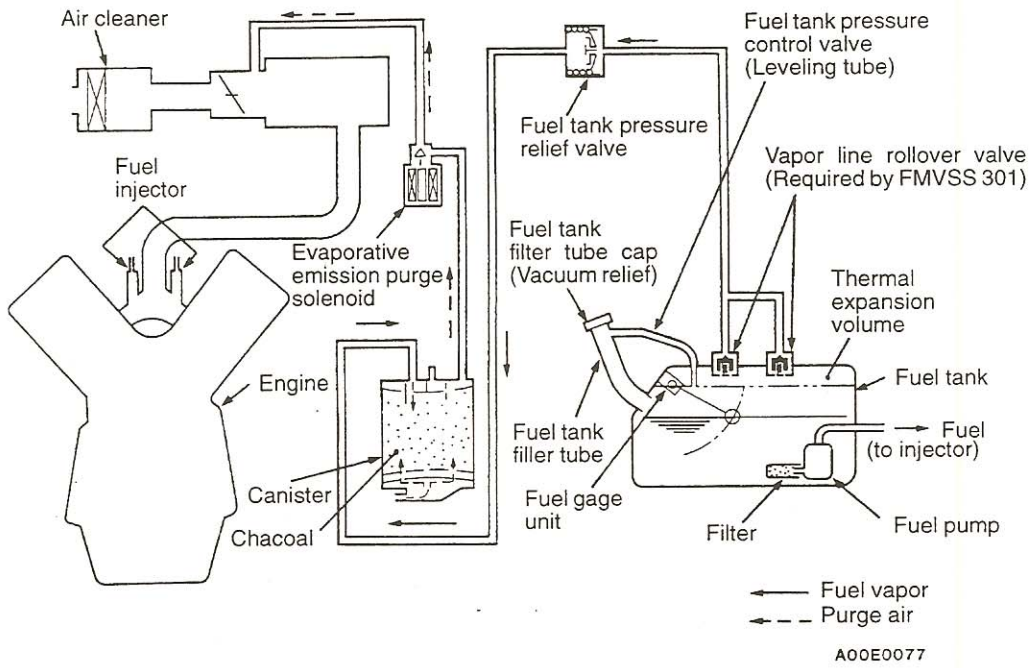
1. Loosen the clamp coupling the air intake hose and the air cleaner cover, and separate the air intake hose
2. Disconnect the volume air flow sensor connector.
3. Disconnect the air cleaner cover clips.
4. Remove the air cleaner cover and replace the air cleaner element with a new one.
5. Clamp the clips and coupling, and then connect the volume air flow sensor connector.

4. EVAPORATIVE EMISSION CONTROL SYSTEM (Check for leaks and clogging) – Except canister

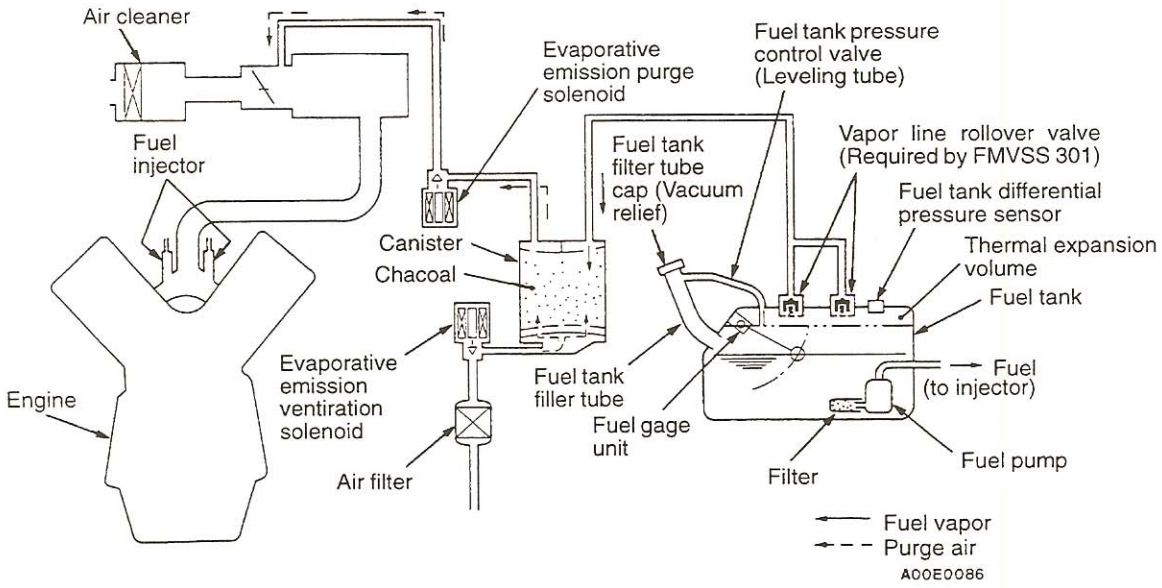
00100190099

1. If the fuel-vapor vent line is clogged or damaged, the fuel vapor mixture will escape into the atmosphere causing excessive emissions. Disconnect the line at both ends, and blow it clean with compressed air. Remove the fuel tank filler tube cap from the filler tube and check to see if there is evidence that the packing makes improper contact to the filler pipe.
2. The fuel tank pressure relief valve installed on the vapor line should be checked for correct operation.

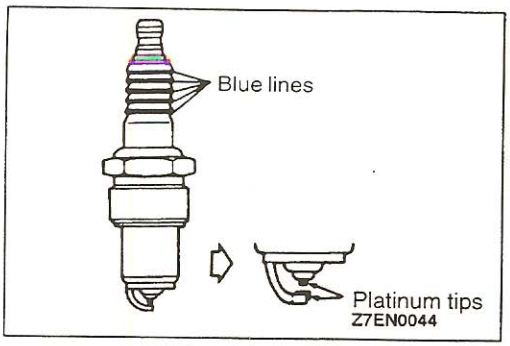
<Except for California>

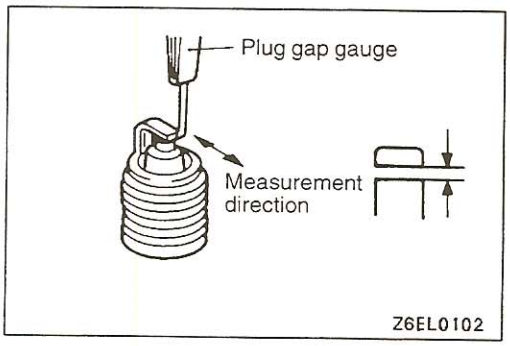


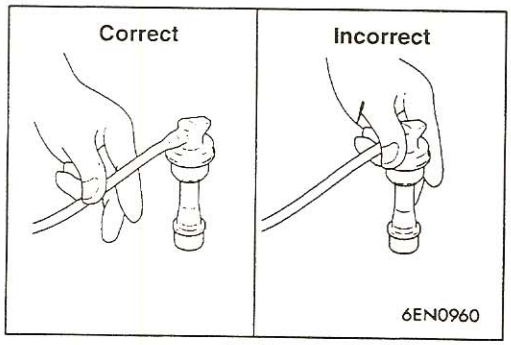
<For California>



TSB Revision







5. SPARK PLUGS (Replace) 00100200136

The spark plugs must fire properly to assure proper en performance and emission control.
Therefore, they should be replaced periodically with new ones.

Spark plug

Maker	Identification No.
NGK	PFR5J-11
DENSO	PK16PR-P11

Spark plug gap: 1.0–1.1 mm (.039–.043 in.)

NOTE
Use care not to damage the platinum tips of the platinum plug.
Don't adjust the gap either.

Specified torque: 25 Nm (15 ft.lbs.)

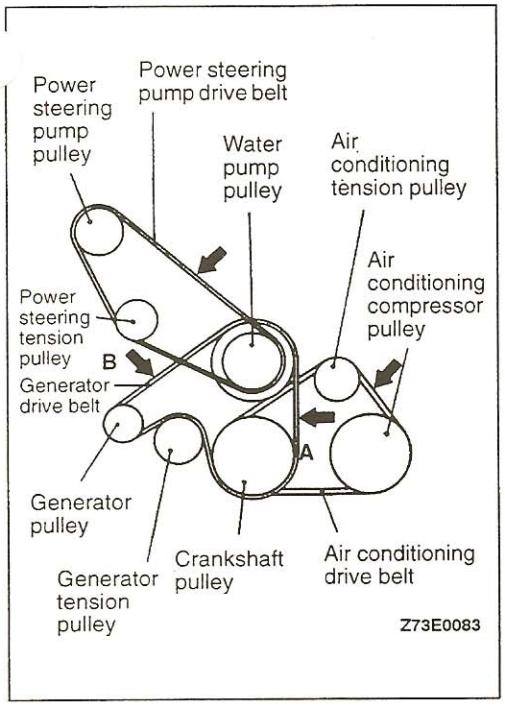
6. IGNITION CABLES (Replace) 00100210047

The ignition cables should be replaced periodically with new ones.
After replacing, make sure that the ignition cables terminals are properly connected and fully seated.

NOTE
When disconnecting an ignition cable, be sure to hold the cable cap. If the cable is disconnected by pulling on the cable alone, an open circuit might result.

7. TIMING BELT (Replace) 00100230111

Replace the belt with a new one periodically to assure proper engine performance.
For removal and installation procedures, refer to GROUP 11 – Timing belt.
For inspection procedures, refer the Engine Overhaul Manual for the appropriate engine.



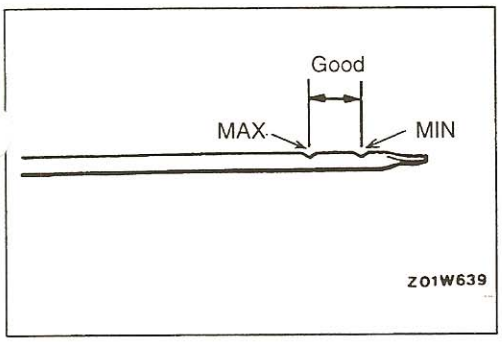
8. DRIVE BELTS (Check condition) 00100250148

Check the tension of the drive belts. Inspect the belts for evidence of cuts and cracks, and replace it if defective. The deflection of the belts must be as shown in the illustration when depressed at a point midway between each of the pulleys with a force of 98 N (22 lbs.).

Standard value:

Item		Check value mm (in.)
For generator	A	5.0–7.0 (.20–.28)
	B	7.5–9.5 (.29–.37)
For power steering		13.8–17.8 (.54–.70)
For air conditioning		6.5–7.5 (.26–.30)

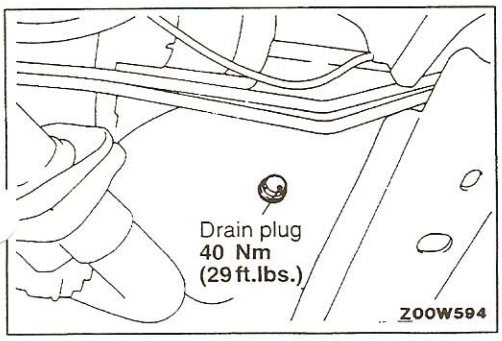
A: Measure between the water pump pulley and the crankshaft pulley.
B: Measure between the water pump pulley and the generator.



9. ENGINE OIL (Inspect oil Level) 00100260233

1. Check that the engine oil level is within the range indicated on the oil level gage.
2. Make sure that the engine oil is clean and free from coolant or gasoline, and that it has an appropriate viscosity grade.

NOTE
1. For this inspection, place the vehicle on a level surface.
2. Check while the engine is stationary. If the engine has been started, stop it and allow for some time before inspection.



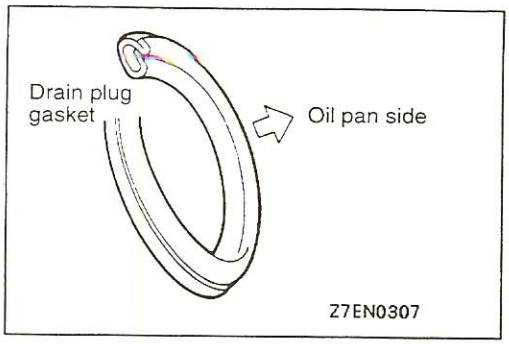
(Change)

Use the specified oil. (Refer to P.00-32.)
1. After warming up the engine, remove the oil filler cap.
2. Remove the drain plug to allow the engine oil to drain.

Caution
Use care as oil could be hot.

3. Replace the drain plug gasket with a new one, and then tighten the drain plug to the specified torque.

TSB Revision



NOTE
Install the drain plug gasket so it faces in the direc shown in the illustration.

4. Pour new engine oil in through the oil filler.

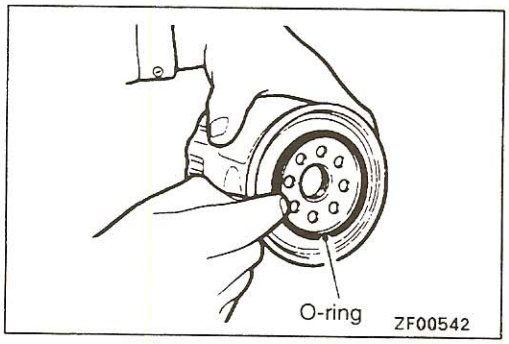
   Engine oil capacity:
   4.3 dm^3 (4.5 qts.) [excluding oil filter 0.3 dm^3 (1/2 qt.) and oil cooler 0.3dm^3 (1/2 qt.)]

5. Start the engine and run it at idle for a few minutes.
6. Stop the engine and check to ensure that the engine oil level is within the level range indicated on the dip stick.

10. ENGINE OIL FILTER (Change) 00100270120

The quality of replacement filters varies considerably. Only high quality filters should be used to assure most efficient service.
Genuine oil filters require that the filter is capable withstanding a pressure of 1,765 kPa (256 psi) are high quality filters and are recommended as follows:

Oil Filter Part Number:
Mitsubishi Genuine Parts: MD136790 or equivalent



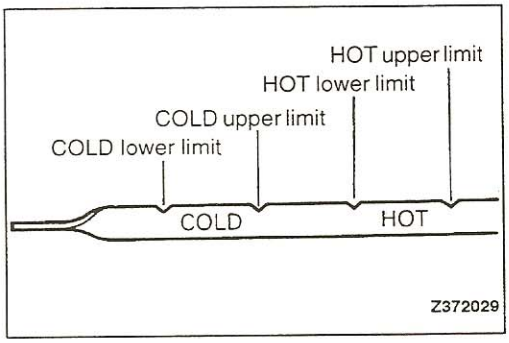
ENGINE OIL FILTER SELECTION

This vehicle is equipped with a full-flow, throw-away oil filter. The same type of filter is recommended as a replacement filter for this vehicle. It is possible, particularly in cold weather, that this vehicle may develop high oil pressure for a short duration. You should make sure that any replacement filter used on this vehicle is a high-quality filter and is capable of withstanding a pressure of 1,765 kPa (256 psi) [manufacturer's specifications] to avoid filter and engine damage. The following is a high-quality filter and is strongly recommended for use on this vehicle : Mitsubishi Engine Oil Filter P/N MD136790.
Any replacement oil filter should be installed in accordance with the oil filter manufacturer's installation instructions.

1. Remove the under cover.
2. Drain the engine oil by removing the oil drain plug.
3. Use an oil filter wrench to remove the engine oil filter.
4. Clean the surface of the filter bracket attachment and ensure the old O-ring has been removed.
5. Lubricate the O-ring of the new oil filter with a small amou... of new engine oil.

TSB Revision

6. Screw on the oil filter by hand, and after the O-ring contacts the flange surface, tighten it another 3/4 turns with a filter wrench, etc. [approx. 14 Nm (10 ft.lbs.)].
7. Add new engine oil through the oil filler.
8. Race the engine two or three times to make sure that no engine oil leaks from the oil filter seal.
9. After stopping the engine, check the oil level and refill if necessary.



11. AUTOMATIC TRANSMISSION (Check the fluid level)

00100290232

Check the fluid level by removing the dipstick. If the fluid is contaminated, replace it with new fluid.

1. Place the vehicle on a level surface.
2. Wipe the area around the dipstick to remove accumulated dirt and then pull out the dipstick.
3. Move the selector lever to the "P" position and apply the parking brake, and then, start the engine.
4. Check that the engine idle speed and fluid operating temperature (50–80°C; 122–176°F) are normal.
5. Move the selector lever to each position in turn to fill the torque converter and hydraulic circuit with fluid. Then place the lever in the "N" position.
6. Check that the fluid level is in the "HOT" range of the dipstick. If the fluid level is low, add fluid until the level reaches the "HOT" range.

12. AUTOMATIC TRANSMISSION FLUID (Replace)

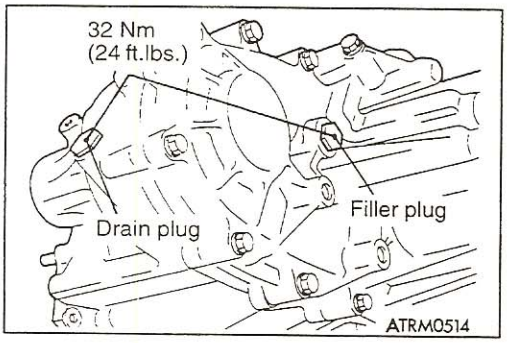
00100

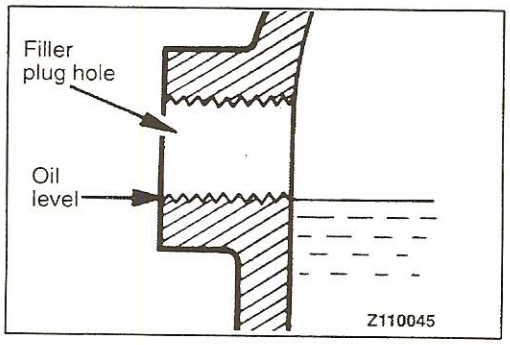
CAUTION: If ATF change is required due to damage to the transmission, be sure to clean the cooler system.

Drain the fluid and check whether there is any evidence of contamination. Replenish with new fluid after the cause of any contamination has been corrected.

1. Place a large flat container beneath the drain plug.
2. Remove the drain plug to allow the transmission fluid to drain.
3. Replace the drain plug gasket with a new one, and then tighten the drain plug.
4. Pour 5 dm^3 (10.6 pints) of specified ATF into case through dipstick hole. [Total quantity of ATF required is approx. 9.8 dm^3 (20.7 pints). Actually however, approx. 5.5 dm^3 (11.6 pints) of fluid can be replaced because rest of fluid remains in torque converter.]

   Specified fluid:
   ATF DEXRON II or equivalent
5. Check the fluid level.





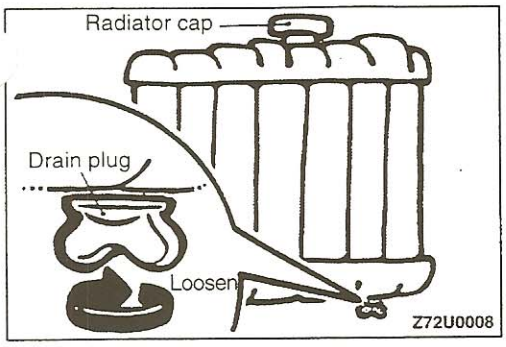
13. TRANSFER (Change oil)

00100300102

Drain the fluid and check whether there is any evidence of contamination. Replenish with new fluid after the cause of any contamination has been corrected.

1. With the vehicle on a flat, level surface, drain out transfer oil.
2. Replace the packing with a new one, and then close the drain plug.
3. Pour new transfer oil in through the filler plug until it reaches the same level as the plug hole.

   Total transfer oil capacity:
   2.5 dm^3 (2.6 qts)



14. ENGINE COOLANT

00100310198

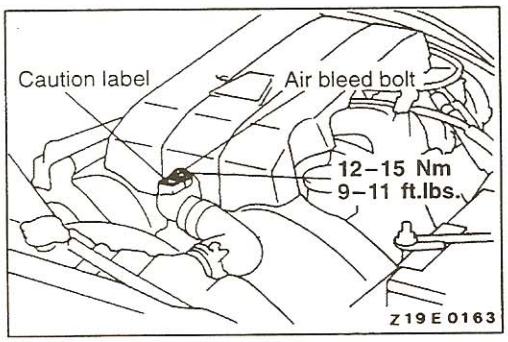
Check the cooling system parts such as the radiator, heater and oil cooler hoses, thermostat and the connections for leakage and damage.

CHANGING COOLANT

1. Set the temperature control lever to the HOT position.
2. Remove the radiator cap, radiator drain plug and engine drain plug to drain the coolant.

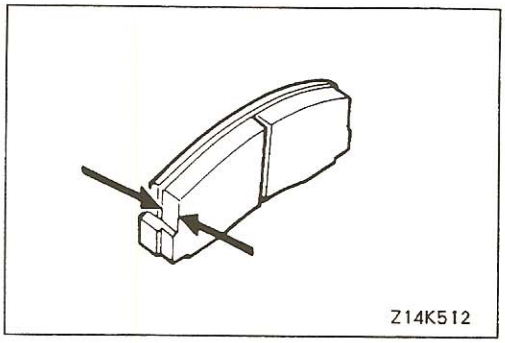
   Caution
   When removing the radiator cap, use care to avoid contact with hot coolant or steam. Place a shop towel over the cap and turn the cap counterclockwise a little to let the pressure escape through the vinyl tube. After relieving the steam pressure, remove the cap by slowly turning it counterclockwise.
3. Remove the reserve tank and drain the coolant.
4. After completely draining the coolant, reinstall the drain plugs and flush the engine and radiator using a radiator cleaning fluid.
5. After the flushing is completed, completely drain the cleaning fluid and install the radiator and engine drain plugs.
6. Loosen the air bleed bolt.
7. By referring to the section on coolant (P.00-34), select an appropriate concentration for safe operating temperature within the range of 30 to 60%. Refill the system with a high quality ethylene glycol antifreeze at the selected concentration. A convenient mixture is a 50% water and 50% antifreeze solution [freezing point: –30°C (–32.8°F)]. (Pour in coolant until it overflows from the air bleed bolt hole, and then tighten the air bleed bolt.

   Engine coolant total capacity
   (including heater and coolant reserve tank):
   9.5 dm^3 (10.0 qts.)



8. Reinstall the radiator cap.
9. Start the engine and let it warm up until the thermostat opens.
10. After repeatedly racing the engine up to 3,000 r/min several times, stop the engine.
11. Remove the radiator cap after the engine has become cold, and pour in coolant up to the entrance for water supplying.
12. Add coolant to the reserve tank between the "FULL" and "LOW" mark if necessary.

    Caution
    Do not overfill the reserve tank.


Z14K512

15. DISC BRAKE PADS (Inspect for wear) 00100320153

Check for fluid contamination and wear. Replace the comp set of pads if defective.

Thickness of lining
Limit: 2.0 mm (.79 in.)

Caution
The pads for the right and left wheels should be replaced at the same time. Never split or intermix brake pad sets. All four pads must be replaced as a complete set.

16. BRAKE HOSES (Check for deterioration or leaks) 00100340142

Inspection of brake hoses and tubing should be included in all brake service operations.
The hoses should be checked for:

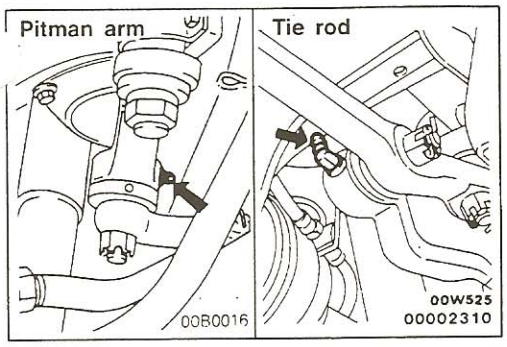
1. Correct length, severe surface cracking, pulling, scuffing or worn spots. (If the fabric casing of the hoses is exposed by cracks or abrasion in the rubber hose cover, the hoses should be replaced. Eventual deterioration of the hose and possible bursting failure may occur.)
2. Incorrect installation, casing twisting or interference with wheel, tire or chassis.

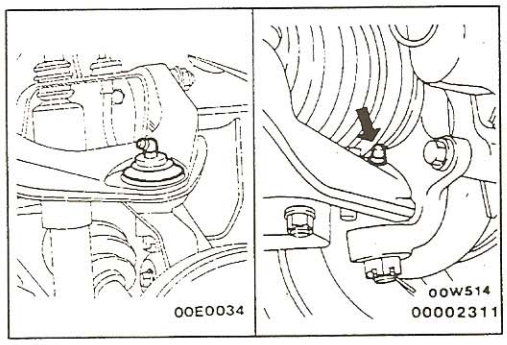
17. BALL JOINT AND STEERING LINKAGE SEALS (Inspect for grease leaks and damage) 00100350145

1. These components, which are permanently lubricated at the factory, do not require periodic lubrication. Dama seals and boots should be replaced to prevent leaka or contamination of the grease.
2. Inspect the dust cover and boots for proper sealing, leakage and damage, and replace them if defective.

18. DRIVE SHAFT BOOTS (Inspect for grease leaks and damage) 00100360148

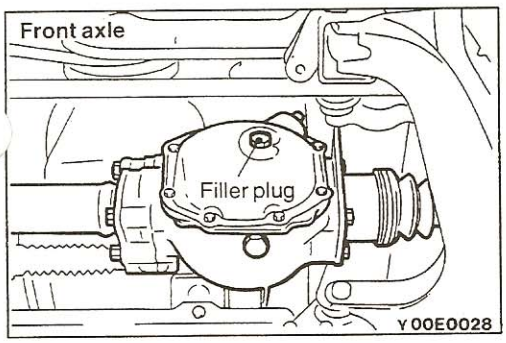
1. These components, which are permanently lubricated at the factory, do not require periodic lubrication. Damaged seals and boots should be replaced to prevent leakage or contamination of the grease.
2. Inspect the dust cover and boots for proper sealing, leakage and damage, and replace them if defective.





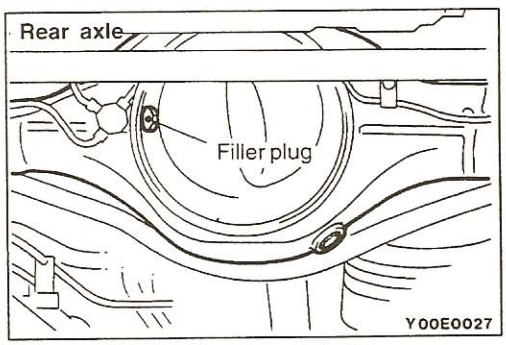
19. BALL JOINTS WITH GREASE FITTING (Lubricate with grease) 00100700056

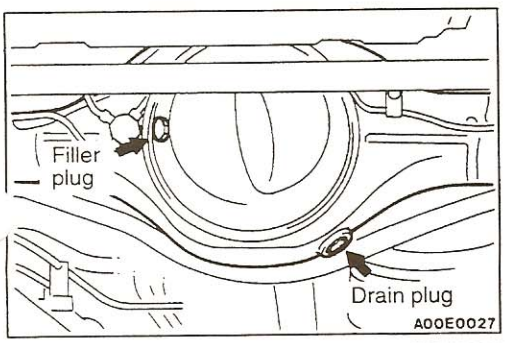
Fill with multipurpose grease at the grease fitting till the grease come out of the dust seal of the pitman arm, tie rod, lower control arm and upper control arm.



20-1. FRONT AXLE AND REAR AXLE (CONVENTIONAL DIFFERENTIAL) (Inspect oil level) 00100710059

Remove the filler plug and inspect the oil level at the bottom of the filler hole. If the oil level is slightly below the filler hole, the condition is satisfactory.



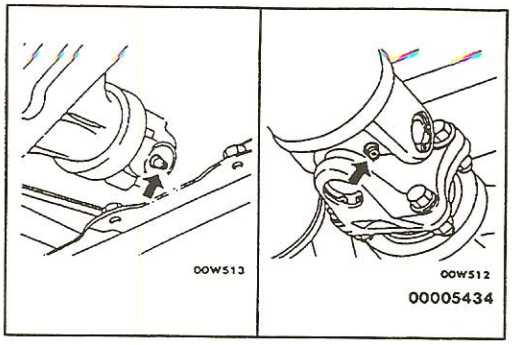


20-2. REAR AXLE OIL (LIMITED-SLIP DIFFERENTIAL) (Change) 00100720052

Before changing the rear axle oil, check that there is no oil leakage from the rear axle housing.
Remove the drain plug and drain out the oil.
Replace the oil plug, and then pour new oil in through the filler hole.

Oil capacity: 3.2 dm^3 (3.3 qts.)

TSB Revision



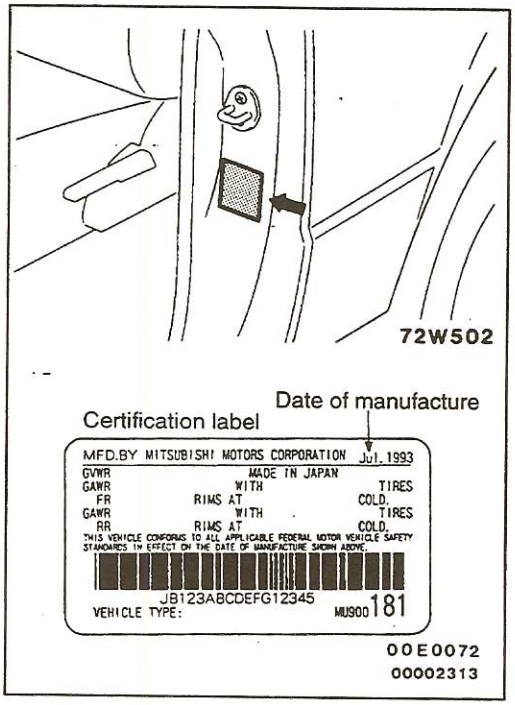
21. PROPELLER SHAFT JOINTS (Lubricate with grease)

001007

Lubricate the propeller shaft joints with grease.
The propeller shaft joints should be repacked with multipurpose grease.

22. EXHAUST SYSTEM (CONNECTION PORTION OF MUFFLER, PIPINGS AND CONVERTER HEAT SHIELDS) (Check and service as required) 00100580131

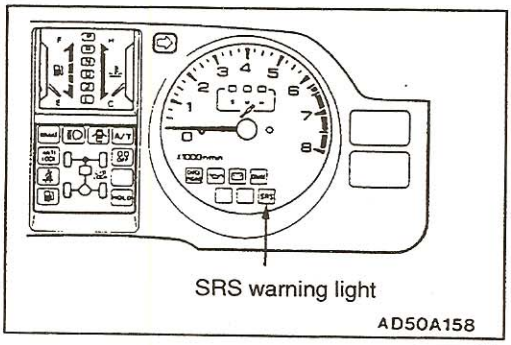
1. Check for holes and gas leaks due to damage, corrosion, etc.
2. Check the joints and connections for looseness and gas leaks.
3. Check the hanger rubber and brackets for damage.



23. SRS MAINTENANCE (SRS component check: damage, function, connection to wiring harness, etc.)

00100370189

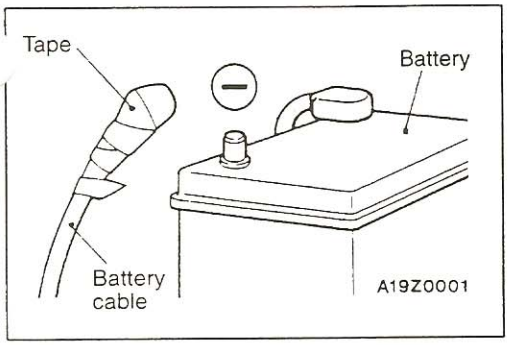
The SRS must be inspected by an authorized dealer 10 ye after the car manufacture date shown on the certifica label located on the left center pillar.



SRS WARNING LIGHT CHECK

Turn the ignition key to the ON position. Does the SRS warning light illuminate for about 7 seconds and turn "OFF" and then remain extinguished for at least 45 second?
If yes, the SRS system is functioning properly. If not, refer to GROUP 52B –Troubleshooting.

TSB Revision

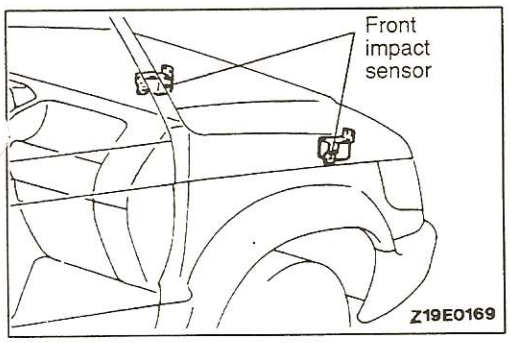


SRS COMPONENT VISUAL CHECK

1. Turn the ignition key to the LOCK position, disconnect the negative battery cable and tape the terminal.

   Caution
   Wait at least 60 seconds after disconnecting the battery cable before doing any further work. The SRS system is designed to retain enough voltage to deploy the air bag for a short time even after the battery has been disconnected, so serious injury may result from unintended air bag deployment if work is done on the SRS system immediately after the battery cable is disconnected.

2. Remove the floor console assembly. (Refer to GROUP 52A – Floor Console.)
3. Disconnect a connector from the SRS diagnosis unit.

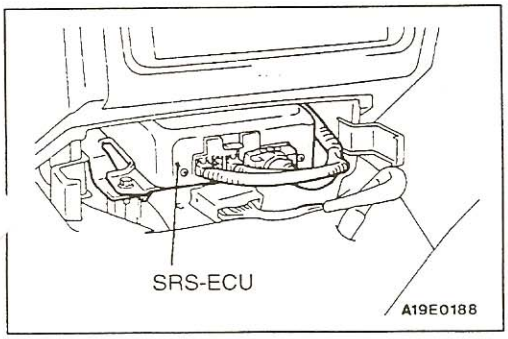


FRONT IMPACT SENSORS

1. Check that the arrows on the sensors face toward the front of the vehicle.
2. Check the radiator support panel and front impact sensor for deformation or rust.

   Caution
   The SRS may not activate if a front impact sensor is not installed properly, which could result in serious injury or death to the vehicle's driver.

3. Check the wiring front impact sensor harness for binds, connector for damage, and check the terminals for deformation.
   Replace sensor and/or wiring harness if they fail the visual check. (Refer to GROUP 52B – SRS Service Precautions and GROUP 52B – Front Impact Sensor.)



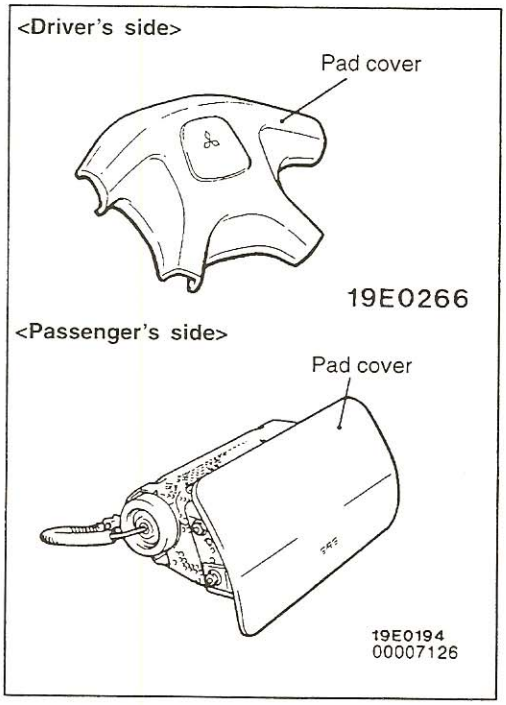
SRS AIR BAG CONTROL UNIT (SRS-ECU)

1. Check the SRS-ECU case and brackets for dents, cracks, deformation or rust.

   Caution
   The SRS may not activate if a SRS diagnosis unit (with built-in safing impact sensor) is not installed properly, which could result in serious injury or death to the vehicle's driver.

TSB Revision

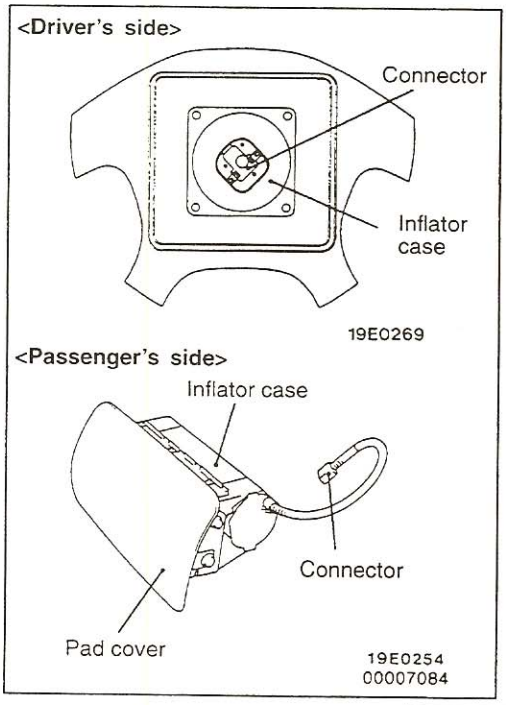
2. Check the connector for damage, and check the terminals for deformation or rust.
   Replace the SRS-ECU if it fails the visual check. (Re to GROUP 52B – SRS Air bag Control Unit.)



AIR BAG MODULE, STEERING WHEEL AND CLOCK SPRING

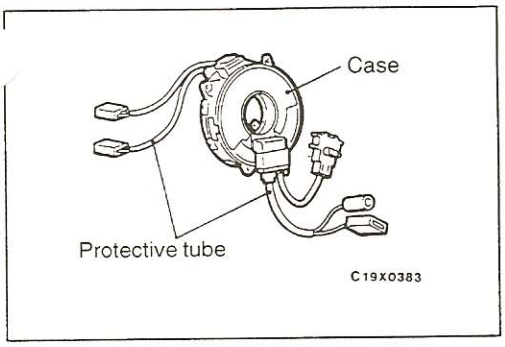
1. Remove the air bag module, steering wheel and clock spring.
   (Refer to GROUP 52B – Air Bag Module and Clock Spring.)

   Caution
   The removed air bag module should be stored in a clean, dry place with the pad cover face up.
2. Check the pad cover for dents, cracks or deformation.

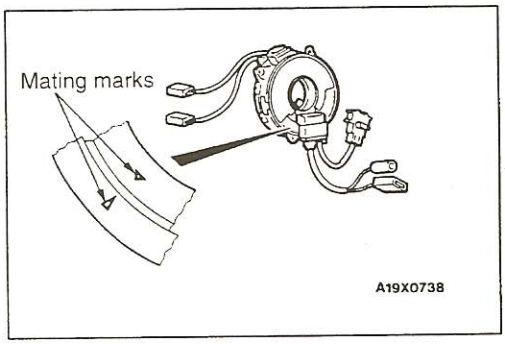


3. Check the connector for damage and deformed terminals, and check the harness for binds.
4. Check the air bag inflator case for dents, cracks or deformation.
5. Check the harness which is built into the steering wheel and connectors for damage, and check the terminals for deformation.

TSB Revision



6. Check the clock spring connectors and protective tube for damage, and terminals for deformities.
7. Visually check the case for damage.

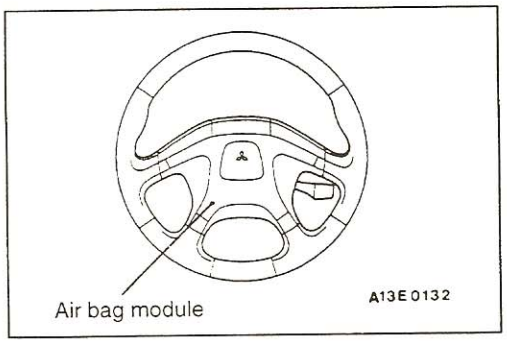


8. Align the mating marks of the clock spring, and after turning the front wheels to the straight-ahead position, install the clock spring to the column switch.

Mating marks alignment

After turning the clock spring fully clockwise, turn it approximately 3 1/3 turns counterclockwise until the mating marks are aligned.

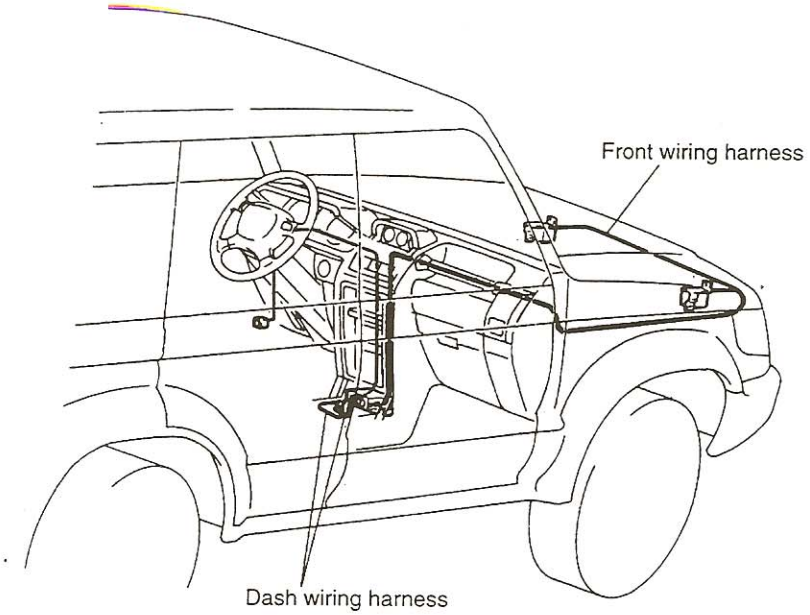
Caution
If the clock spring's mating mark is not properly aligned, the steering wheel may not be completely rotational during a turn, or the flat cable within the clock spring may be severed, obstructing normal operation of the SRS and possibly leading to serious injury to the vehicle's driver and passenger.



9. Install the steering column covers, steering wheel and air bag module.
10. Check the steering wheel for noise, binding or difficult operation.
11. Check the steering wheel for excessive free play.
    REPLACE ANY VISUALLY INSPECTED PART IF IT FAILS THAT INSPECTION. (Refer to GROUP 52B – Air Bag Module and Clock Spring.)

Caution
The SRS may not activate if any of the above components are not installed properly, which could result in serious injury or death to the vehicle's driver and passenger.

WIRING HARNESS



Z19E0174

1. Check the connector for poor connection.
2. Check the harness for binds check the connectors for damage, and check the terminals for deformation. REPLACE ANY CONNECTORS OR HARNESS TI FAIL THE VISUAL INSPECTION. (Refer to GROUP 52B – SRS Service Precautions.)

Caution
The SRS may not activate if SRS harnesses or connectors are damaged or improperly connected, which could result in serious injury or death to the vehicle's driver and passenger.

MAIN SEALANT AND ADHESIVE TABLE

00100380045

SEALANTS FOR ENGINE ACCESSORIES

Application	Recommended brand
Sealing between rocker cover and camshaft bearing cap (4G6 DOHC and 6G7 engines only)	3M ATD Part No. 8660 or equivalent
Sealing between semi-circular packing and rocker cover and between semi-circular packing and cylinder head	
Oil pressure switch (except 4G1 and 6G7 engines)	
Engine coolant temperature switch, Engine coolant temperature sensor, Thermo valve, Thermo switch, Joints, Engine coolant temperature gauge unit (large size)	3M Nut Locking Part No. 4171 or equivalent
Engine coolant temperature gauge unit (small size, MD091056 only)	3M ATD Part No. 8660 or equivalent
Oil pan (except 4G5 engine)	MITSUBISHI GENUINE Part No. MD970389 or equivalent

SEALING BETWEEN GLASS AND WEATHERSTRIP

Application	Recomended brand
Sealing between tempered glass and weatherstrip	3M ATD Part No.8513 or equivalent
Sealing between body flange and weatherstrip	3M ATD Part No. 8509 or equivalent
Sealing between laminated glass and weatherstrip	

ADHESION WITH RIBBON SEALER

Application	Recomended brand
Waterproof film for door, Fender panel, Splash shield, Mud guard, Rear combination light	3M ATD Part No. 8625 or equivalent

ADHESIVES FOR INTERIOR TRIM

APPLICATION	Recomended brand
Adhesion of polyvinylchloride sheet	3M Part No. EC-1368 or equivalent
Adhesion of door weatherstrip to body	3M ATD Part No. 8001 or 3M ATD Part No. 8011 or equivalent
Sealing between grommet or packing and metal seal	3M ATD Part No. 8513 or equivalent
Adhesion of headlining and other interior trim materials	3M Part No. EC–1368 or 3M ATD Part No. 8080 or equivalent
Adhesion of fuel tank to pad	

BODY SEALANT

Application	Recomended brand
Sealing of sheet metal, drip rail, floor, body side panel, trunk, front panel and the like joints	3M ATD Part No. 8531 or 3M ATD Part No. 8646 or equivalent
Sealing of tailgate hinges	

TSB Revision

CHASSIS SEALANT

Application	Recomended brand
Sealing of flange surfaces and threaded portions	3M ATD Part No. 8659 or equivalent
Fuel gauge unit packing	
Sealing of flange surfaces, threaded portions, packing and dust cover • Differential carrier packing • Dust covers for ball joint and linkage • Steering gear box packing and shims • Steering gear housing rack support cover and top cover • Mating surface of knuckle arm flange	3M ATD Part No. 8663 or equivalent
Sealing between accelerator arm bracket and toeboard	Drying sealant
Sealant for drum brake shoe hold-down pin and wheel cylinder	3M ATD Part No.8155 or equivalent

FAST BONDING ADHESIVE

Application	Recommended brand
Adhesion of all materials except polyethylene, polypropylene, fluorocarbon resin or other materials with highly absorbent surface	3M ATD Part No. 8155 or equivalent

ANAEROBIC FAST BONDING ADHESIVES

Application	Recommended brand
Fixing of bolts and screws • Tightening of drive gear to differential case • Bolts for coupling tilt steering upper column with lower column	3M Stud locking Part No. 4170 or equivalent
Fixing of bearing, fan, pulley and gear connections	
Sealing of small recess or flange surface	
Steering angle stopper bolt	3M Nut locking Part No. 4171 or equivalent

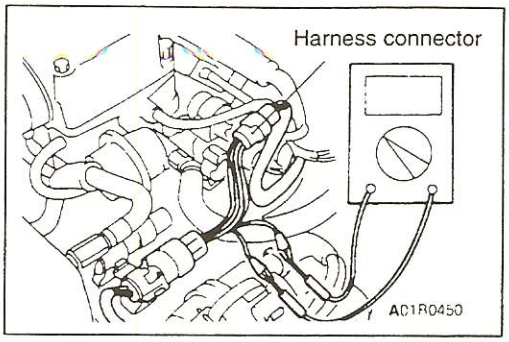
UNDERCOAT

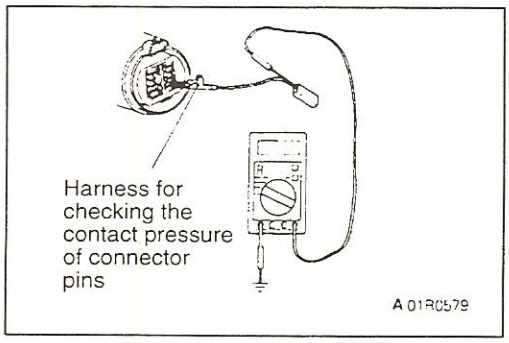
Application	Recommend brand
Undercoat	3M ATD Part No. 8864 or equivalent

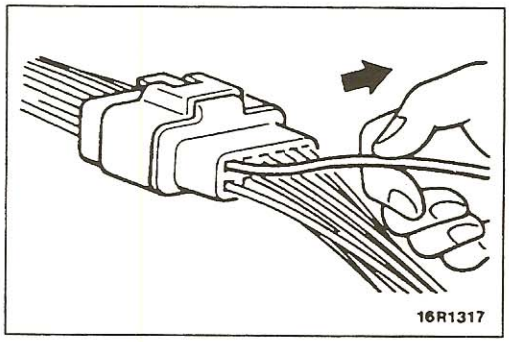
GENERAL <ELECTRICAL>

CONTENTS

00109000805







HARNESS CONNECTOR INSPECTION

001003

CONNECTOR CONTINUITY AND VOLTAGE TEST

Follow the steps below to avoid causing poor connector contact and/or reduced waterproof performance of connectors when checking continuity and/or voltage at connectors of waterproof connectors.

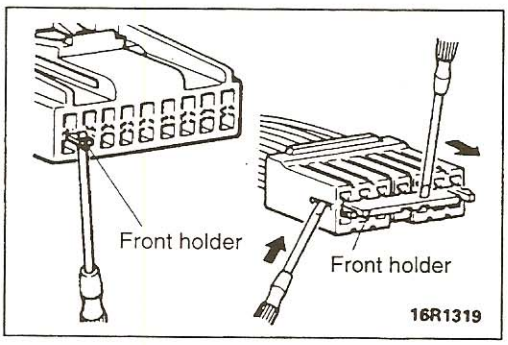
(1) If checking is performed with the circuit in the state of continuity, be sure to use the special tool (harness connector). Never insert a test bar from the harness side, because to do so will reduce the waterproof performance and result in corrosion.
(2) If the connector is disconnected for checking and the facing part is the female pin side, the harness for checking the contact pressure of connector pins should be used. Never force the insertion of a test bar, because to do so will cause poor or improper contact.
(3) If the facing part is the male pin side, contact the test bar directly to the pins. Care must be taken not to short-circuit the connector pins.

IMPROPER TERMINAL ENGAGEMENT CHECK

When the terminal stopper of the connector is out of order, engagement of the male and female terminals becomes improper even when the connector itself is engaged perfe and terminal sometimes slips out to rear side of connec... Make sure, that each terminal does not come off the connector by pulling each harness wire.

CONNECTOR TERMINAL ENGAGEMENT AND DISENGAGEMENT

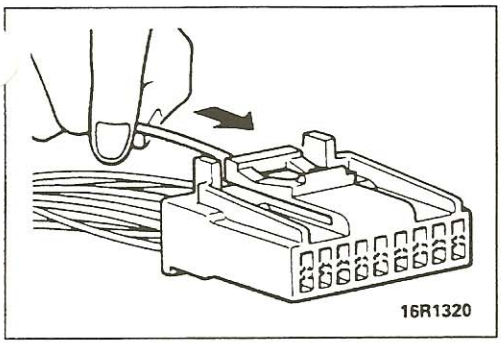
A connector that engages loosely can be repaired by removing the female terminal from the connector housing and raising its lance to establish securer engagement. Removal of the connector terminal used for MFI and ELC-4 A/T control circuit can be done in the following manner.



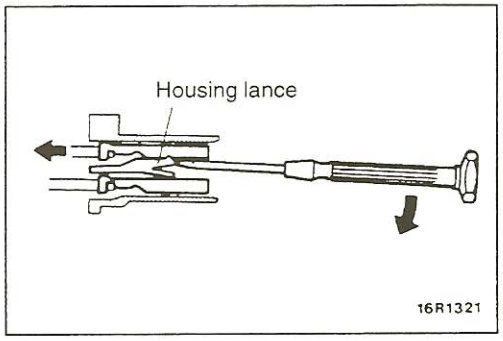
COMPUTER CONNECTOR

(1) Insert a screwdriver [1.4 mm (.06 in.) width] as shown in the figure, disengage front holder, and remove it.

TSB Revision

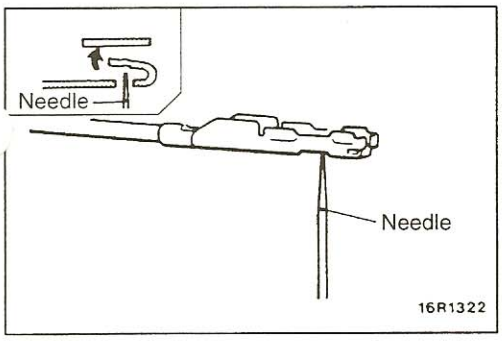


(2) Insert the harness terminal to be repaired deep into the connector from harness side and hold it there.



(3) Insert the tip of the screwdriver [1.4 mm (.06 in.) width] into the connector as shown in the figure, raise the housing lance slightly with it, and pull out the harness.

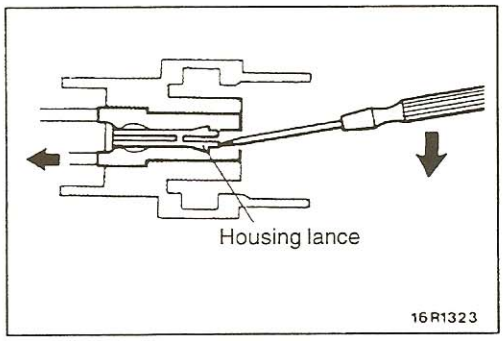
Caution
Tool No. 753787-1 supplied by AMP can be used instead of screwdriver.

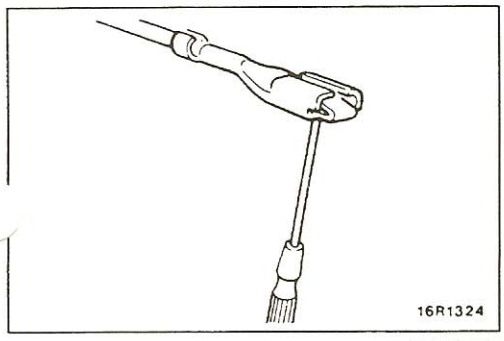


(4) Insert a needle through the hole provided on the terminal and raise the contact point of the male terminal.

ROUND WATERPROOF CONNECTOR

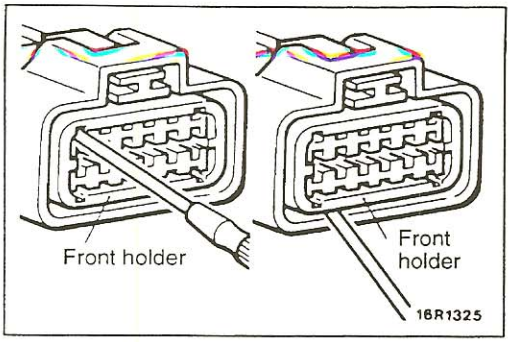
(1) Remove the waterproof cap by using a screwdriver.
(2) Insert the tip of the screwdriver [1.4 mm (.06 in.) or 2.0 mm (.08 in.) width] into the connector as shown in the figure, raise the housing lance slightly with it, and pull out harness.





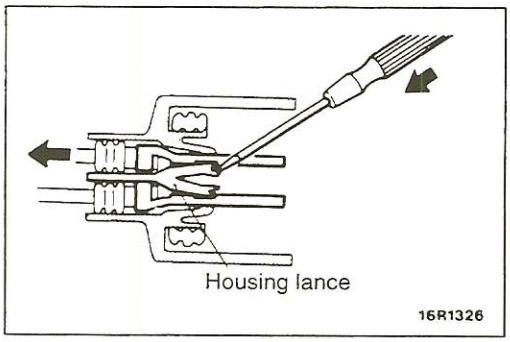
(3) Insert a screwdriver through the hole provided on the terminal and raise the contact point of the male terminal.

TSB Revision

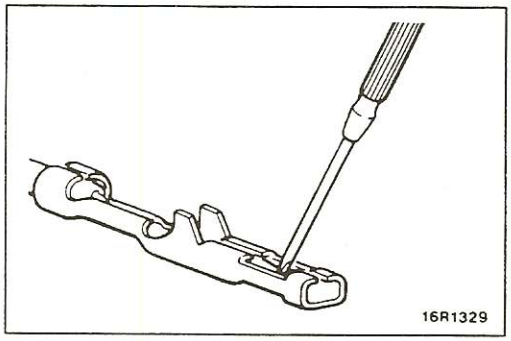


RECTANGULAR WATERPROOF CONNECTOR

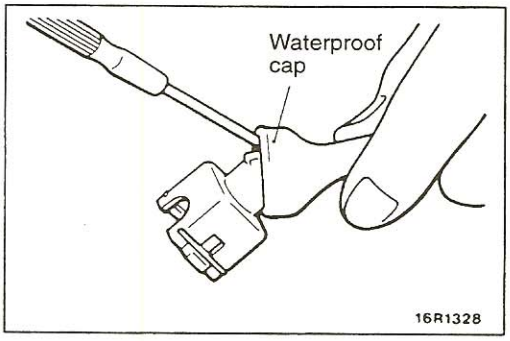
(1) Disengage the front holder by using a screwdriver remove it.



(2) Insert the tip of a screwdriver [*0.8 mm (.03 in.) width] into the connector as shown in the figure, push it lightly to raise the housing lance, and pull out the harness.
*If the right size screwdriver is not available, convert a conventional driver to the proper size.

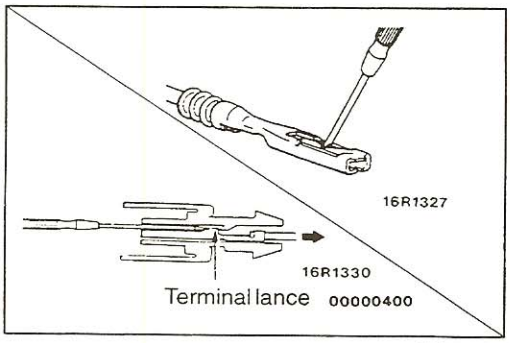


(3) Press the contact point of the male terminal down by holding a screwdriver [1.4 mm (.06 in.) width] as shown in the figure.



INJECTOR CONNECTOR

(1) Remove the waterproof cap.



(2) Insert the tip of a screwdriver [1.4 mm (.06 in.) width] into the connector as shown in the figure, press in the terminal lance, and pull out the harness.
(3) Press the contact point of the male terminal down by holding a screwdriver [1.4 mm (.06 in.) width] as shown in the figure.

Caution
Make sure the lance is in the proper condition before the terminal is inserted into the connector.

TSB Revision

HOW TO DIAGNOSE

00100430016

The most important point in troubleshooting is to determine "Probable Causes". Once the probable causes are determined, parts to be checked can be limited to those associated with such probable causes. Therefore, unnecessary checks can be eliminated. The determination of the probable causes must be based on a theory and be supported by facts and must not be based on intuition only.

TROUBLESHOOTING STEPS

If an attempt is made to solve a problem without going through correct steps for troubleshooting, the problem symptoms could become more complicated, resulting in failure to determine the causes correctly and making incorrect repairs. The four steps below should be followed in troubleshooting.

1 Observation of Problem Symptoms	Observe the symptom carefully. Check if there are also other problems.
2 Determination of Probable Causes	In determining the probable causes, it is necessary to check the wiring diagram to understand the circuit as a system. Knowledge of switches, relays and other parts is necessary for accurate determination. The causes of similar problems in the past must be taken into account.
3 Checking of Parts Associated with Probable Causes and Determination of Faulty Parts	Troubleshooting is carried out by making step by step checks until the true cause is found. Always go through the procedures considering what check is to be made where for the best results.
4 Repair and Confirmation	After the problems are corrected, be sure to check that the system operates correctly. Also check that new problems have not been caused by the repair.

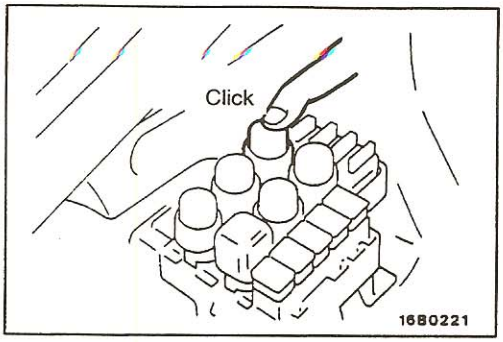
INFORMATION FOR DIAGNOSIS

This manual contains the cable diagrams as well as the individual circuit drawings, operational explanations, and troubleshooting hints for each component required to facilitate the task of troubleshooting. The information is complied in the following manner:

(1) Cable diagrams show the connector positions, etc., on the actual vehicle as well as the harness path.
(2) Circuit drawings show the configuration of the circuit with all switches in their normal positions.
(3) Operational explanations include circuit drawings of voltage flow when the switch is operated and how the component operates in reaction.
(4) Troubleshooting hints include numerous examples of problems which might occur, traced backward in a common-sense manner to the origin of the trouble. Problems whose origins may not be found in this manner are pursued through the various system circuits.

NOTE
Components of ECI, ETACS, ECS, etc. with ECU do not include 3 and 4 above. For this information, refer to a manual which includes details of these components.

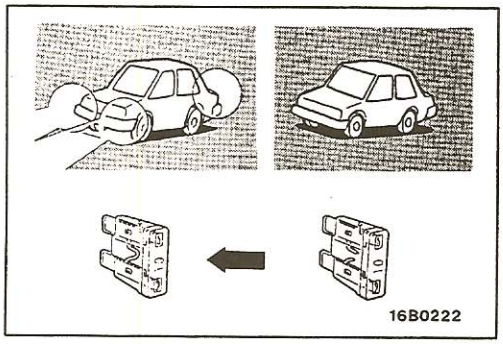
TSB Revision



INSPECTION

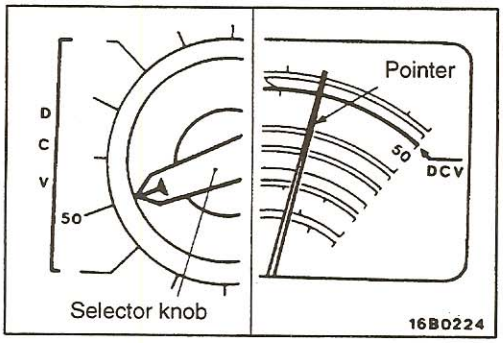
1. Visual and aural checks

Check relay operation, blower motor rotation, light illumination, etc. visually or aurally. The flow of current is invisible but can be checked by the operation of the parts.



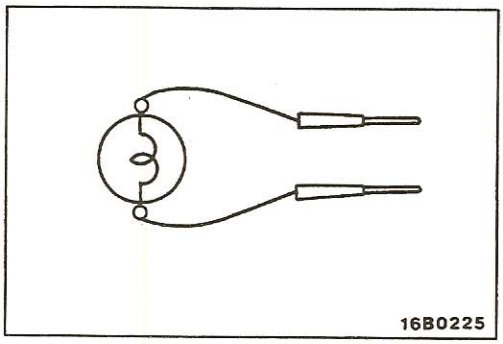
2. Simple checks

For example, if a headlight does not come on and a faulty fuse or poor grounding is suspected, replace the fuse with a new one or ground the light to the body by a jumper wire to determine which part is responsible for the problem.



3. Checking with instruments

Use an appropriate instrument in an adequate range and read the indication correctly. You must have sufficient knowledge and experience to handle instruments corr ly.

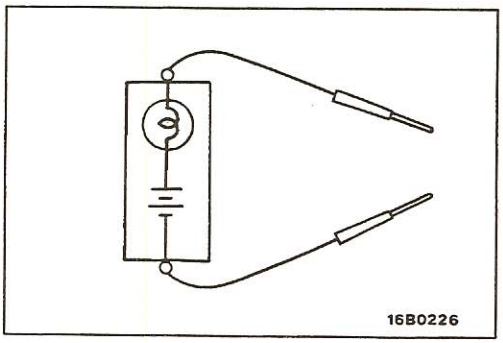


INSPECTION INSTRUMENTS

For inspection, use the following instruments:

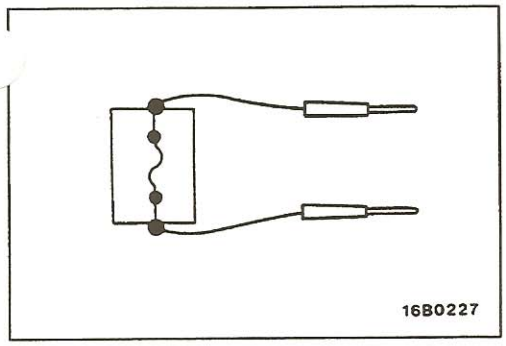
1. Test lights

A test light consists of a 12V bulb and lead wires. It is used to check voltages or shortcircuits.



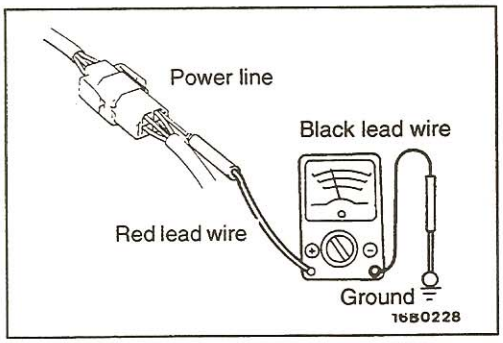
2. Self-power test light

A self-power test light consists of a bulb, battery and lead wires connected in series. It is used to check continuity or grounding.



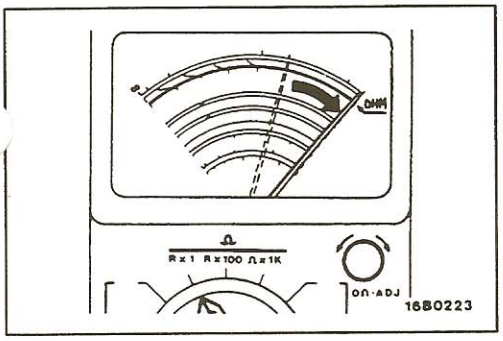
3. Jumper wire

A jumper wire is used to close an open circuit. Never use one to connect a power supply directly to a load.



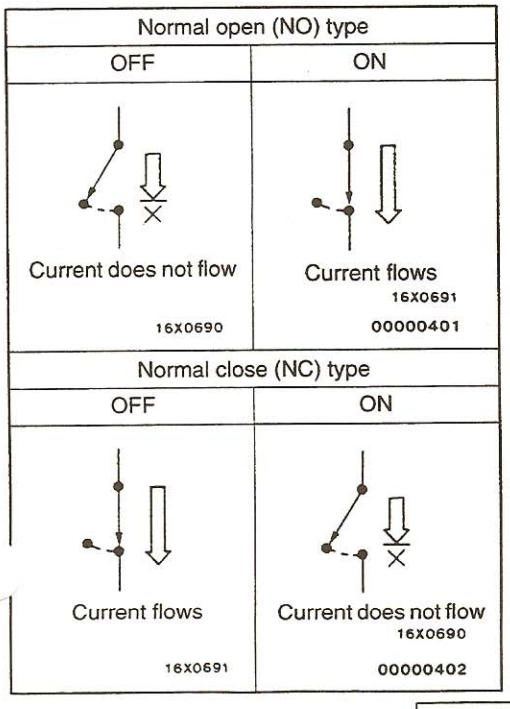
4. Voltmeter

A voltmeter is used to measure the circuit voltage. Normally, the positive (red lead) probe is applied to the point of voltage measurement and the negative (black lead) probe to the body ground.



5. Ohmmeter

An ohmmeter is used to check continuity or measure resistance of a switch or coil. If the measuring range has been changed, the zero point must be adjusted before measurement.



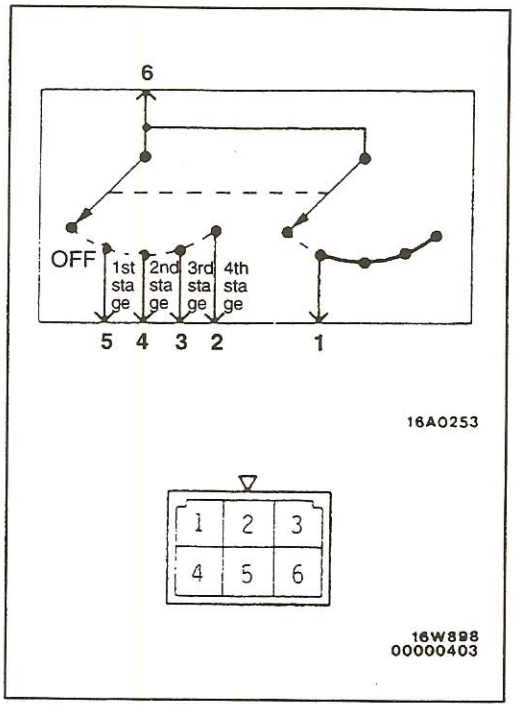
CHECKING SWITCHES

In a circuit diagram, a switch is represented by a symbol and in the idle state.

1. Normal open or normal close switch

Switches are classified into those which make the circuit open and those which make the circuit closed when off.

TSB Revision

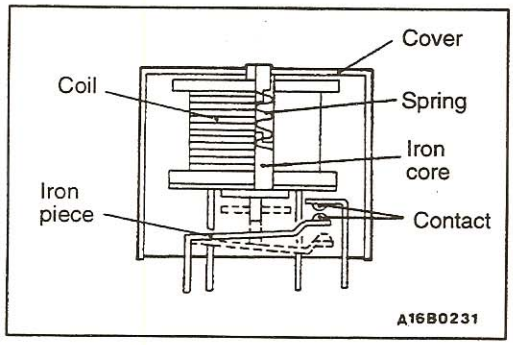


2. Switch connection

This figure illustrates a complex switch. The conti between terminals at each position is as indicated in the table below.

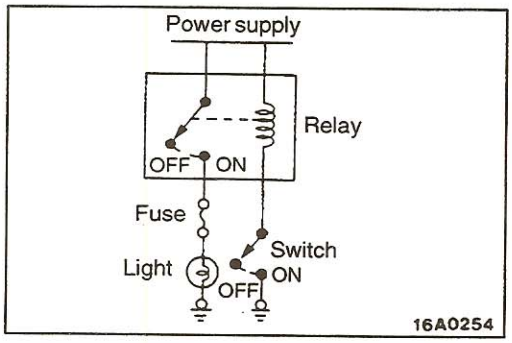
Position	Terminal No.					
	1	2	3	4	5	6
OFF						
1st stage	○				○	○
2nd stage	○			○		○
3rd stage	○		○			○
4th stage	○	○				○

NOTE
○—○ denotes continuity between terminals.

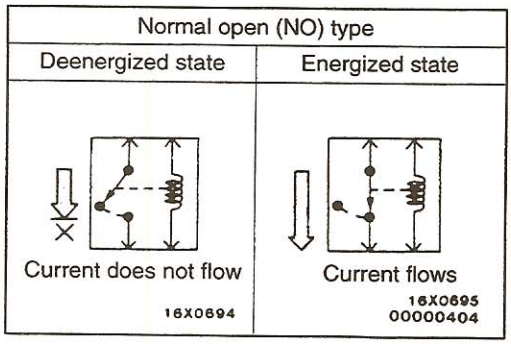


CHECKING RELAYS

1. When current flows through the coil of a relay, its core is magnetized to attract the iron piece, closing (ON) the contact at the tip of the iron piece. When the coil cur is turned off, the iron piece returns to its original posit... by a spring, opening the contact (OFF).



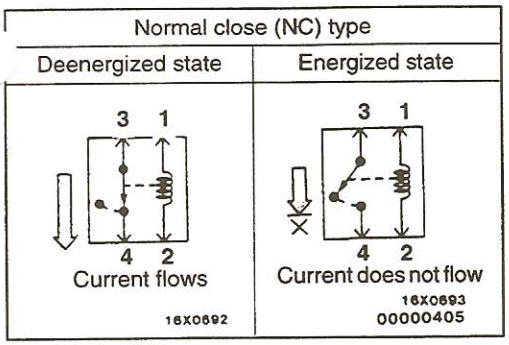
2. By using a relay, a heavy current can be turned on and off by a switch of small capacity. For example, in the circuit shown here, when the switch is turned on (closed), current flows to the coil of the relay. Then, its contact is turned on (closed) and the light comes on. The current flowing at this time to the switch is the relay coil current only, and is very small.



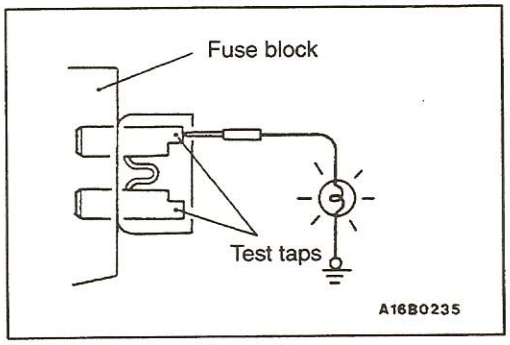
3. The relays may be classified into the normal open-type and the normal close-type by their contact construction.

NOTE
The deenergized state means that no current is flowing through the coil and the energized state means that current is flowing through the coil.

TSB Revision

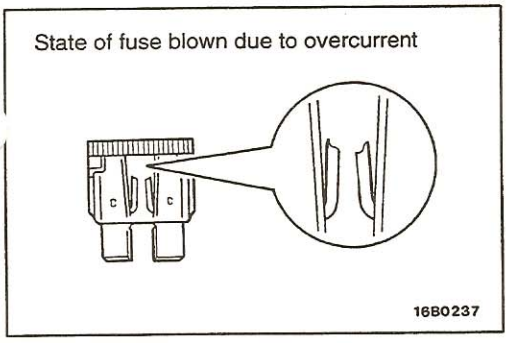


When a normal close-type relay as illustrated here is checked, there should be continuity between terminals 1 and 2 and between terminals 3 and 4 when the relay is deenergized, and the continuity should be lost between terminals 3 and 4 when the battery voltage is applied to the terminals 1 and 2. A relay can be checked in this manner. It cannot be determine if a relay is okay or faulty by checking its state only when it is deenergized (or energized).



CHECKING FUSES

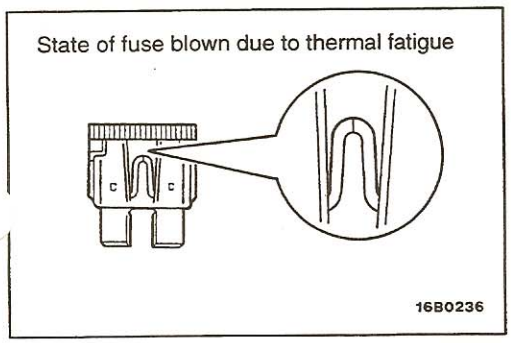
A blade type fuse has test taps provided to allow checking of the fuse itself without removing it from the fuse block. The fuse is okay if the test light comes on when its one lead is connected to the test taps (one at a time) and the other lead is grounded. (Change the ignition switch position so that the fuse circuit becomes live.)



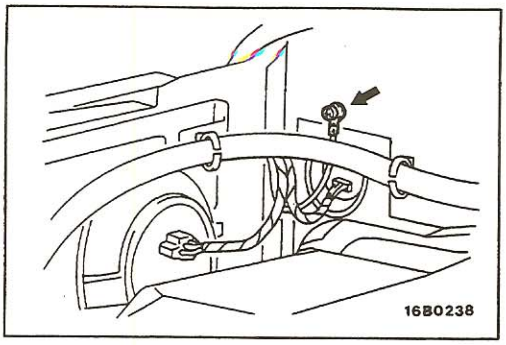
CAUTIONS IN EVENT OF BLOWN FUSE

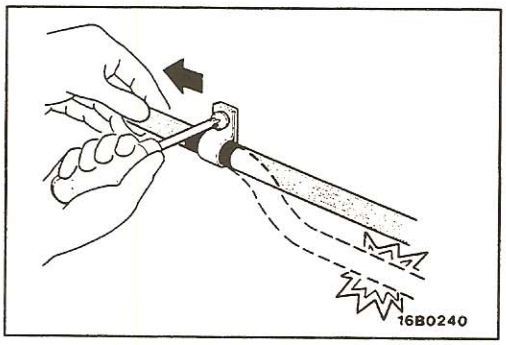
When a fuse is blown, there are two probable causes as follows: One is that it is blown due to flow of current exceeding its rating. The other is that it is blown due to repeated on/off current flowing through it. Which of the two causes is responsible can be easily determined by visual check as described below.

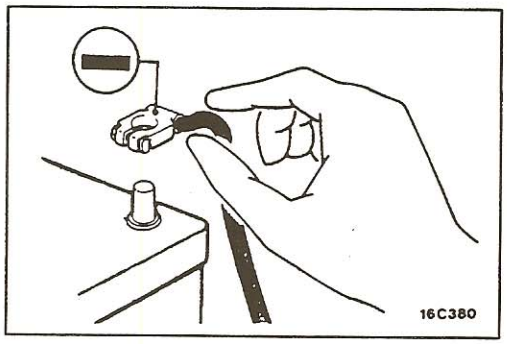
(1) Fuse blown due to current exceeding rating
The illustration shows the state of a fuse blown due to this cause. In this case, do not replace the fuse with a new one hastily since a current heavy enough to blow the fuse has flowed through it. First, check the circuit use only a fase of the for shorts and check for abnormal electric parts. After correcting shorts or replacing parts, use only a fuse of the same capacity as a replacement. Never use a fuse of lager capacity than the one that has blown. If such a fuse is used, electric parts or wirings could be damaged before the fuse blows in the event an overcurrent occurs again.

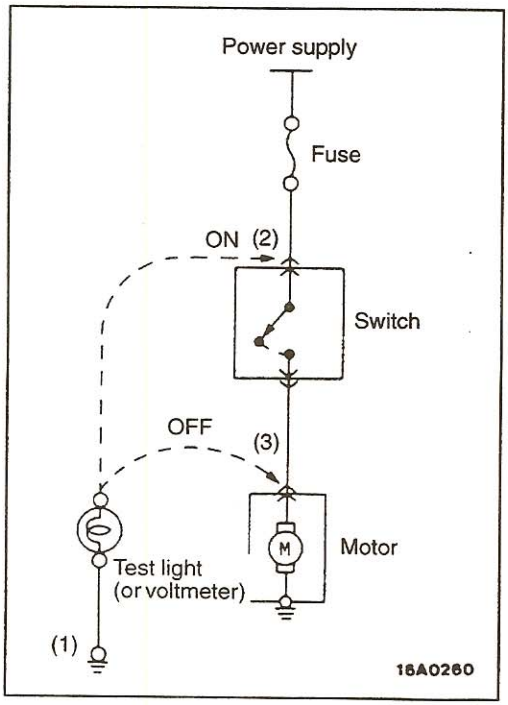


(2) Fuse blown due to repeated current on/off
The illustration shows the state of a fuse blown due to repeated current on/off. Normally, this type of problem occurs after a fairly long period of use and is less frequent than the above type. In this case, simply replace with a new fuse of the same capacity.









CABLES AND WIRES CHECK

1. Check connections for looseness, rust and stains.
2. Check terminals and wires for corrosion by battery electrolyte, etc.
3. Check terminals and wires for open circuit or impending open circuit.
4. Check wire insulation and coating for damage, cracks and degrading.
5. Check conductive parts of terminals for contact with other metallic parts (vehicle body and other parts).
6. Check grounding parts to verify that there is complete continuity between attaching bolt(s) and vehicle body.
7. Check for incorrect wiring.
8. Check that wirings are clamped to prevent contact with sharp corners of the vehicle body, etc. or hot parts (exhaust manifold, pipe, etc.).
9. Check that wirings are clamped firmly to secure enough clearance from the fan pulley, fan belt, and other rotating or moving parts.
10. Check that the wirings between the fixed parts such as the vehicle body and the vibrating parts such as the engine are made with adequate allowance for vibrations.

BATTERY HANDLING

When checking or servicing does not require power from the on-vehicle battery, be sure to disconnect the cable from the battery (–) terminal. This is to prevent problems could be caused by a short circuit. Disconnect the (–) terminal first and reconnect it last.

GENERAL ELECTRICAL SYSTEM CHECK

A circuit consists of the power supply, switch, relay, load, ground, etc. There are various methods to check a circuit including an overall check, voltage check, short-circuit check, and continuity check. Each of # these methods is briefly described in the following:

1. VOLTAGE CHECK

(1) Ground one lead wire of the test light. If a voltmeter is used instead of the test light, ground the grounding side lead wire.

(2) Connect the other lead wire of the test light to the power side terminal of the switch connector. The test light should come on or the voltmeter should indicate a voltage.

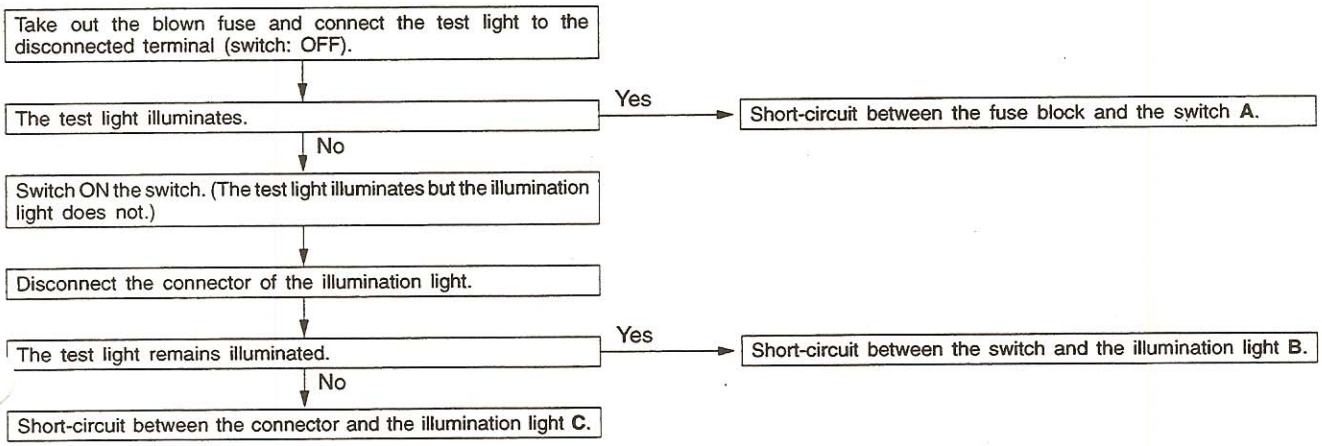
(3) Then, connect the test light or voltmeter to the motor connector. The test light should not come on, or the voltmeter should indicate no voltage. When the switch is turned on in this state, the test light should come on, or the voltmeter should indicate a volt with motor starting to run.

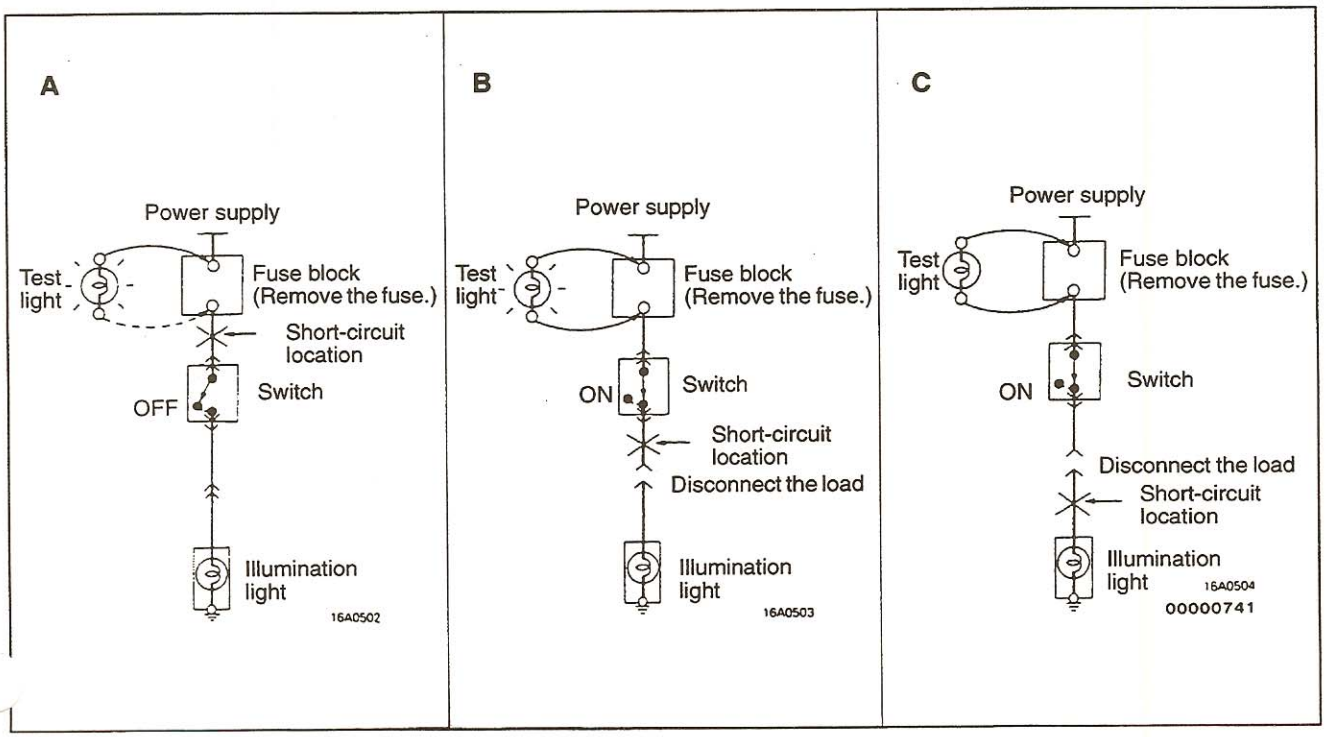
TSB Revision

(4) The circuit illustrated here is normal. If there is any problem, such as the motor failing to run, check voltages beginning at the connector nearest to the motor until the faulty part is identified.

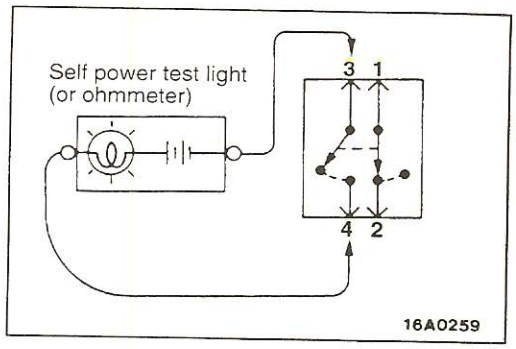
2. SHORT-CIRCUIT CHECK

Because the fuse has blown, it is probable that there is a short circuit. Follow the procedures below to narrow down the short-circuit location.





TSB Revision



3. CONTINUITY CHECK

(1) When the switch is in the OFF position, the self p test light must illuminate or the ohmmeter should read 0 ohm, only when the terminals 1 and 2 are interconnected.

(2) When the switch is the ON position, the self power test light should come on or the ohmmeter should read 0 ohm, only when the terminals 3 and 4 are interconnected.

ENGINE

CONTENTS

11109000504

NOTES

ENGINE <3.5L>

CONTENTS

11109000511

ENGINE <3.5L>

1110002

GENERAL SPECIFICATIONS

Items			Specifications
Type			V-type, Over Head Camshaft
Number of cylinders			6
Bore mm (in.)			93.0 (3.661)
Stroke mm (in.)			85.8 (3.378)
Piston displacement cm^3 (cu. in.)			3,497 (213.4)
Compression ratio			9.0
Firing order			1-2-3-4-5-6
Valve timing	Intake valve	Opens (BTDC)	13°
		Closes (ABDC)	55°
	Exhaust valve	Opens (BBDC)	51°
		Closes (ATDC)	17°

SERVICE SPECIFICATIONS

11100030397

Items		Standard value	Limit
Drive belt tension N (lbs.) Generator V-ribbed type	When checked	392–588 (87 – 130)	–
	When new belt is installed	637–833 (141 – 184)	–
	When used belt is installed	441–539 (98–119)	–
Drive belt tension N (lbs.) Power steering pump	When checked	294–490 (66 – 110)	–
	When new belt is installed	490–686 (110 – 154)	–
	When used belt is installed	343–441 (77 – 99)	–
Drive belt deflection <Reference value> mm (in.) Generator V-ribbed type	When checked	A: 5.0–7.0 (.20 –.28)	–
		B: 7.5 – 9.5 (.30 – .37)	–
	When new belt is installed	A: 4.0–5.0 (.16 – .20)	–
		B: 5.5–7.5 (.22 – .30)	–
	When used belt is installed	A: 5.5–6.5 (.22 – .26)	–
		B: 8.0–9.0 (.31 – .35)	–
Drive belt deflection <Reference value> mm (in.) Power steering pump	When checked	13.8 – 17.8 (.54 – .70)	–
	When new belt is installed	10.7 – 13.7 (.42 – .54)	–
	When used belt is installed	14.8 – 16.8 (.58 – .66)	–
Drive belt deflection <Reference value> mm (in.) A/C compressor	When checked	6.5–7.5 (.26– .30)	–
	When new belt is installed	5.0–6.0 (.20 – .24)	–
	When used belt is installed	6.5–7.5 (.26 – .30)	–
Basic ignition timing at idle		5° BTDC ± 3°	–
Actual ignition timing at curb idle		Approx. 15° BTDC	–
CO contents %		0.5 or less	–
HC contents ppm		100 or less	–
Curb idle speed r/min		700±100	–

TSB Revision

Items		Standard value	Limit
Compression pressure (250–400 r/min) kPa (psi)		1,200 (171)	min. 890 (127)
Compression pressure difference of all cylinder kPa (psi)		–	max. 100 (14)
Intake manifold vacuum at curb idle kPa (in.Hg)		–	min. 60 (18)
Timing belt	Amount of projection of auto tensioner rod mm (in.) (Distance between the tensioner arm and auto tensioner body)	3.8 – 5.0 (.150 – .196)	–

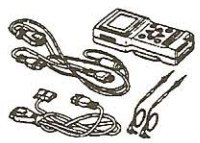
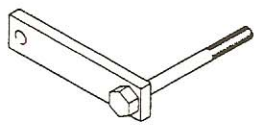
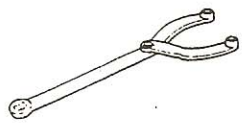
SEALANT

11100050164

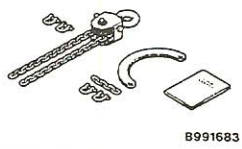
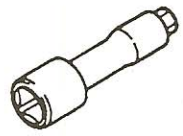
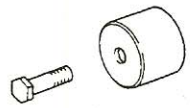
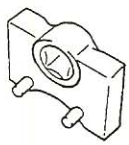
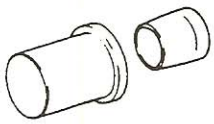
Items	Recommended sealant
Oil pan	MITSUBISHI GENUINE Part No. MD970389 or equivalent

SPECIAL TOOLS

11100060549

Tool	Tool number and name	Supersession	Application
	MB991502 Scan tool (MUT-II)	MB991496-0D	• Checking of engine idling speed • Checking of ignition timing
	MD998781 Flywheel stopper	–	Drive plate supporting
	MD998718 Crankshaft rear oil seal installer	MD998718-01	Installation of the crankshaft rear oil seal
	MB990767 End yoke holder	MB990767-01	Supporting the sprocket and shaft pulley during removal and installation Use with MD998715
	MD998715 Pulley holding pins	MIT308239	Supporting the crankshaft pulley when crankshaft bolt and pulley are removed or reinstalled. Use together with MB990767 Camshaft pulley supporting
	MD998769 Crankshaft sprocket spacer	General Service Tool	Used if the crankshaft needs to be rotated to attach the timing belt, etc.

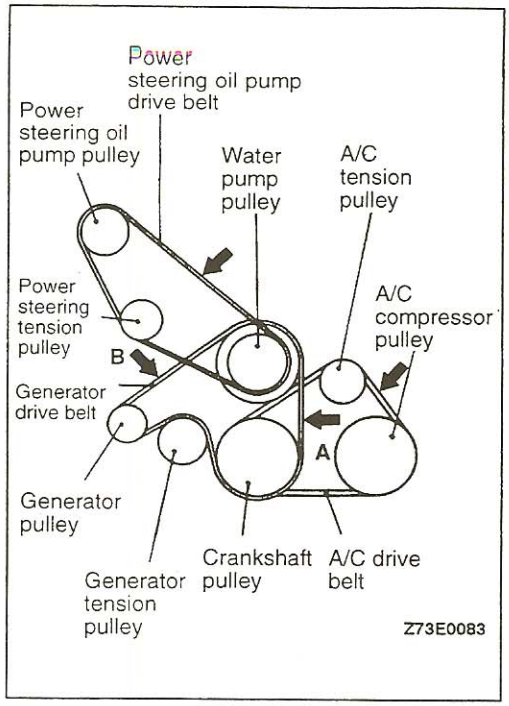
TSB Revision

Tool	Tool number and name	Supersession	Application
 B991683	MB991683 Sling chain set	–	Removal and installation engine assembly
	MD998051 Wrench, cylinder head bolt	MD998051-01 or General Service Tool	Loosening and tightening of cylinder head bolt
	MD998713 Camshaft oil seal installer	MD998713-01	Camshaft oil seal installation
	MB991559 Camshaft oil seal installer	–	Press fitting the camshaft oil seal (For left bank)
	MD998767 Tension pulley socket wrench	MD998752-01	Adjustment of the timing belt
	MD998717 Crankshaft front oil seal installer	MD998717-01	Press-fitting of crankshaft front oil seal

TROUBLESHOOTING

11100070337

Trouble Symptom	Probable Cause	Remedy
Compression is too low	Blown cylinder head gasket	Replace the gasket.
	Worn or damaged piston rings	Replace the rings.
	Worn piston or cylinder	Repair or replace the piston and/or the cylinder block.
	Worn or damaged valve seat	Repair or replace the valve and/or the seat ring
	Worn or damaged valve guide	Replace valve guide
Drop in oil pressure	Engine oil level is too low	Check the engine oil level.
	Malfunction of oil pressure switch	Replace the oil pressure switch.
	Clogged oil filter	Install a new filter.
	Worn oil pump gears or cover	Replace the gears and/or the cover.
	Thin or diluted engine oil	Change the engine oil to the correct viscosity.
	Stuck (open) oil relief valve	Repair the relief valve.
	Excessive bearing clearance	Replace the bearings.
Oil pressure too high	Stuck (closed) oil relief valve	Repair the relief valve.
Noisy valves	Malfunction of lash adjuster (Air mixed in a high-pressure chamber)	Check the lash adjuster.
	Thin or diluted engine oil (low oil pressure)	Change the engine oil.
	Worn or damaged valve stem or valve guide	Replace the valve and/or the guide.
Connecting rod noise/main bearing noise	Insufficient oil supply	Check the engine oil level.
	Thin or diluted engine oil	Change the engine oil.
	Excessive bearing clearance	Replace the bearings.



ON-VEHICLE SERVICE

11100310040

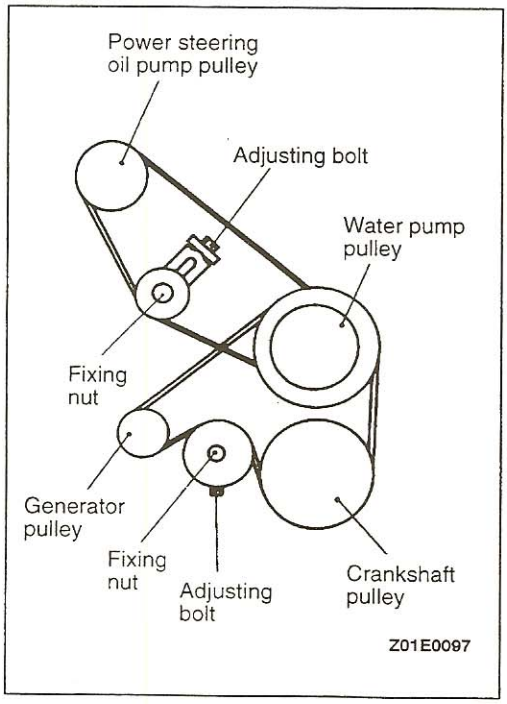
DRIVE BELT TENSION CHECK AND ADJUSTMENT

Check the belt tension by using a belt-tension gage or apply 98 N (22 lbs.) of force to the belt midway between the pulleys as shown in the illustration, and measure the deflection.

Standard value:

Item		Check value	Adjustment value new belt	Adjustment value used belt
For generator	Tension N (lbs.)	392–588 (87–130)	637–833 (141–184)	441–539 (98–119)
	Deflection <Reference value> mm (in.)	A: 5.0–7.0 (.20–.28)	A: 4.0–5.0 (.16–.20)	A: 5.5–6.5 (.22–.26)
		B: 7.5 – 9.5 (.30 – .37)	B: 5.5–7.5 (.22–.30)	B: 8.0–9.0 (.31–.35)
For power steering	Tension N (lbs.)	294–490 (66–110)	490–686 (110–154)	343–441 (77–99)
	Deflection <Reference value> mm (in.)	13.8 – 17.8 (.54 – .70)	10.7 – 13.7 (.42 – .54)	14.8 – 16.8 (.58 – .66)
For A/C	Deflection mm (in.)	6.5–7.5 (.26–.30)	5.0–6.0 (.20–.24)	6.5–7.5 (.26–.30)

A: Measure between the water pump pulley and the crankshaft pulley.
B: Measure between the water pump pulley and the generator.



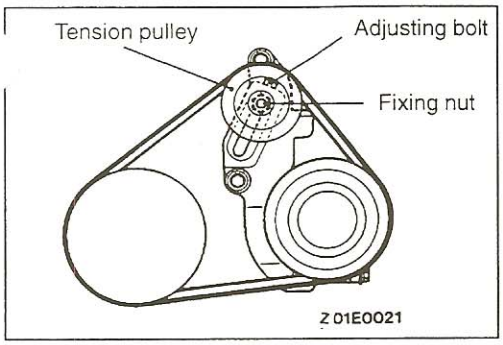
GENERATOR DRIVE BELT AND POWER STEERING OIL PUMP DRIVE BELT TENSION ADJUSTMENT

(1) Loosen the tension pulley fixing nut.
(2) Tighten the fixing nut temporarily to the following tightening torque.

Tightening torque: 9.8 – 19.6 Nm (7 – 14 ft.lbs.)

(3) Adjust the belt tension using the adjusting bolt.
(4) Tighten the fixing nut.
(5) Crank the engine once or more.
(6) Check the belt tension.

TSB Revision



AIR CONDITIONING COMPRESSOR DRIVE BELT TENSION ADJUSTMENT

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

IGNITION TIMING CHECK

11100170358

(1) Before inspection, set the vehicles in the following condition.
- Engine coolant temperature: 80 – 95°C (176 – 203°F)
- Lights and all accessories: OFF
- Transmission: P range

(2) Connect the scan tool to the date link connector.
(3) Set up a timing light.
(4) Start the engine and run at idle.
(5) Check that the idle speed is at approx. 700 r/min.
(6) Select the "item No.17" of the actuator test on the scan tool.
(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, check the MFI components by referring to GROUP 13A – On-vehicle Inspection of MFI Components.
(9) Press the clear key of the scan tool (select force-activating cancel mode), and cancel the actuator test.

NOTE
If it is not cancelled, force-activation continues for 27 minutes. Do not drive the vehicle in this condition, or the engine could be damaged.

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

Standard value: Approx. 15° BTDC

NOTE
1. Ignition timing is variable within about ±7°, even under normal operating.
2. And it is automatically further advanced by about 5° from 15° BTDC at the higher altitudes.

CURB IDLE SPEED CHECK

11100190484

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

(2) Check the basic ignition timing.

Standard value: 5° BTDC ± 3°

(3) After turning the ignition switch to OFF, connect the scan tool to the data link connector.
(4) Start the engine and run it at idle.
(5) Run the engine at idle for 2 minutes.
(6) Check the curb idle speed.

Standard value: 700 ± 100 r/min

NOTE
The idle speed is adjusted automatically by the idle air control (IAC) system.

(7) If there is a deviation from the standard value refer to GROUP 13A – Check Chart Classified by Trouble Symptoms, and check the MFI components.

IDLE MIXTURE CHECK

11100210470

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

(2) Turn the ignition switch to OFF and connect the scan tool to the data link connector.

(3) Check to be sure that the basic ignition timing is at the standard value.

Standard value: 5° BTDC ± 3°

(4) Start the engine and race it at an engine speed of 2,500 r/min for two minutes.

(5) Connect a CO and HC tester.

(6) Check the CO contents and the HC contents while the engine is idling.

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

(7) If the concentrations are outside the standard values, check the following items.
- Diagnostic output
- Closed loop control
  (If closed loop control is being carried out normally, the heated oxygen sensor output signal will vary between 0–400 mV and 600–1,000 mV while the engine is idling.)
- Fuel pressure
- Injectors
- Ignition coil, spark plug cables, spark plugs
- Evaporative emission control system
- Compression pressure

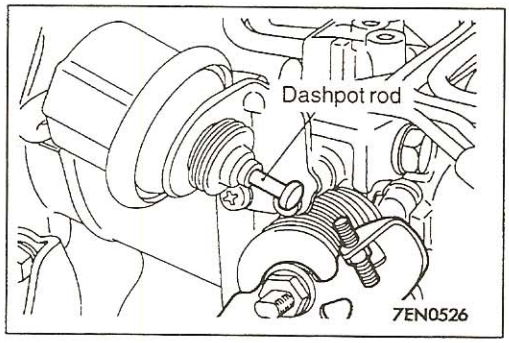
NOTE
If the results of the checks for all items are normal but the CO and HC concentrations still exceed the standard values, replace the three-way catalyst.

DASHPOT CHECK AND ADJUSTMENT <California>

111002

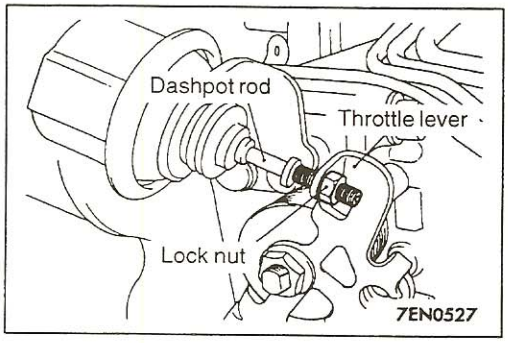
(1) Inspect the idle speed before inspection and adjustment of the dashpot.
(2) Set the vehicle in the following conditions before dashpot inspection and adjustment.
- Engine coolant temperature: 80–95°C (176 – 203°F)
- Lights and accessories: OFF
- Transmission: P range

(3) Connect the scan tool to the data link connector.
(4) Start the engine.



(5) Open the throttle valve until the dashpot rod makes a full stroke.
(6) Close the throttle valve slowly to find a point where the throttle lever contacts the dashpot rod (a point where the dashpot starts to contract). Hold the throttle valve at this point.
(7) Check the engine speed (at which the dashpot starts to operate).

Standard value: 2,200 ± 200 r/min

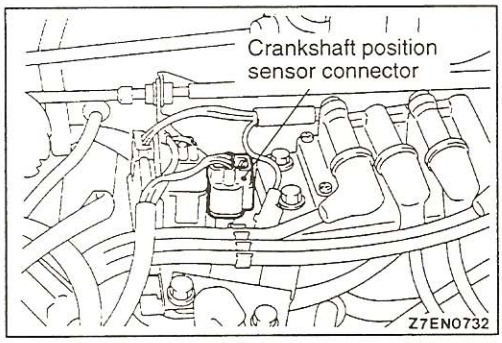


(8) If the engine speed is not within the specified limit, loosen the lock nut on the rod and turn the rod to make adjustment for proper dashpot starting engine speed.
(9) Release the throttle valve to make sure that the engine speed slowly drops to the idle speed.

COMPRESSION PRESSURE CHECK 11100260611

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

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

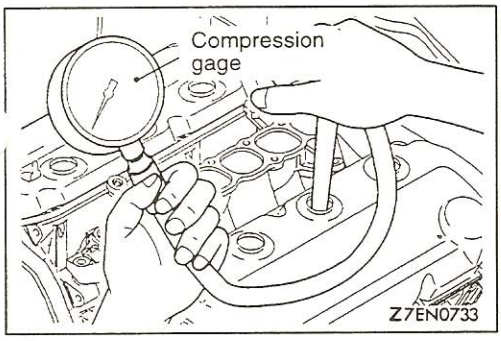


(4) Disconnect the crankshaft position sensor connector.

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

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

Caution
1. **Keep away from the spark plug hole when cranking.**
2. **Do not let water, oil, fuel, etc. enter the cylinder through cracks, or these heated materials will gush out from the spark plug hole, which is dangerous.**



(6) Set the compression gage to a spark plug mounting hole.
(7) Crank the engine with the throttle valve fully open and measure the compression pressure.

Standard value: 1200 kPa (171 psi.)/250–400 r/min

Limit: min. 890 kPa (127 psi.)/250–400 r/min

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

Limit: max. 100 kPa (14 psi.)

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

(10) Reconnect the crankshaft position sensor connector.
(11) Reinstall the spark plugs and spark plug cables.
(12) Use the scan tool to erase the diagnostic trouble codes, or disconnect the negative battery cable for 10 seconds or more and then re-connect it.

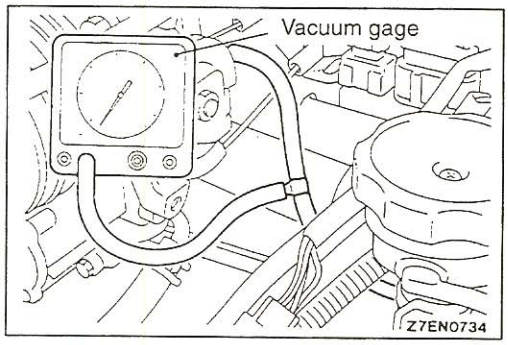
NOTE
This will erase the diagnostic trouble code resulting from the distributor connector being disconnected.

TSB Revision

MANIFOLD VACUUM CHECK

11100270508

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



(2) Connect a tachometer.
(3) Connect a three-way joint to the vacuum hose between the intake manifold plenum and the fuel-pressure regulator, and then connect a vacuum gage.
(4) Start the engine and check that the idle speed is within the standard value range.
Take a reading of the vacuum gage.

Limit: min. 60 kPa (18 in.Hg)

LASH ADJUSTER CHECK

11100290566

If an abnormal noise (knocking) that seems to be coming from the lash adjuster is heard and does not stop directly after starting the engine, 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 is run at idle after having warmed 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 the engine. (In these cases, the lash adjusters are norm

TSB Revision

(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 has disappeared, the cause of the noise was probably that oil sludge had caused the lash adjusters to become stuck. If this happens, carry out the following check. If the noise level does not change, go to step (5).

1) Let the engine cool down sufficiently.
2) Turn the crankshaft two full revolutions.
3) Carry out a simple lash adjuster check. (Refer to GROUP 11A-14.)
   - If any of the rocker arms can be pushed down easily during the simple lash adjuster check, replace the corresponding lash adjusters.
   - If the simple lash adjuster check has been carried out but all lash adjusters are normal (if none of the rocker arms could be pushed down easily), check for some other cause of the problem.

NOTE
You can check whether the lash adjusters are normal or not by carrying out a leak-down test.
(Refer to GROUP 11B – Rocker Arm and Camshaft.)

Caution
When installing a new lash adjuster, make sure that the air has been fully bled before carrying out the installation.
(Refer to GROUP 11B – Rocker Arm and Camshaft.)

(5) Bleed the air from the lash adjusters. (Refer to GROUP 11A-15.)

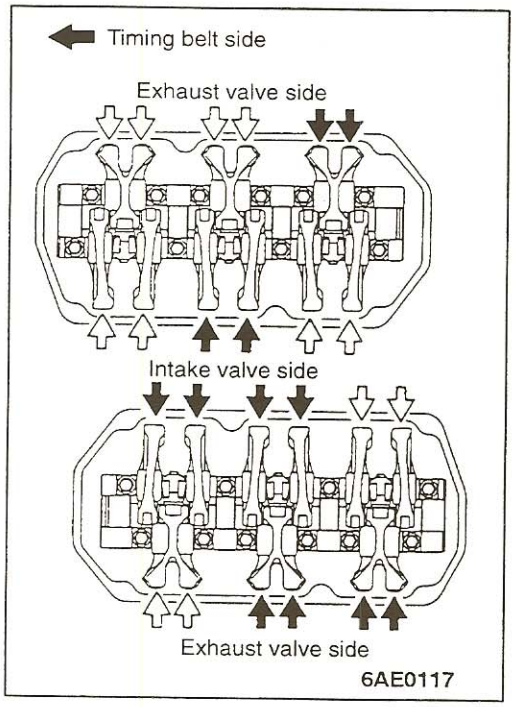
(6) If the noise does not disappear even after the air has been bled from the lash adjusters, carry out the following check.

1) Carry out a simple lash adjuster check. (Refer to GROUP 11A-14.)
   - If one of the rocker arms can be pushed down easily during the simple lash adjuster check, replace the corresponding lash adjusters.
   - If two or more of the rocker arms can be pushed down easily during the simple lash adjuster check, the cause may be that the oil passage to the cylinder head is blocked.
     Check for blockages in the oil passage, and clear the blockages if any are found. If there are no blockages, replace the lash adjusters.
   - If the simple lash adjuster check has been carried out but all lash adjusters are normal (if none of the rocker arms could be pushed down easily), check for some other cause of the problem.

NOTE
You can check whether the lash adjusters are nc or not by carrying out a leak-down test.
(Refer to GROUP 11B – Rocker Arm and Camshaft.)

Caution
When installing a new lash adjuster, make sure that the air has been fully bled before carrying out the installation.
(Refer to GROUP 11B – Rocker Arm and Camshaft.)

(7) Start the engine and check that the abnormal noise has disappeared. If necessary, bleed the air from the lash adjusters. (Refer to GROUP 11A-15.)



<SIMPLE LASH ADJUSTER CHECK>

(1) Stop the engine.
(2) Remove the rocker cover.
(3) Set the No. 1 cylinder to the compression top dead center position.
(4) Check the rocker arms indicated by white arrows in illustration at left by the procedure given below.
  1) Check whether the rocker arm moves downwards when the part of the rocker arm which touches the top of the lash adjuster is pushed.
    - If the rocker arm moves down easily when it is pushed, make a note of which is the corresponding lash adjuster.
    - If the rocker arm feels extremely stiff when it is pushed and does not move down, the lash adjuster is normal, so check for some other cause of the problem.

<Checking a Y-shaped rocker arm>

NOTE
It will not be possible to depress the Y-shaped rocker arm at the exhaust valve side if one lash adjuster is defective but the other one is normal. In such cases, carry out the following procedure using a thickness gauge.

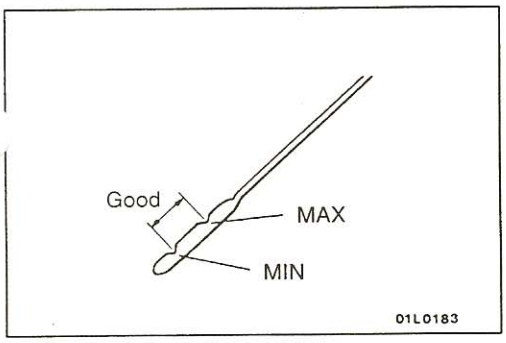
(1) Check that a thickness gauge with a thickness of 0.1 – 0.2 mm can be inserted easily between the valve and the lash adjuster.
(2) If the thickness gauge can be inserted easily, make a note of which is the corresponding lash adjuster.
(3) If the thickness gauge cannot be inserted easily, the lash adjuster is normal, so check for some other cause of the problem.

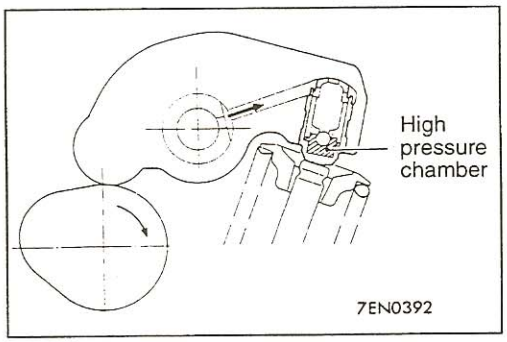
(5) Slowly turn the crankshaft 360° in the clockwise direc.
(6) Check the rocker arms indicated by black arrows in the illustration at left in the same way as explained in step (4).

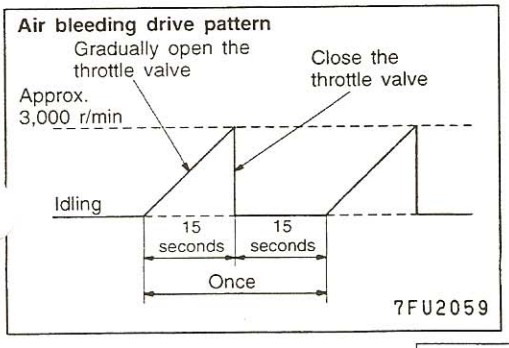
TSB Revision

<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. Air and oil will not separate easily in oil that has degenerated, 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 nay 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 not change in the noise level after 30 repetitions, 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.

TSB Revision

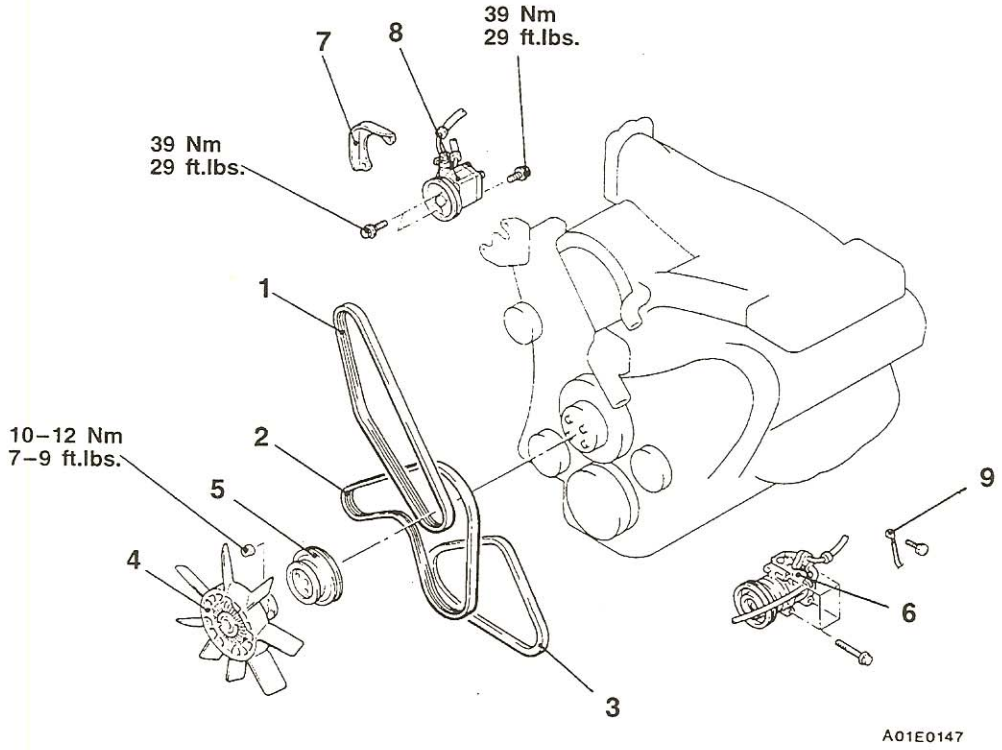
ENGINE ASSEMBLY

11200100732

REMOVAL AND INSTALLATION

Pre-removal Operation
- Hood Removal (Refer to GROUP 42 – Hood.)
- Battery and Battery Tray Removal
- Auto-cruise Control Intermediate Link Removal (Refer to GROUP 17 – Cruise Control.)
- Radiator Removal (Refer to GROUP 14 – Radiator.)
- Under Skid Plate, Undercover Removal
- Front Exhaust Pipe <FEDERAL> (Refer to GROUP 15 – Exhaust Pipe, Muffler and Catalytic Converter.)
- Warm up Three-way Catalytic Converter <CALIFORNIA> Removal (Refer to GROUP 15 – Exhaust Pipe, Muffler and Catalytic Converter.)
- Transmission and Transfer Assembly Removal (Refer to GROUP 23A – Transmission and Transfer Assembly.)

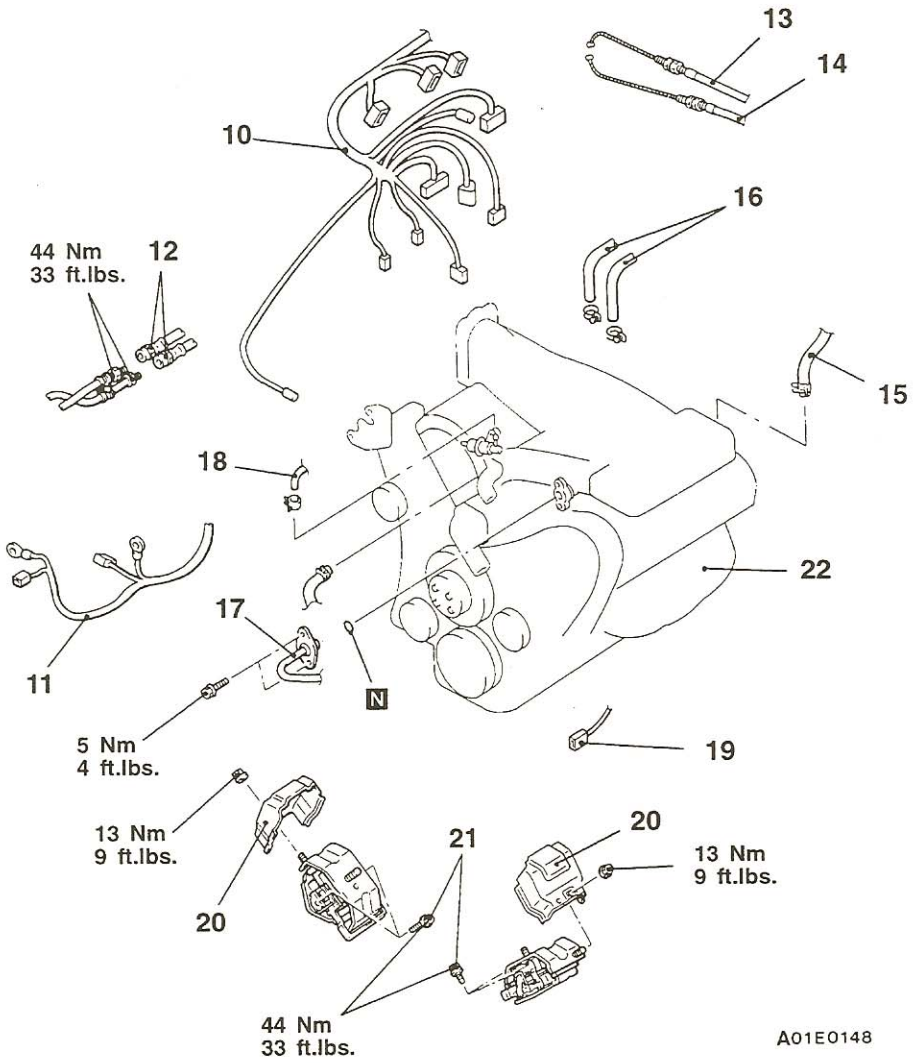
Post-installation Operation
- Transmission and Transfer Assembly Installation (Refer to GROUP 23A – Transmission and Transfer Assembly.)
- Front Exhaust Pipe <FEDERAL> (Refer to GROUP 15 – Exhaust Pipe, Muffler and Catalytic Converter.)
- Warm up Three-way Catalytic Converter <CALIFORNIA> Installation (Refer to GROUP 15 – Exhaust Pipe, Muffler and Catalytic Converter.)
- Under Skid Plate, Undercover Installation
- Radiator Installation (Refer to GROUP 14 – Radiator.)
- Battery and Battery Tray Installation
- Auto-cruise Control Intermediate Link Installation and Adjustment (Refer of GROUP 17 – Cruise Control.)
- Hood Installation (Refer to GROUP 42 – Hood.)
- Engine Adjustment
- Accelerator cable Adjustment (Refer to GROUP 17 – On-vehicle Service.)
- Throttle Cable Adjustment (Refer to GROUP 23 – On-vehicle Service.)
- Engine Oil Supplying and Checking



Removal Steps

1. Power steering drive belt
2. Generator drive belt
3. A/C drive belt
4. Cooling fan
5. Water pump pulley
6. A/C compressor ◀A▶
7. Cover ◀A▶
8. Power steering pump
9. Ground cable connection

TSB Revision



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

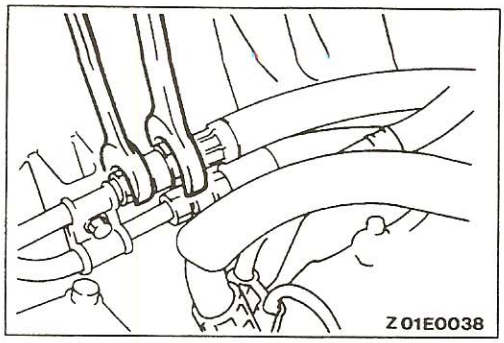
REMOVAL SERVICE POINTS

◀A▶ COMPRESSOR <A/C>/OIL PUMP (POWER STEERING) REMOVAL

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

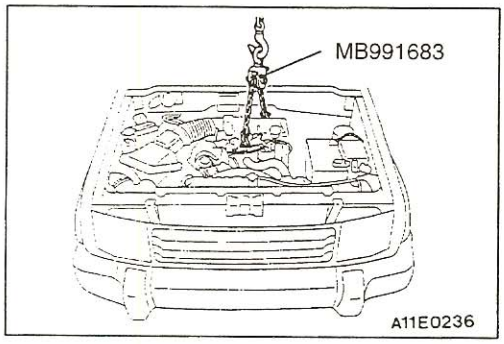
NOTE
Suspend the removed oil pump (by using wire or similar material) at a place where no damage will be caused during removal/installation of the engine assembly.

TSB Revision



◀B▶ OIL COOLER HOSE CONNECTION REMOVAL

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



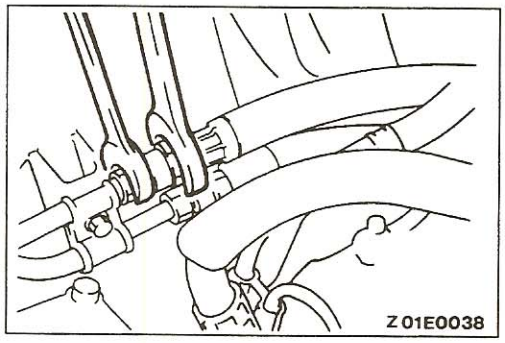
◀C▶ ENGINE ASSEMBLY REMOVAL

(1) Check that all cables, hoses, harness connectors, etc. are disconnected from the engine.
(2) Lift the special tool (MB991683) and a chain block slowly to remove the engine assembly upward from the engine compartment.

INSTALLATION SERVICE POINTS

▶A◀ ENGINE ASSEMBLY INSTALLATION

Use the special tool (MB991683) and a chain block to inst the engine assembly. When doing so, check carefully all pipes and hoses are connected, and that none are twisted, damaged, etc.



▶B◀ OIL COOLER HOSE CONNECTION

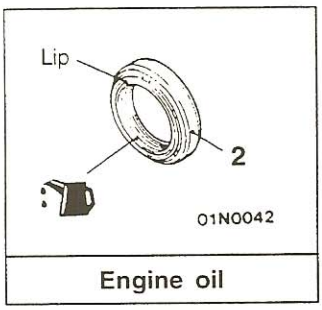
Use a spanner or similar tool to connect the oil cooler hose.

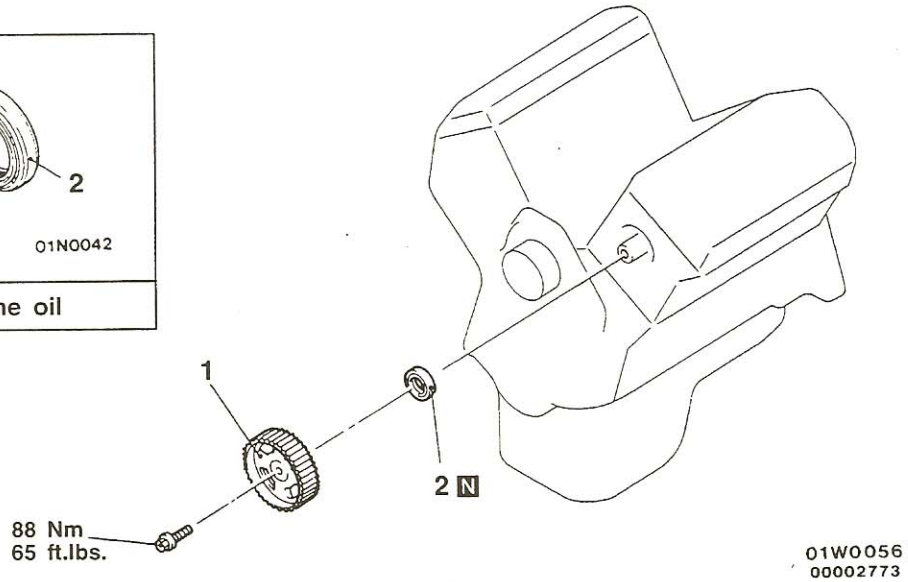
CAMSHAFT OIL SEAL

11200220155

REMOVAL AND INSTALLATION

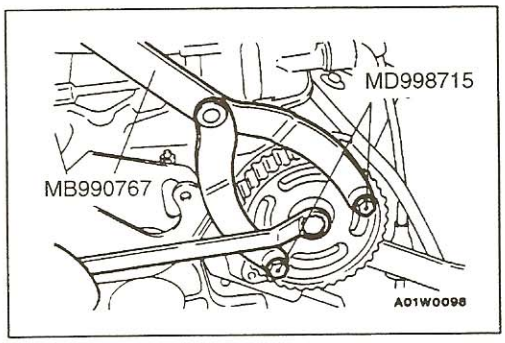
Pre-removal and Post-installation operation
- Timing Belt Removal and Installation (Refer to GROUP 11A-31.)





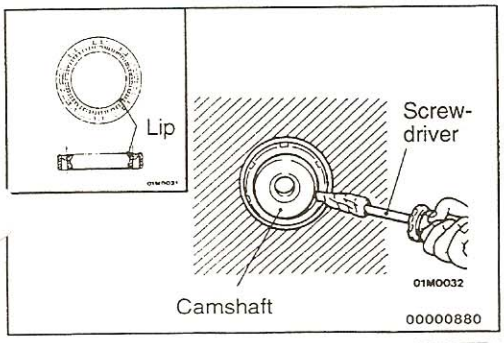
Removal steps

◀A▶ ▶B◀ 1. Camshaft sprocket
◀B▶ ▶A◀ 2. Camshaft oil seals



REMOVAL SERVICE POINTS

◀A▶ CAMSHAFT SPROCKET REMOVAL

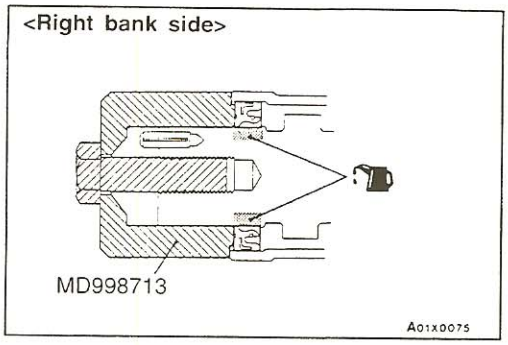


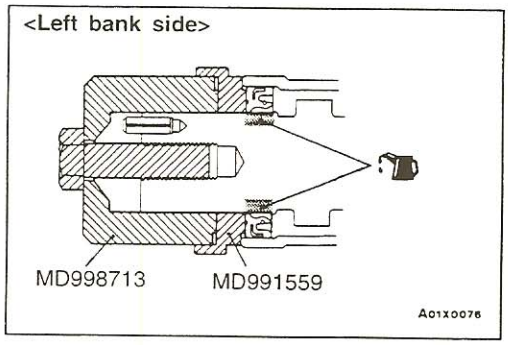
◀B▶ CAMSHAFT OIL SEAL REMOVAL

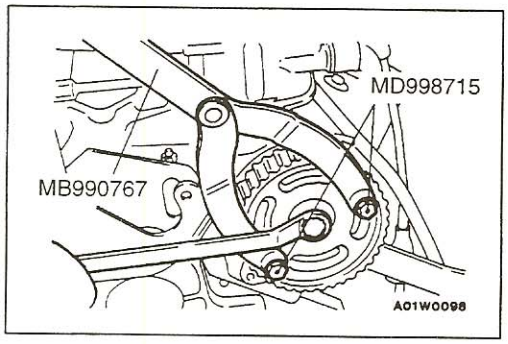
(1) Cut out a portion in the camshaft oil seal lip.
(2) Cover the tip of a screwdriver with a cloth and apply it to the cutout in the oil seal to pry off the oil seal.

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

TSB Revision







INSTALLATION SERVICE POINTS

▶A◀ CAMSHAFT OIL SEAL INSTALLATION

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

▶B◀ CAMSHAFT SPROCKET INSTALLATION

CRANKSHAFT OIL SEALS

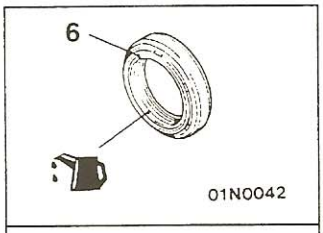
11200340332

FRONT OIL SEAL

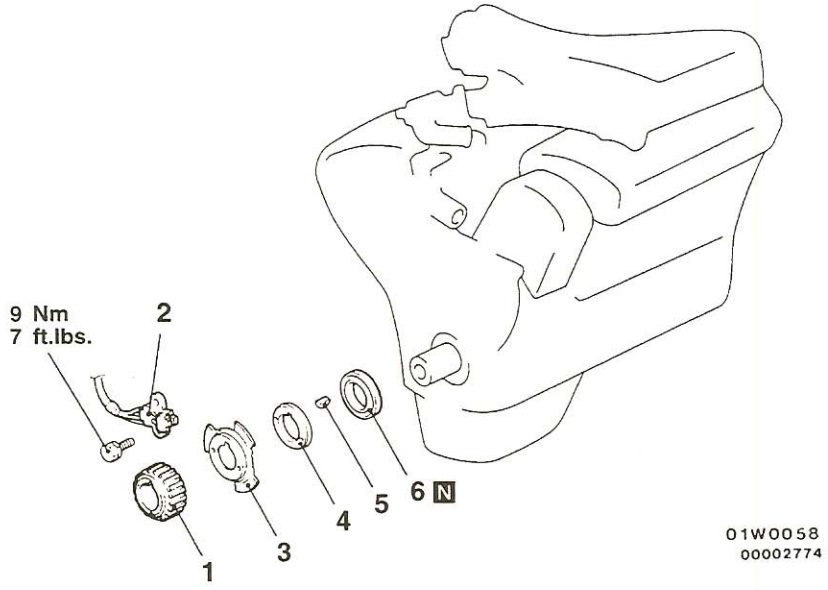
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Timing Belt Removal and Installation (Refer to P.11A-31.)

Adjustment
- Engine Adjustment

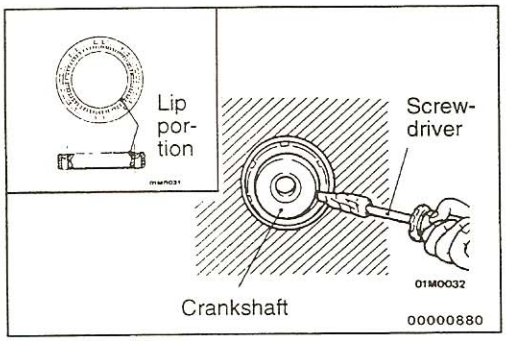


Engine oil



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

◀A▶ ▶A◀ 6. Crankshaft front oil seal

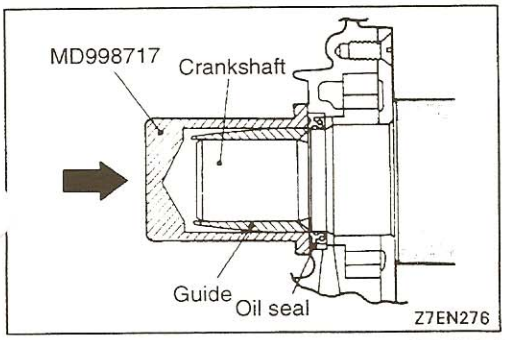


REMOVAL SERVICE POINT

◀A▶ OIL SEAL REMOVAL

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

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



INSTALLATION SERVICE POINT

▶A◀ OIL SEAL INSTALLATION

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

NOTE
Knock it as far as the surface.

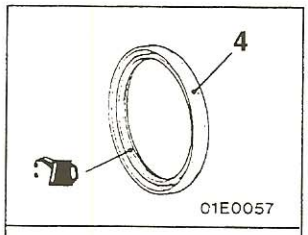
TSB Revision

REAR OIL SEAL

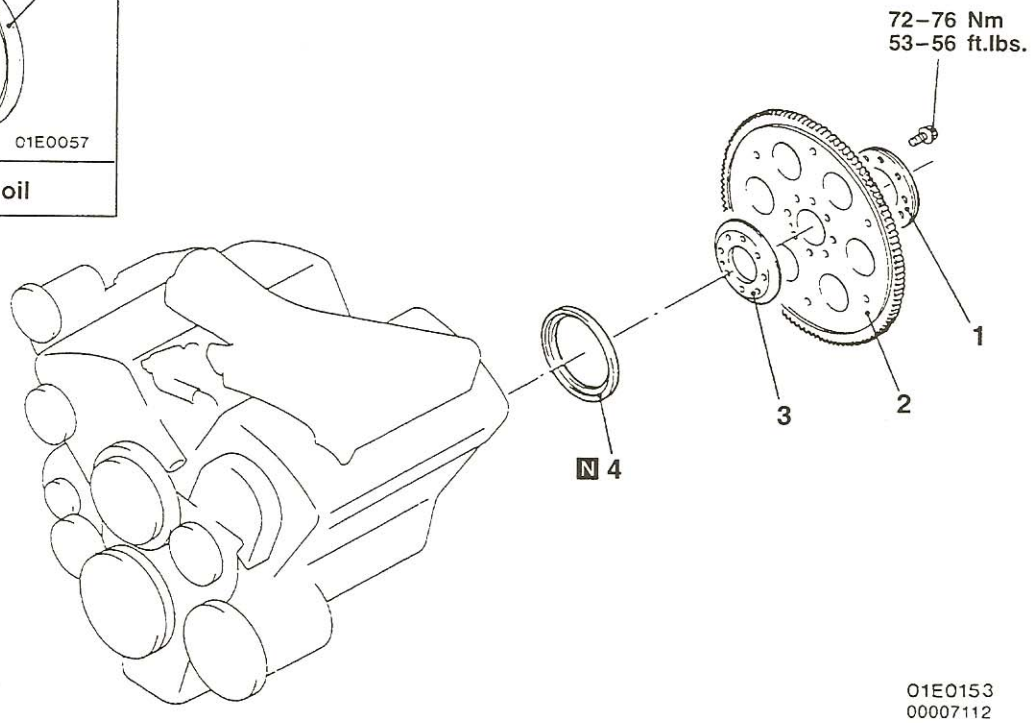
REMOVAL AND INSTALLATION

11200370409

Pre-removal and Post-installation Operation
- Transmission Removal and Installation (Refer to GROUP 23A – Transmission and Transfer Assembly.)



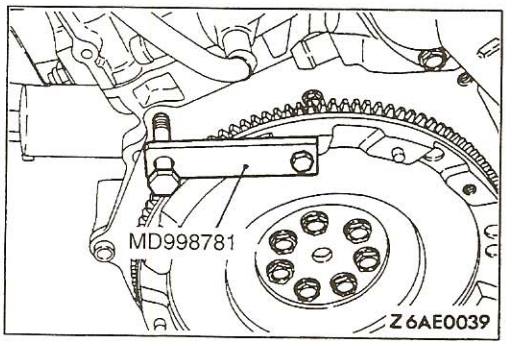
Engine oil



01E0153
00007112

Removal Steps

◀A▶ ▶B◀ 1. Adaptor plate A
◀A▶ ▶B◀ 2. Drive plate
◀A▶ ▶B◀ 3. Adaptor plate B
◀B▶ ▶A◀ 4. Oil seal

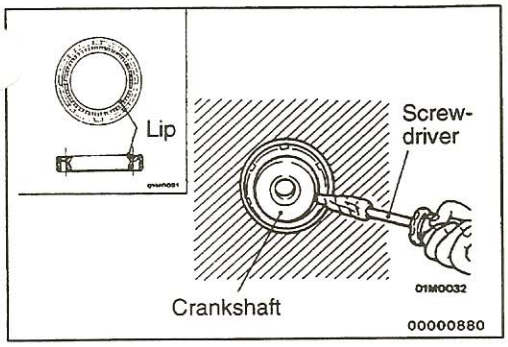


REMOVAL SERVICE POINTS

◀A▶ ADAPTOR PLATE A/DRIVE PLATE/ADAPTOR PLATE B REMOVAL

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

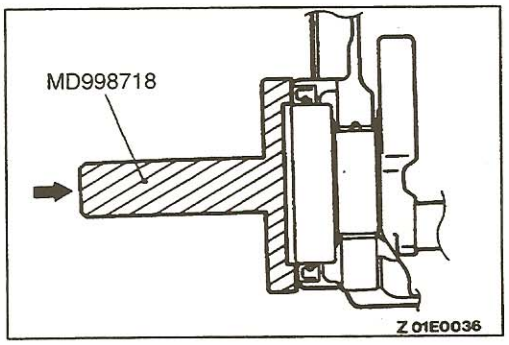
TSB Revision



◀B▶ OIL SEAL REMOVAL

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

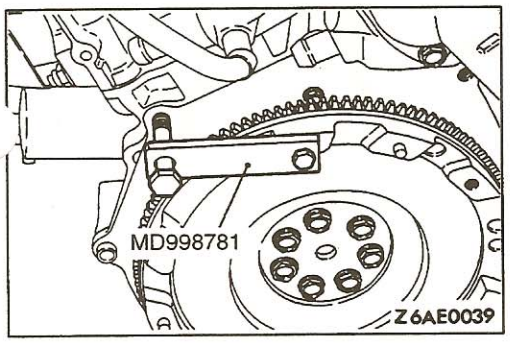
Caution
Take care not to damage the crankshaft and oil seal case.



INSTALLATION SERVICE POINTS

▶A◀ OIL SEAL INSTALLATION

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



▶B◀ ADAPTOR PLATE B/DRIVE PLATE/ADAPTOR PLATE A INSTALLATION

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

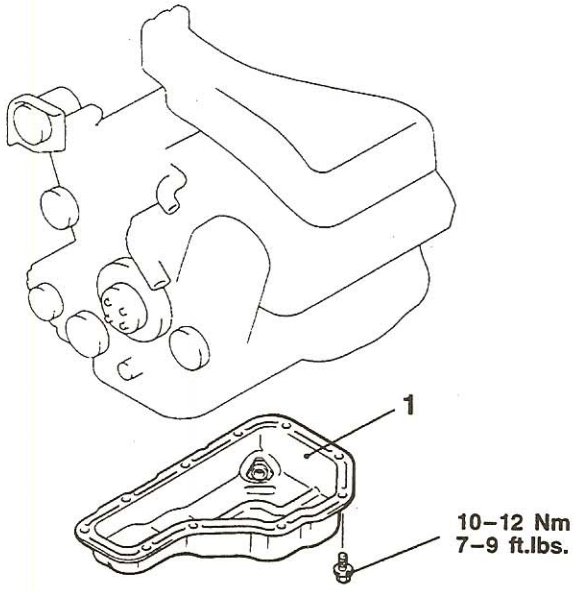
OIL PAN AND OIL SCREEN

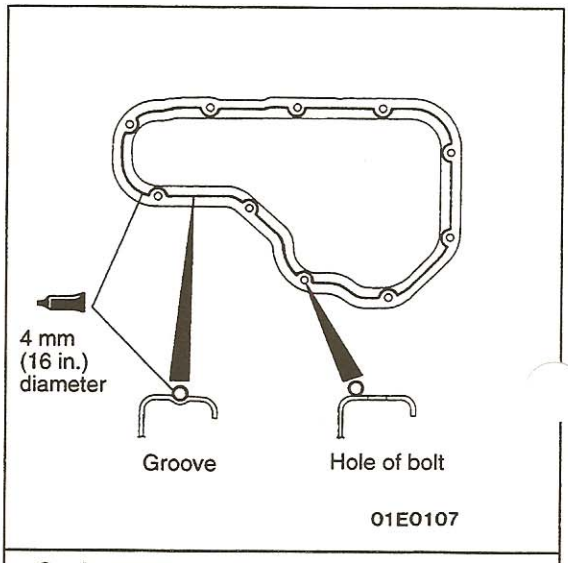
1120025

OIL PAN, LOWER
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
Removal and Installation
- Under Skid Plate, Undercover
- Front Exhaust Pipe <FEDERAL> (Refer to GROUP 15 – Exhaust Pipe, Mufflers and Catalytic Converter.)
- Warm up Three-way Catalytic Converter <CALIFORNIA> (Refer to GROUP 15 – Exhaust Pipe, Mufflers and Catalytic Conveter.)

Draining and Supplying
- Engine Oil (Refer to GROUP 00 – Maintenance Service.)

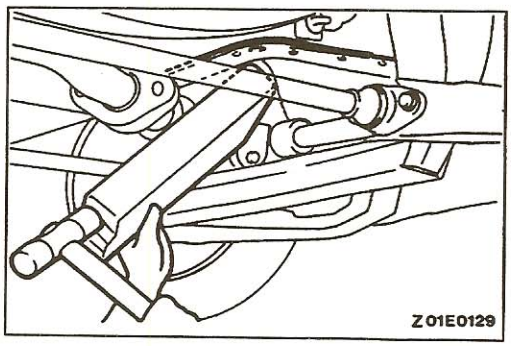




Sealant:
MITSUBISHI GENUINE PART NO. MD970389 or equivalent

01E0152
00002776

◀A▶ ▶A◀ 1. Oil pan, lower



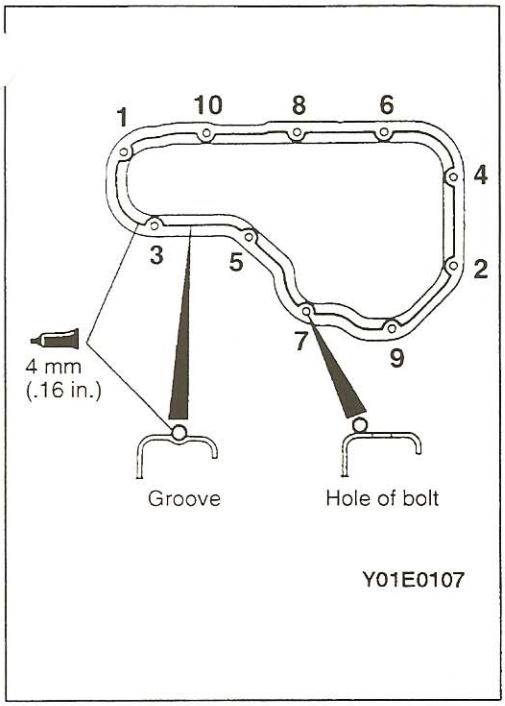
REMOVAL SERVICE POINT

◀A▶ OIL PAN, LOWER REMOVAL

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

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

TSB Revision



INSTALLATION SERVICE POINT

▶A◀ OIL PAN, LOWER INSTALLATION

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

Specified sealant:
MITSUBISHI GENUINE PART No. MD970389 or equivalent

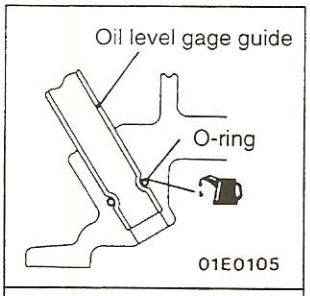
NOTE
The sealant should be applied in a continuous bead approximately 4 mm (.16 in.) in diameter.

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

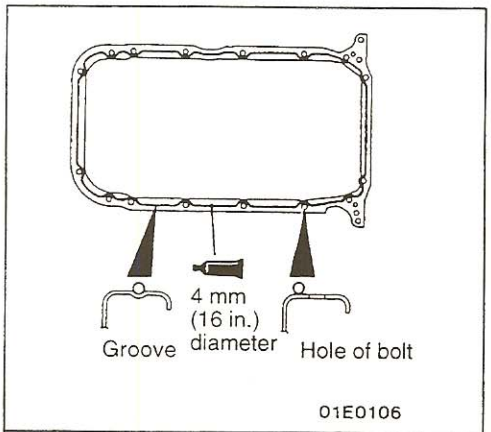
OIL PAN, UPPER AND OIL SCREEN

REMOVAL AND INSTALLATION

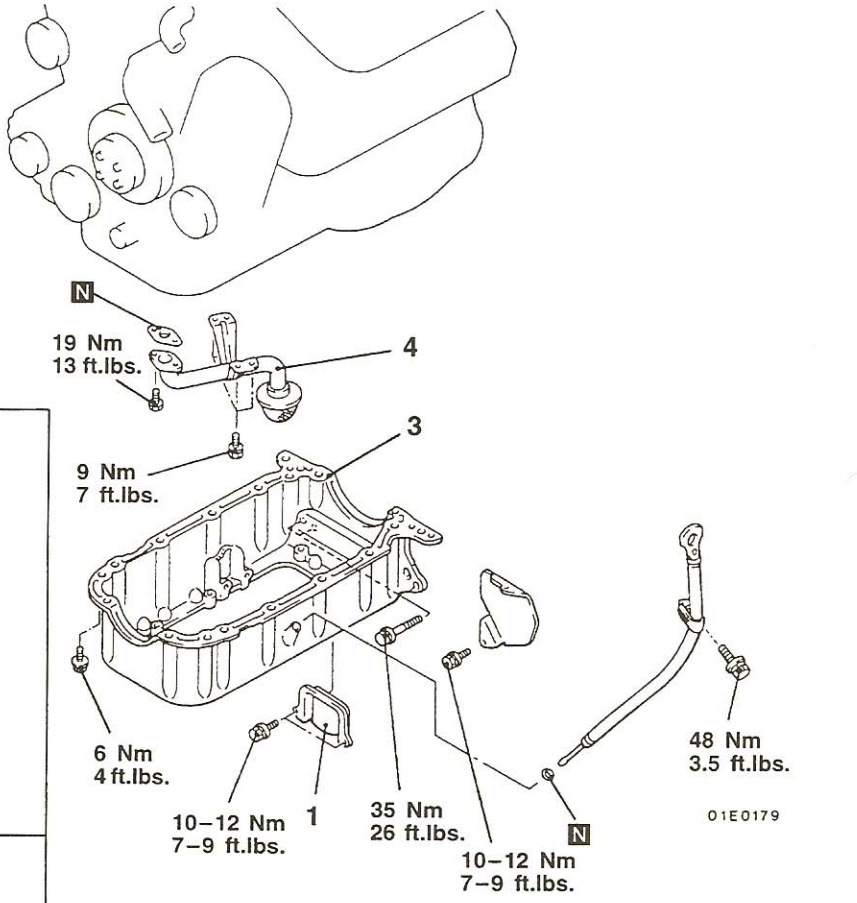
Pre-removal and Post-installation Operation
Removal and Installation
- Oil pan, Lower (Refer to P.11-24.)
- Front Differential Carrier (Refer to GROUP 26 – Differential Carrier and Free-Wheeling Clutch.)



Engine oil



Sealant:
MITSUBISHI GENUINE PART NO.
MD970389 or equivalent



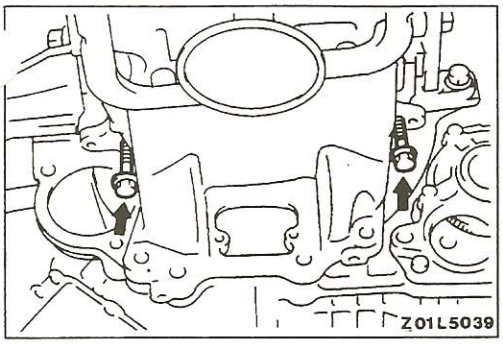
00005443

Removal steps

1. Cover
2. Oil level gage guide

◀B▶ ▶B◀ 3. Oil pan, upper
4. Oil screen

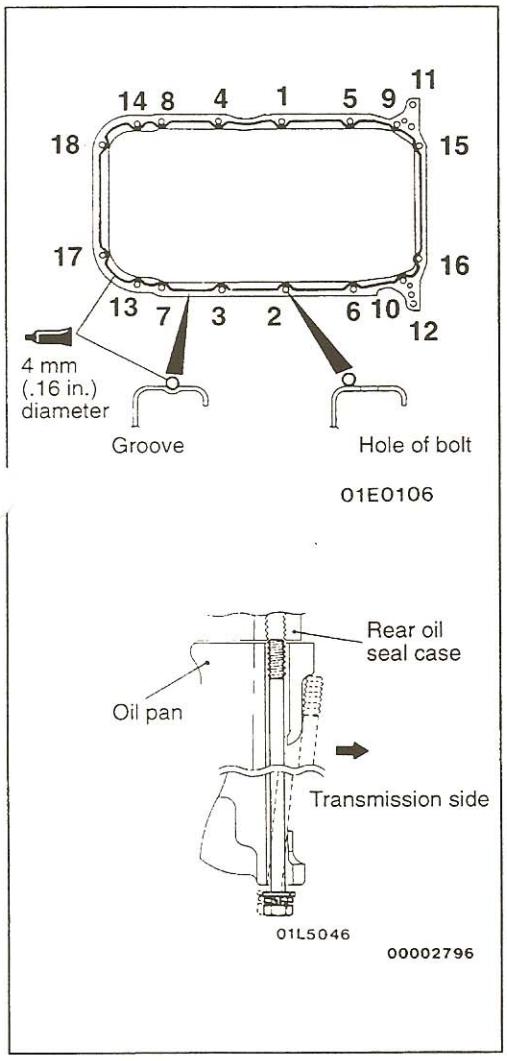
TSB Revision



REMOVAL SERVICE POINT

◀B▶ OIL PAN, UPPER REMOVAL

Install a bolt [diameter × length: 10 × 38 mm (.39 × 1.50 in.)] to link the oil pan, upper with the transmission in the hole of the oil pan, upper as shown in the illustration, and then tighten the bolt to remove the oil pan, upper.



INSTALLATION SERVICE POINT

▶B◀ OIL PAN, UPPER INSTALLATION

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

Specified sealant:
MITSUBISHI GENUINE PART No. MD970389 or equivalent

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

(4) Install the oil pan to the cylinder block within 30 minutes after applying the sealant.
(5) Tighten the oil pan mounting bolts in the order shown in the illustration at left.

Caution
The bolt holes for bolts 15 and 16 in the illustration are cut away on the transmission side, so be careful not to insert these bolts at an angle.

INSPECTION

11200260034

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

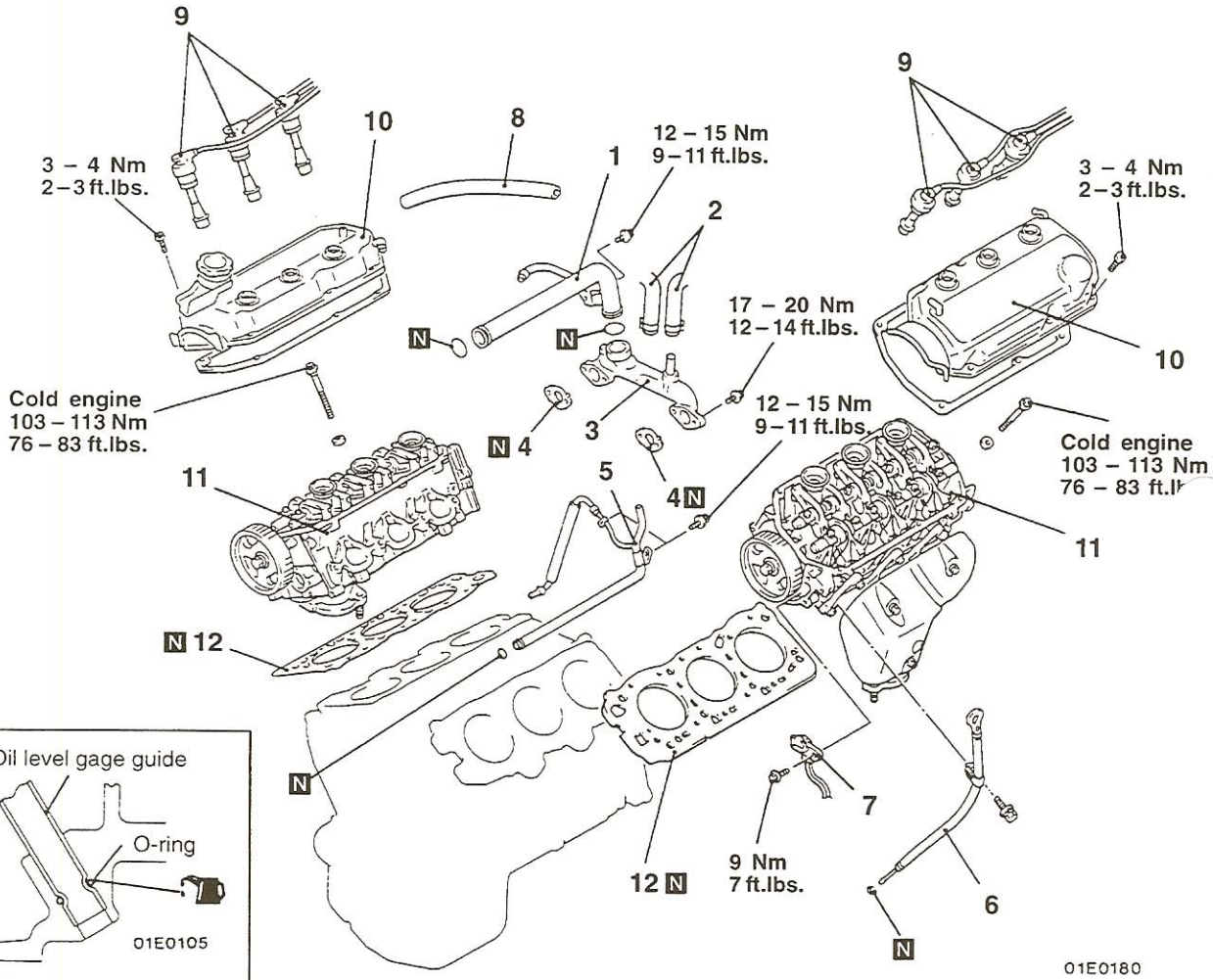
TSB Revision

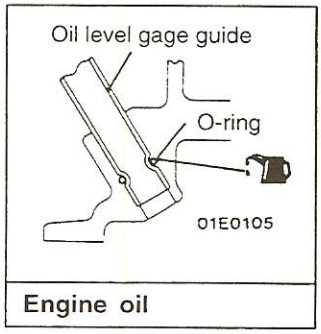
CYLINDER HEAD GASKET

11200400726

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Engine Coolant Draining and Supplying (Refer to GROUP 00 – Maintenance Service.)
- Timing Belt Removal and Installation (Refer to P.11A-31.)
- Intake Manifold Removal and Installation (Refer to GROUP 15 – Intake Manifold.)



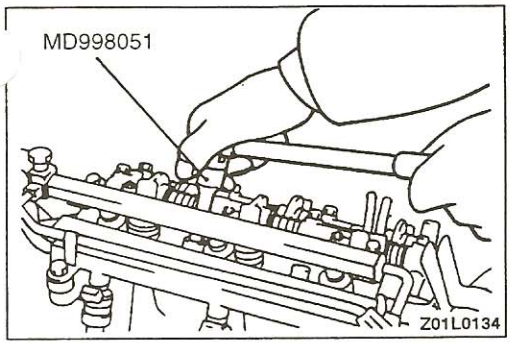


Engine oil

Removal steps

▶C◀ 1. Water outlet pipe
2. Heater hose
▶D◀ 3. Water passage
▶D◀ 4. Gasket
▶C◀ 5. Water pipe and hose assembly
6. Oil level gage guide <Only left bank is removed>
7. Camshaft position sensor <Only left bank is removed>
8. Ventilation hose
9. Spark plug cable
10. Rocker cover
◀A▶ ▶B◀ 11. Cylinder head assembly
▶A◀ 12. Cylinder head gasket

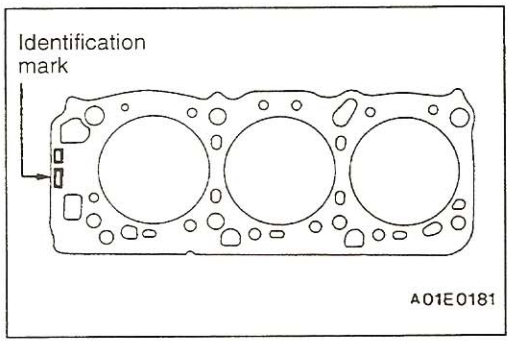
TSB Revision



REMOVAL SERVICE POINT

◀A▶ CYLINDER HEAD ASSEMBLY REMOVAL

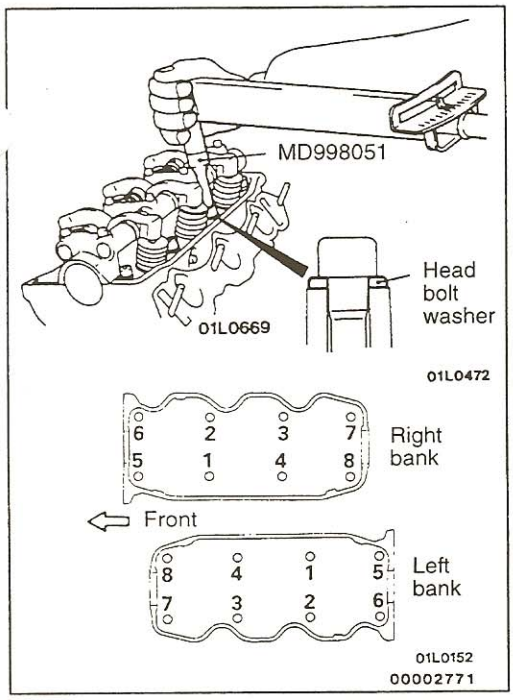
Using the special tool, after loosening the bolts (in 2 or 3 cycles), remove the cylinder head assembly.



INSTALLATION SERVICE POINTS

▶A◀ CYLINDER HEAD GASKET INSTALLATION

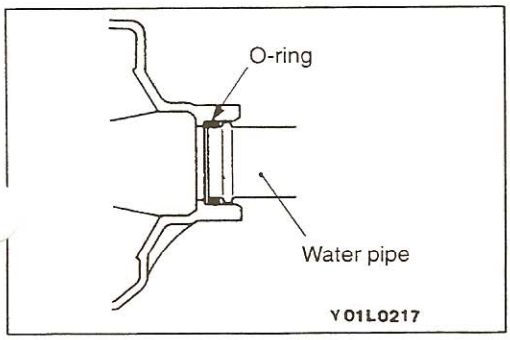
(1) Degrease the mounting surface of the cylinder head gasket.
(2) Lay the cylinder head gasket on cylinder block with the identification mark at front top.



▶B◀ CYLINDER HEAD ASSEMBLY INSTALLATION

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

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

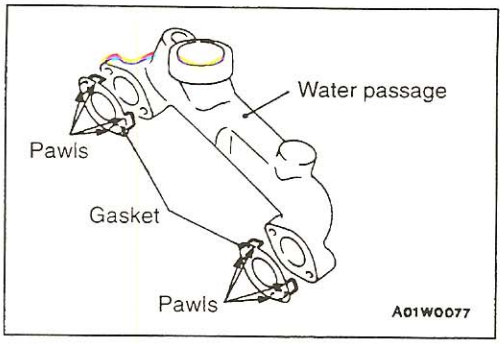


▶C◀ WATER PIPE AND HOSE ASSEMBLY / WATER OUTLET PIPE INSTALLATION

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

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

TSB Revision



▶D◀ GASKET/WATER PASSAGE INSTALLATION

Bend the tabs onto the water passage assembly, and t
install the water passage assembly to the cylinder head so
that the gasket doesn't slip.

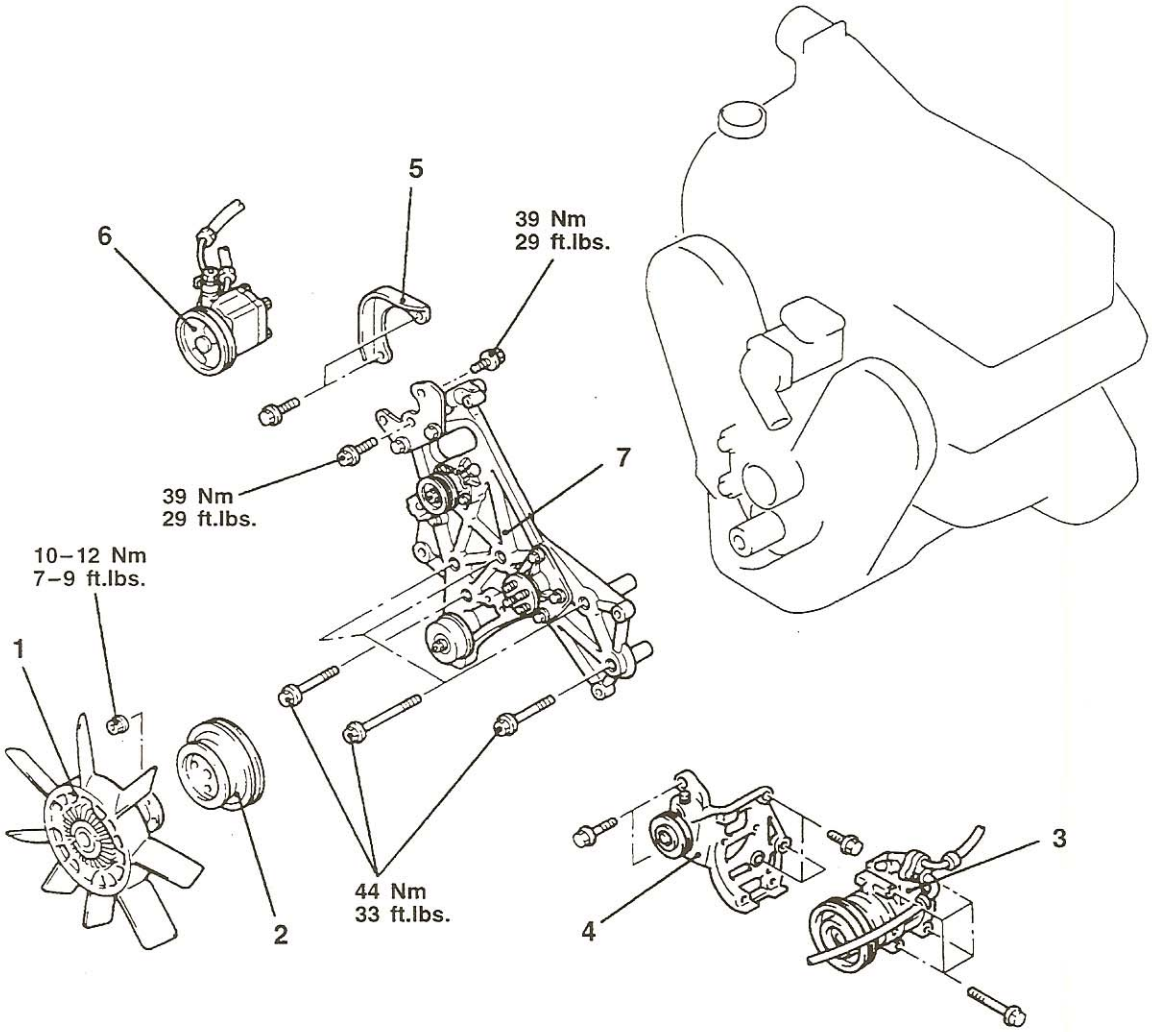
TIMING BELT

11200430589

REMOVAL AND INSTALLATION

Pre-removal Operation
- Radiator Removal
  (Refer to GROUP 14 – Radiator.)
- Generator Removal
  (Refer to GROUP 16 – Generator.)
- Under Skid Plate, Undercover Removal

Post-installation Operation
- Under Skid Plate, Undercover Installation
- Generator Installation
  (Refer to GROUP 16 – Generator.)
- Radiator Installation (Refer to GROUP 14 – Radiator.)
- Engine Adjustment



C01W0074

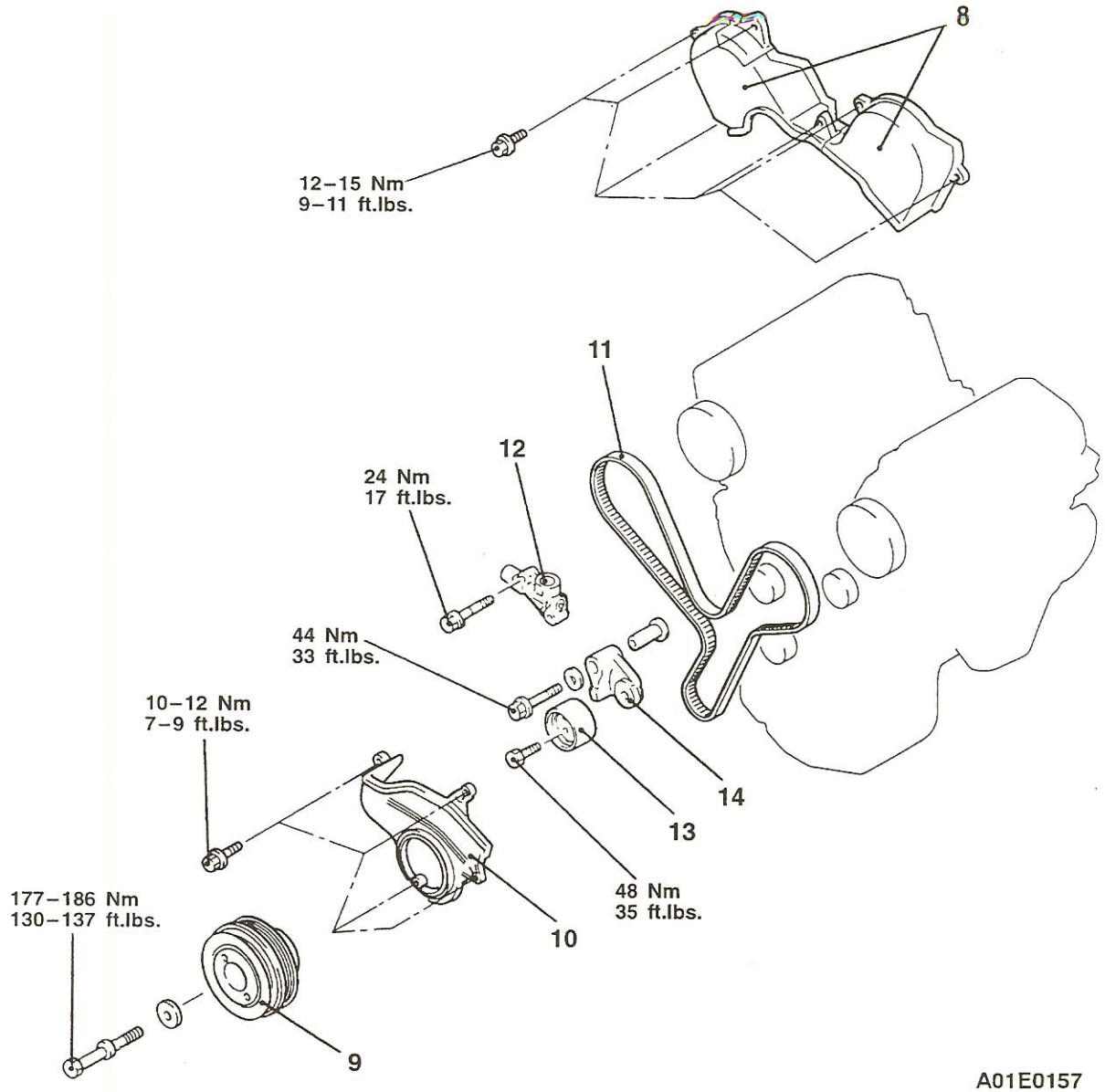
Removal steps

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

◀A▶ 3

◀A▶ 5

TSB Revision



8. Timing belt upper cover
◀B▶ ▶C◀ 9. Crankshaft pulley
10. Timing belt lower cover
◀C▶ ▶B◀ 11. Timing belt
▶A◀ 12. Auto tensioner
13. Tension pulley
14. Tension arm assembly

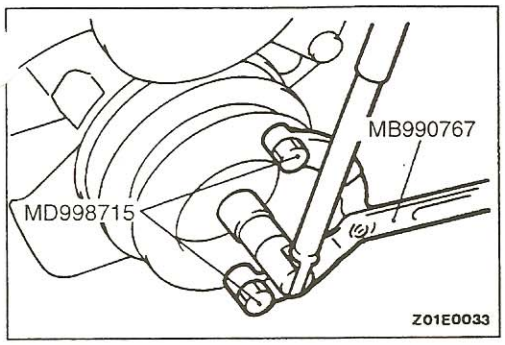
REMOVAL SERVICE POINTS

◀A▶ COMPRESSOR <A/C>/OIL PUMP (POWER STEERING) REMOVAL

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

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

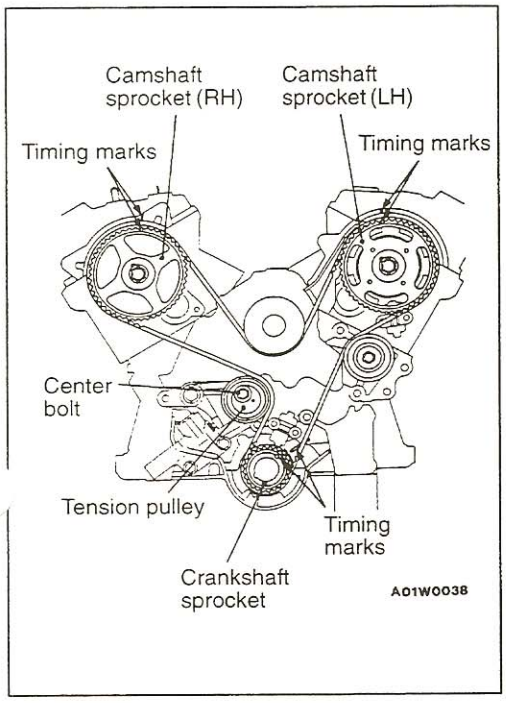
TSB Revision



◀B▶ CRANKSHAFT PULLEY REMOVAL

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

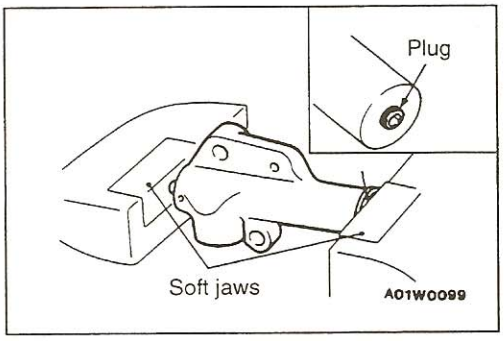
Caution
Use only the specified special tools, or a damaged pulley damper could result.

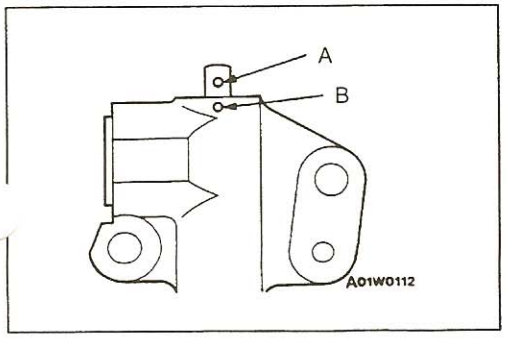


◀C▶ TIMING BELT REMOVAL

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

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





INSTALLATION SERVICE POINTS

▶A◀ AUTO TENSIONER INSTALLATION

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

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

TSB Revision

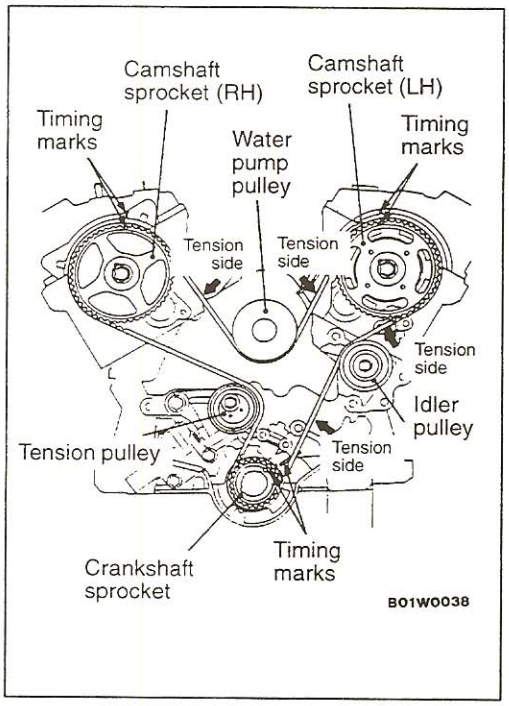
3) Insert a wire [1.4 mm (.055 in.) in diameter] into the set holes.

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

4) Unclamp the auto tensioner from the vise.

(2) Install the auto tensioner.

Caution
Leave the wire installed in the auto tensioner.



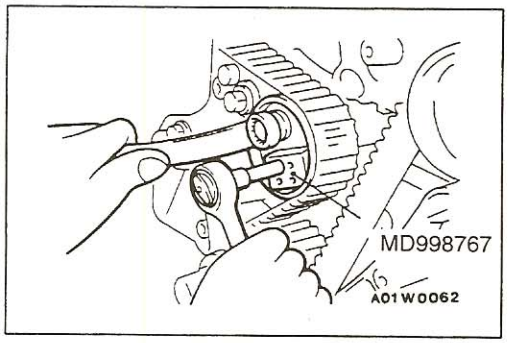
▶B◀ TIMING BELT INSTALLATION

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

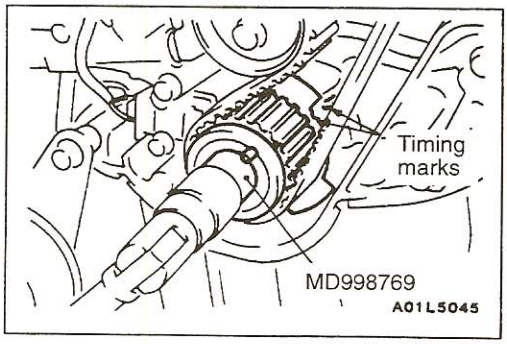
(2) Install the timing belt by the following procedure so that there is no defection in the timing belt between each sprocket and pulley.
1. Crankshaft sprocket
2. Idler pulley
3. Camshaft sprocket (left side)
4. Water pump pulley
5. Camshaft sprocket (right side)
6. Tension pulley

Caution
The camshaft sprocket (right side) can turn easily due to the spring force applied, so be careful not to get your fingers caught.

(3) Turn the camshaft sprocket (right side) counterclockwise until the tension side of the timing belt is firmly stretched, and then check again that all timing marks are aligned.

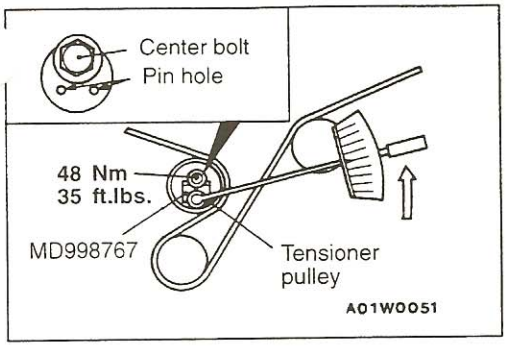


(4) Use the special tool to push the tension pulley into the timing belt, and then temporarily tighten the center bolt.



(5) Use the special tool to turn the crankshaft 1/4 of a turn counterclockwise and then turn it again clockwise until the timing marks are aligned.

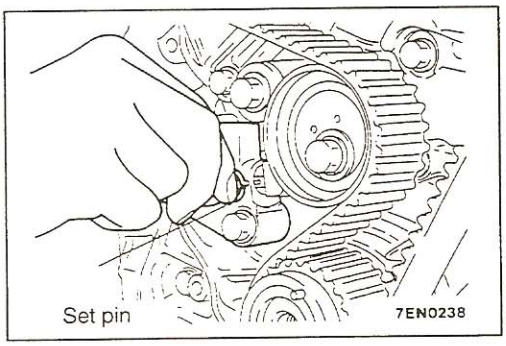
TSB Revision



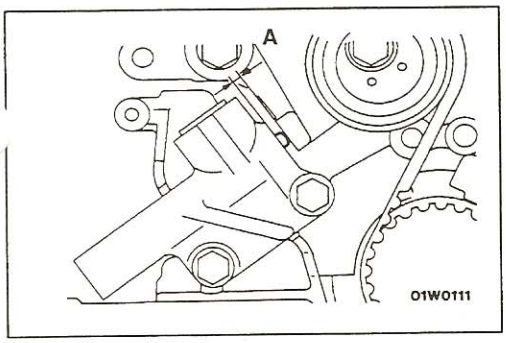
(6) Loosen the center bolt on the tensioner pulley. Using the special tool and torque wrench, apply tensioning torque to the timing belt and, at the same time, tighten the center bolt to specification.

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

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



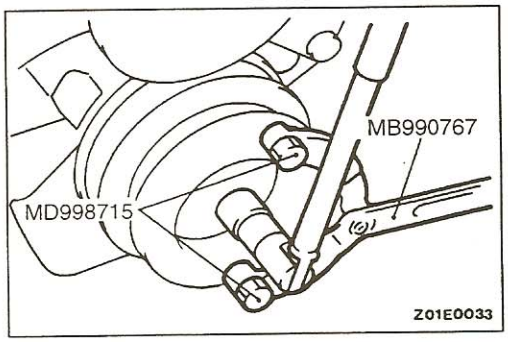
(7) Remove the setting pin that has been inserted into the auto tensioner.
(8) Turn the crankshaft two turns clockwise to align the timing marks.



(9) Leave everything in this condition for five minutes or more, and then check that the protrusion of the auto tensioner push rod is within the range of the standard value.

Standard value (A): 3.8 to 5.0 mm (.150 to .196 in.)

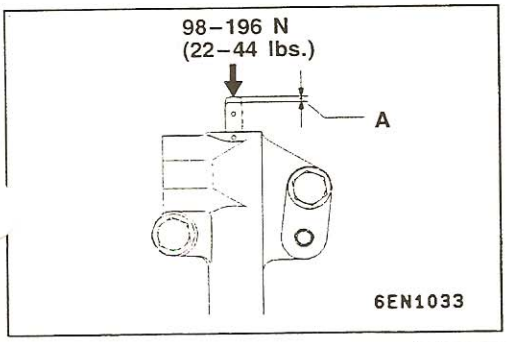
(10) If the protrusion is out of specification, repeat steps (5) to (9).
(11) Check again that timing marks on all sprockets are aligned properly.



▶C◀ CRANKSHAFT PULLEY INSTALLATION

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

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



INSPECTION

11200440032

AUTO TENSIONER

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

Standard value (A): 1 mm (.04 in.) or less

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

TSB Revision

NOTES

ENGINE OVERHAUL

<3.5L>

CONTENTS

11309000289

GENERAL INFORMATION

11300010

GENERAL SPECIFICATIONS

Descriptions			Specifications
Type			60° V, SOHC (per bank)
Number of cylinders			6
Combustion chamber			Pentroof type
Total displacement cm^3 (cu.in.)			3,497 (213.4)
Cylinder bore mm (in.)			93.0 (3.66)
Piston stroke mm (in.)			85.8 (3.38)
Compression ratio			9.0
Valve timing	Intake valve	Opens (BTDC)	13°
		Closes (ABDC)	55°
	Exhaust valve	Opens (BBDC)	51°
		Closes (ATDC)	17°
Lubrication system			Pressure feed, full-flow filtration
Oil pump type			Trochoid type
Cooling system			Water-cooled forced circulation
Water pump type			Centrifugal impeller type
EGR type			Single type
Injector type and number			Electromagnetic, 6
Injector identification mark			DDH210
Throttle bore mm (in.)			60 (2.36)
Throttle position sensor			Variable resistor type
Closed throttle position switch			Rotary contact type, within throttle position sensor

SPECIFICATIONS

11300030362

SERVICE SPECIFICATIONS

Items			Standard value	Limit
Fuel and emission parts				
Injector coil resistance Ω			13–16 at 20°C (68°F)	–
Rocker arms and camshaft				
Camshaft	Cam height mm (in.)	Intake	37.71 (1.48)	37.21 (1.47)
		Exhaust	37.14 (1.46)	36.64 (1.44)
Camshaft	Journal diameter mm (in.)		44.93 (1.77)	–
Cylinder head and valve				
Cylinder head	Flatness of gasket surface mm (in.)		0.03 (.0012)	0.2 (.008)
	Grinding limit of gasket surface *Includes/combined with cylinder block grinding mm (in.)		–	*0.2 (.008)
	Overall height mm (in.)		120 (4.72)	–
Valve	Thickness of valve head (margin) mm (in.)	Intake	1.0 (.039)	0.5 (.019)
		Exhaust	1.2 (.047)	0.7 (.028)
	Valve overall height mm (in.)	Intake	112.30 (4.4213)	111.80 (4.4016)
		Exhaust	114.11 (4.4925)	113.61 (4.4728)
	Stem diameter mm (in.)	Intake	6.0 (.236)	–
		Exhaust	6.0 (.236)	–
	Stem to guide clearance mm (in.)	Intake	0.02–0.05 (.0008–.0020)	0.10 (.004)
		Exhaust	0.04–0.07 (.0016–.0028)	0.15 (.006)
	Valve stem projection mm (in.)		49.30 (1.9409)	49.80 (1.9606)
Valve face angle			45°–45.5°	–
Cylinder head and valve				
Valve spring	Free height mm (in.)		51.0 (2.01)	50.0 (1.97)
	Load/installed height N/mm (lbs./in.)		267/44.2 (60/1.740)	–
	Out of squareness		2° or less	Max. 4°
Valve seat	Valve contact width mm (in.)		0.9–1.3 (.035–.051)	–
Valve guide	Inner diameter mm (in.)		6.0 (.315)	–
	Outer diameter mm (in.)		11.0 (.433)	–

TSB Revision

Items		Standard value	Limit
Front case, oil pump and oil pan			
Oil pump	Tip clearance mm (in.)	0.06–0.18 (.0024–.0071)	–
	Side clearance mm (in.)	0.04–0.10 (.0016–.0039)	–
	Body clearance mm (in.)	0.10–0.18 (.0039–.0071)	0.35 (.0138)
Oil cooler by-pass valve	Dimension (L) [Normal temperature] mm (in.)	34.5 (1.36)	–
	By-pass hole closing temperature [97–103°C (207–217°F) or more] mm (in.)	40 (1.57) or more	–
	Oil pressure at curb idle speed kPa (psi) [Conditions: oil temperature is 75–90°C (167–194°F)]	80 (11.4) or more	–
Piston and connecting rod			
Piston	Outer diameter mm (in.)	93.0 (3.66)	–
Piston ring	Ring to ring groove clearance No. 1 ring mm (in.)	0.03–0.07 (.0012–.0028)	0.1 (.004)
	Ring to ring groove clearance No. 2 ring mm (in.)	0.02–0.06 (.0008–.0024)	0.1 (.004)
	End gap No. 1 ring mm (in.)	0.30–0.45 (.0118–.0177)	0.8 (.031)
	End gap No. 2 ring mm (in.)	0.45–0.60 (.0177–.0236)	0.8 (.031)
	End gap oil ring mm (in.)	0.10–0.35 (.0039–.0138)	1.0 (.039)
Piston pin	Outer diameter mm (in.)	22.0 (.87)	–
Crankshaft	Oil clearance of pin mm (in.)	0.02–0.05 (.0008–.0020)	0.1 (.004)
Connecting rod	Big end side clearance mm (in.)	0.10–0.25 (.0039–.0098)	0.4 (.016)
Crankshaft and drive plate			
Crankshaft	End play mm (in.)	0.05–0.25 (.0020–.0098)	0.3 (.012)
	Journal outer diameter mm (in.)	64 (2.52)	–
	Pin outer diameter mm (in.)	55 (2.17)	–
	Oil clearance of journal mm (in.)	0.02–0.04 (.0008–.0016)	0.1 (.0039)
Piston	Piston to cylinder clearance mm (in.)	0.03–0.05 (.0012–.0020)	–
Cylinder block	Flatness of gasket surface mm (in.)	0.05 (.002)	0.1 (.004)
	Grinding limit of gasket surface *Includes/combined with cylinder block grinding mm (in.)	–	*0.2 (.008)
	Overall height mm (in.)	210.4–210.6 (8.28–8.29)	–
	Cylinder bore inner diameter mm (in.)	91.1 (3.59)	–

TSB Revision

REWORK DIMENSIONS

Items			Standard value	Limit
Cylinder head and valve				
Cylinder head	Oversize valve guide hole (both intake and exhaust) mm (in.)	0.05	11.05–11.07 (.4350–.4358)	–
		0.25	11.25–13.32 (.4429–.4457)	–
		0.50	11.50–11.52 (.4528–.4535)	–
	Oversize intake valve seat ring hole mm (in.)	0.3	34.30–34.33 (1.3504–1.3516)	–
		0.6	34.60–34.63 (1.3622–1.3634)	–
	Oversize exhaust valve seat ring hole mm (in.)	0.3	31.80–32.83 (1.2520–1.2531)	–
		0.6	32.10–32.13 (1.2638–1.2650)	–
Crankshaft and drive plate				
Crankshaft	Out of roundness and taper of journal and pin mm (in.)		0.005 (.0002)	–

TORQUE SPECIFICATIONS

Items		Nm	ft.lbs.
Generator and drive belt			
Cooling fan bolt		11	8
Fan pulley nut		11	8
Cooling fan bracket bolt		41	30
Oil filler bolt		21	15
Tensioner pulley nut		50	36
Timing indicator bolt		11	8
Tensioner bracket stay bolt		24	17
Generator bolt	M8	21	15
	M10	51	38
Accessory mount bolt		44	32
Accessory mount stay bolt	M8	23	17
	M10	49	36
Engine hanger		17	13
Crankshaft bolt		182	134
Intake manifold plenum and throttle body			
Manifold differential pressure sensor bolt		4.9	3.6
Air intake fitting bolt and nut		18	13
Ignition coil bolt		13	10
Water outlet fitting bracket bolt		19	14
EGR pipe bolt		18	13
EGR pipe flare nut		59	43
Intake manifold plenum stay bolt	M8	18	13
	M10	36	27
EGR valve bolt		22	16
Throttle body bolt		12	8

Items	Nm	ft.lbs.
Ignition system		
Spark plug	25	18
Timing belt		
Crankshaft/camshaft position sensor bolt	9	7
Auto tensioner bolt	24	17
Tensioner pulley bolt	49	35
Tensioner arm bolt	44	33
Idler pulley bolt	44	33
Camshaft sprocket bolt	88	64
Intake manifold and fuel parts		
Injector and fuel rail bolt	12	9
Fuel pressure regulator bolt	9	7
Fuel pipe bolt	9	7
Engine coolant temperature gauge unit	11	8
Engine coolant temperature sensor	30	22
Water outlet fitting bolt	19	14
Water inlet fitting bolt	19	14
Thermostat case bolt	19	14
Water passage bolt	19	14
Water (outlet) pipe bolt	14	10
Bracket	24	13
Intake manifold nut	21	16
Exhaust manifold		
Oil level gauge guide bolt	14	10
Heat protector bolt	14	10
Exhaust manifold nut	29	22
Water pump bolt	24	17

Items		Nm	ft.lbs.
Rocker arms and camshafts			
Rocker cover bolt		3.5	2.5
Thrust case bolt		13	9
Rocker arm, rocker arm shaft bolt		31	23
Cylinder head and valve			
Cylinder head bolt		108	80
Oil pan and oil pump			
Oil pressure gauge unit		10	7
Oil cooler by-pass valve		55	40
Oil filter bracket bolt	M8	24	17
	M10	40	30
Drain plug		40	30
Oil pan (upper) bolt		6	4
Oil pan lower bolt		11	8
Cover bolt	M6 × 10	11	8
	M6 × 18	6	4
Baffle plate bolt		11	8
Oil screen bolt	M6	9	7
	M8	19	14
Plug		45	33
Oil pump case bolt		14	10
Oil pump cover bolt		10	7
Piston and connecting rod			
Connecting rod cap nut		52	38
Crankshaft and drive plate			
Drive plate bolt		74	54
Rear plate bolt		11	8
Bell housing cover bolt		9	7
Oil seal case bolt		11	8
Bearing cap bolt		74	54
Bracket			
Bracket bolt	M8	22	16
	M10	41	30
	M12	75	54

TSB Revision

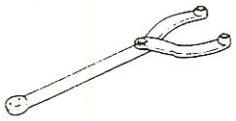
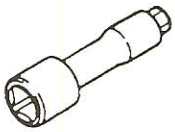
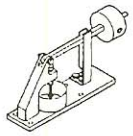
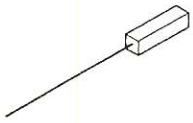
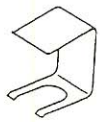
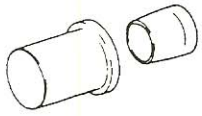
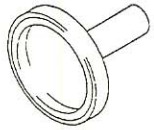
SEALANT

11300050214

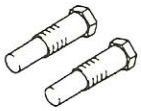
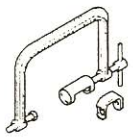
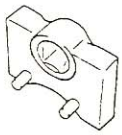
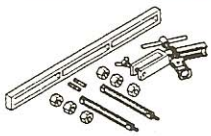
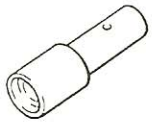
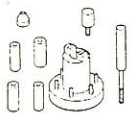
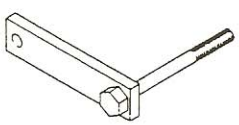
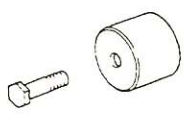
Items	Specified sealant	Quantity
Engine coolant temperature sensor	3M NUT Locking Part No. 4171	As required
Engine coolant temperature gauge unit	3M ATD Part No. 8660	As required
Oil pressure switch	3M ATD Part No. 8660	As required
Oil pressure gauge unit	3M ATD Part No. 8660	As required
Oil pump case	Mitsubishi Genuine Part No. MD970389	As required
Oil pan	Mitsubishi Genuine Part No. MD970389	As required
Oil seal case	Mitsubishi Genuine Part No. MD970389	As required

SPECIAL TOOLS

11300060231

Tool	Tool number and name	Supersession	Application
	MB990767 End yoke holder Use with MD998715	MB990767-01 Use with MIT308239	Holding camshaft sprocket when loosening bolt.
	MB991559 Camshaft oil seal installer adaptor	–	Installation of camshaft oil seal (Left bank) (Use with MD998713)
	MD998051 Cylinder head bolt wrench	MD998051-01 or General service tool	Loosening and tightening cylinder head bolts
	MD998440 Leak-down tester	–	Leak-down test of lash adjuster
	MD998441 Lash adjuster retainer	–	Bleeding of air inside adjuster
	MD998442 Air bleed wire	–	Air bleeding of auto lash adjuster
	MD998443 Lash adjuster holder (8)	MD998443-01	Supporting lash adjuster to prevent it from falling when rocker shaft assembly is removed or installed
	MD998717 Crankshaft front oil seal installer	MD998717-01	Installation of crankshaft front oil seal
	MD998718 Crankshaft rear oil seal installer	MD998718-01 Use with MB990938-01	Installation of crankshaft rear oil seal

TSB Revision

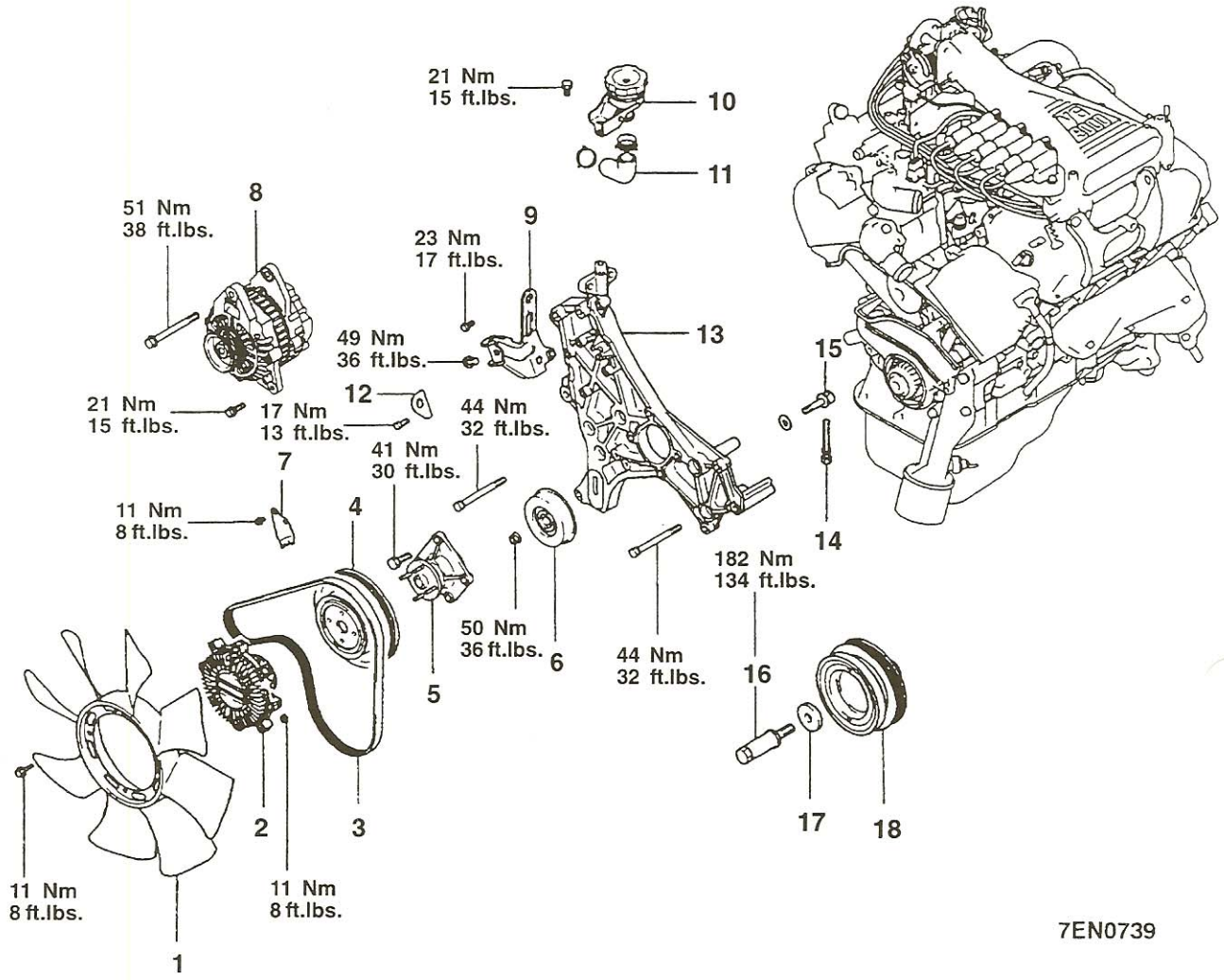
Tool	Tool number and name	Supersession	Application
	MD998715 Pulley holding pins (2)	MIT308239	Holding camshaft sprocket when loosening or torquing bolt
	MD998727 Oil pan remover	MD998727-01	Removal of oil pan
	MD998735 Valve spring compressor	MD998735-01	Removal and installation of valve and related parts
	MD998767 Tension pulley wrench	MD998752-01	Adjustment of timing belt tension
	MD998769 Crankshaft sprocket spacer	General service tool	Rotation of crankshaft when installing piston and timing belt
	MD998772 Valve spring compressor	General service tool	Compression of valve spring
	MD998774 Valve stem seal installer	MD998774-01	Installation of valve stem seal
	MD998780 Piston pin setting tool	MIT216941	Removal and installation of piston pin
	MD998781 Flywheel stopper	General service tool	Loosening and tightening crankshaft bolts
	Camshaft oil seal installer	MD998713-01	Installation of camshaft oil seal (left bank) (Use with MB991559)

TSB Revision

GENERATOR AND DRIVE BELT

11300130161

REMOVAL AND INSTALLATION



7EN0739

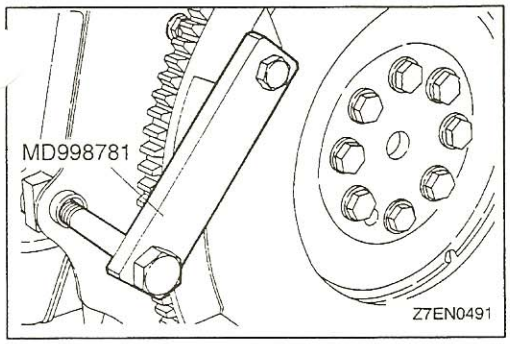
Removal steps

1. Cooling fan
2. Fan clutch
3. Drive belt
4. Cooling fan pulley
5. Cooling fan bracket
6. Drive belt tensioner pulley
7. Timing indicator
8. Generator
9. Accessory mount stay
10. Oil filler
11. Tube
12. Engine hanger
13. Accessory mount
14. Adjusting bolt
15. Adjusting stud

◀A▶ ▶A◀ 16. Crankshaft bolt

17. Crankshaft pulley washer
18. Damper pulley

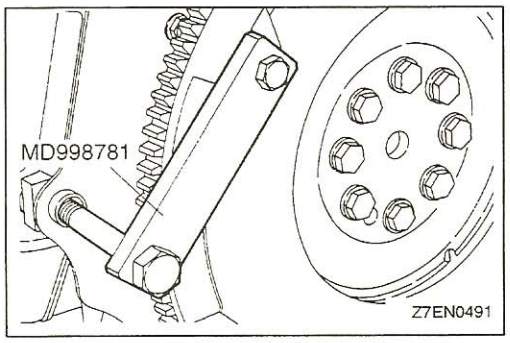
TSB Revision



REMOVAL SERVICE POINT

◀A▶ CRANKSHAFT BOLT LOOSENING

(1) Using the special tool, hold the drive plate.
(2) Remove the crankshaft bolt.



INSTALLATION SERVICE POINT

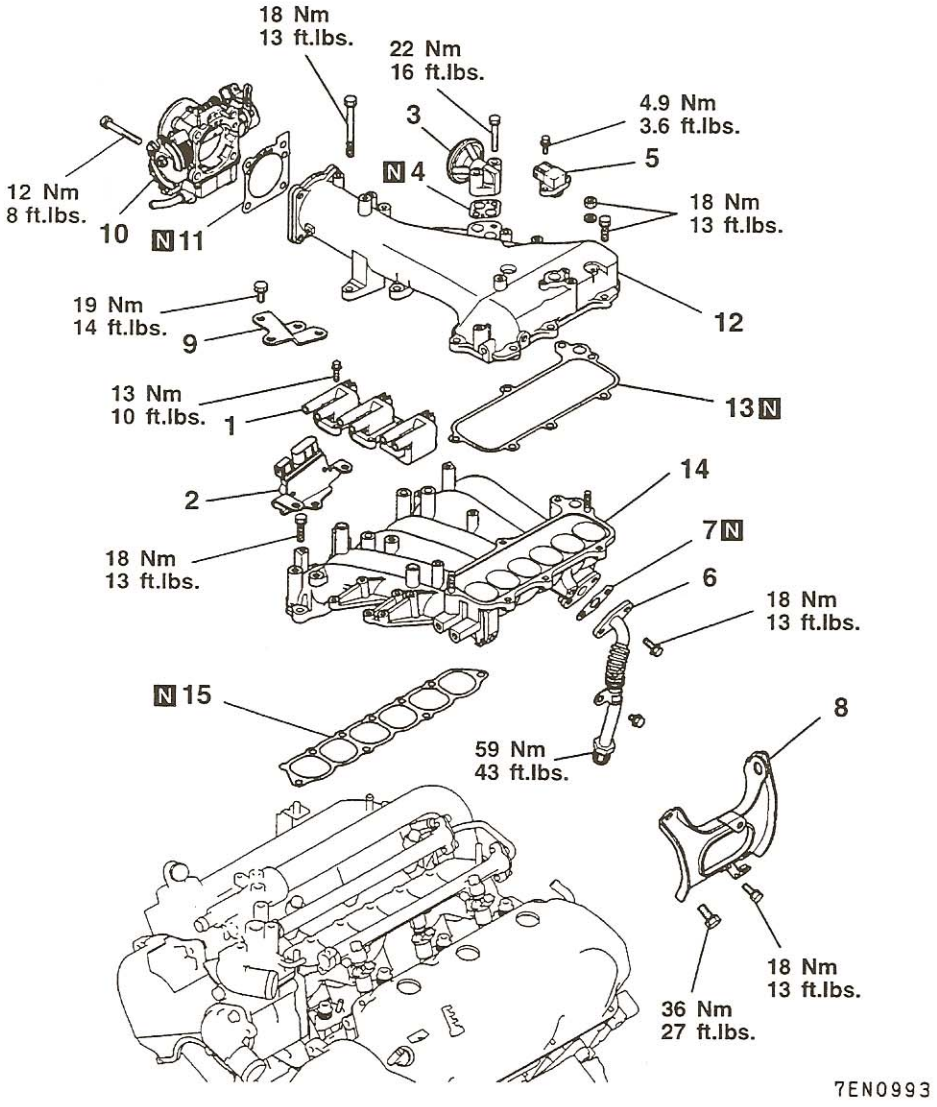
▶A◀ CRANKSHAFT BOLT TIGHTENING

(1) Using the special tool, hold the drive plate.
(2) Install the crankshaft bolt.

INTAKE MANIFOLD PLENUM AND THROTTLE BODY

11300330007

REMOVAL AND INSTALLATION



Removal steps

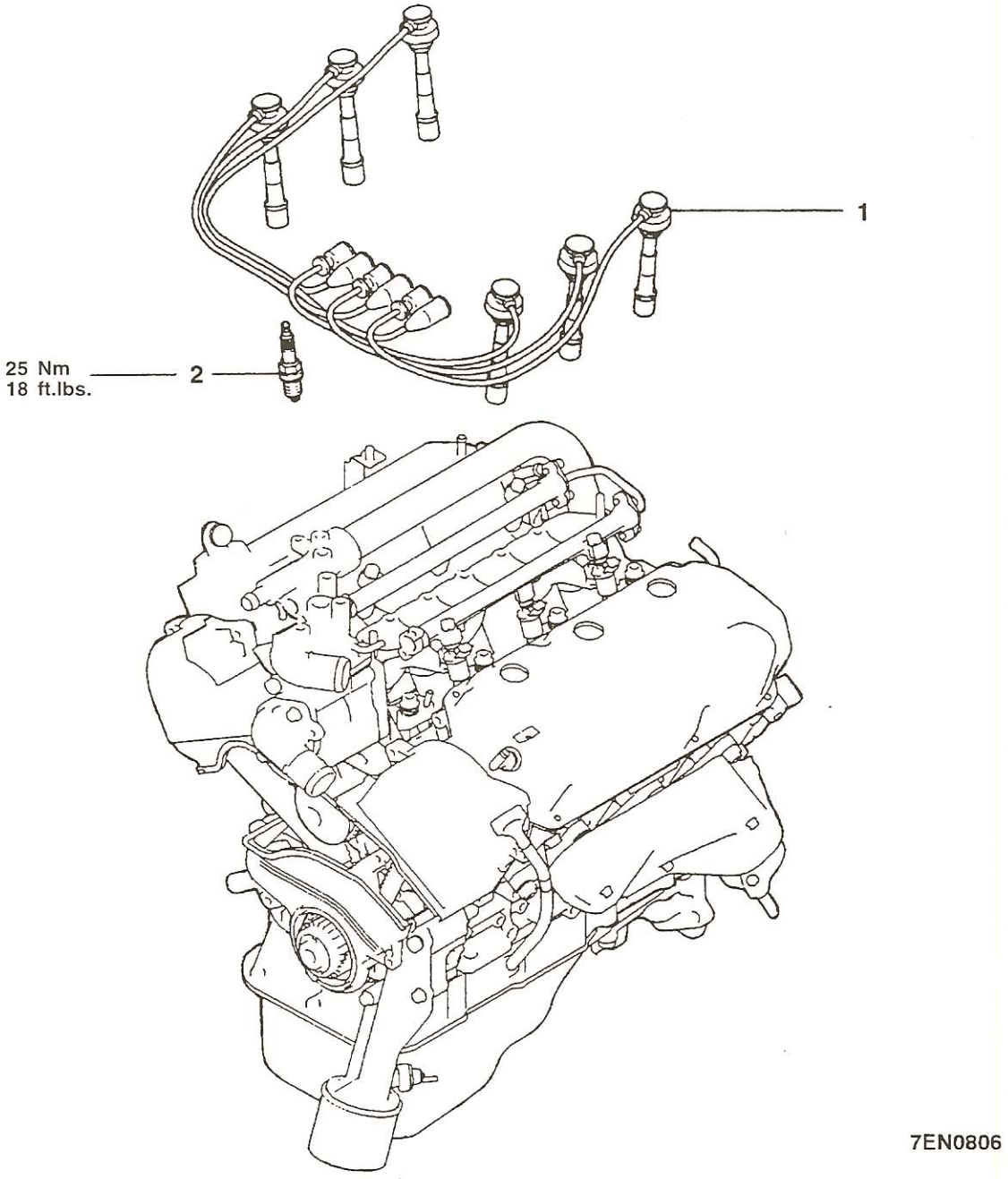
1. Ignition coil
2. Ignition power transistor
3. EGR valve <For Federal>
4. EGR valve gasket <For Federal>
5. Manifold differential pressure sensor <For Federal>
6. EGR pipe <For Federal>
7. EGR pipe gasket <For Federal>
8. Intake manifold plenum stay
9. Water outlet fittng bracket
10. Throttle body
11. Throttle body gasket
12. Air intake fitting
13. Intake fitting gasket
14. Intake upper manifold
15. Intake manifold plenum gasket

TSB Revision

IGNITION SYSTEM

11300160078

REMOVAL AND INSTALLATION



Removal steps

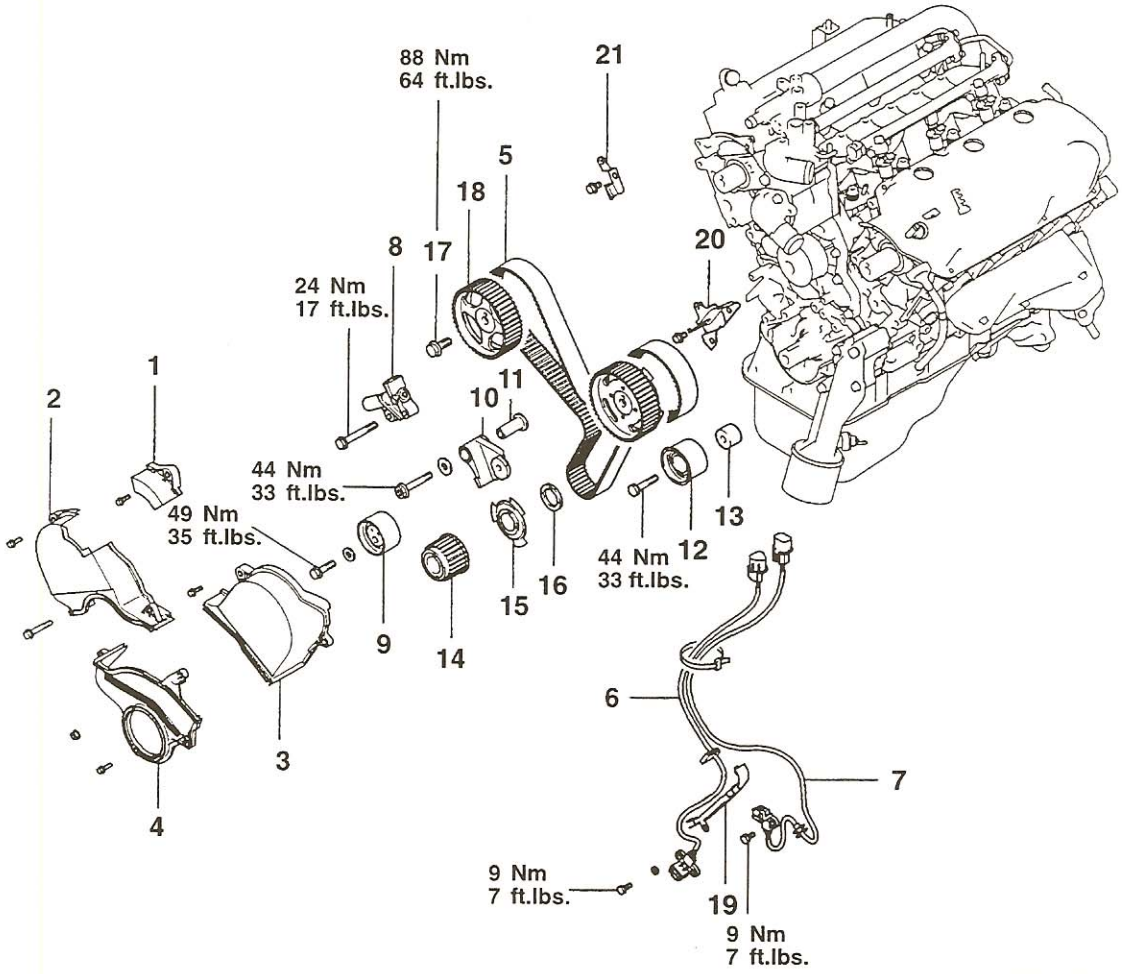
1. Spark plug cables
2. Spark plugs

TSB Revision

TIMING BELT

1130019

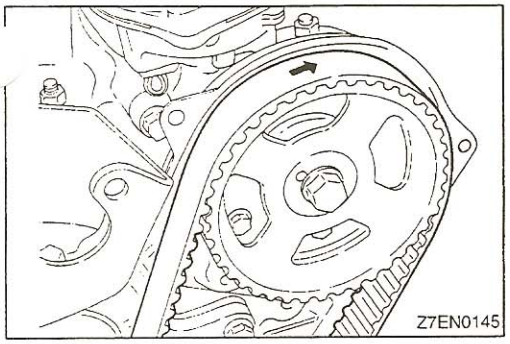
REMOVAL AND INSTALLATION



Removal steps

1. Timing belt cover cap
2. Timing belt front upper cover, right
3. Timing belt front upper cover, left
4. Timing belt front lower cover
◀A▶ ▶C◀ 5. Timing belt
6. Crankshaft position sensor
7. Camshaft position sensor
▶B◀ 8. Auto-tensioner
9. Tensioner pulley
10. Tensioner arm
11. Shaft
12. Idler pulley
13. Idler pulley spacer
14. Crankshaft sproket
15. Crankshaft sensing blade
16. Crankshaft spacer
◀B▶ ▶A◀ 17. Camshaft sproket bolt
18. Camshaft sproket
19. Harness protector
20. Timing belt rear cover, left
21. Timing belt rear cover, right

TSB Revision



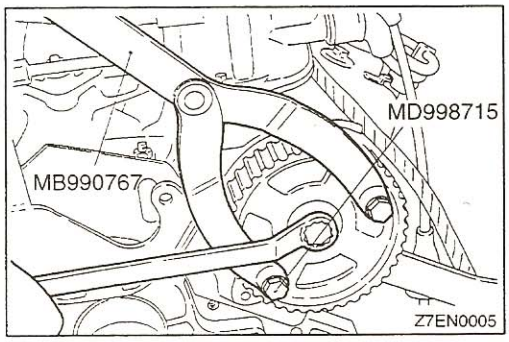
REMOVAL SERVICE POINTS

◀A▶ TIMING BELT REMOVAL

(1) Mark the belt running direction for reference in reinstallation.

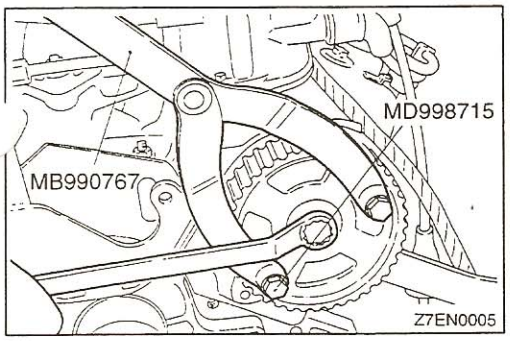
NOTE
(1) Water or oil on the belt shortens its life drastically, so the removed timing belt, sprocket, and tensioner must be kept free from oil and water. Do not immerse parts in cleaning solvent.
(2) If there is oil or water on any part, check the front case oil seal, camshaft oil seal and water pump for leaks.

◀B▶ CAMSHAFT SPROCKET BOLT LOOSENING



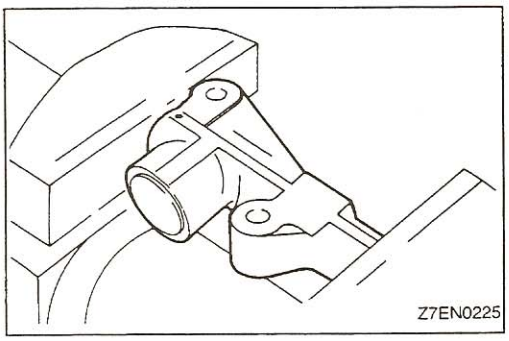
INSTALLATION SERVICE POINTS

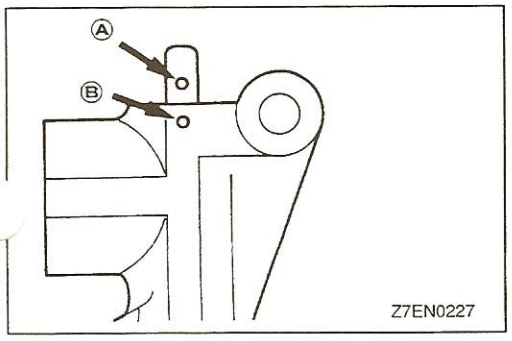
▶A◀ CAMSHAFT SPROCKET BOLT TIGHTENING



▶B◀ AUTO-TENSIONER INSTALLATION

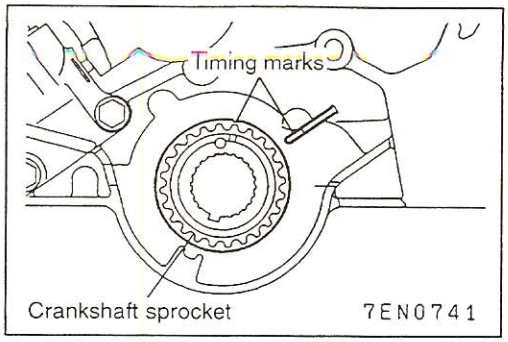
If the auto-tensioner rod is fully extended, set it in the retracted position with the following procedure.
(1) Set the auto-tensioner in a vice.





(2) Slowly close the vice to force the rod in until the set hole (A) of the rod is lined up with the set hole (B) of the cylinder.
(3) Insert a wire [1.4 mm (.055 in.) in diameter] into the set holes.
(4) Remove the auto-tensioner from the vice.

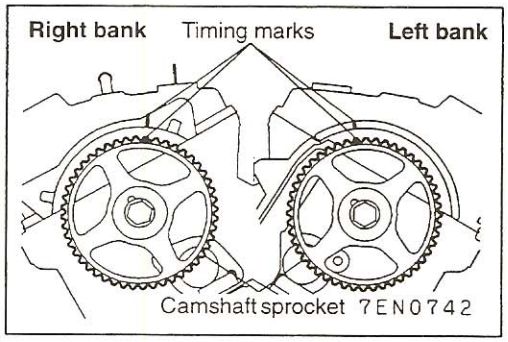
TSB Revision



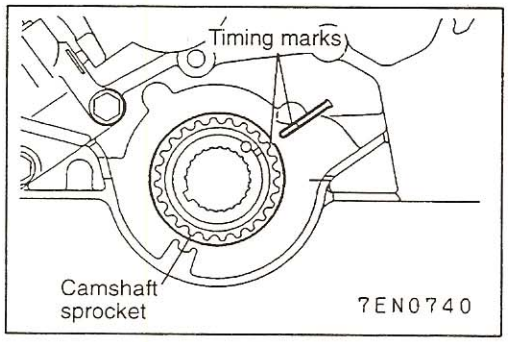
▶C◀ TIMING BELT INSTALLATION

(1) Move the timing mark of the crankshaft sprocket th teeth to slightly lower the piston below the top dead cent on the compression stroke of the No. 1 cylinder.

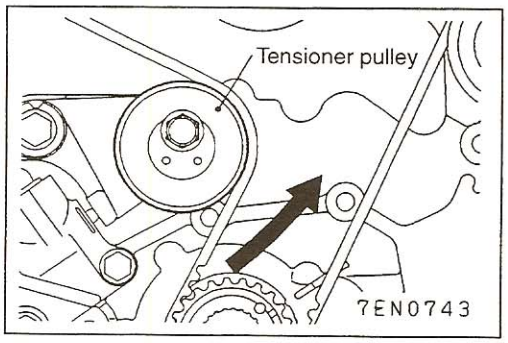
Caution
If the camshaft sprocket is rotated with the piston at the top dead center on the compression stroke of the No. 1 cyliner, the valve and piston might interfere.



(2) Line up the timing marks of the left bank camshaft sprockets.
(3) Line up the timing marks of the right bank camshaft sprockets.

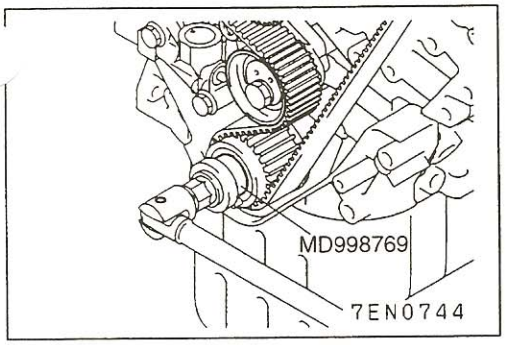


(4) Line up the timing marks of the crankshaft sprockets.
(5) Install the timing belt on each sprocket in the following sequence.
  (1) Install the timing belt on the crankshaft sprocket a then on the idler pulley, while tightening it to prev slackness.
  (2) Install the timing belt on the left bank camshaft sprocket.
  (3) Install the timing belt on the water pump pulley, while taking up the slack.
  (4) Install the timing belt on the right bank camshaft sprocket.
  (5) Install the timing belt on the tensioner pulley.

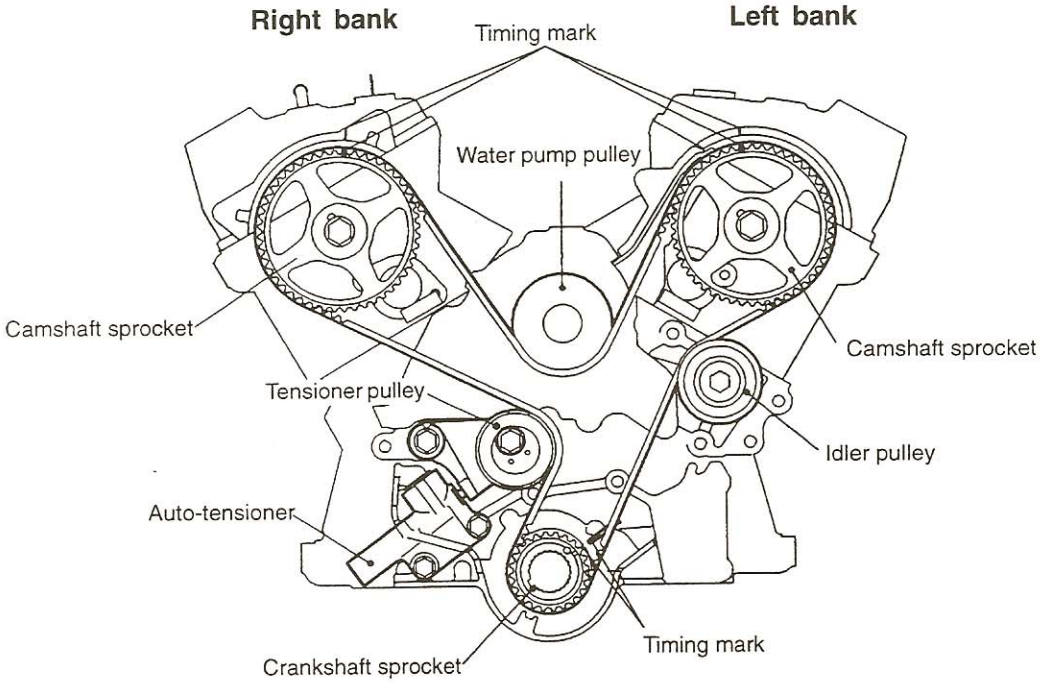


(6) Lightly press the tensioner pulley against the belt and temporatily tighten the center bolt.
(7) Check to see that the timing marks of all the sprockets are in a alignment.

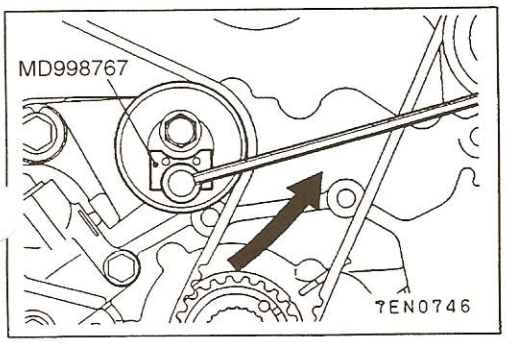
TSB Revision



(8) Using a special tool, rotate the crankshaft a quarter of a turn counter-clockwise. Then rotate it back clokwise to verify that all the timing marks are in alignment.

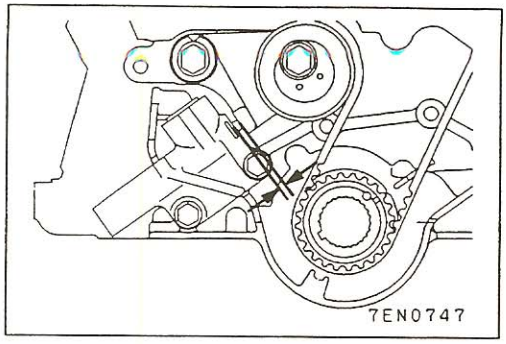


7EN0745



(9) Mount a special tool and torque wrench on the tensioner pulley.
(10) Torque it to 4.4 Nm (3.3 ft.lbs.) with the torque wrench.
(11) While holding the tensioner pulley in position, tighten the center bolt to the specified torque.
(12) Rotate the crankshaft two turns clockwise and leave it alone for approx. 5 minutes.

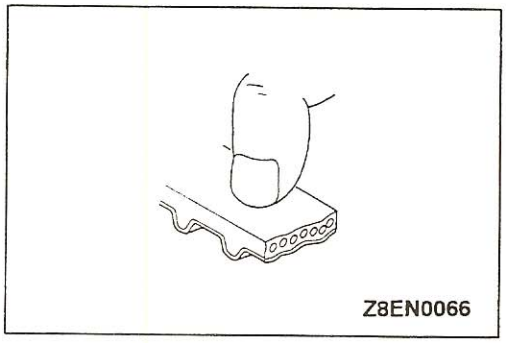
TSB Revision



(13)Check to see whether the metal wire inserted when the auto-tensioner was installed can be removed without resistance.
If the metal wire can be removed without any resistance, it means that the belt has a proper tension. Therefore, remove the metal wire. In this condition, check that the projection of the rod of the auto-tensioner is within the standard value.

Standard value: 3.8 – 4.5 mm (.150 – .177 in.)

(14)If the metal wire offers opposition when removed, repeat the foregoing steps (9) through (12) until a proper belt tension is obtained.

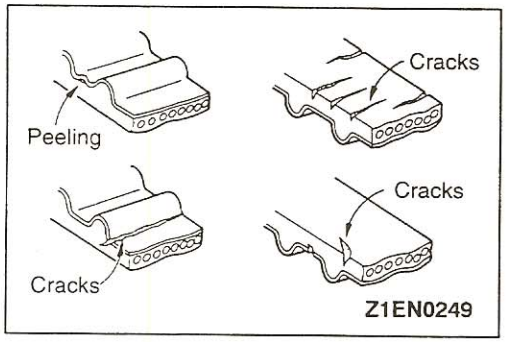


INSPECTION

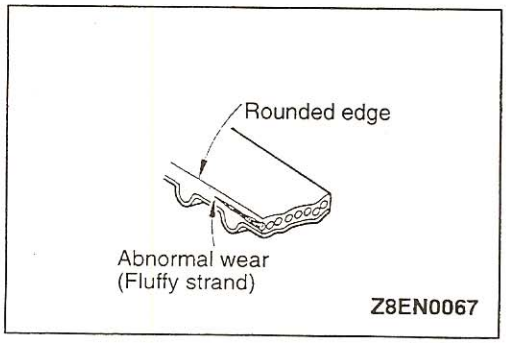
11300200169

TIMING BELT

Replace belt if any of the following conditions exist.
(1) Hardening of back rubber–back side is glossy with resilience and leaves no indent when pressed with fingernail.

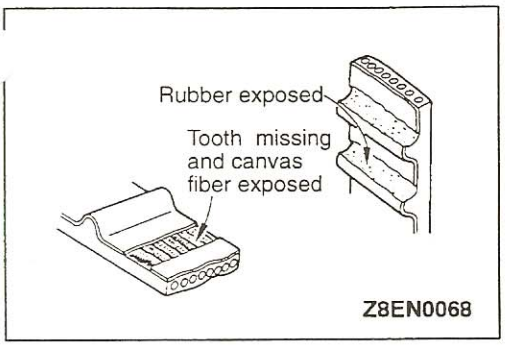


(2) Cracks on rubber back
(3) Cracks or peeling of canvas
(4) Cracks on tooth bottom
(5) Cracks on belt

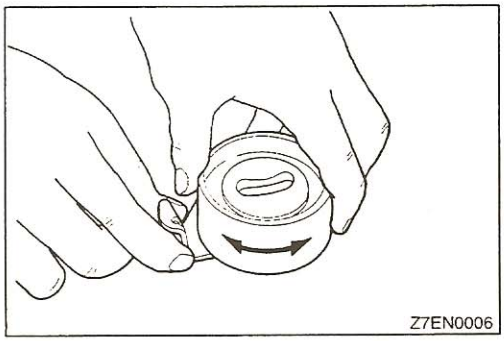


(6) Abnormal wear of belt sides. The sides are normal if they are sharp as if cut by a knife.

TSB Revision

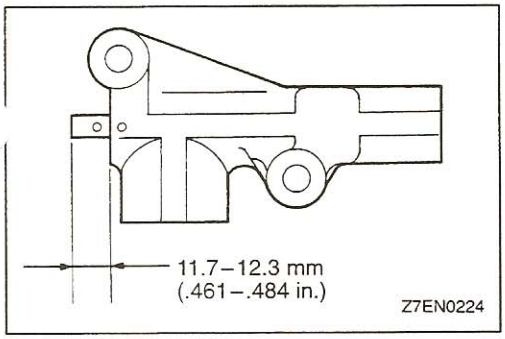


(7) Abnormal wear on teeth
(8) Tooth missing and canvas fiber exposed.



TENSIONER

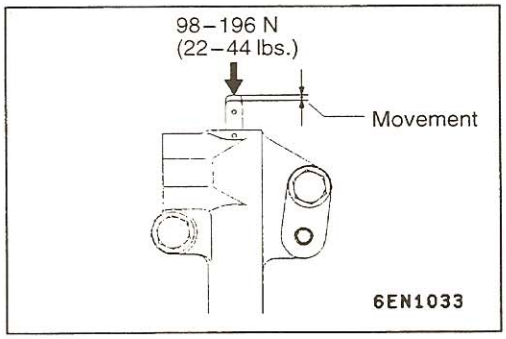
(1) Turn the pulley. If it rotates unsmoothly, develops noise or excessive play, replace the timing belt tensioner.



AUTO-TENSIONER

(1) Check for oil leaks. If oil leaks are evident, replace the auto-tensioner.
(2) Check the rod end for wear or damage and replace the auto-tensioner if necessary.
(3) Measure the rod projection length. If the reading is outside the standard value, replace the auto-tensioner.

Standard value: 11.7–12.3 mm (.461–.484 in.)

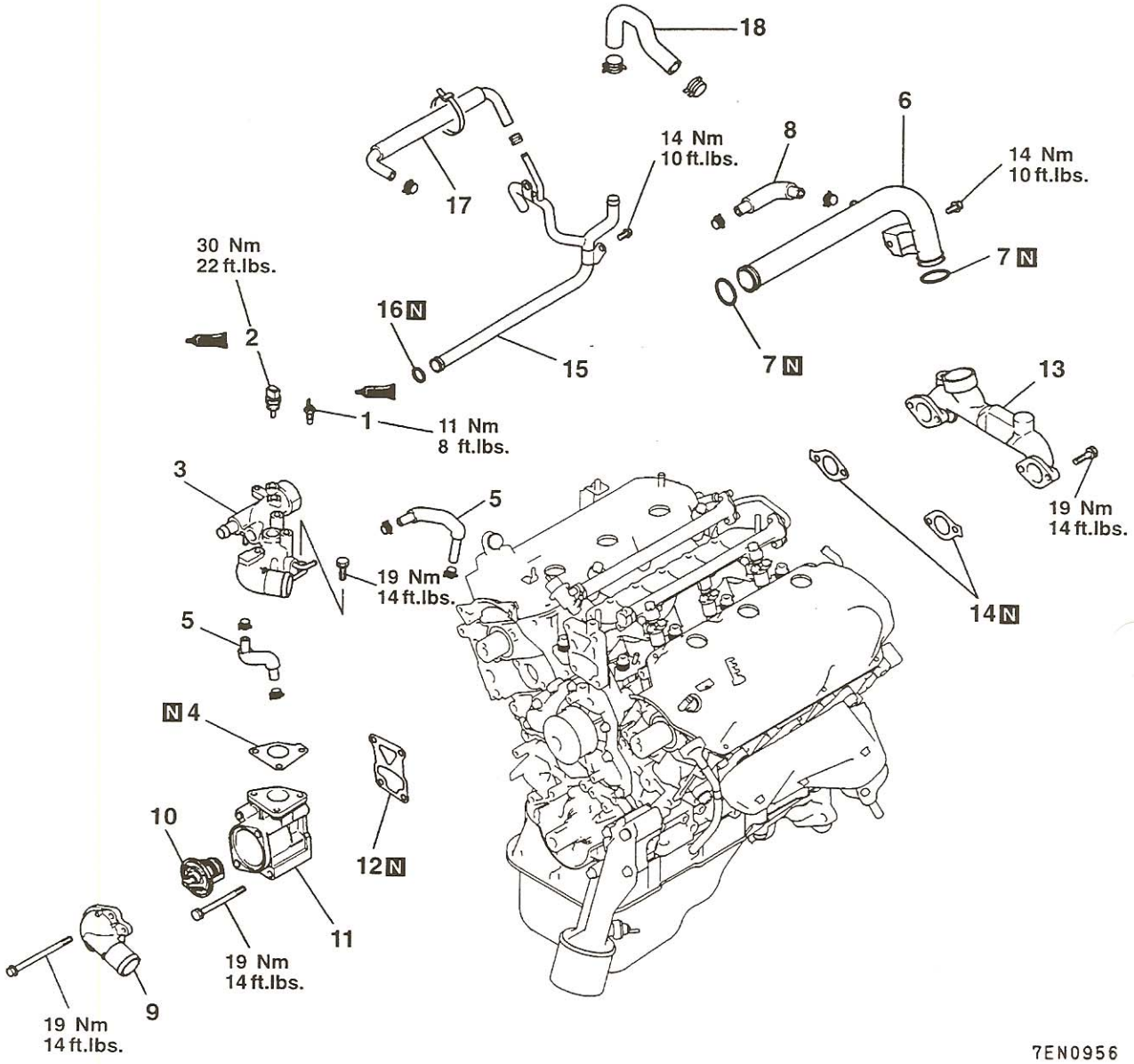


(4) Press the rod with a force of 98 to 196 N (22 to 44 lbs.) and measure the movement of rod.
If the measured value is out of the standard value, replace the auto-tensioner.

Standard value: 1 mm (.0393 in.) or less

INTAKE MANIFOLD AND FUEL PARTS

REMOVAL AND INSTALLATION

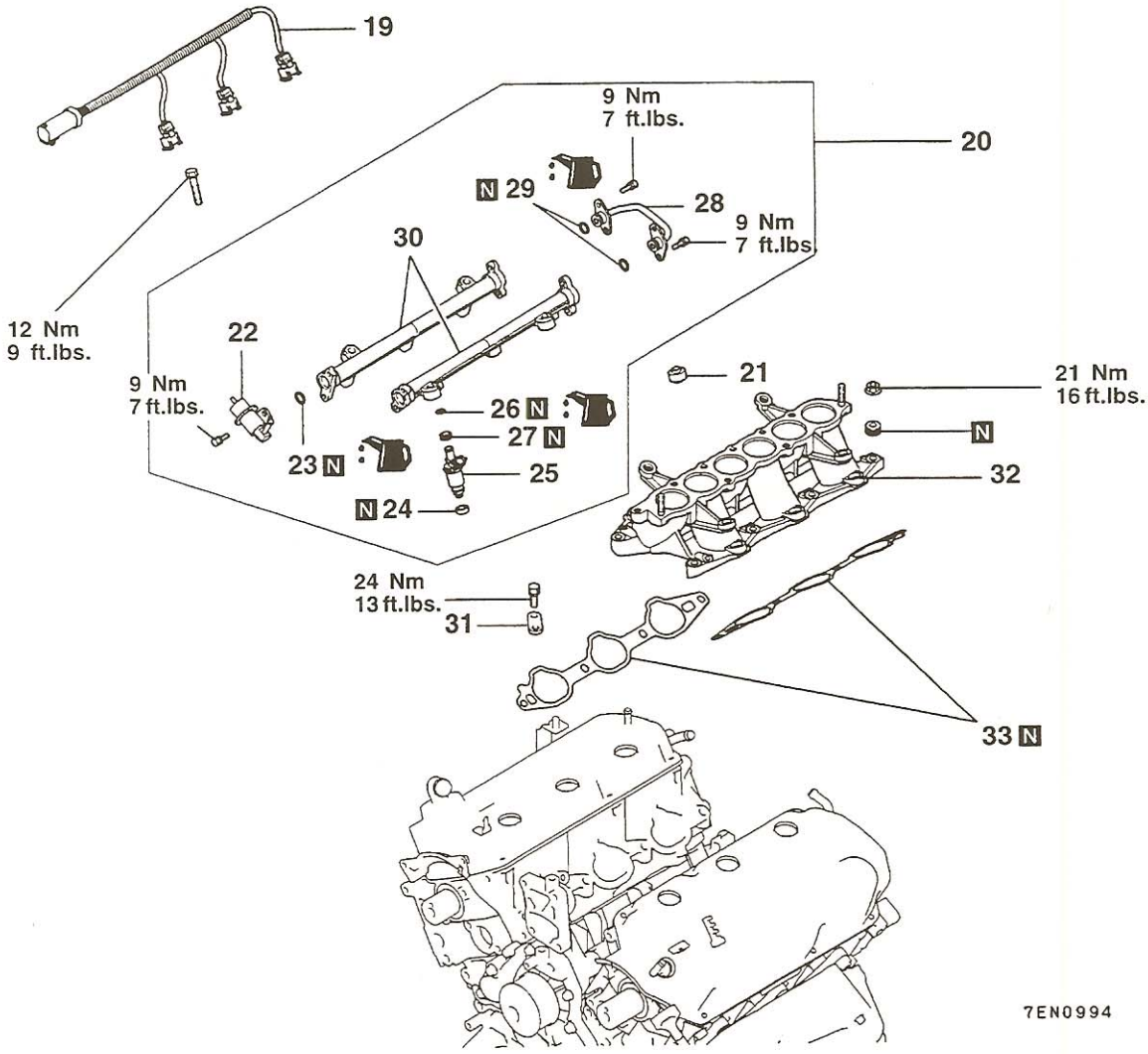


7EN0956

Removal steps

- ▶G◀ 1. Engine coolant temperature gauge unit
- ▶F◀ 2. Engine coolant temperature sensor
- 3. Water outlet fitting
- 4. Water outlet fitting gasket
- 5. Water hose
- ▶D◀ 6. Water outlet pipe
- ▶D◀ 7. O-ring
- 8. Water hose
- 9. Water inlet fitting
- ▶E◀ 10. Thermostat
- 11. Thermostat case
- 12. Thermostat case gasket
- 13. Water passage
- 14. Gasket
- ▶D◀ 15. Water pipe
- ▶D◀ 16. O-ring
- 17. Water hose
- 18. Water hose

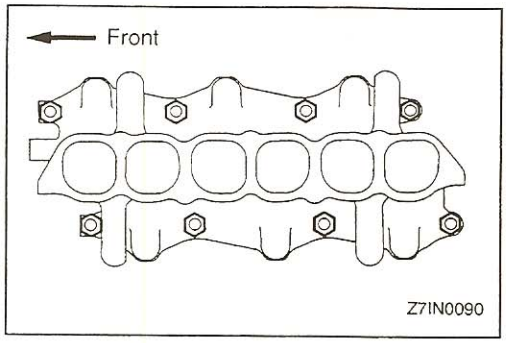
TSB Revision



Removal steps

19. Injector harness
20. Injector and fuel rail
21. Insulator
▶C◀ 22. Fuel pressure regulator
23. O-ring
24. Insulator
▶B◀ 25. Injector
26. O-ring
27. Grommet
28. Fuel pipe
29. O-ring
30. Fuel rail
31. Bracket
▶A◀ 32. Intake manifold
33. Intake manifold gasket

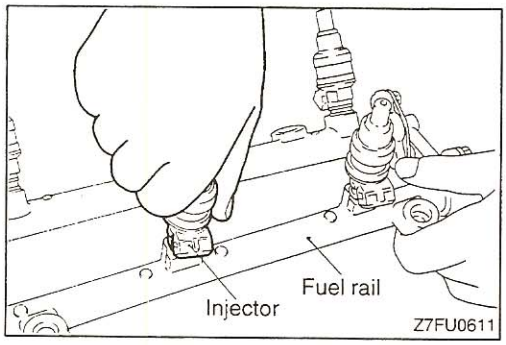
TSB Revision



INSTALLATION SERVICE POINTS

▶A◀ INTAKE MANIFOLD INSTALLATION

(1) Tighten the nuts on the right bank to 5 – 8 Nm (3.7 – 5.9 ft.lbs.).
(2) Tighten the nuts on the left bank to the specified torque. Then tighten the nuts on right bank to the specified torque.
(3) Tighten the nuts on the left bank and those on the right bank again in that order.



▶B◀ INJECTOR INSTALLATION

(1) Before installing the injector, the rubber O-ring must be lubricated with a drop of new engine oil for easy installation.

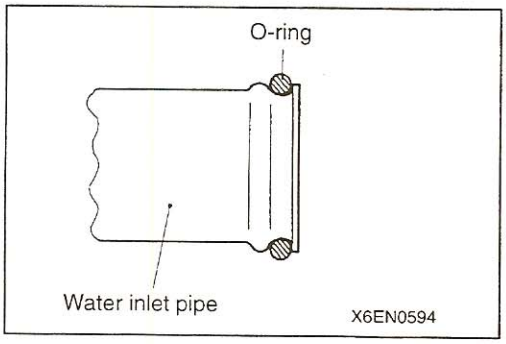
Caution
Use care not to let the engine oil enter the fuel rail.

(2) Insert the injector top end into the fuel rail. Be careful not to damage O-ring during installation.

▶C◀ FUEL PRESSURE REGULATOR INSTALLATION

(1) Before installing the pressure regulator, the O-ring must be lubricated with a drop of new engine oil for easy installation.

Caution
Use care not to let the engine oil enter the fuel rail.

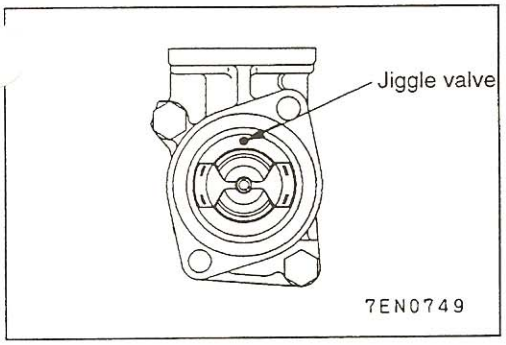


▶D◀ O-RING AND WATER PIPE INSTALLATION

(1) Wet the O-ring (with water) to ease assembly.

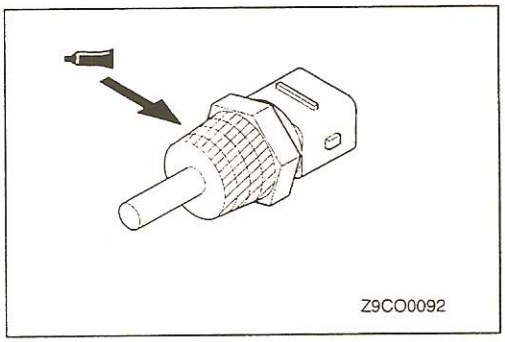
Caution
Keep the O-ring free of oil or grease.

TSB Revision



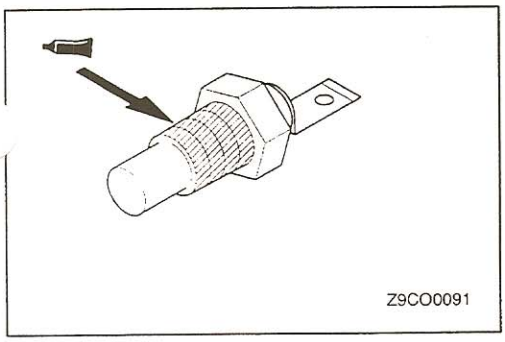
▶E◀ THERMOSTAT INSTALLATION

(1) Install the thermostat in the thermostat case with its jiggle valve located at the top position.



▶F◀ SEALANT APPLICATION TO ENGINE COOLANT TEMPERATURE SENSOR

Specified sealant:
3M Nut Locking No. 4171 or equivalent



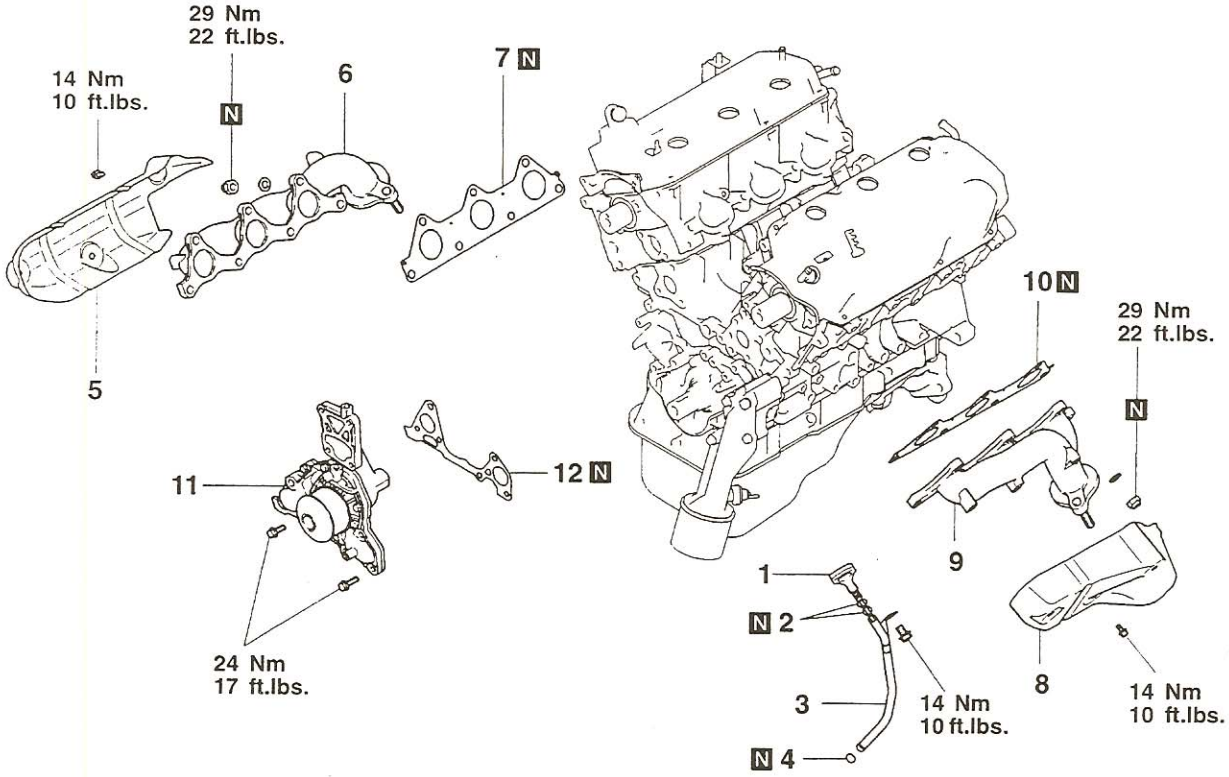
▶G◀ SEALANT APPLICATION TO ENGINE COOLANT TEMPERATURE GAUGE UNIT

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

EXHAUST MANIFOLD

1130049

REMOVAL AND INSTALLATION



7EN0753

Removal steps

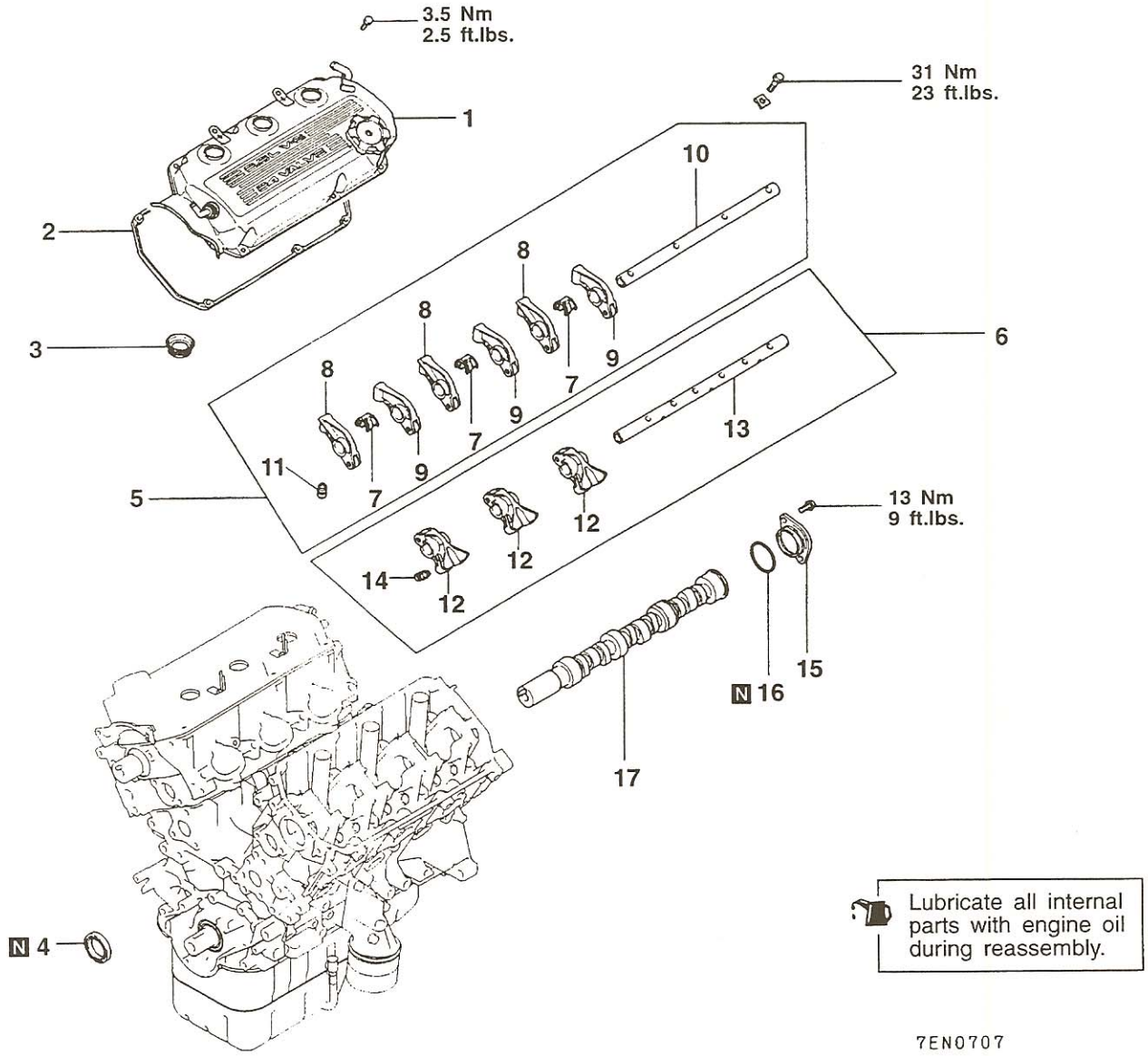
1. Oil level gauge (dipstick)
2. O-ring
3. Oil level gauge guide
4. O-ring
5. Heat protector, right
6. Exhaust manifold, right
7. Exhaust manifold gasket
8. Heat protector, left
9. Exhaust manifold, left
10. Exhaust manifold gasket
11. Water pump
12. Water pump gasket

TSB Revision

ROCKER ARMS AND CAMSHAFT

11300540216

REMOVAL AND INSTALLATION

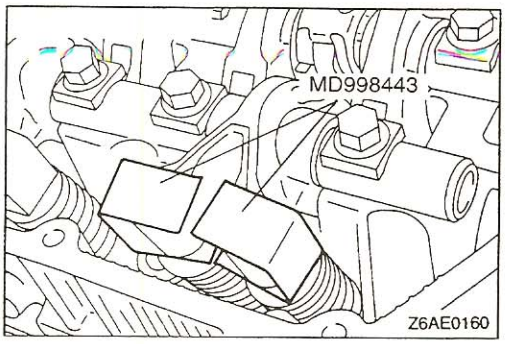


Removal steps

1. Rocker cover
2. Rocker cover gasket
3. Oil seal
4. Camshaft oil seal
5. Rocker arm, rocker arm shaft
6. Rocker arm, rocker arm shaft
7. Rocker shaft spring
8. Rocker arm A
9. Rocker arm B
10. Rocker arm shaft
11. Lash adjuster
12. Rocker arm C
13. Rocker arm shaft
14. Lash adjuster
15. Thrust case
16. O-ring
17. Camshaft

◀A▶ ▶D◀ ◀A▶ ▶C◀ ▶C◀ ▶B◀ ▶B◀ ▶A◀

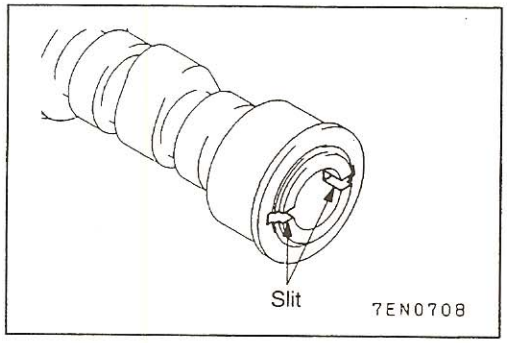
TSB Revision



REMOVAL SERVICE POINT

◀A▶ ROCKER ARM, ROCKER ARM SHAFT REMOV

(1) Install the special tools to the rocker arm to hold the lash adjuster.
(2) Loosen the rocker arm shaft bolts.
(3) Remove the rocker arms and shaft as an assembly.



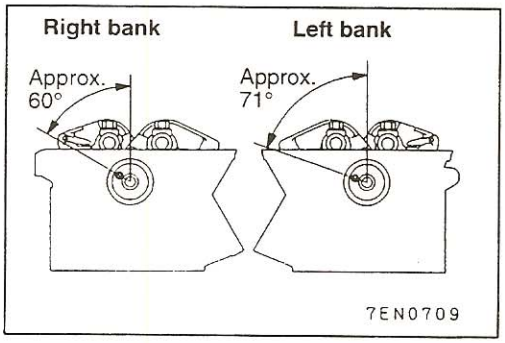
INSTALLATION SERVICE POINTS

▶A◀ CAMSHAFT INSTALLATION

(1) Apply engine oil to the camshaft journals and cams and then install the camshafts.

Caution
Use care to prevent confusion of the right and left bank camshafts.

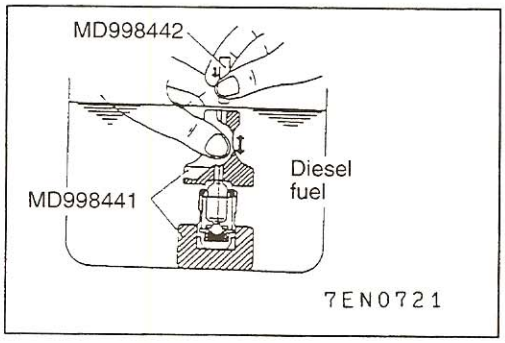
NOTE
The right bank camshaft is identified by a slit 4 mm wide at the rear end of the camshaft.

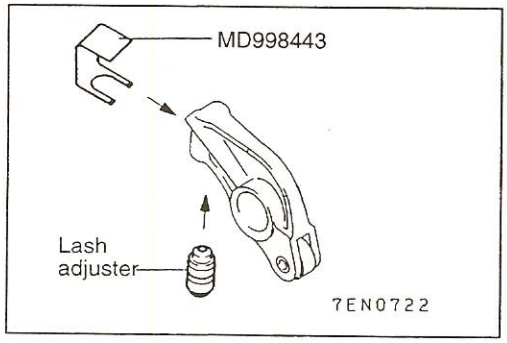


(2) Check to see that the dowel pin of the camshaft is located at the position shown.

▶B◀ LASH ADJUSTER INSTALLATION

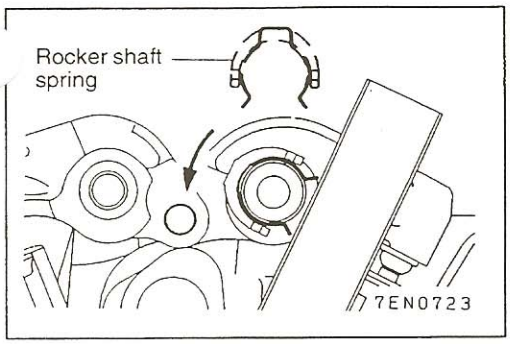
(1) Immerse the lash adjuster in clean diesel fuel.
(2) Using the special tool (air bleed wire), move the pluger up and down 4 or 5 times while pushing down lightly on the check ball in order to bleed out the air.

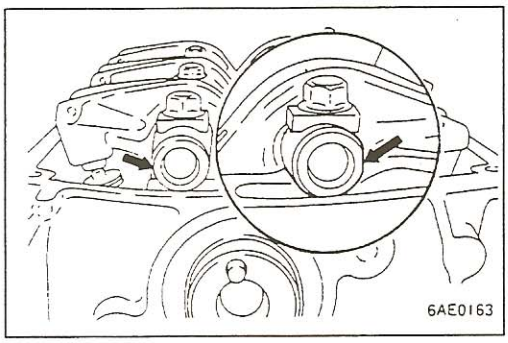


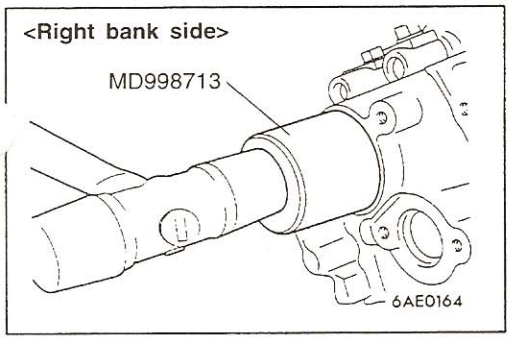


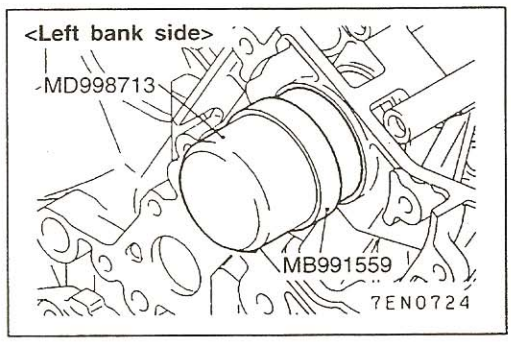
(3) Insert the lash adjuster to rocker arm, being careful not to spill the diesel fuel. Then use the special tool to prevent the adjuster for falling while istalling it.

TSB Revision









▶C◀ ROCKER ARM, ROCKER ARM SHAFT AND ROCKER SHAFT SPRING INSTALLATION

(1) Temporatily tighten the rocker shaft with bolts so that all the intake valve rocker arms do not push the valves.
(2) Insert the rocker shaft spring from above and mount it at right angles to the plug guide.

NOTE
Before installing the exhaust rocker arms and rocker arm shaft, mount the rocker shaft spring.

(3) Remove the special tools used to hold the lash adjuster in position.
(4) Make sure that the notch of the rocker shaft is directed as shown in the ilustration.

▶D◀ CAMSHAFT OIL SEAL INSTALLATION

INSPECTION

11300550202

ROCKER ARM SHAFT

(1) Check the rocker arm mounting portions of the rocker arm shafts for wear or damage. Replace as necessary.

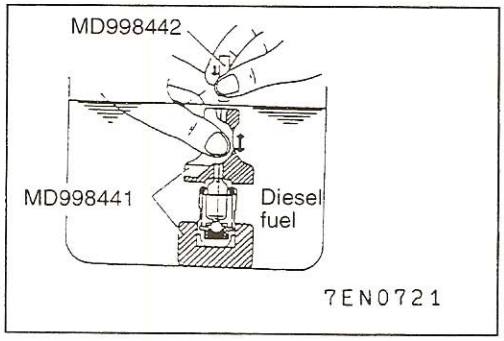
ROCKER ARM

(1) Check the roller surface and replace the rocker arm if recesses, damage or heat seizure is observed.
(2) Check roller rotation and replace the rocker arm if uneven rotation or roller backlash is observed.
(3) Check the inside diameter and replace the rocker arm if damage or seizure is observed.

CAMSHAFT

(1) Inspect the camshaft bearing journals for damage and binding. If the journals are binding, also check the cylinder head for damage. Also check the cylinder head oil holes for clogging.
(2) Check the tooth surface of the distributor drive gear teeth of the camshaft and replace if abnormal wear is evident.
(3) Check the cam surface for abnormal wear and damage and replace if defective. Also measure the cam height and replace if out of limit.

	Standard value	Limit
Intake mm (in.)	37.58 (1.48)	37.08 (1.46)
Exhaust mm (in.)	36.95 (1.45)	36.45 (1.44)



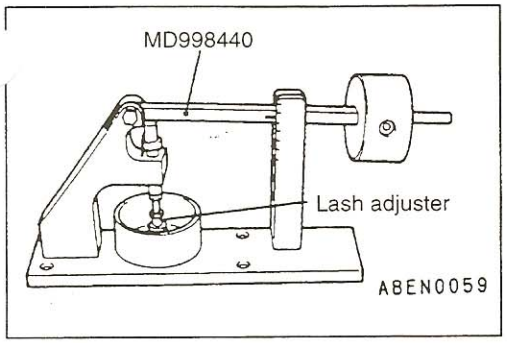
LASH ADJUSTER LEAK DOWN TEST

Caution
1. The lash adjuster is a precision part. Keep it free from dust and other foreign matters.
2. Do not disassemble the lash adjusters.
3. When cleaning the lash adjusters, use clean diesel fuel only.

(1) Immerse the lash adjuster in clean diesel fuel.
(2) While lightly pushing down the inner steel ball using the special tool, move the plunger up and down four or five times to bleed air.
Use of the Retainer facilitates the air bleeding of the rocker arm mounted type lash adjuster.
(3) Remove the special tool and press the plunger. If the plunger is hard to push in, the lash adjuster is normal. If the plunger can be readily pushed in all the way, bleed the lash adjuster again and test again. If the plunger is still loose, replace the lash adjuster.

Caution
Upon completion of air bleeding, hold the lash adjuster upright to prevents the inside diesel fuel from spilling.

TSB Revision



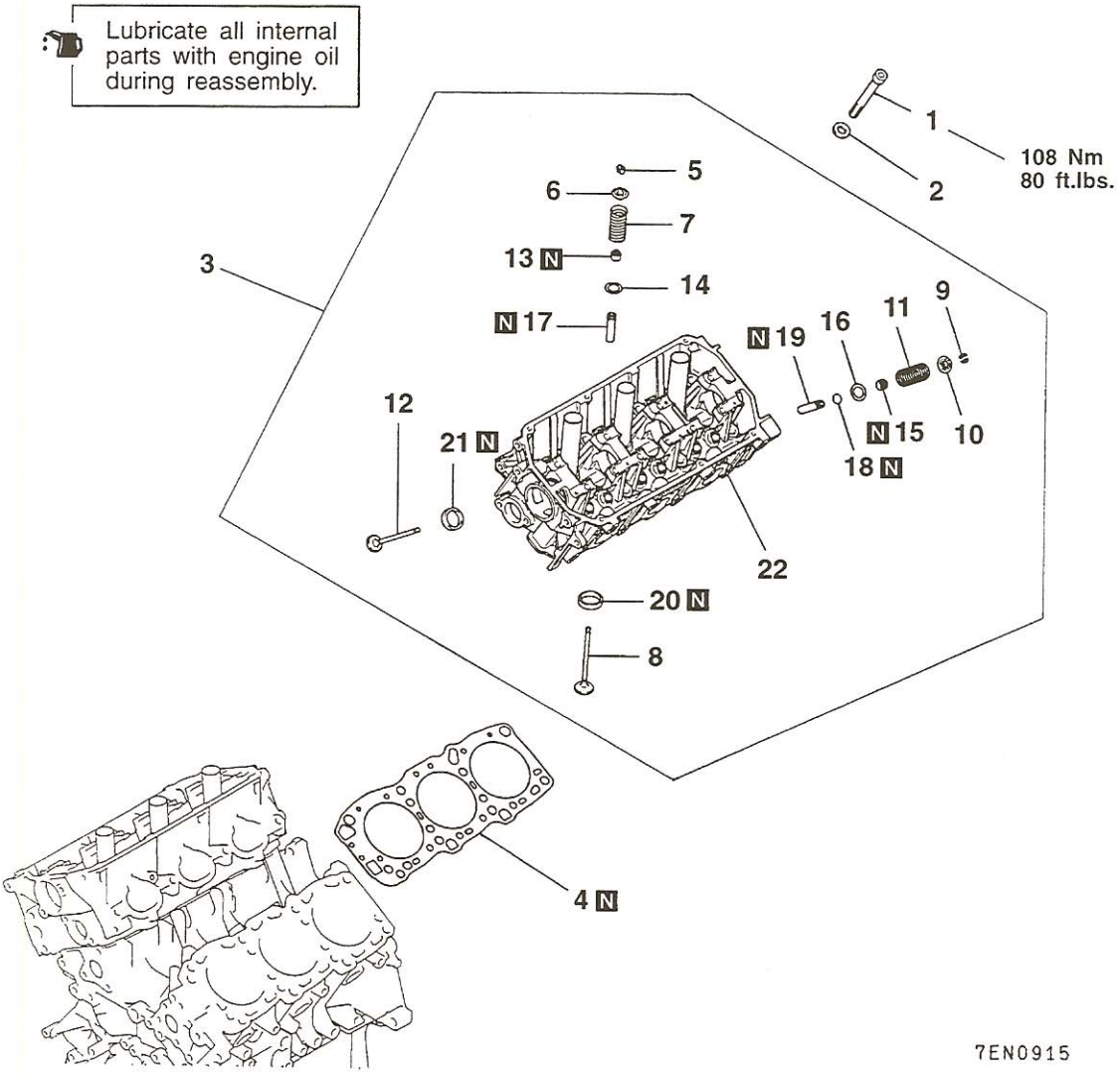
(4) After air bleeding, set the lash adjuster on the special tool (Leak down tester MD998440).
(5) After the plunger has gone down somewhat 0.2–0.5 mm (.008–.020 in.), measure the time taken for it to go down 1 mm (.04 in.). Replace if the measured time is out of specification.

Standard value:
4–20 seconds / 1 mm (.04 in.)
[Diesel fuel at 15–20°C (50–68°F)]

CYLINDER HEAD AND VALVE

1130069

REMOVAL AND INSTALLATION



Removal steps

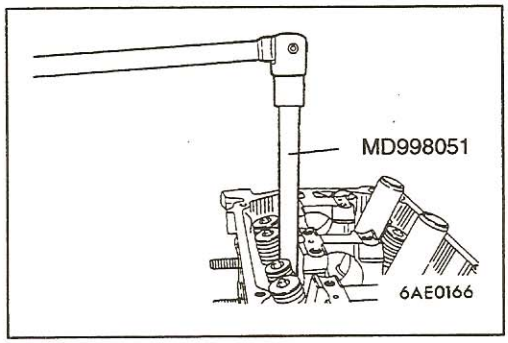
◀A▶ ▶D◀ 1. Cylinder head bolt
2. Washer
3. Cylinder head assembly
4. Cylinder head gasket
◀B▶ ▶C◀ 5. Retainer lock
6. Valve spring retainer
▶B◀ 7. Valve spring
8. Inlet valve
◀B▶ ▶C◀ 9. Retainer lock
10. Valve spring retainer
▶B◀ 11. Valve spring
12. Exhaust valve
◀C▶ ▶A◀ 13. Valve stem seal
14. Valve spring seat
◀C▶ ▶A◀ 15. Valve stem seal
16. Valve spring seat
17. Inlet valve guide
18. Snap ring
19. Exhaust valve guide
20. Inlet valve seat
21. Exhaust valve seat
22. Cylinder head

TSB Revision

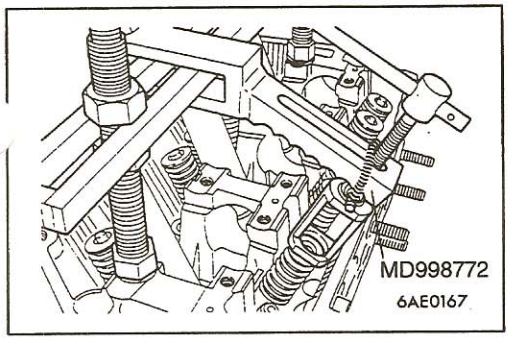
REMOVAL SERVICE POINTS

PRECAUTION FOR REMOVED PARTS

(1) Keep removed parts in order according to the cylinder number and intake/exhaust.

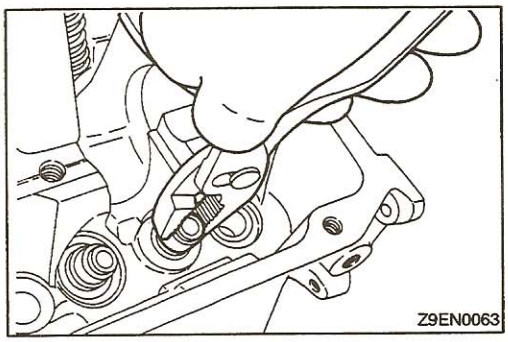


◀A▶ CYLINDER HEAD BOLT REMOVAL



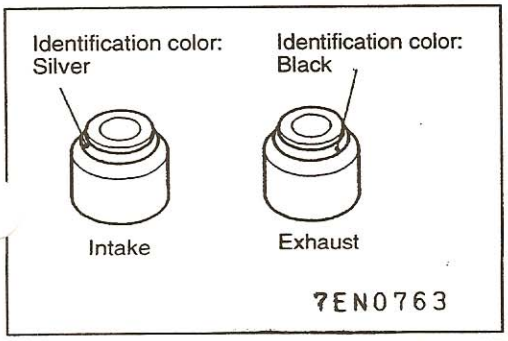
◀B▶ RETAINER LOCK REMOVAL

(1) Using the special tool, compress the spring.
(2) Remove the retainer locks.



◀C▶ VALVE STEM SEAL REMOVAL

(1) Do not reuse removed valve stem seals.

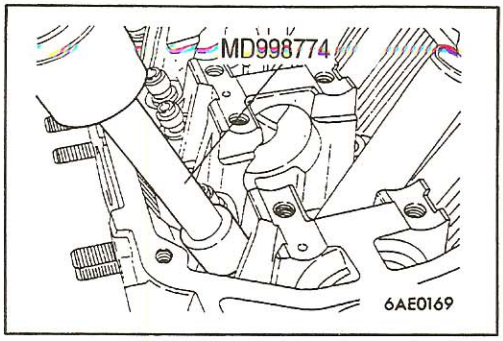


INSTALLATION SERVICE POINTS

▶A◀ VALVE STEM SEAL INSTALLATION

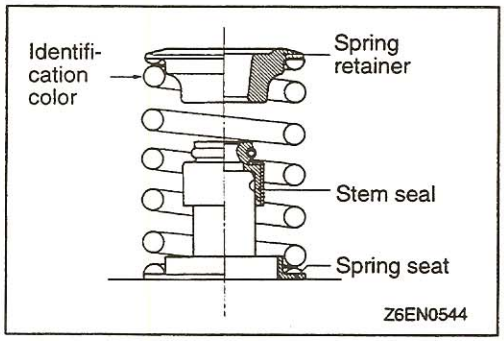
(1) Install the valve spring seat.
(2) Using the special tool, install a new stem seal to the valve guide.

TSB Revision



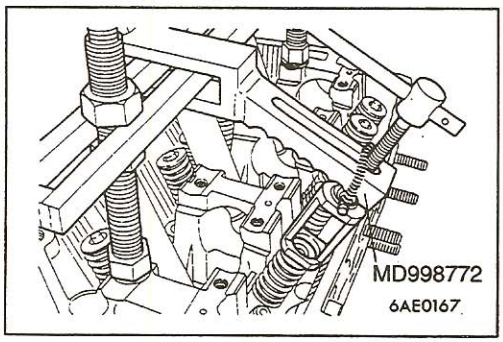
Caution

1. **Valve stem seals for intake valve and for exha valve are different. Be sure to install the corre ones.**
   Vavle stem seal identification color
   Intake: Silver
   Exhaust: Black
2. **Do not reuse removed valve stem seal.**
3. **Always use the special tool to install the valve stem seal. Improperly installed valve stem seal may cause oil leak.**



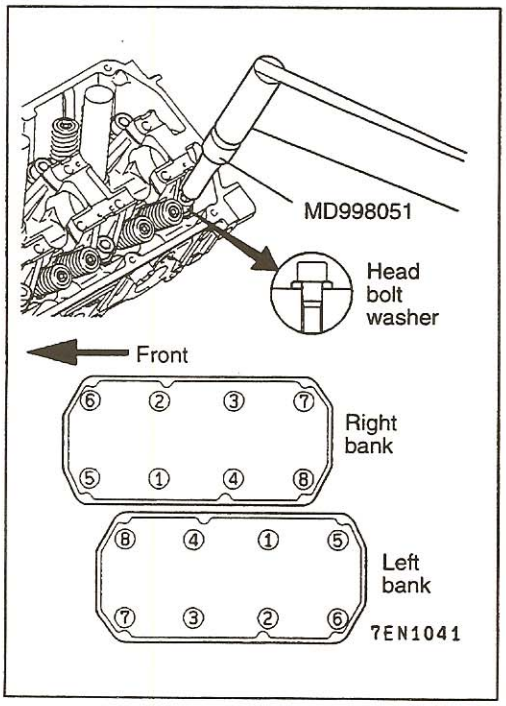
▶B◀ VALVE SPRING INSTALLATION

(1) Direct the valve spring end with identification color toward the spring retainer.



▶C◀ RETAINER LOCK INSTALLATION

(1) Using the special tool, compress the valve spring and insert the retainer lock into position.

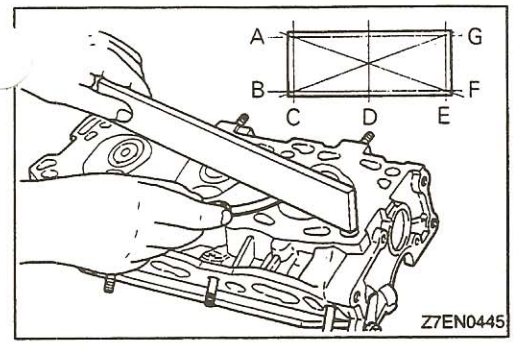


▶D◀ CYLINDER HEAD BOLT INSTALLATION

(1) Tighten the cylinder head bolts in the sequence shown. Each bolt should be tightened in two to three steps, torquing progressively. Tighten to the specified torque in the final sequence.

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

TSB Revision



INSPECTION

11300700232

CYLINDER HEAD

(1) Check the cylinder head gasket surface for flatness by using a straightedge in the directions of A through G shown in the illustration.

Standard value: 0.03 mm (.0012 in.)

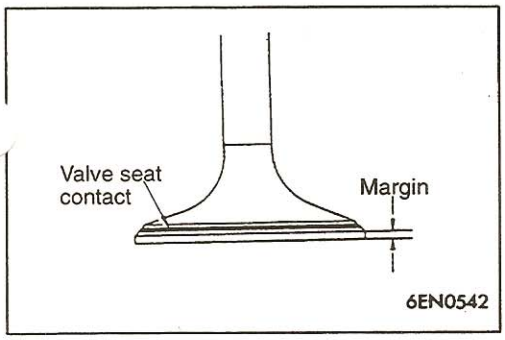
Limit: 0.2 mm (.008 in.)

(2) If the service limit is exceeded, correct to meet the specification.

Grinding limit: *0.2 mm (.008 in.)

* Total resurfacing depth of both cylinder head and cylinder block.

Overall height: 120 mm (4.72 in.)



VALVE

(1) Check the valve face for correct contact. If incorrect, reface using a valve refacer. Valve should make a uniform contact with the seat at the center of valve face.

(2) If the margin exceeds the service limit, replace the valve.

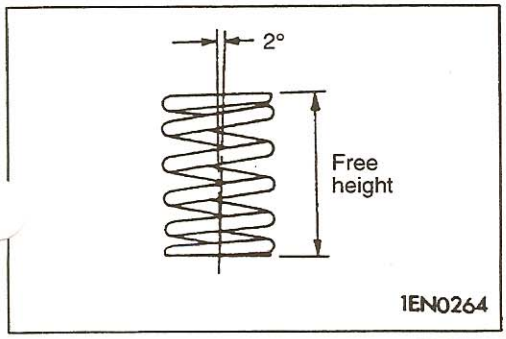
Standard value
<Intake> 1.0 mm (.039 in.)
<Exhaust> 1.2 mm (.047 in.)

Limit
<Intake> 0.5 mm (.019 in.)
<Exhaust> 0.7 mm (.028 in.)

(3) Measure the valve's total length. If the measurement is less than specified, replace the valve.

Standard value
<Intake> 112.30 mm (4.4213 in.)
<Exhaust> 114.11 mm (4.4925 in.)

Limit
<Intake> 118.80 mm (4.4016 in.)
<Exhaust> 113.61 mm (4.4728 in.)



VALVE SPRINGS

(1) Measure the free height of the spring and, if it is smaller than the limit, replace.

Standard value: 51.0 mm (2.01 in.)

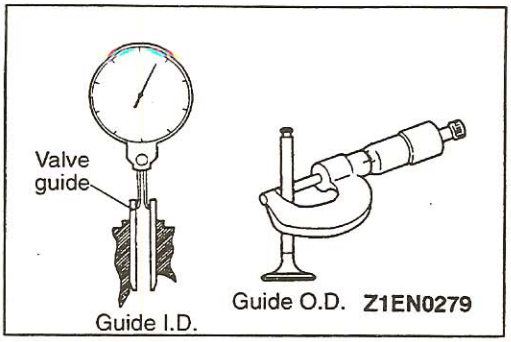
Limit: 50.0 mm (1.97 in.)

(2) Measure the squareness of the spring and, if the limit is exceeded, replace.

Standard value: 2°

Limit: Max. 4°

TSB Revision

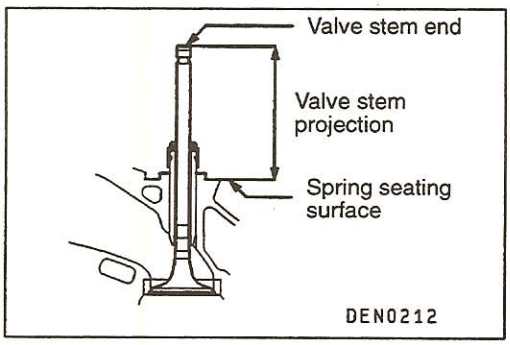


VALVE GUIDES

(1) Measure the clearance between the valve guide and v. stem. If the limit is exceeded, replace the valve gui... or valve, or both.

Standard value
<Intake> 0.02–0.05 mm (.0008–.0020 in.)
<Exhaust> 0.04–0.07 mm (.0016–.0028 in.)

Limit
<Intake> 0.10 mm (.004 in.)
<Exhaust> 0.15 mm (.006 in.)

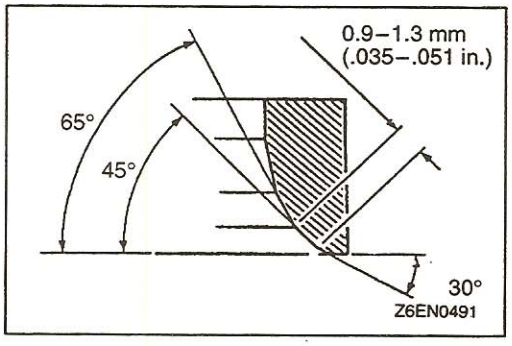


VALVE SEAT

(1) Assemble the valve, then measure the valve stem projection between the end of the valve stem and the spring seating surface. If the measurement exceeds the specified limit, replace the valve seat.

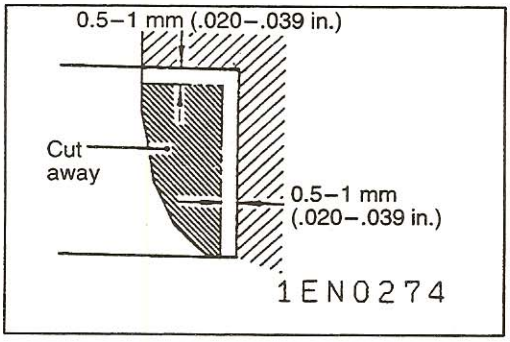
Standard value: 49.30 mm (1.9409 in.)

Limit: 49.80 mm (1.9606 in.)



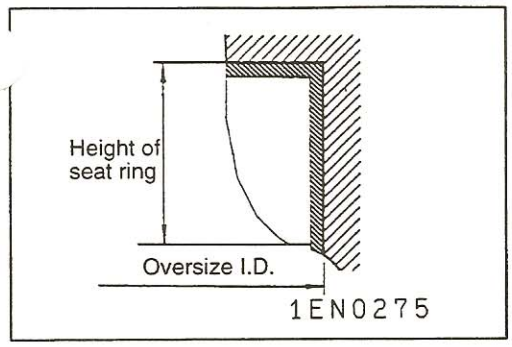
VALVE SEAT RECONDITIONING PROCEDURE

(1) Before correcting the valve seat, check for clearance between the valve guide and valve and, if necessary, replace the valve guide.
(2) Using the special tool or seat grinder, correct to obta... the specified seat width and angle.
(3) After correcting the valve seat, lap the valve and valve seat using lapping compound. Then, check the valve stem projection (refer to VALVE SEAT in INSPECTION).



VALVE SEAT REPLACEMENT PROCEDURE

(1) Cut the valve seat to be replaced from the inside to thin the wall thickness. Then, remove the valve seat.

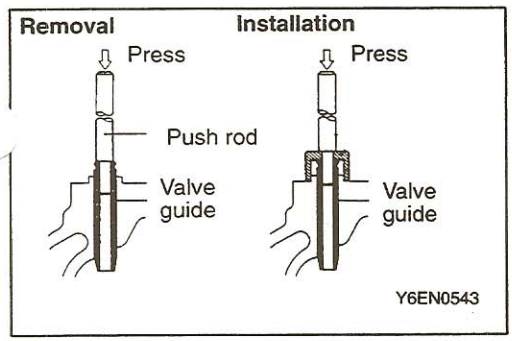


(2) Rebore the valve seat hole in the cylinder head to a selected oversize valve seat diameter.

Seat ring hole diameter:

Intake valve
0.3 O.S. 34.30 – 34.33 mm (1.3504 – 1.3516 in.)
0.6 O.S. 34.60 – 34.63 mm (1.3622 – 1.3634 in.)
Exhaust valve
0.3 O.S. 31.80 – 32.83 mm (1.2520 – 1.2531 in.)
0.6 O.S. 32.10 – 32.13 mm (1.2638 – 1.2650 in.)

(3) Before fitting the valve seat, either heat the cylinder head up to approximately 250°C (482°F) or cool the valve seat in liquid nitrogen, to prevent the cylinder head bore from galling.
(4) Using a valve seat cutter, correct the valve seat to the specified width and angle.
See "VALVE SEAT RECONDITIONING PROCEDURE"



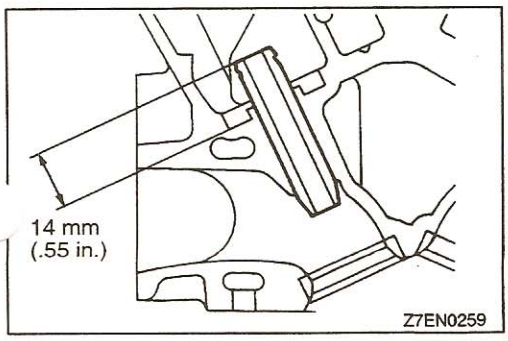
VALVE GUIDE REPLACEMENT PROCEDURE

(1) Remove the snap ring fom the exhaust valve guide.
(2) Using the press, remove the valve guide toward the cylinder block.
(3) Rebore the valve guide hole of the cylinder head so that it fits the press-fitted oversize valve guide.

Caution
Do not install a valve guide of the same size again.

Valve guide hole diameter:
0.05 O.S. 11.05 – 11.07 mm (.4350 – .4358 in.)
0.25 O.S. 11.25 – 11.27 mm (.4429 – .4457 in.)
0.50 O.S. 11.50 – 11.52 mm (.4528 – .4535 in.)

(4) Install the new snap ring into groove of exhaust valve guide.



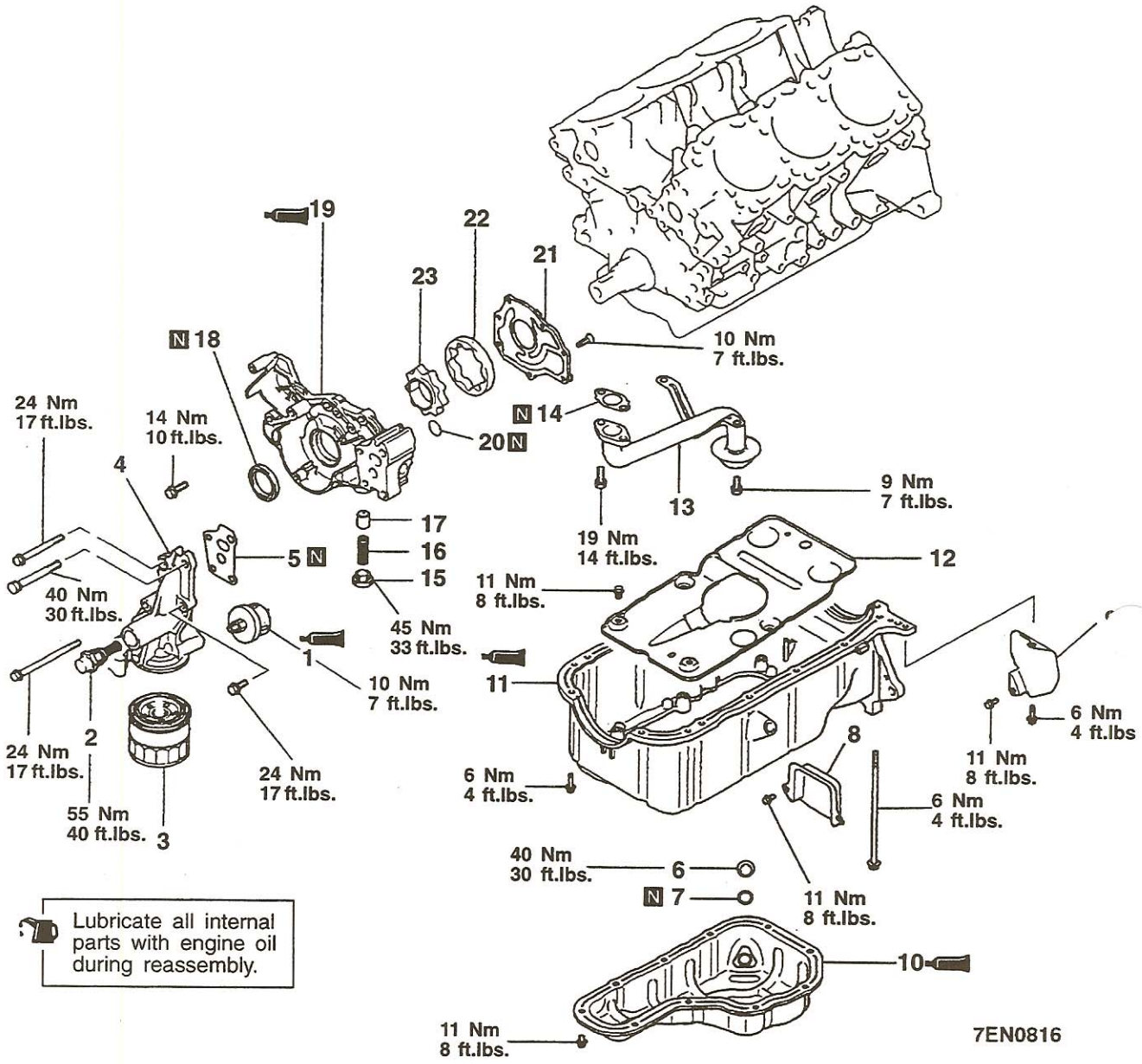
(5) Press-fit the valve guide until it protrudes 14 mm (.55 in.) from the cylinder head top surface as shown in the illustration.

NOTE
1. When press-fitting the valve guide, work from the cylinder head top surface.
2. Pay attention to the difference in length of the valve guides. [intake side: 45.5 mm (1.79 in.); exhaust side: 50.5 mm (1.99 in.)]
3. After installing the valve guides, insert new valves in them to check for sliding condition.

TSB Revision

OIL PAN AND OIL PUMP

REMOVAL AND INSTALLATION



Removal steps

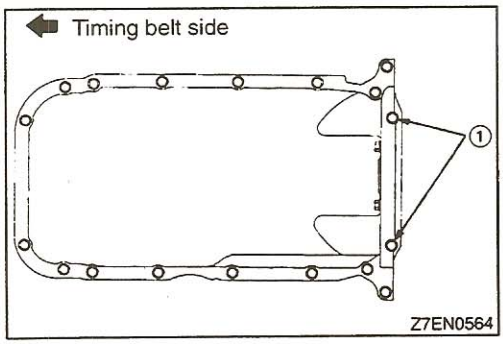
- ▶H◀ 1. Oil pressure gauge unit
- 2. Oil cooler by-pass valve
- ▶G◀ 3. Oil filter
- 4. Oil filter bracket
- 5. Oil filter bracket gasket
- 6. Drain plug
- ▶F◀ 7. Drain plug gasket
- 8. Cover
- 9. Cover
- ◀A▶ ▶E◀ 10. Oil pan, lower
- ◀B▶ ▶D◀ 11. Oil pan, upper
- 12. Baffle plate
- 13. Oil screen
- 14. Oil screen gasket
- 15. Plug
- 16. Relief spring
- 17. Relief plunger
- ▶C◀ 18. Crankshaft oil seal
- ▶B◀ 19. Oil pump case
- 20. O-ring
- 21. Oil pump cover
- ◀C▶ ▶A◀ 22. Oil pump outer rotor
- ◀C▶ ▶A◀ 23. Oil pump inner rotor

TSB Revision

REMOVAL SERVICE POINTS

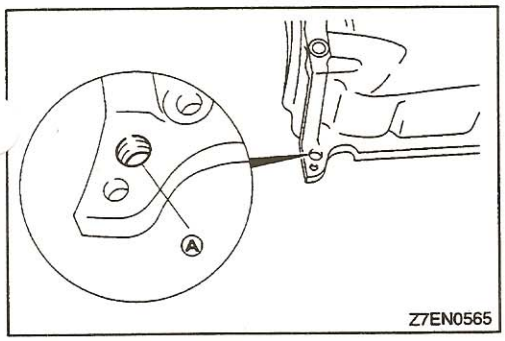
◀A▶ OIL PAN, LOWER REMOVAL

Caution
Do not use a scraper or special tool to remove the oil pan.



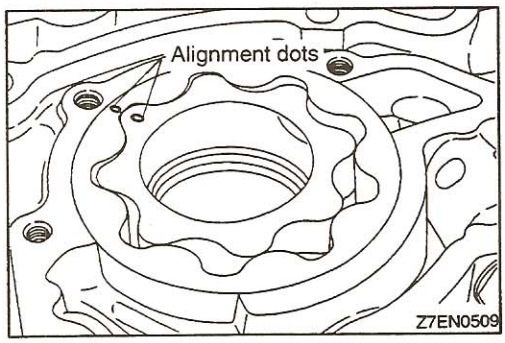
◀B▶ OIL PAN, UPPER REMOVAL

(1) Remove the bolts 1 shown in the illustration.
(2) Remove all other bolts.



(3) Thread the bolt into the illustrated bolt hole A (at each end) to remove the oil pan.

Caution
Do not use a scraper or special tool to remove the oil pan.



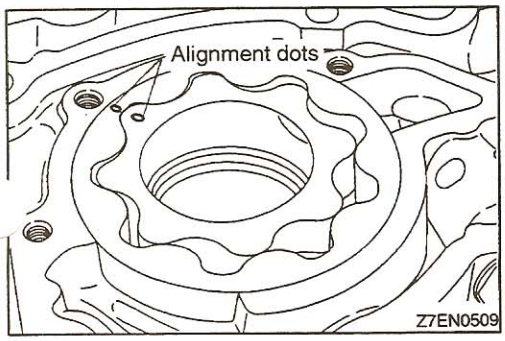
◀C▶ OUTER ROTOR/INNER ROTOR REMOVAL

(1) Make alignment dots on the outer and inner rotors for reference in reassembly.

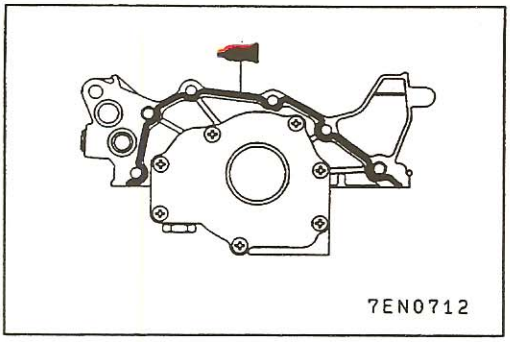
INSTALLATION SERVICE POINTS

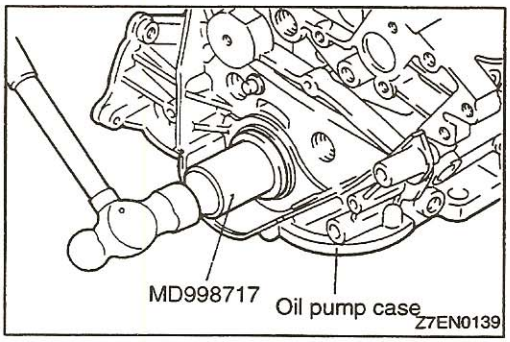
▶A◀ INNER ROTOR/OUTER ROTOR INSTALLATION

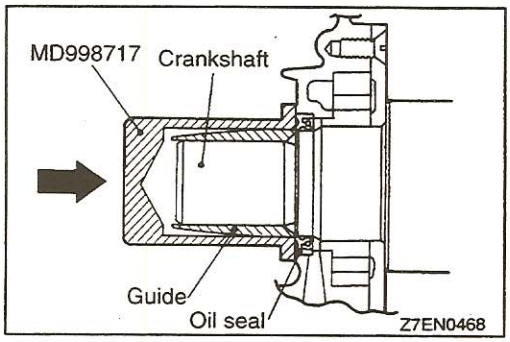
(1) Apply engine oil to the rotors. Then, install the rotors ensuring that the alignment dots made at disassembly are properly aligned.

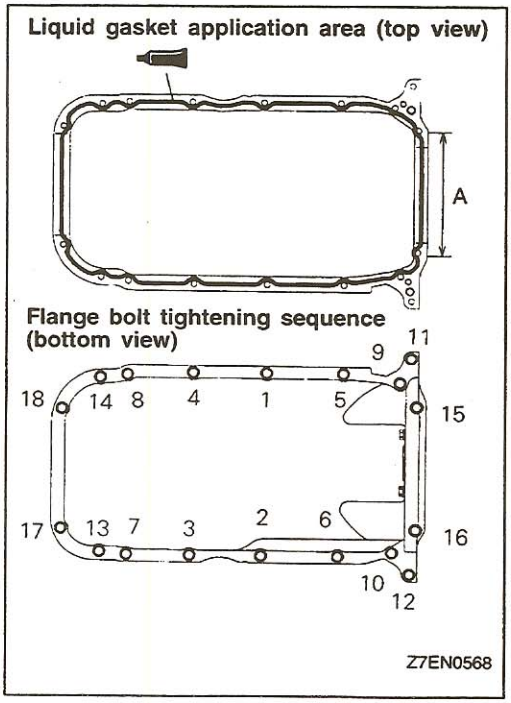


TSB Revision









▶B◀ OIL PUMP CASE INSTALLATION

(1) Remove the sealant from the cylinder block (oil pu mounting plane) and oil pump
(2) Apply a 3 mm (.118 in.) diameter bead of sealant to the oil pump case. Be sure to install the oil pump case quickly while the sealant is wet (within 15 minutes).
(3) After installation, keep the sealed area away from the oil and coolant for approx. 1 hour.

Specified sealant:
MITSUBISHI GENUINE Part No. MD970389 or equivalent

▶C◀ CRANKSHAFT FRONT OIL SEAL INSTALLATION

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

NOTE
Knock it as far as it goes.

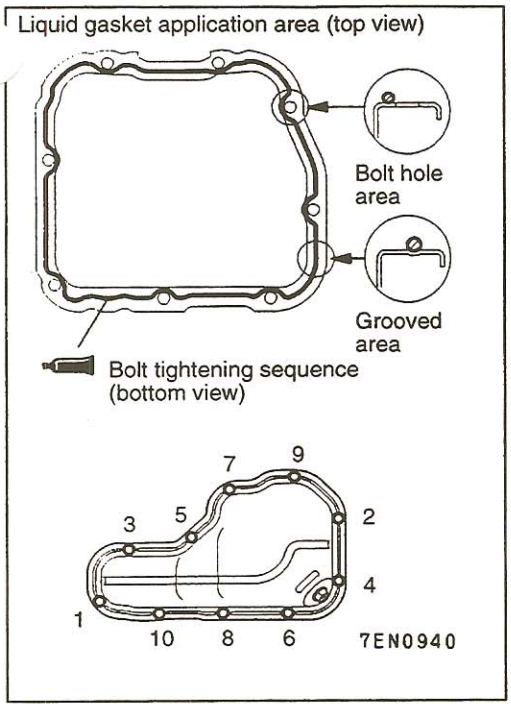
▶D◀ OIL PAN, UPPER INSTALLATION

(1) Clean the gasket surfaces of the cylinder block and upper oil pan.
(2) Apply a 4 mm (.157 in.) diameter bead of sealant to the oil pan. Be sure to install the oil pan quickly while the sealant is wet (within 15 minutes).
(3) Tighten the upper oil pan bolts in the sequence shown.
(4) After installation, keep the sealed area away from the oil and coolant for approx. 1 hour.

Caution
When installing the upper oil pan, be sure not to expel the sealant from the oil pan flange at portion A in the illustration.

Specified sealant:
MITSUBISHI GENUINE Part No. MD970389 or equivalent

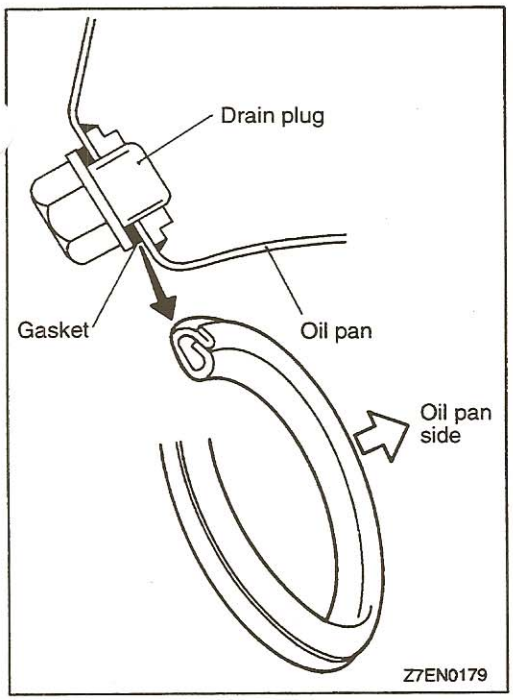
TSB Revision



▶E◀ OIL PAN, LOWER INSTALLATION

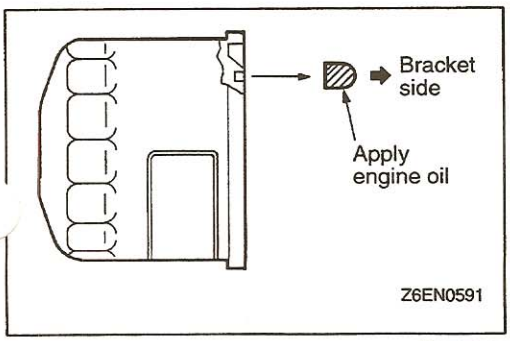
(1) Clean the gasket surfaces of the upper and lower oil pans.
(2) Apply a 4 mm (.157 in.) diameter bead of sealant to the oil pan. Be sure to install the oil pan quickly while the sealant is wet (within 15 minutes).
(3) Tighten the lower oil pan bolts in the sequence shown.
(4) After installation, keep the sealed area away from the oil and coolant for approx. 1 hour.

Specified sealant:
MITSUBISHI GENUINE Part No. MD970389 or equivalent



▶F◀ DRAIN PLUG GASKET INSTALLATION

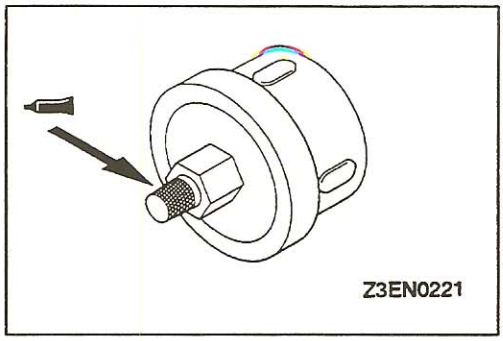
(1) Install the drain plug gasket as illustrated.



▶G◀ OIL FILTER INSTALLATION

(1) Clean the installation surface of the filter bracket.
(2) Apply engine oil to the O-ring of the oil filter.
(3) Screw the oil filter on until the O-ring contacts the bracket. Then tighten 3/4 turn [14 Nm (10 ft.lbs)].

TSB Revision



▶H◀ SEALANT APPLICATION TO OIL PRESSURE GAUGE UNIT

(1) Coat the threads of the gauge unit with sealant and install it using the special tool.

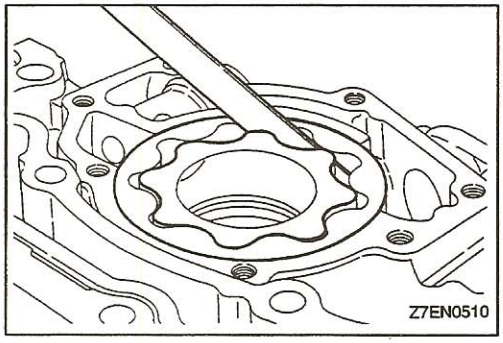
Specified sealant:
3M ATD Part No.8660 or equivalent

Caution
1. **Keep the end of threaded portion clear of sealant.**
2. **Avoid an overtightening.**

INSPECTION

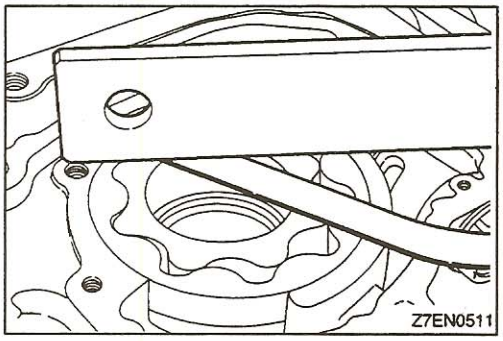
11300820051

OIL PUMP



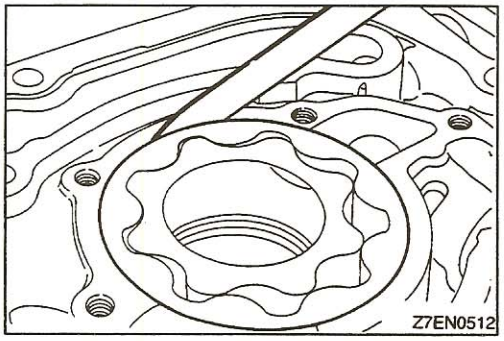
(1) Check the tip clearance.

Standard value: 0.06–0.18 mm (.0024–.0071 in.)



(2) Check the side clearance.

Standard value: 0.04–0.10 mm (.0016–.0039 in.)

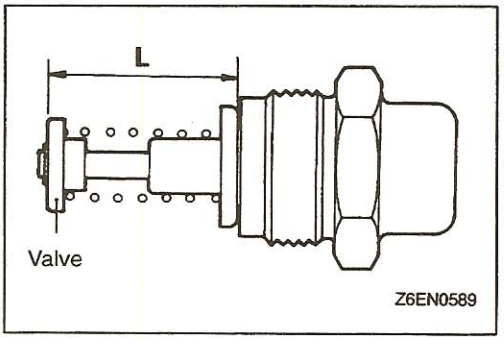


(3) Check the body clearance.

Standard value: 0.10–0.18 mm (.0040–.0070 in.)

Limit: 0.35 mm (.0138 in.)

OIL COOLER BYPASS VALVE



(1) Make sure that the valve moves smoothly.
(2) Ensure that the dimension L measures the standard value under normal temperature and humidity.

Dimension L: 34.5 mm (1.358 in.)

(3) The dimension must be the standard value w measured after the valve has been dipped in 10 (212°F) oil.

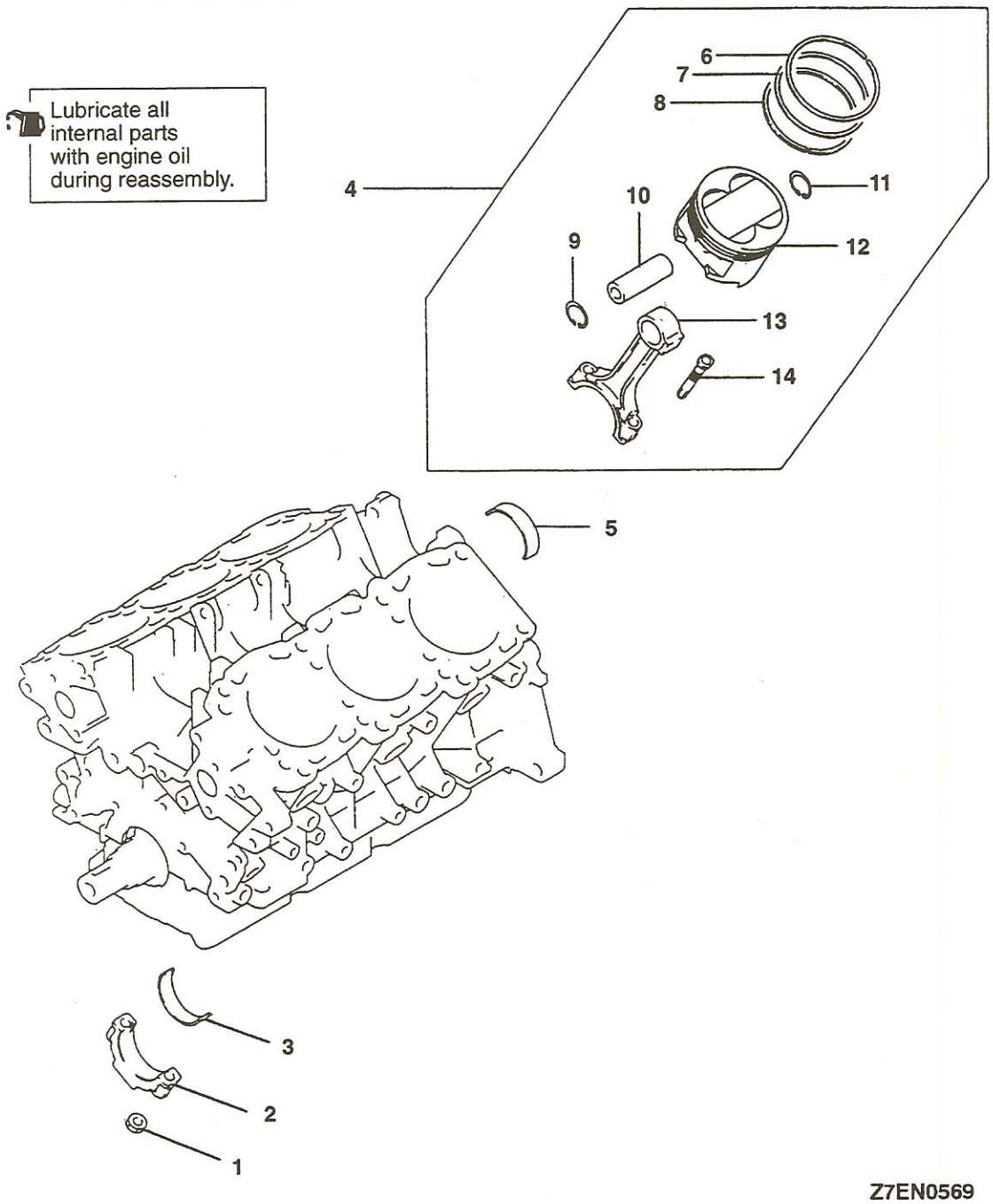
Dimension L: 40 mm (1.57 in.) or more

TSB Revision

PISTON AND CONNECTING ROD

11300840149

REMOVAL AND INSTALLATION

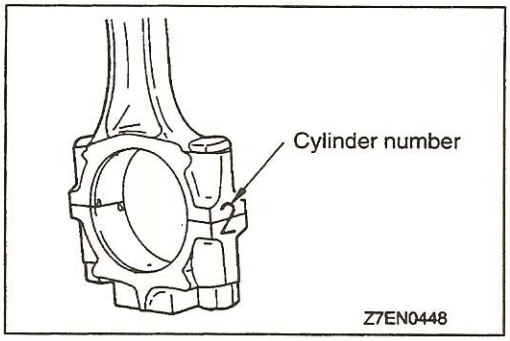


Z7EN0569

Removal steps

- ▶G◀ 1. Nut
- ◀A▶ ▶F◀ 2. Connecting rod cap
- ▶D◀ 3. Connecting rod bearing, lower
- ▶E◀ 4. Piston and connecting rod assembly
- ▶D◀ 5. Connecting rod bearing, upper
- ▶C◀ 6. Piston ring No. 1
- ▶C◀ 7. Piston ring No. 2
- ▶B◀ 8. Oil ring
- 9. Snap ring
- ◀B▶ ▶A◀ 10. Piston pin
- 11. Snap ring
- 12. Piston
- 13. Connecting rod
- 14. Bolt

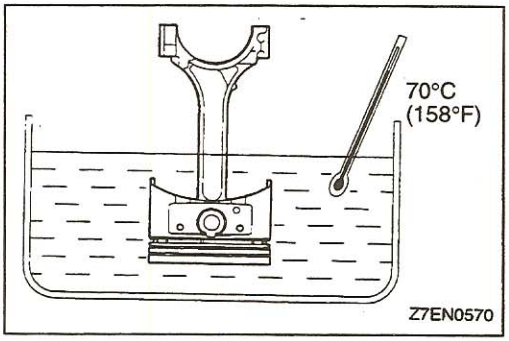
TSB Revision



REMOVAL SERVICE POINTS

◀A▶ CONNECTING ROD CAP REMOVAL

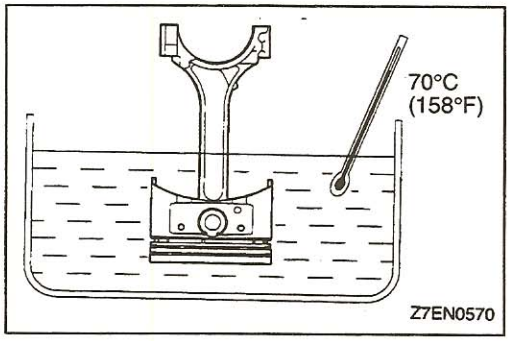
(1) Mark the cylinder number on the side of the connecting rod big end for correct reassembly.
(2) Keep the removed connecting rods, caps, and bearings in order according to the cylinder number.



◀B▶ PISTON PIN REMOVAL

(1) Remove the snap rings.
(2) Heat the piston to approximately 70°C (158°F) and pull out the piston pin.

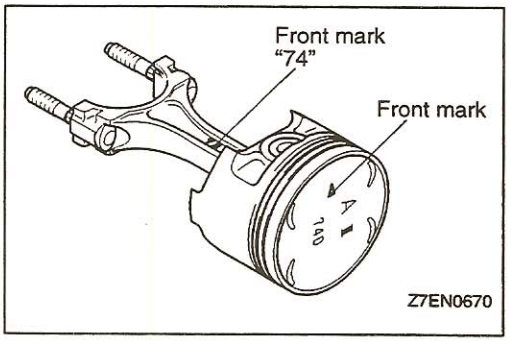
Caution
The clearance between the piston and the piston pin is an almost tight fit at normal temperature. Therefore, be sure to heat the piston before pulling out the piston pin. In addition, note that the piston is hot after heating.



INSTALLATION SERVICE POINTS

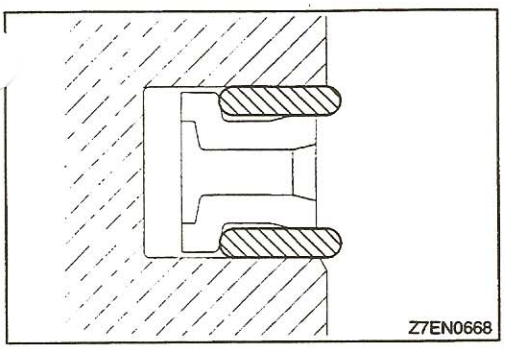
▶A◀ PISTON PIN INSTALLATION

(1) Heat the piston pin to approximately 70°C (158°F) and set the snap ring on one side first. Be sure to ins the snap ring with the shear droop directed toward the inside.



(2) Make sure that the identification marks of the piston, piston pin and connecting rod small end are of the appropriate class.
(3) With the front mark of the connecting rod and that of the piston located on the same side, insert the piston pin.
(4) After insertion of the piston pin, set the other snap ring.

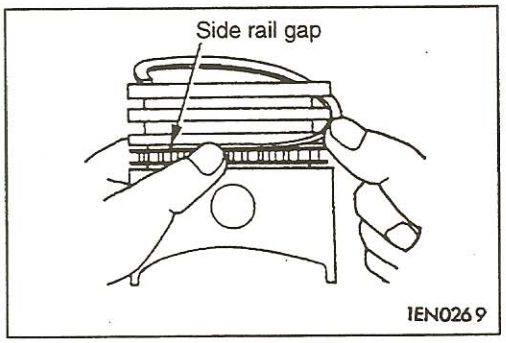
Caution
1. **Apply ample coat of engine oil to the periphery of the piston pin and the hole of the connecting rod small end.**
2. **The clearance between the piston and the piston pin is an almost tight fit at normal temperature. Therefore, be sure to heat the piston before inserting the piston pin.**
3. **In addition, note that the piston is hot after heating.**



▶B◀ OIL RING INSTALLATION

(1) Fit the oil ring spacer into the piston ring groove.

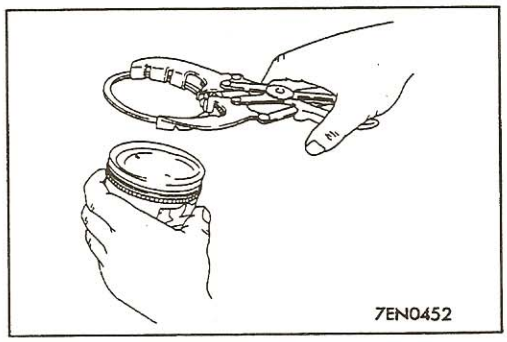
NOTE
The side rails and spacer may be installed in either direction.



(2) Install the upper side rail
To install the side rail, first fit one end of the rail into the piston groove, then press the remaining portion into the position by finger. See illustration.
Use of a ring expander to expand the side rail end gap can break the side rail, unlike other piston rings.

NOTE
Do not use any piston ring expander when installing the side rail.

(3) Install the lower side rail in the same procedure as described in step (2).
(4) Make sure that the side rails move smoothly in either direction.



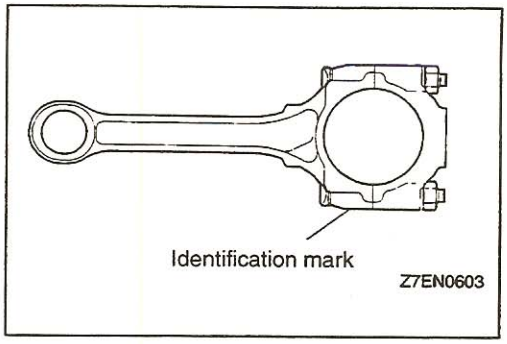
▶C◀ PISTON RING NO.2/PISTON RING NO.1 INSTALLATION

(1) Using a piston ring expander, fit No.2 and then No.1 piston ring into position.

NOTE
(1) The ring end is provided with the identification mark.

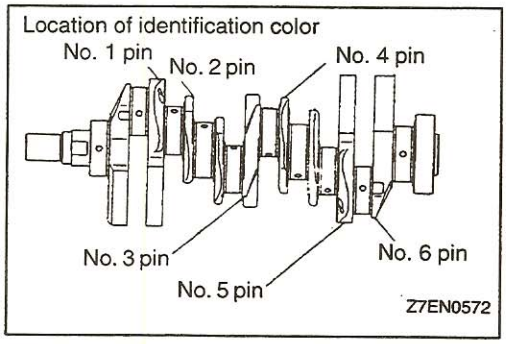
Identification mark:
No.1 ring 1T
No.2 ring 2T

(2) Install piston rings with identification mark facing up, to the piston crown side.

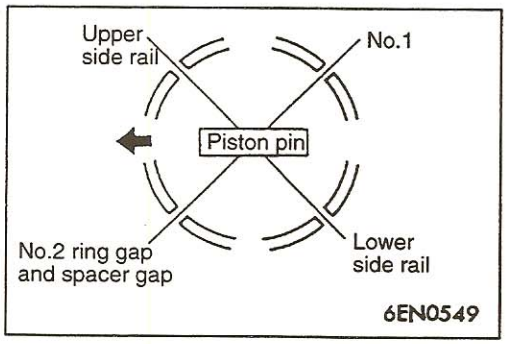


▶D◀ CONNECTING ROD BEARING INSTALLATION

(1) When replacing the bearing, select the proper bea according to the crankshaft identification color and the connecting rod identification mark and install it.

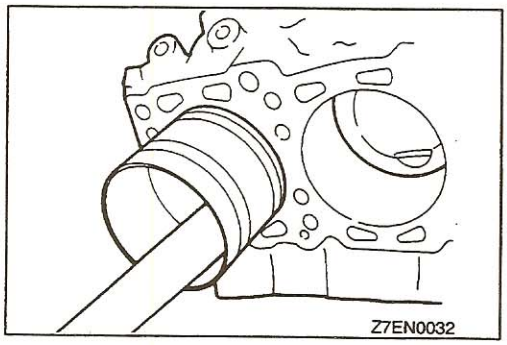


Crankshaft pin			Connecting rod		Connecting rod bearing	
Identification mark (production part)	Identification color (service part)	Outer diameter mm (in.)	Identification mark	Big end inner diameter mm (in.)	Identification color	Thickness mm (in.)
None	Yellow	54.994–55.000 (2.1651–2.1654)	0	58.000–58.006 (2.2835–2.2837)	Pink	1.483–1.486 (.0584–.0585)
			1	58.006–58.012 (2.2837–2.2839)	Red	1.486–1.489 (.0585–.0586)
			2	58.012–58.018 (2.2839–2.2842)	Green	1.489–1.492 (.0586–.0587)
None	None	54.988–54.994 (2.1649–2.1651)	0	58.000–58.006 (2.2835–2.2837)	Red	1.486–1.489 (.0585–.0586)
			1	58.006–58.012 (2.2837–2.2839)	Green	1.489–1.492 (.0586–.0587)
			2	58.012–58.018 (2.2839–2.2842)	Black	1.492–1.495 (.0587–.0589)
None	White	54.982–54.988 (2.1646–2.1649)	0	58.000–58.006 (2.2835–2.2837)	Green	1.489–1.49 (.0586–.058.
			1	58.006–58.012 (2.2837–2.2839)	Black	1.492–1.495 (.0587–.0589)
			2	58.012–58.018 (2.2839–2.2842)	Brown	1.495–1.498 (.0589–.0590)



▶E◀ PISTON AND CONNECTING ROD INSTALLATION

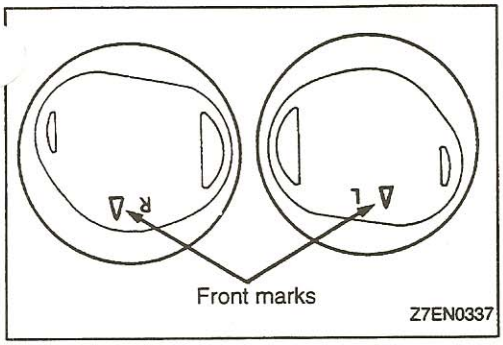
(1) Liberally coat the circumference of the piston, piston ring, and oil ring with engine oil.
(2) Arrange the piston ring and oil ring gaps (side rail and spacer) as shown in the illustration.
(3) Rotate the crankshaft so that the crank pin is on the center of the cylinder bore.



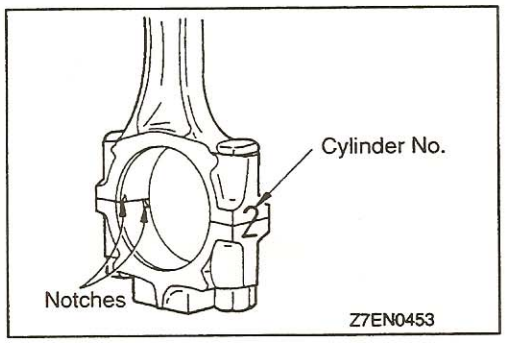
(4) Use suitable thread protectors on the connecting rod bolts before inserting the piston and connecting rod assembly into the cylinder block.
Care must be taken not to nick the crank pin.
(5) Using a suitable piston ring compressor tool, install the piston and connecting rod assembly into the cylinder block.

Caution
Install the piston with the front mark (arrow mark) on the top of the piston directed towards the engine front (timing belt side).

TSB Revision

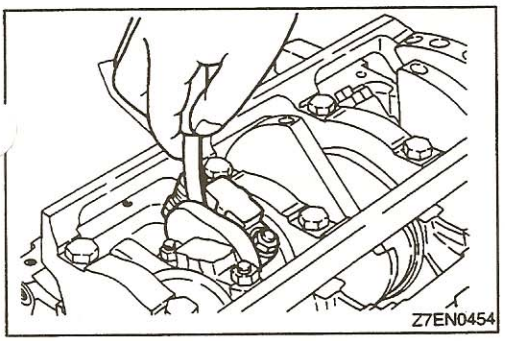


NOTE
Two types of pistons, one for cylinders 1, 3 and 5 and the other for cylinders 2, 4 and 6, have been used.
Piston with R: For cylinders 1, 3 and 5
Piston with L: For cylinders 2, 4 and 6



▶F◀ CONNECTING ROD CAP INSTALLATION

(1) Mate the correct bearing cap with the correct connecting rod by checking with the alignment marks marked during disassembly. If a new connecting rod is used which has no alignment mark, position the notches for locking the bearing on the same side.



(2) Check if the thrust clearance in the connecting rod big end is correct.

Standard value: 0.10–0.25 mm (.0039–.0098 in.)

Limit: 0.4 mm (.016 in.)

▶G◀ NUT INSTALLATION

NOTE
Installation of the connecting rod nut should be performed with the cylinder head or the spark plug removed

(1) Since the connecting rod bolts and nuts are torqued using the plastic area tightening method, the bolts should be examined BEFORE reuse. If the bolt threads are "necked down", the bolt should be replaced. Necking can be checked by running a nut with fingers to the full length of the bolt threads. If the nut does not run down smoothly, the bolt should be replaced.
(2) Before installation of each nut, apply engine oil to the threaded portion and bearing surface of the nut
(3) Loosely tighten each nut to the bolt.
(4) Then tighten the nuts alternately to a torque of 34 Nm (25 ft.lbs.) to install the cap properly.
(5) Make a paint mark on the head of each nut.
(6) Make a paint mark on the bolt end at the position 90° to 100° from the paint mark made on the nut in the direction of tightening the nut.

(7) Give a 90° to 100° turn to the nut and make sure that the paint mark on the nut and that on the bolt are alignment.

Caution

1. **If the nut is turned less than 90°, proper fastening performance may not be expected. When tightening the nut, therefore, be careful to give a sufficient turn to it.**
2. **If the nut is overtightened (exceeding 100°), loosen the nut completely and then retighten it by repeating the tightening procedure from step (1).**

INSPECTION

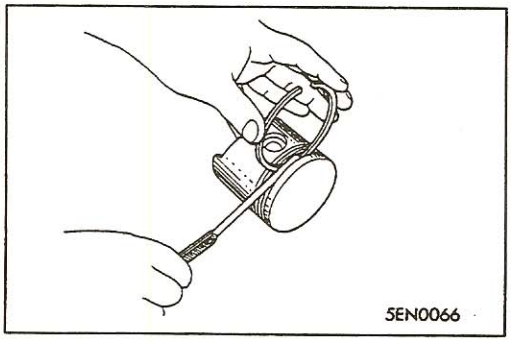
11300850142

PISTON

(1) Replace the piston if scratches or seizure is evident on its surfaces (especially the thrust surface). Replace the piston if it is cracked.

PISTON RING

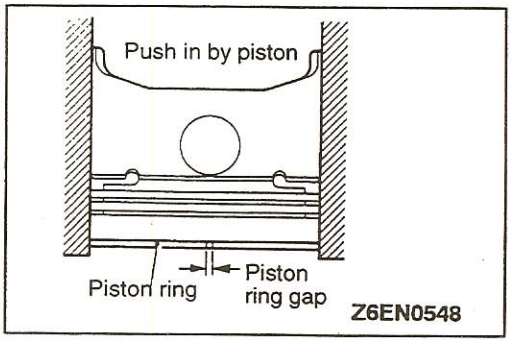
(1) Check the piston ring for damage, excessive wear, and breakage and replace if defects are evident. If the piston has been replaced with a new one, the piston rings must also be replaced with new ones.



(2) Check for clearance between the piston ring and ring groove. If the limit is exceeded, replace the ring or piston, or both.

Standard value:
No. 1 0.03–0.07 mm (.0012–.0028 in.)
No. 2 0.02–0.06 mm (.0008–.0024 in.)

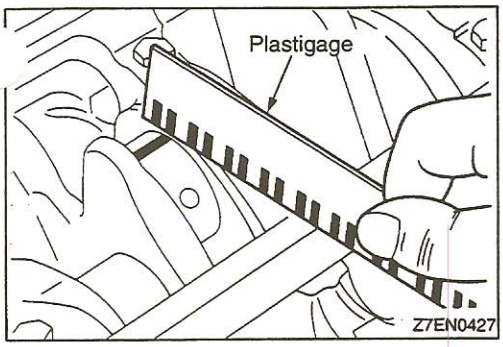
Limit: 0.1 mm (.004 in.)

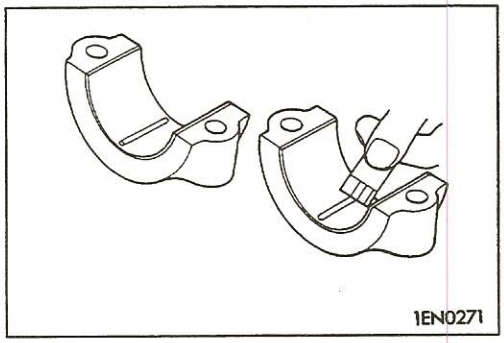


(3) Insert the piston ring into the cylinder bore. Force the ring down with a piston, the piston crown being in contact with the ring, to correctly position it at right angles to the cylinder wall. Then, measure the end gap with a feeler gauge.
If the ring gap is excessive, replace the piston ring.

Standard value:
No. 1 0.30–0.45 mm (.0118–.0177 in.)
No. 2 0.45–0.60 mm (.0177–.0236 in.)
Oil 0.10–0.35 mm (.0039–.0138 in.)

Limit:
No. 1, No. 2 0.8 mm (.031 in.)
Oil 1.0 mm (.039 in.)





CRANKSHAFT PIN OIL CLEARANCE (PLASTIGAGE METHOD)

The crankshaft oil clearance can be measured easily by using Plastigage, as follows:

(1) Remove oil and grease and any other foreign material from the crankshaft pin and the bearing inner surface.
(2) Install the crankshaft.
(3) Cut Plastigage to the same length as the width of the bearing and place it on the pin in parallel with its axis.
(4) Gently place the crankshaft bearing cap over it and tighten the bolts to the specified torque.
(5) Remove the bolts and gently remove the crankshaft bearing cap.
(6) Measure the width of the smashed Plastigage at its widest section by using a scale printed on the Plastigage bag.

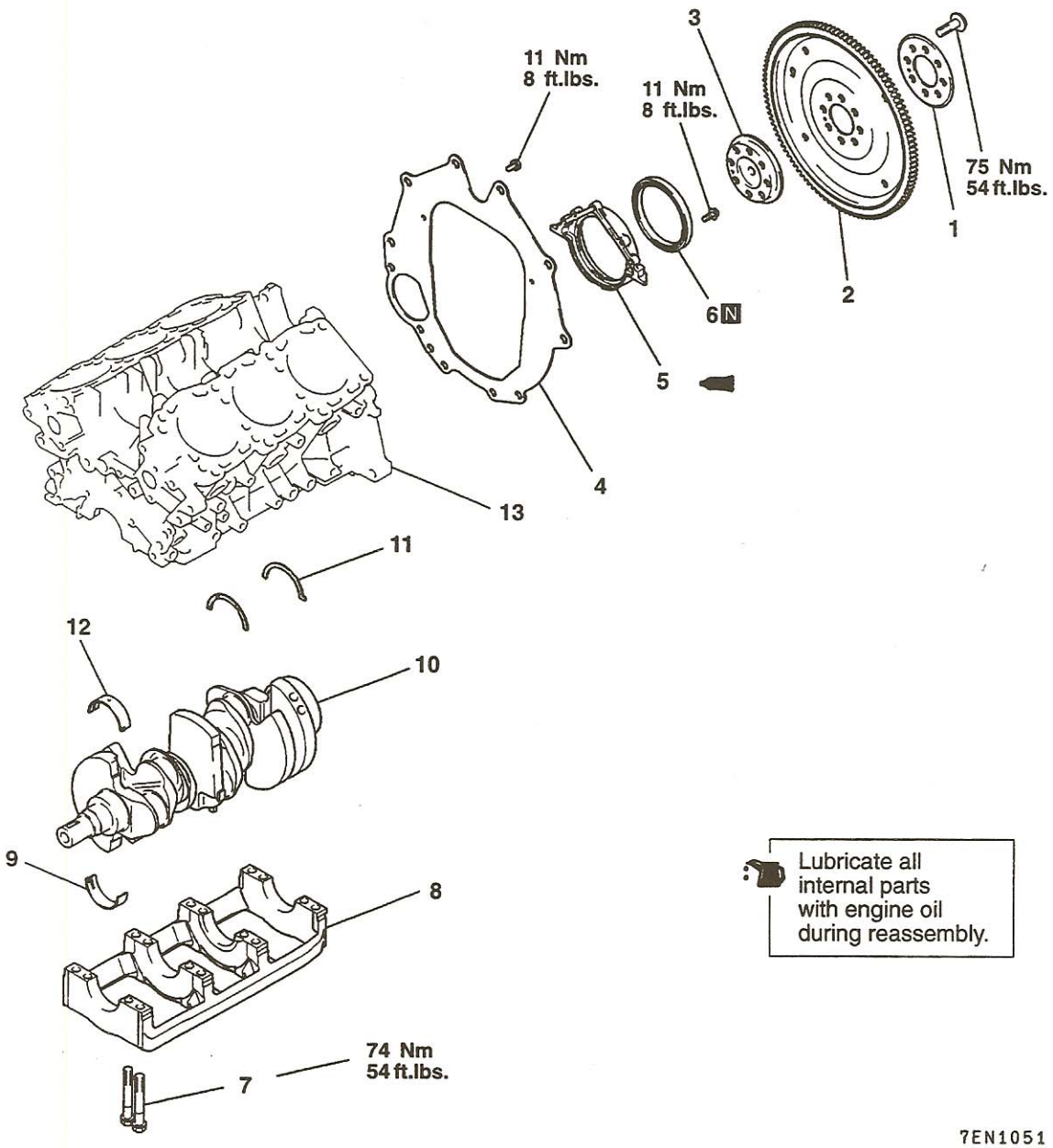
Standard value: 0.03–0.05 mm (.0012–.0020 in.)

Limit: 0.1 mm (.004 in.)

CRANKSHAFT AND DRIVE PLATE

11300870

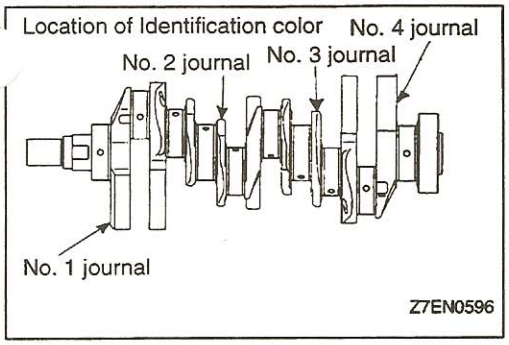
REMOVAL AND INSTALLATION

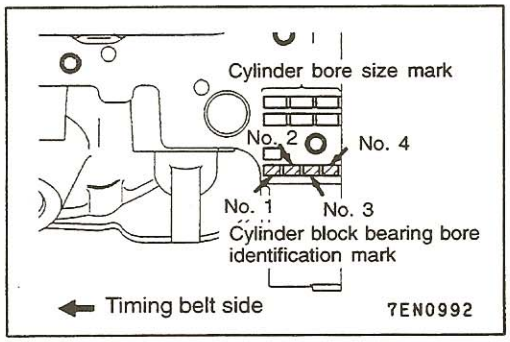


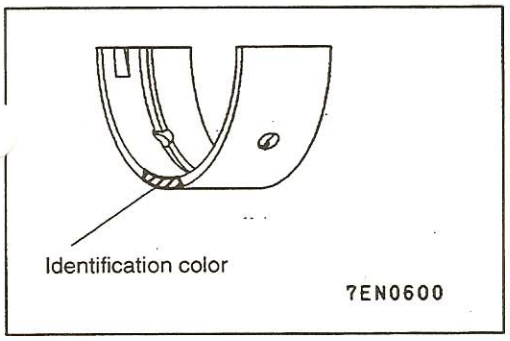
Removal steps

1. Adaptor plate
2. Drive plate
3. Crankshaft adaptor
4. Rear plate
▶D◀ 5. Oil seal case
▶C◀ 6. Crankshaft rear oil seal
▶B◀ 7. Bearing cap bolt
▶B◀ 8. Bearing cap
▶A◀ 9. Crankshaft bearing, lower
10. Crankshaft
▶A◀ 11. Thrust bearing
▶A◀ 12. Crankshaft bearing, upper
13. Cylinder block

TSB Revision







INSTALLATION SERVICE POINTS

▶A◀ CRANKSHAFT BEARING INSTALLATION

When the bearing needs replacing, select and install a proper bearing by the following procedure.

(1) Measure the crankshaft journal diameter and confirm its classification from the following table. In the case of a bearing supplied as a service part, its identification color is painted at the position shown in the illustration.

(2) The cylinder block bearing bore diameter identification marks are stamped at the position shown in the illustration from the front of the engine, beginning at No 1.

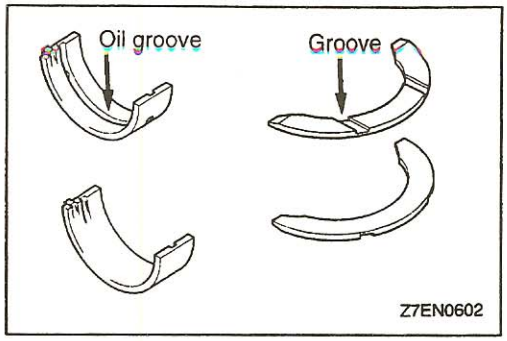
Crankshaft journal				Cylinder block bearing bore diameter	Crankshaft bearing
Classification	Identification mark (production part)	Identification color (service part)	Outer diameter mm (in.)	Identification mark	Identification color (service part)
1	None	Yellow	63.994–64.000 (2.5194–2.5197)	I	Pink
				II	Red
				III	Green
2	None	None	63.988–63.994 (2.5192–2.5194)	I	Red
				II	Green
				III	Black
3	None	White	63.982–63.988 (2.5190–2.5192)	I	Green
				II	Black
				III	Brown

(3) Select a proper bearing from the above table on the basis of the identification data confirmed under Items (1) and (2).

[Example]

1) If the measured value of a crankshaft journal outer diameter is 63.996 mm, the journal is classified as "1" in the table. (In case the crankshaft is also replaced by a spare part, check the identification color painted on the new crankshaft. If it is yellow, for example, the journal is classified as "1".)

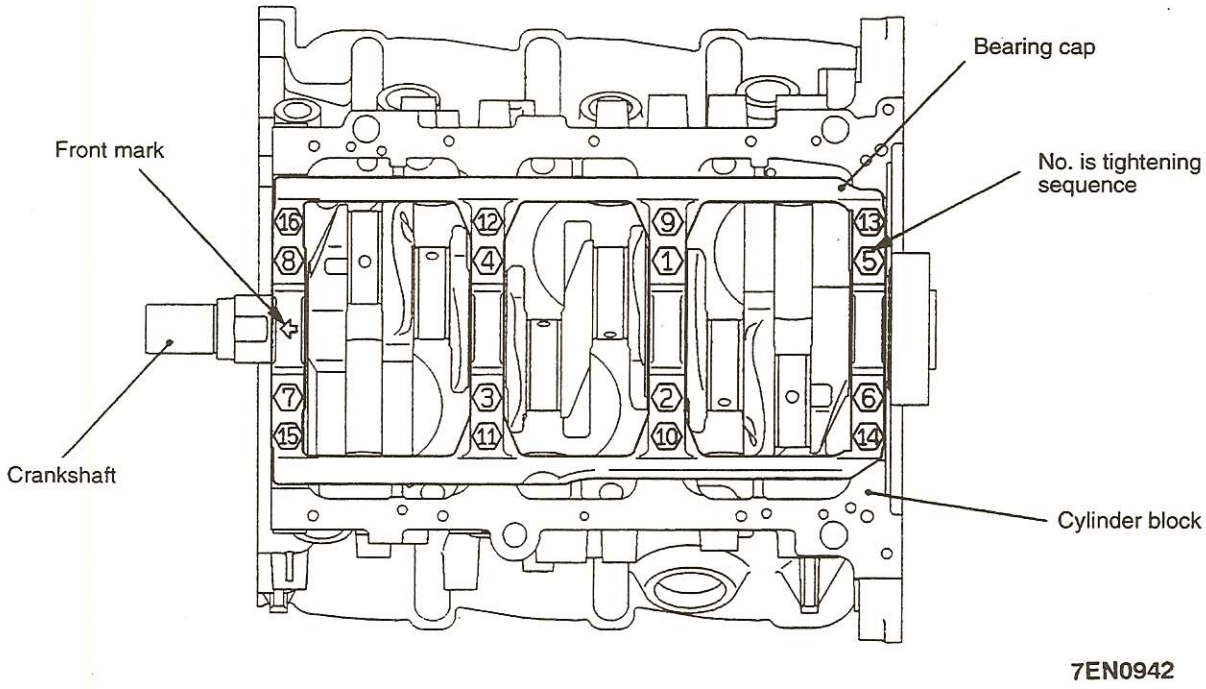
2) Next, check the cylinder block bearing hole identification mark stamped on the cylinder block. If it is "I" , read the "Identification color for the spare bearing" column to find the identification color of the bearing to be used. In this case, it is "pink".

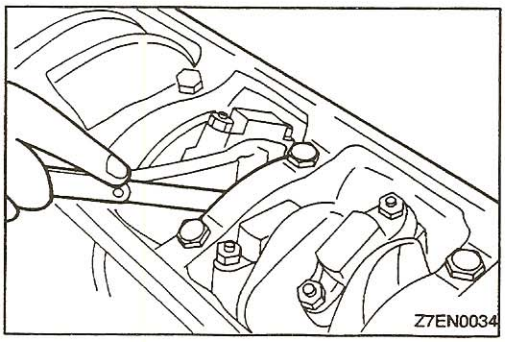


(4) Install the bearing halves with oil groove in the cylinder block side.
(5) Install the bearing halves without oil groove on the bearing cap side.
(6) Install the thrust bearings on both sides of the No.3 bearing with the grooves facing outward.

▶B◀ BEARING CAP/BEARING BOLT INSTALLATION

(1) Attach the bearing cap on the cylinder block as shown in the illustration.
(2) Tighten the bearing cap bolts to the specified torque in the sequence shown in the illustration.
(3) Check that the crankshaft rotates smoothly.



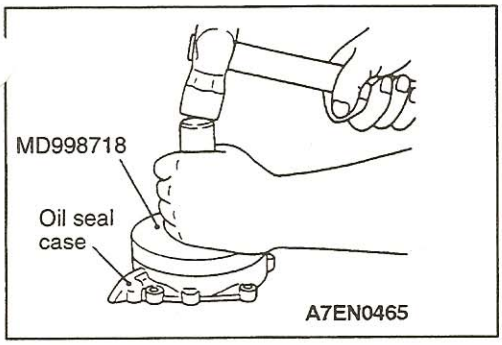


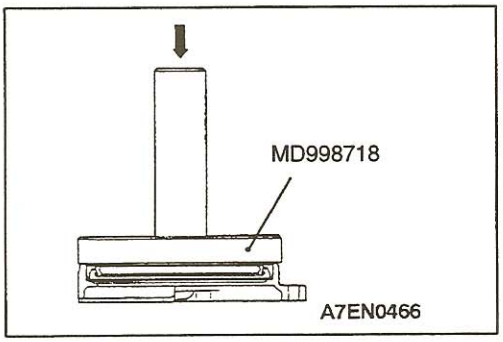
(4) Check the end play. If it exceeds the limit value, replace the thrust bearing.

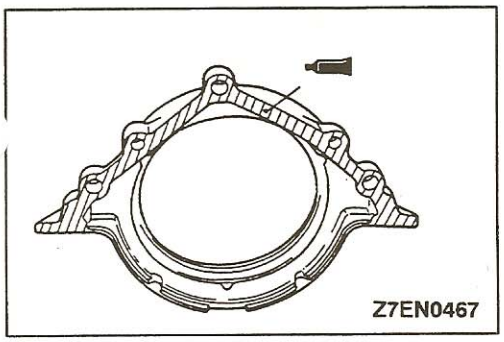
Standard value : 0.05–0.25 mm (.0020–.0098 in.)

Limit: 0.3 mm (.012 in.)

TSB Revision







▶C◀ CRANKSHAFT REAR OIL SEAL INSTALLATION

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

▶D◀ OIL SEAL CASE INSTALLATION

(1) Apply specified sealant to the area shown in the illustration.

Specified sealant:
MITSUBISHI GENUINE Part No. MD970389 or equivalent

NOTE
(1) Install the oil seal case within 15 minutes after applying liquid gasket.
(2) Then wait at least one hour. Never start the engine or let engine oil or coolant touch the adhesion surface during that time.

(2) Apply a small amount of engine oil to the entire circumference of the oil seal lip section, and place the oil seal case on the cylinder block.

INSPECTION

11300880127

CRANKSHAFT

If the oil clearance exceeds the limit, replace the bearing, and crankshaft if necessary.

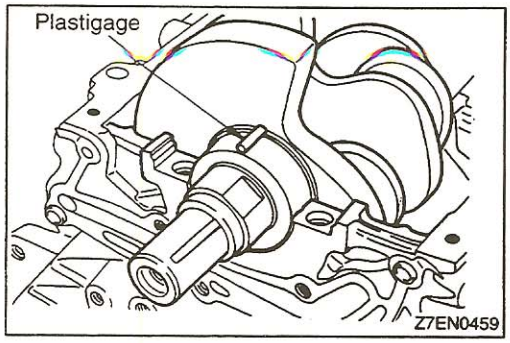
(1) Measure the outside diameter of the journals and the inside diameter of the crankshaft bearings. If the difference between them (oil clearance) exceeds the limit, replace the crankshaft bearing and, if necessary, crankshaft.

Standard value: 0.02–0.04 mm (.0008–.0016 in.)

Limit: 0.1 mm (.004 in.)

Caution
Do not attempt an undersize machining of the crankshaft with special surface treatment. This crankshaft can be identified by its dull gray appearance.

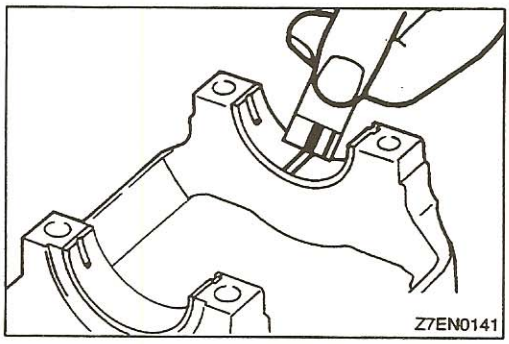
TSB Revision



CRANKSHAFT JOURNAL OIL CLEARANCE <PLASTIGAGE METHOD>

The crankshaft oil clearance can be measured easily by using Plastigage, as follows:

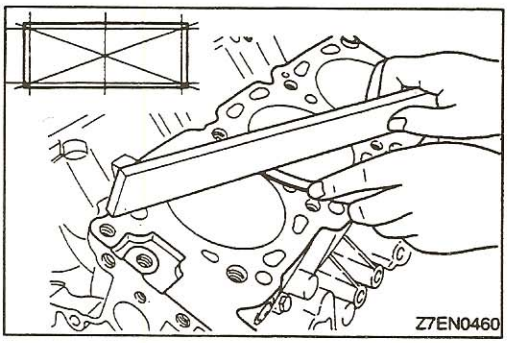
(1) Remove oil and grease and any other foreign material from the crankshaft journal and bearing inner surface.
(2) Install the crankshaft.
(3) Cut Plastigage to the same length as the width of the bearing and place it on the journal in parallel with its axis.



(4) Gently place the crankshaft bearing cap over it and tighten the bolts to the specified torque.
(5) Remove the bolts and gently remove the crankshaft bearing cap.
(6) Measure the width of the smashed Plastigage at its widest section by using a scale printed on the Plastigage bag.

CRANKSHAFT REAR OIL SEAL

(1) Check the oil seal lip for wear and damage.
(2) Check rubber for deterioration or hardening.
(3) Check the oil seal case for cracks and damage.



CYLINDER BLOCK

(1) Visually check for scratches, rust, and corrosion. Use also a flaw detecting agent for the check. If defects are evident, correct, or replace.
(2) Using a straightedge and feeler gauge, check the block top surface for warpage. Make sure that the surface is free from gasket chips and other foreign matter.

Standard value: 0.05 mm (.002 in.)

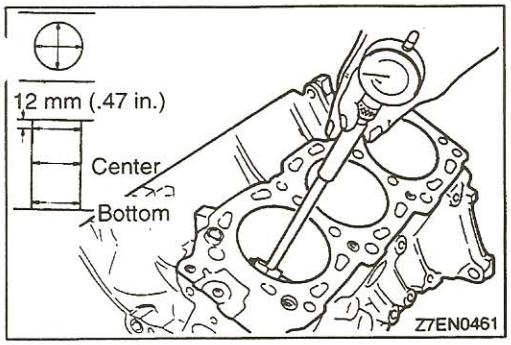
Limit: 0.1 mm (.004 in.)

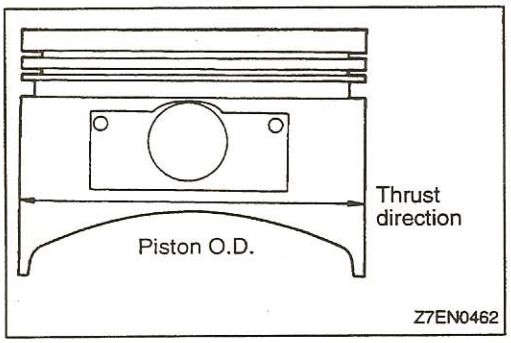
(3) If the distortion is excessive, correct within the allowable limit or replace.

Grinding limit: 0.2 mm (.008 in.)
***Includes/combined with cylinder head grinding.**

Cylinder block height (when new):
227.9–228.1 mm (8.972–8.980 in.)

TSB Revision





(4) Check the cylinder walls for scratches and seizure. If defects are evident, correct (rebore to an oversize) or replace.

(5) Using a cylinder gauge, measure the cylinder bore and cylindricity. If worn badly, correct by boring the cylinders to an oversize and replace pistons and piston rings. Measure at the points shown in the illustration.

Standard value:
Cylinder I.D.: 93.0 mm (3.66 in.)
Cylindricity: 0.01 mm (.0004 in.)

BORING CYLINDER

(1) Oversize pistons to be used should be determined on the basis of the largest bore cylinder.

Piston size identification

Size	Identification mark
0.50 mm (.02 in.) O.S.	0.50
1.00 mm (.04 in.) O.S.	1.00

NOTE
Size mark is stamped on the piston top.

(2) Measure the outside diameter of the piston to be used. Measure it in the thrust direction as shown.

(3) Based on the measured piston O.D., calculate the boring finish dimension.

Boring finish dimension =
Piston O.D. + (clearance between piston O.D. and cylinder) – 0.02 mm (.0008 in.) (honing margin)

(4) Bore all cylinders to the calculated boring finish dimension.

Caution
To prevent distortion that may result from temperature rise during honing, bore cylinders in the order of No.2, No.4, No.6, No.1, No.3 and No.5.

(5) Hone to the final finish dimension (piston O.D. + clearance between piston O.D. and cylinder).

(6) Check the clearance between the piston and cylinder.

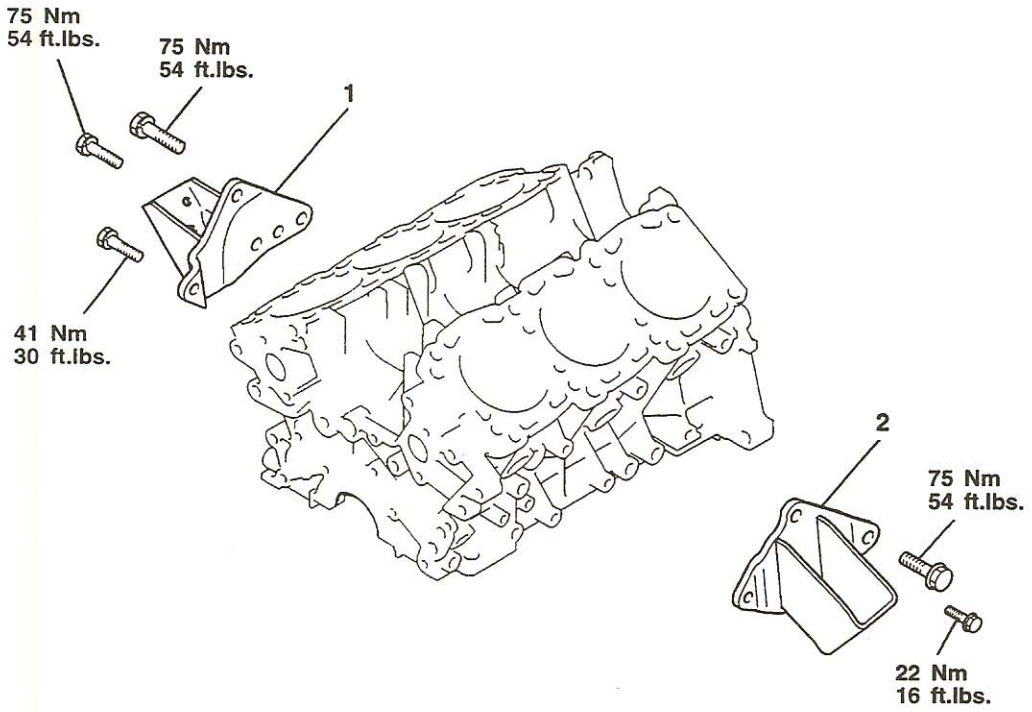
Clearance between piston and cylinder:
0.03–0.05 mm (.0012–.0020 in.)

NOTE
When boring cylinders, finish all of six cylinders to the same oversize. Do not bore only one cylinder to an oversize.

BRACKET

11300900045

REMOVAL AND INSTALLATION



7EN0943

Removal steps

1. Engine support bracket, right
2. Engine support bracket, left

TSB Revision

ENGINE LUBRICATION

CONTENTS

12109000082

GENERAL INFORMATION

12100010004

ENGINE OILS

Health Warning

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

Recommended Precautions

The most effective precaution is to adapt working practices which prevent, as far as practicable, the risk of skin contact with mineral oils. For example; Use enclosed systems for handling used engine oil and degrease components, where practicable, before handling them.
Other precautions:

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

GENERAL SPECIFICATIONS

12100020018

Items	Specification
Engine oil cooler performance kJ/h (kcal/h, BTU/h)	26,790 (6,400, 25,396)

LUBRICANTS

12100040236

Items	Recommended lubricant	Quantity dm^3 (U.S.qts.) (including volume inside oil filter and oil cooler)
Engine oil	Engine oil displaying EOLCS certification mark or conforming the API classification SJ ECII or SJ/CD ECII	4.9 (5.2)

ON-VEHICLE SERVICE

12100090118

ENGINE OIL INSPECTION

Refer to GROUP 00 – Maintenance Service.

ENGINE OIL REPLACEMENT

12100100248

Refer to GROUP 00 – Maintenance Service.

OIL FILTER REPLACEMENT

121001

Refer to GROUP 00 – Maintenance Service.

TSB Revision

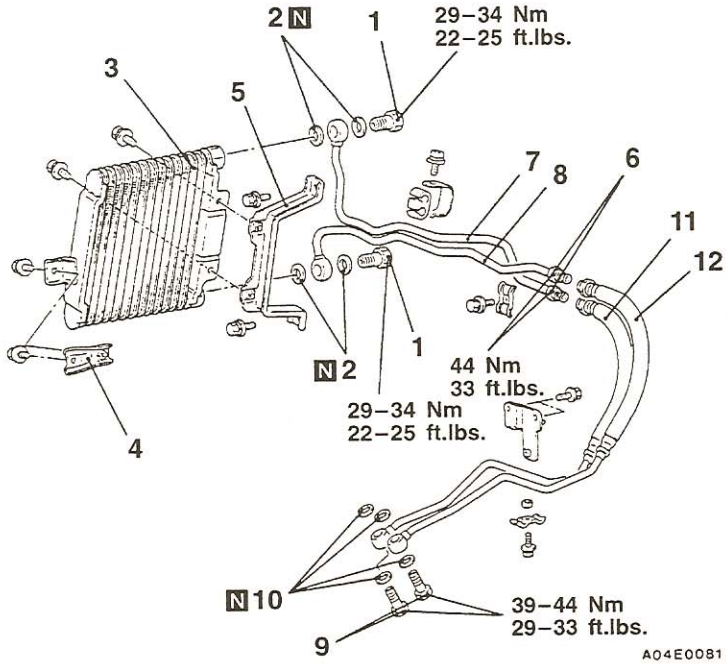
ENGINE OIL COOLER

12100130124

REMOVAL AND INSTALLATION

Pre-removal Operation
- Radiator Grille Removal

Post-installation Operation
- Radiator Grille Installation
- Engine Oil Supplying and Checking



Removal steps

◀A▶
1. Eye bolts
2. Gaskets
3. Engine oil cooler
4. Stay
5. Bracket
6. Engine oil cooler pipe connection

◀A▶
7. Return pipe
8. Feed pipe
9. Eye bolts
10. Gaskets
11. Return hose
12. Feed hose

REMOVAL SERVICE POINT

◀A▶ EYE BOLTS REMOVAL

Caution
Be sure to hold the weld nut of the oil cooler while loosening the eye bolt.

INSPECTION

12100140097

- Check for foreign material between the oil cooler fins.
- Check the oil cooler fins for bends or damage.
- Check the oil cooler pipes for cracks, damage, clogging or deterioration.

TSB Revision

NOTES

FUEL

CONTENTS

13109000508

NOTE
The tinted sections are not included in this manual.

NOTES

MULTIPORT FUEL INJECTION

CONTENTS

13109000492

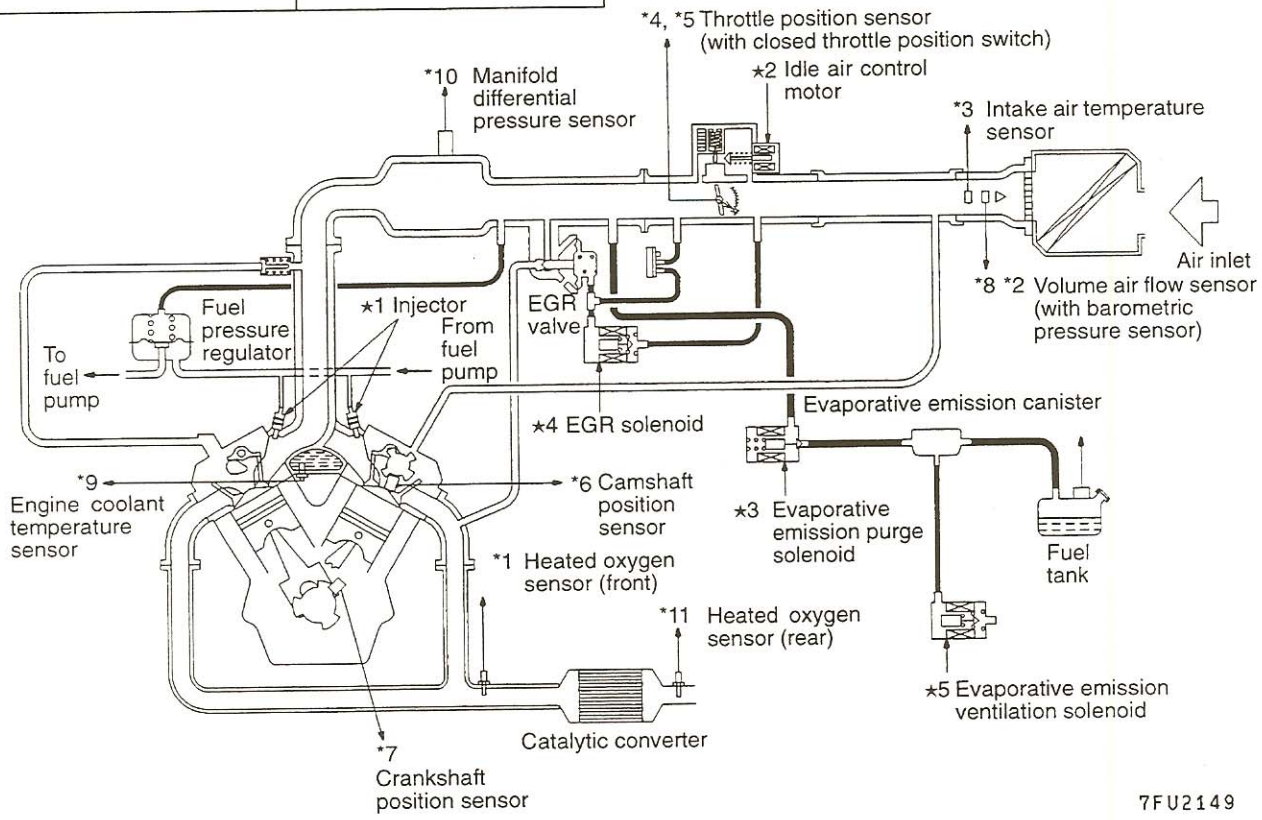
GENERAL INFORMATION

13100010548

MULTIPORT FUEL INJECTION (MFI) SYSTEM DIAGRAM

<Federal>

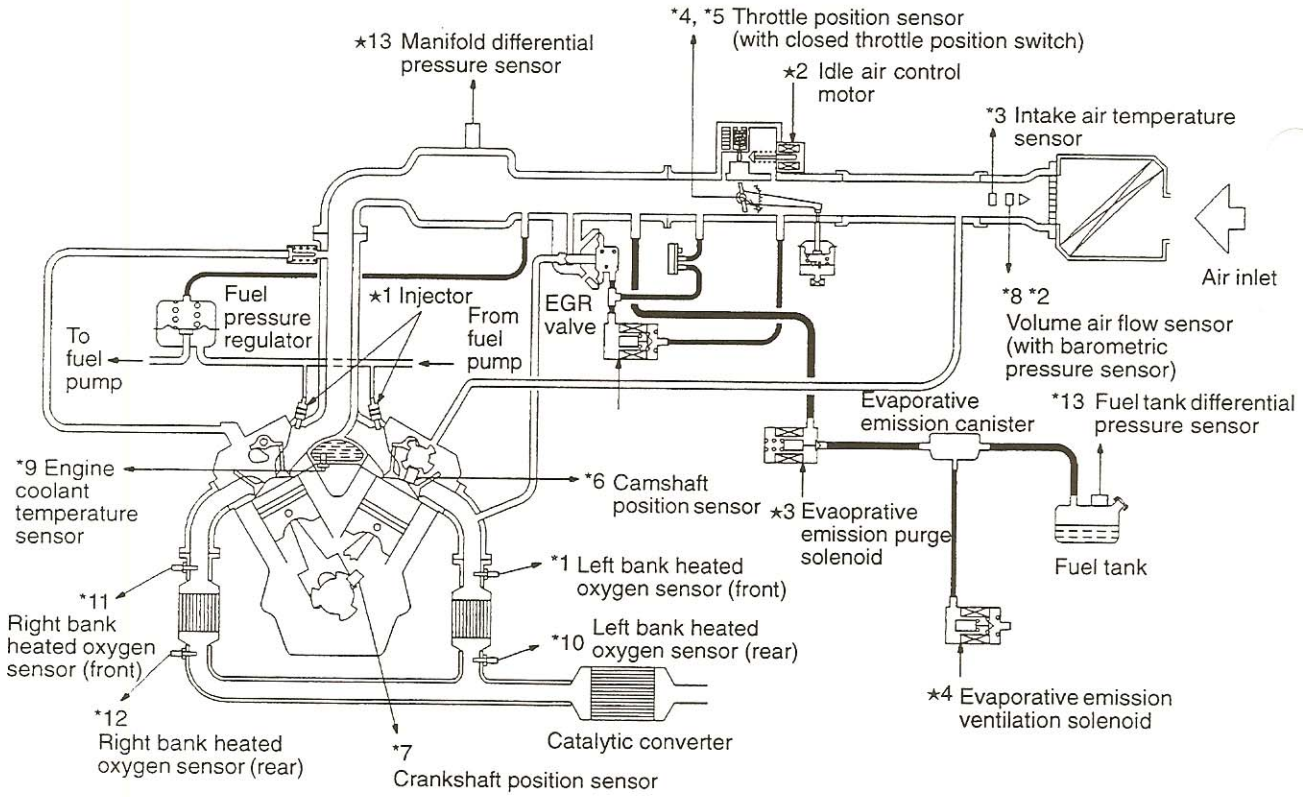
*1 Heated oxygen sensor (front) *2 Volume air flow sensor *3 Intake air temperature sensor *4 Throttle position sensor *5 Closed throttle position switch *6 Camshaft position sensor *7 Crankshaft position sensor *8 Barometric pressure sensor *9 Engine coolant temperature sensor *10 Manifold differential pressure sensor *11 Heated oxygen sensor (rear) *12 Fuel tank differential pressure sensor	• Power supply • Vehicle speed sensor • A/C switch • Park/Neutral position switch • Power steering pressure switch • Ignition switch-ST • Ignition switch-IG	⇨ Engine control module ⇨	★1 Injector ★2 Idle air control motor ★3 Evaporative emission purge solenoid ★4 EGR solenoid ★5 Evaporative emission ventilation solenoid • Fuel pump relay • Multiport fuel injection (MFI) relay • A/C compressor clutch relay • Check engine/Malfunction indicator lamp • Diagnostic output • Ignition coil, Ignition power transistor



TSB Revision

<California>

*1 Left bank heated oxygen sensor (front) *2 Volume air flow sensor *3 Intake air temperature sensor *4 Throttle position sensor *5 Closed throttle position switch *6 Camshaft position sensor *7 Crankshaft position sensor *8 Barometric pressure sensor *9 Engine coolant temperature sensor *10 Left bank heated oxygen sensor (rear) *11 Right bank heated oxygen sensor (front) *12 Right bank heated oxygen sensor (rear) *13 Manifold differential pressure sensor *14 Fuel tank differential pressure sensor	• Power supply • Vehicle speed sensor • A/C switch • Park/Neutral position switch • Power steering pressure switch • Ignition switch-ST • Ignition switch-IG	⇨ Engine control module ⇨	★1 Injector ★2 Idle air control motor ★3 Evaporative emission purge solenoid ★4 EGR solenoid ★5 Evaporative emission ventilation solenoid • Fuel pump relay • Multiport fuel injection (MFI) relay • A/C compressor clutch relay • Check engine/Malfunction indicator lamp • Diagnostic output • Ignition coil, Ignition power transistor



7FU2150

TSB Revision

GENERAL SPECIFICATIONS

Items			Specifications
Throttle body	Throttle bore mm (in.)		60 (2.36)
	Throttle position sensor		Variable resistor type
	Idle air control motor		Stepper motor type (Stepper motor type by-pass air control system)
	Closed throttle position switch		Rotary contact type, within throttle position sensor
ECM	Identification model No.	Federal	E2T68679
		California	E2T68678
Sensors	Volume air flow sensor		Karman vortex type
	Barometric pressure sensor		Semiconductor type
	Intake air temperature sensor		Thermistor type
	Engine coolant temperature sensor		Thermistor type
	Heated oxygen sensor		Zirconia type
	Vehicle speed sensor		Reed switch type
	Park/Neutral position switch <A/T>		Contact switch type
	Camshaft position sensor		Hall element type
	Crankshaft position sensor		Hall element type
	Power steering pressure switch		Contact switch type
	Manifold differential pressure sensor		Semiconductor type
Actuators	Multiport fuel injection (MFI) relay		Contact switch type
	Injector type and number		Electromagnetic type, 6
	Injector identification mark		EDH 240
	EGR solenoid		Duty cycle type solenoid valve
	Evaporative emission purge solenoid		Duty cycle type solenoid valve
Fuel pressure regulator	Regulator pressure kPa (psi)		335 (47.6)

TSB Revision

SERVICE SPECIFICATIONS

13100036117

Items		Standard value
Basic ignition timing		5° BTDC ±3° at curb idle
Curb idle speed r/min		700±100
Idle speed when air conditioning ON r/min		900 in neutral
Basic idle speed r/min		700±50
Throttle position sensor adjusting voltage mV		400–1,000
Throttle position sensor resistance kΩ		3.5–6.5
Idle air control motor coil resistance Ω		28–33 [at 20°C (68 °F)]
Intake air temperature sensor resistance kΩ	20°C (68 °F)	2.7
	80°C (176 °F)	0.4
Engine coolant temperature sensor resistance kΩ	20°C (68 °F)	2.4
	80°C (176 °F)	0.3
Heated oxygen sensor output voltage V		0.6–1.0
Fuel pressure kPa (psi)	Vacuum hose disconnection	330–350 (47–50) at curb idle
	Vacuum hose connection	Approx. 270 (38) at curb idle
Injector coil resistance Ω		13–16 [at 20°C (68 °F)]

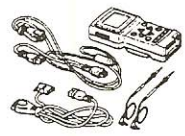
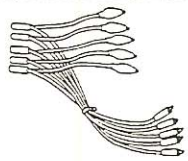
SEALANT

13100050106

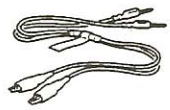
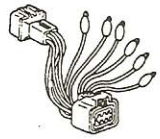
Items	Specified sealant
Engine coolant temperature sensor threaded portion	3M Nut Locking Part No. 4171 or equivalent

SPECIAL TOOLS

13100060260

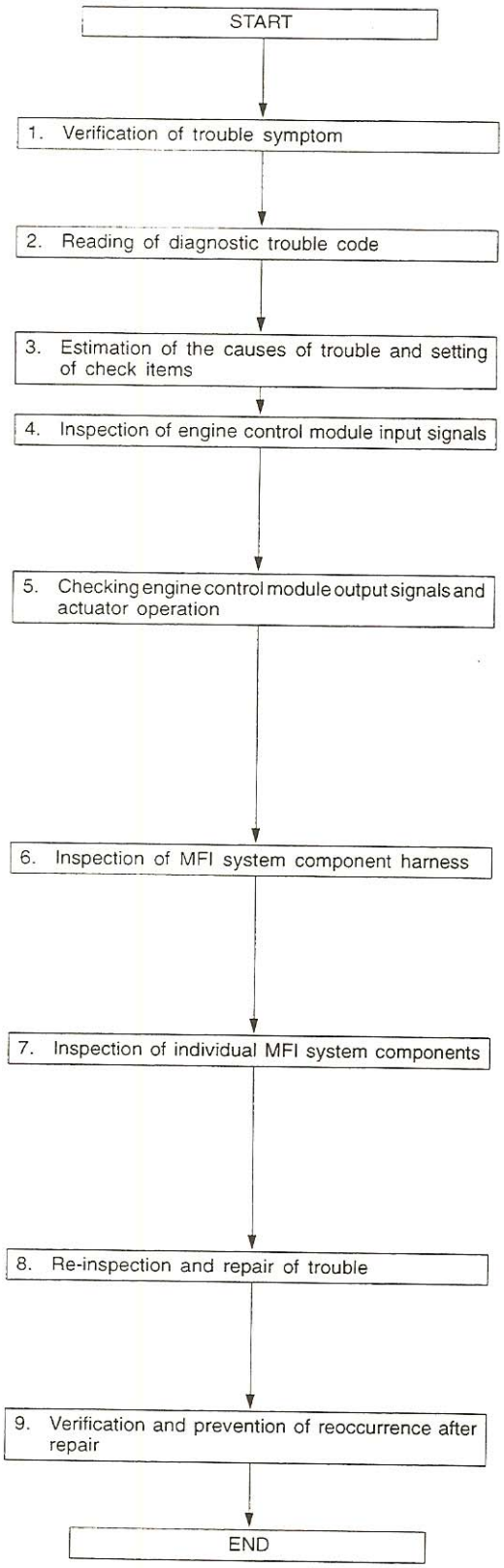
Tool	Tool number and name	Supersession	Application
	MB991502 Scan tool (MUT-II)	MB991496-0D	• Reading of diagnostic trouble codes • MFI system check
	MB991348 Test harness set	Tool not available	• Adjustment of throttle position sensor • Inspection using an analyzer

TSB Revision

Tool	Tool number and name	Supersession	Application
	MB991529 Reading of diagnostic trouble codes	Tool not necessary if scan tool (MUT-II) is available	• Reading of diagnostic trouble codes • Basic idle speed adjustment
	MD998464 Test harness (4 pin, square)	MD998464-01	• Heated oxygen sensor check
	MD998463 Test harness (6 pin, square)	MD998463-01	• Idle air control motor check • Inspection using an analyzer
	MD998709 Adapter hose	MIT210196	• Fuel pressure measurement
	MD998742 Fuel pressure test adapter	MD998742-01	• Fuel pressure measurement

TROUBLESHOOTING

13110020016

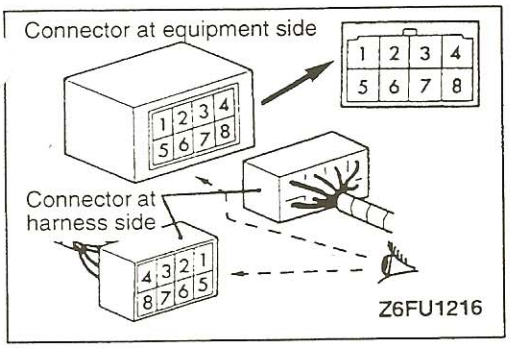


EXPLANATION OF TROUBLESHOOTING PROCEDURES

Effective troubleshooting procedures for MFI system problems are given below.

1. Verification of trouble symptom
   - Reproduce the trouble symptoms and verify the characteristics of the trouble and the conditions (engine condition, driving conditions, etc.) under which they are produced.
2. Reading of diagnostic trouble code
   - Take a reading of the diagnostic trouble codes and if a diagnostic trouble code is output, locate and correct the trouble while referring to the DIAGNOSTIC CHART.
3. Estimation of the causes of trouble and setting of check items
   - Referring to the Check Chart, verify the check items and checking order for the trouble symptom.
4. Checking engine control module input and output signals
   - Using a scan tool or analyzer, check the input and output signals of the engine control module.
   - If the input and output signals are normal, the sensor input/actuator control is judged as normal. Then, check the input and output signals of the next check item.
5. Checking engine control module output signals and actuator operation
   - Use the scan tool to check the signals output from the engine control module. Also, drive the actuator using the actuator test function to check the actuator operation
   - Use an oscilloscope to check the signals output from the engine control module.
   - If the signals output from the engine control module and the operation of the actuator are normal, the actuator control is judged to be normal. Then, check the next check item.
6. Inspection of MFI system component harness
   - If the engine control module input/output signals are abnormal, check the MFI system component body harness and repair as necessary.
   - After repairing, check the engine control module input/output signals again. If they are normal, proceed to check the input/output signals of the next check item.
7. Inspection of individual MFI system components
   - If the body harness is normal but the engine control module input/output signals are abnormal, check individual MFI system components and repair or replace as necessary.
   - After repairing or replacement, check the engine control module input/output signals again. If they are normal, proceed to check the input/output signals of the next check item.
8. Re-inspection and repair of trouble
   - If the harness inspection and individual component inspection results are normal but the engine control module input/output signals are abnormal, re-examine the causes of the trouble while referring to the troubleshooting hints and the checks and repairs included in other groups.
9. Verification and prevention of reoccurrence after repair
   - Carry out tests to see if the same problems occur again and make sure that the same problems will not be repeated.
   - Eliminate the causes of the trouble to prevent its reoccurrence.

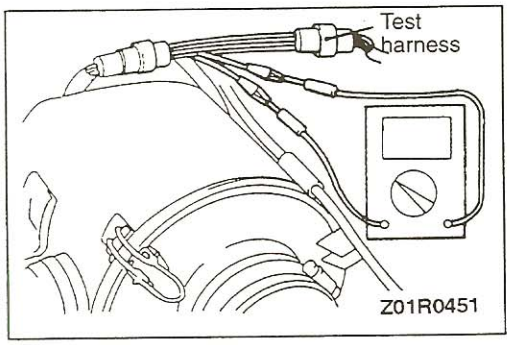
TSB Revision



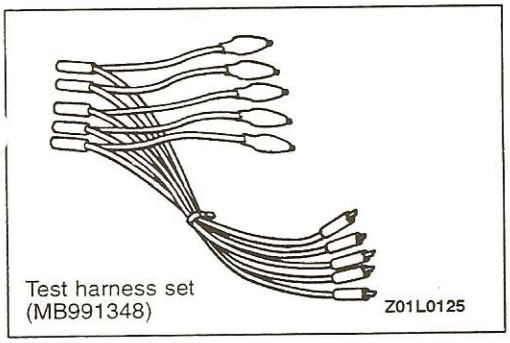
EXPLANATION AND PRECAUTION RELATED TO HARNESS CHECKING

13110030019

- Connector symbols are described as seen from the terminal end for the connector.
- The abbreviation "B+" used for the normal judgment value when checking the voltage is the abbreviation for battery positive voltage.

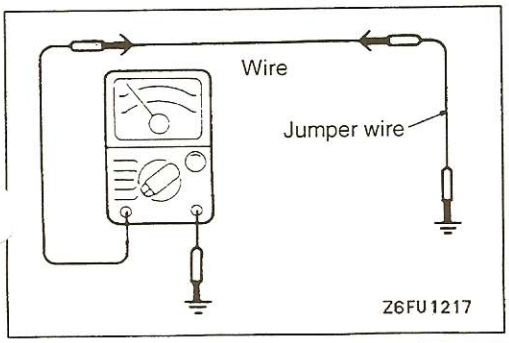


- Be sure to use the special tool (test harness) when, for a waterproof connector, checking while the circuit is conductive. If probe is inserted from the harness side, the waterproof capability will be lowered, thereby causing/corrosion, so never do so.
- When a connector is disconnected in order to check terminal voltage, etc., never insert a probe if the terminal to be checked is a female pin, because the forceful insertion of a probe will cause improper or incomplete contact.



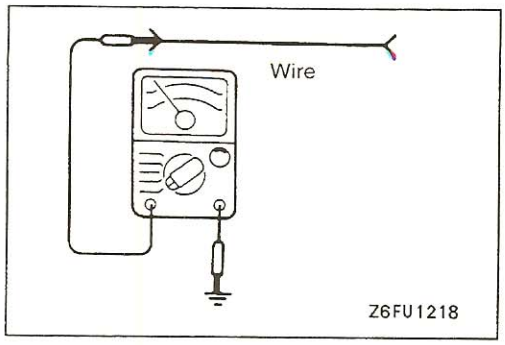
- Also, if there is no test harness that conforms to the connector, use the test harness set (MB991348) which can be directly connected between the terminals.

- When disconnecting the connector and inspecting the terminal voltage, etc., if the inspection terminal is a female pin, the special tool (inspection harness set: MB991223) should be used instead of inserting a probe.

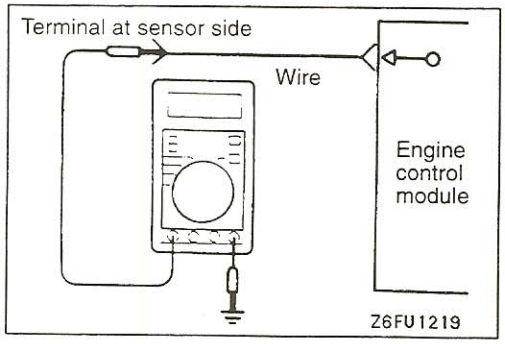


- When checking for damaged or disconnected wiring of a harness (open circuit) and if both ends of the harness are unconnected, use a jumper wire to ground one end of the harness, and then check for continuity between the other end and ground. By doing this, you can check for damaged or disconnected wiring, and, if there is no continuity, the harness should be repaired.
  However, when checking for a open circuit in the power supply line, check for continuity between both ends directly, without using a jumper wire to ground one end of the harness.

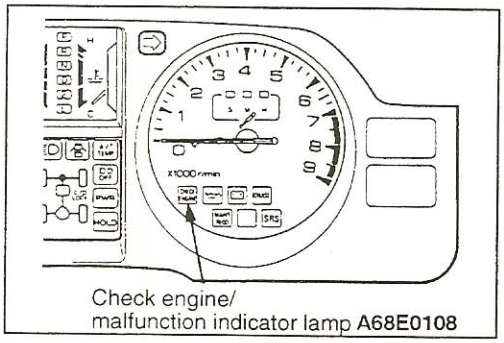
TSB Revision



- When checking for a harness short-circuit (short-circuit to ground), open one end of the harness and then ch for continuity between the other end and ground. If th is continuity, the harness is short-circuited to ground and should be repaired.



- If the voltage (power-supply voltage) supplied to a sensor is not normal, repair the harness. If the voltage to the sensor is still not normal after the harness has been repaired, replace the engine control module and check again.



CHECK ENGINE/MALFUNCTION INDICATOR LAMP

13110040067

Among the on-board diagnostic items, a check engine/malfunction indicator lamp illuminates to notify driver of the emission control items when an irregularity is detected. However, when an irregular signal returns to normal and the engine control module judges that it has returned to normal, the check engine/malfunction indicator lamp switches off. Moreover, when the ignition switch is turned off, the lamp switches off. Even if the ignition switch is turned on again, the lamp does not illuminate until the irregularity is detected. Here, immediately after the ignition switch is turned on, the check engine/malfunction indicator lamp illuminates for 5 seconds to indicated that the lamp operates normally.

Items Indicated by The Check Engine/Malfunction Indicator Lamp

DTC No.	Items	DTC No.	Items
–	Engine control module (ECM) malfunction	P0303*	Cylinder 3 misfire detected
P0100	Volume air flow circuit malfunction	P0304*	Cylinder 4 misfire detected
P0105	Barometric pressure circuit malfunction	P0305*	Cylinder 5 misfire detected
P0110	Intake air temperature circuit malfunction	P0306*	Cylinder 6 misfire detected
P0115	Engine coolant temperature circuit malfunction	P0335	Crankshaft position sensor circuit malfunction
P0120	Throttle position circuit malfunction	P0340	Camshaft position sensor circuit malfunction
P0125*	Excessive time to enter closed loop fuel control	P0400	Exhaust gas recirculation flow malfunction
P0130	O_2 sensor circuit malfunction (bank 1 sensor 1)	P0403	Exhaust gas recirculation solenoid malfunction
P0135	O_2 sensor heater circuit malfunction (bank 1 sensor 1)	P0420	Catalyst system efficiency below threshold (bank 1) <Federal>
P0136	O_2 sensor circuit malfunction (bank 1 sensor 2)	P0421	Warm up catalyst efficiency below threshold (bank 1) <California>
P0141	O_2 sensor heater circuit malfunction (bank 1 sensor 2)	P0431	Warm up catalyst efficiency below threshold (bank 2) <California>
P0150	O_2 sensor circuit malfunction (bank 2 sensor 1) <California>	P0442	Evaporative emission control system leak detected
P0155	O_2 sensor heater circuit malfunction (bank 2 sensor 1) <California>	P0443	Evaporative emission control system purge control valve circuit malfunction
P0156	O_2 sensor circuit malfunction (bank 2 sensor 2) <California>	P0446	Evaporative emission control system vent control malfunction
P0161	O_2 sensor heater circuit malfunction (bank 2 sensor 2) <California>	P0450	Evaporative emission control system pressure sensor malfunction
P0170	Fuel trim malfunction (bank 1)	P0455	Evaporative emission control system leak detected (Gross leak)
P0173	Fuel trim malfunction (bank 2) <California>	P0505	Idle control system malfunction
P0201	Injector circuit malfunction – cylinder 1	P0510	Closed throttle position switch malfunction
P0202	Injector circuit malfunction – cylinder 2	P0551	Power steering pressure sensor circuit range/performance
P0203	Injector circuit malfunction – cylinder 3	P0705	Transmission range sensor circuit malfunction (RPNDL Input)
P0204	Injector circuit malfunction – cylinder 4	P1400	Manifold differential pressure sensor circuit malfunction
P0205	Injector circuit malfunction – cylinder 5	P1600	Serial communication link malfunction (with 4A/T)
P0206	Injector circuit malfunction – cylinder 6	P1715	PG assembly malfunction
P0300*	Random misfire detected	P1750	Solenoid assembly malfunction
P0301*	Cylinder 1 misfire detected	P1791	Engine coolant temperature level input circuit (to TCM) malfunction
P0302*	Cylinder 2 misfire detected		

TSB Revision

NOTE

1. After the Engine Control Module (ECM) detects a malfunction, the check engine/malfunction indicator lamp illuminates when the engine is next turned on and the same malfunction is re-detected.
   However, for items marked with a "*" , the check engine/malfunction indicator lamp illuminates on the first detection of the malfunction.
2. After the check engine/malfunction indicator lamp illuminates, it will be switched off under the following conditions.
   - When the ECM monitored the powertrain malfunction three times* and detected malfunction.
     *: In this case, one time indicates from engine start to stop.
   - For misfiring or a fuel trim malfunction, when driving conditions (engine speed, engine coolant temperature, etc.) are similar to those when the malfunction was first recorded.

Caution
If the check engine/malfunction indicator lamp illuminates because of a malfunction of the ECM, transmission between the scan tool and the ECM cannot occur. In this case, the diagnostic trouble code cannot be read.

ON-BOARD DIAGNOSTICS

13110050077

The engine control module monitors the input/output signals (some signals at all times and the others under specified conditions) of the engine control module.
When a malfunction has continued for a specified time or longer since the irregular signal is initially monitored, the engine control module judges that a malfunction has occurred.
After the ECM first detects a malfunction, a diagnostic trouble code is recorded when the engine is restarted and the same malfunction is re-detected. However, for items marked with a "*", a diagnostic trouble code is recorded on the first detection of the malfunction.
There are 51 diagnostic items, and the diagnostic results can be read out with a scan tool.
Moreover, since memorization of the diagnostic trouble codes is backed up directly by the battery, the diagnostic results are memorized even if the ignition key is turned off. The diagnostic trouble codes will, however, be erased when the battery terminal or the engine control module connector is disconnected.
In addition, the diagnostic trouble code can also be erased by turning the ignition switch to ON and sending the diagnostic trouble code erase signal from the scan tool to the engine control module.

Caution
If the sensor connector is disconnected with the ignition switch turned on, the diagnostic trouble code is memorized. In this case, send the diagnostic trouble code erase signal to the engine control module in order to erase the diagnostic memory.

The 51 diagnostic items are provided as follows and if plural items are activated, they are indicated sequentially from the smallest code number.

Caution
The diagnostic trouble code of ignition timing adjustment signal is output whenever terminal for ignition timing adjustment is grounded. Therefore, it is not a malfunction that the code is output when adjusting ignition timing.

The ECM records the diagnostic trouble code and the engine operating conditions at the time the malfunction was detected. These data are called "freeze frame" data.
This data indicates the engine operating condition from when nothing at all is detected to the initial detection of malfunction.
This data can be read by using the scan tool, and can then be used in simulation tests for troubleshooting. Data items are as follows.

Data	Unit
Engine coolant temperature	°C
Engine speed	r/min
Vehicle speed	km/h
Long-term fuel compensation (Long-term fuel trim)	%
Short-term fuel compensation (Short-term fuel trim)	%
Fuel control condition	• Open loop • Closed loop • Open loop-drive condition • Open loop-DTC set • Closed loop-O_2 (rear) failed
Calculation load value	%
Diagnostic trouble code during data recording	–

OBD-II DRIVE CYCLE

All kinds of diagnostic trouble codes can be monitored by carrying out a short drive in accordance the following 6 drive cycle patterns. In other words, doing such a drive allows to regenerate any kind of trouble which involves illuminating the Check Engine/Malfunction Indicator Lamp and to check the repair procedure has eliminated the trouble (the Check Engine/Malfunction Indicator Lamp is no longer illuminated).

Caution

Two mechanics should always get on the vehicle when carrying out a drive test.

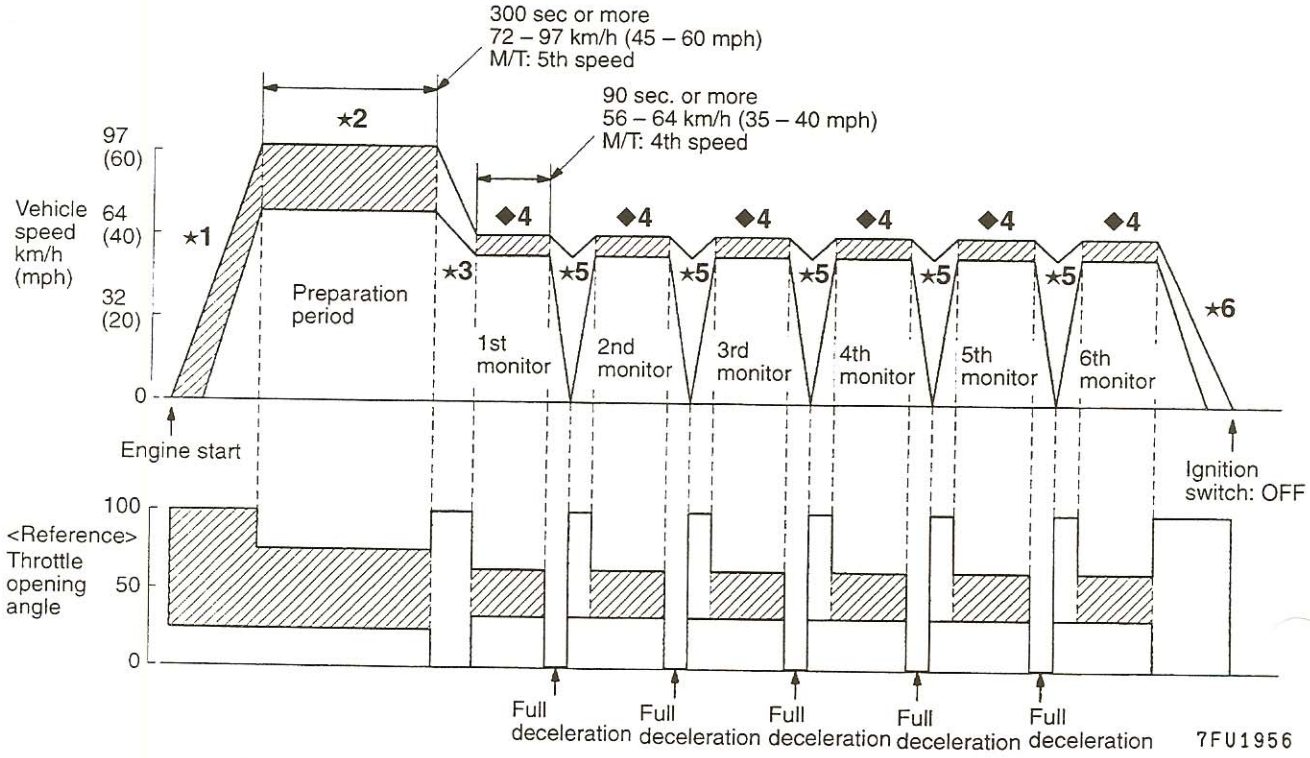
Catalytic converter monitor (P0420, P0421, P0431)

Test requirements/procedure

1. All of the following requirements should be met when carrying out a drive test.
   (1) Atmospheric temperature: –10°C (14°F) or more
   (2) Condition of A/T:
   - Selector lever position: D range
   - Overdrive switch: ON
   - Pattarn select switch: OFF

   (3) A/C switch: OFF
2. One trip monitor will be completed by driving according to the steps below (from start to switch off). It will take 20 minutes.
   ★1: Start the engine, and accelerate gradually to 72 km/h (45 mph) or more.
   ★2: Preparation period; continue driving between 72 and 97 km/h (45 and 60 mph) for 300 seconds. Brake may be applied for this period if it continues for only a few seconds.
   ★3: Decelerate to 56 – 64 km/h (35 – 40 mph).
   ◆4: Drive between 56 and 64 km/h (35 and 40 mph) at a constant throttle angle (by not moving the throttle pedal as much as possible) for 90 seconds or more during monitor.
   ★5: Decelerate with the throttle valve fully closed (Brake may be applied for this period). After the vehicle is being decelerated for ten seconds, accelerate gradually to 56 – 64 km/h (35 – mph). Then repeat ◆4 and ★5 steps six times. (The procedure in steps ◆4 and ★5 should be completed a total of six times.)
   ★6: Decelerate and stop the vehicle. Then turn off the ignition switch.

Drive cycle pattern



TSB Revision

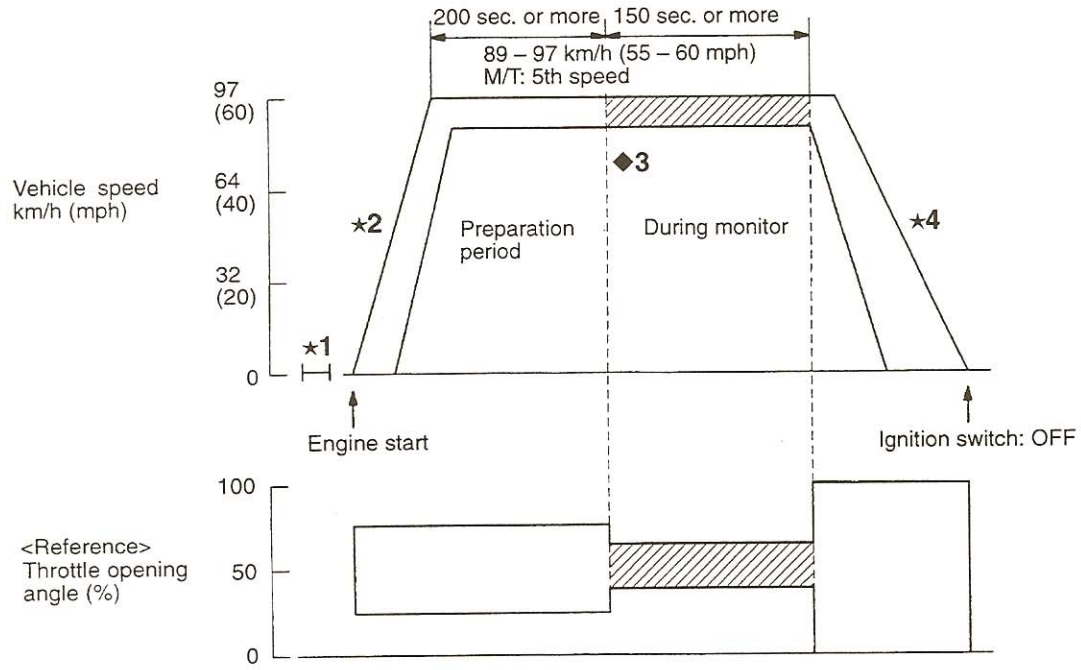
Caution
Vehicle speed and throttle opening angle should be within the shaded rage.

Evaporative emission control system leak monitor (P0442, P0450, P0455)

Test requirements/procedure

1. Test requirements/procedure
   (1) Engine coolant temperature: 45°C (113°F) or less (Before the test, engine stopped)
   (2) Atmospheric temperature: 5°C (41°F) or more, 45°C (113°F) or less
   (3) Condition of A/T:
   - Selector lever position: D range
   - Overdrive switch: ON
   - Pattarn select switch: OFF
2. One trip monitor will be completed by driving according to the steps below (from start to switch off). It will take 8 minutes.
   ★1: Check that both the engine coolant temperature and intake air temperature satisfy the conditions in 1. above (when engine is stopped).
   ★2: Monitor pre-preparation period: start the engine and accelerate to a speed of between 89 – 97 km/h (55 – 60 mph). Acceleration, deceleration and braking can be carried out during this period. Drive for 200 seconds or more while maintaining the vehicle speed at between 89 – 97 km/h (55 – 60 mph). Braking and throttle operations can be carried out during this time as long as the vehicle speed remains within the specified range.
   ◆3: Drive between 89 and 97 km/h (55 and 60 mph) at a constant throttle angle (by not moving the throttle pedal as much as possible) for 150 seconds or more during monitor. Moreover, do not turn the steering wheel suddenly.
   ★4: Decelerate and stop the vehicle. Then turn off the ignition switch.

Drive cycle pattern



7FU1957

Caution
Vehicle speed and throttle opening angle should be within the shaded rage.

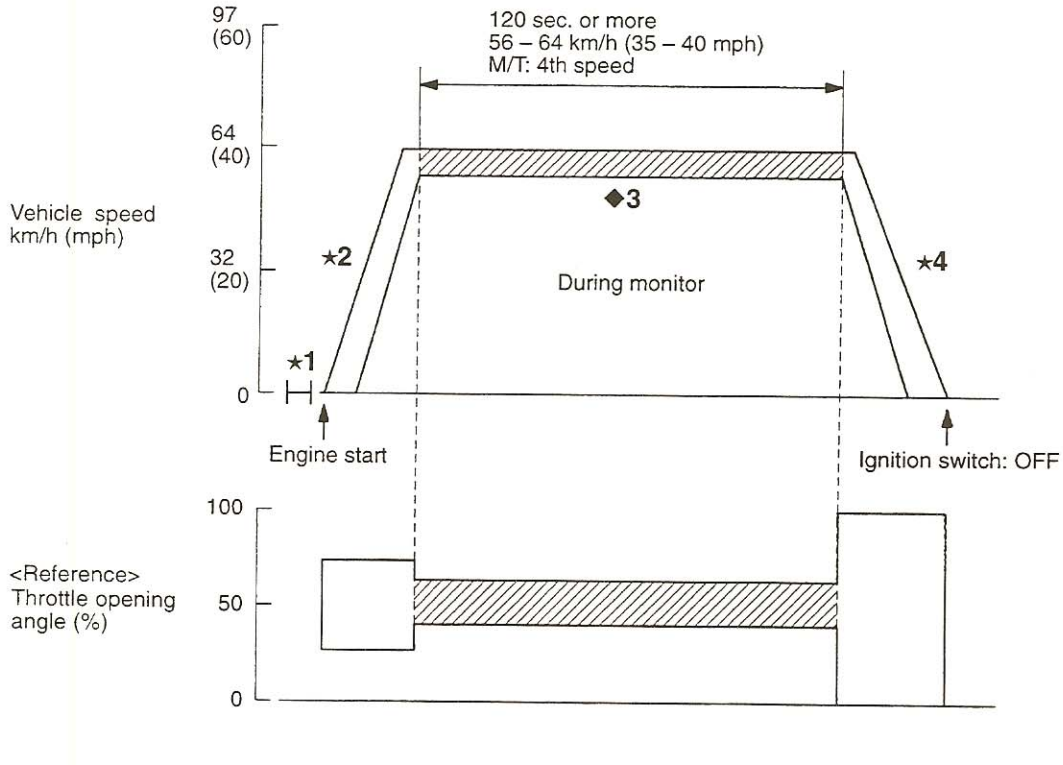
TSB Revision

Heated oxygen sensor monitor (P0130, P0136, P0150, P0156)

Test requirements/procedure

1. Test requirements/procedure
   (1) Engine coolant temperature: 80°C (176°F) or more (Engine fully warmed up)
   (2) Atmospheric temperature: –10°C (14°F) or more
   (3) Condition of A/T:
   - Selector lever position: D range
   - Overdrive switch: ON
   - Pattarn select switch: OFF
2. One trip monitor will be completed by driving according to the steps below (from start to switch off). It will take 5 minutes.
   ★1: After warming up the engine, turn off the ignition switch.
   ★2: Start the engine, and accelerate to 56 – 64 km/h (35 – 40 mph).
   ◆3: Drive between 56 and 64 km/h (35 and 40 mph) at a constant throttle angle (by not moving the throttle pedal as much as possible) for 120 seconds or more during monitor. Moreover, do not turn the steering wheel suddenly.
   ★4: Decelerate and stop the vehicle. Then turn off the ignition switch.

Drive cycle pattern



Caution
Vehicle speed and throttle opening angle should be within the shaded rage.

TSB Revision

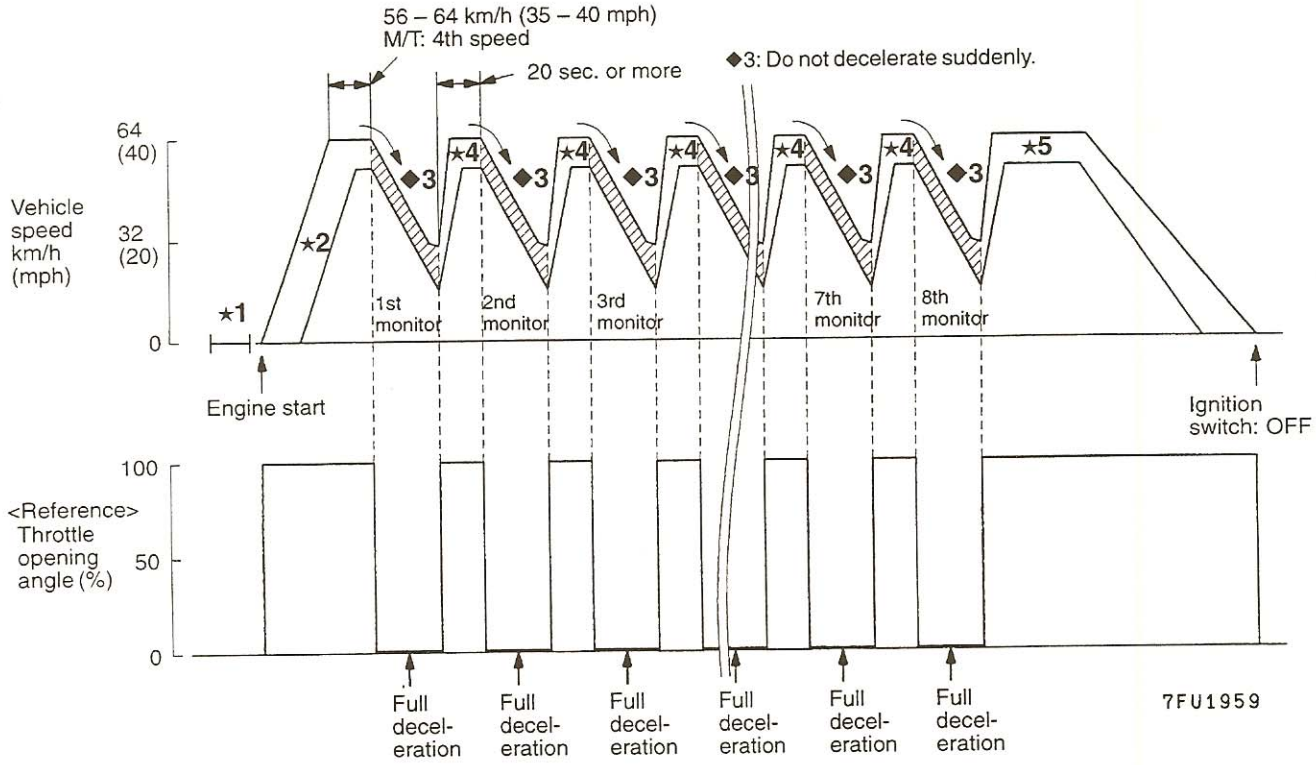
Exhaust gas recirculation (EGR) system monitor (P0400)

Test requirements/procedure

1. All of the following requirements should be met when carrying out a drive test.
   (1) Engine coolant temperature: 80°C (176°F) or more (Engine fully warmed up)
   (2) Atmospheric temperature: 5°C (41°F) or more
   (3) Condition of A/T:
   - Selector lever position: D range
   - Overdrive switch: ON
   - Pattarn select switch: OFF

   (4) A/C switch: OFF
2. One trip monitor will be completed by driving according to the steps below (from start to switch off). It will take approx. 10 minutes.
   ★1: After warming up, turn off the ignition switch.
   ★2: Start the engine, and accelerate to 56 – 64 km/h (35 – 40 mph).
   ◆3: Close the throttle fully from 2000 – 3000 r/min with the clutch engaged <M/T>, and then decelerate to 900 r/min without applying brakes. Moreover, do not turn the steering wheel or switch on or off the lights.
   ★4: Accelerate to 56 – 64 km/h (35 – 40 mph), and continue driving for 20 seconds. (After 1st monitor (deceleration), wait for 20 seconds or more until the next monitor (deceleration) starts). Then repeat ◆3 and ★4 steps eight times.
   ★5: Decelerate and stop. Then turn off the ignition switch.

Drive cycle pattern



Caution
Vehicle speed should be within the shaded rage.

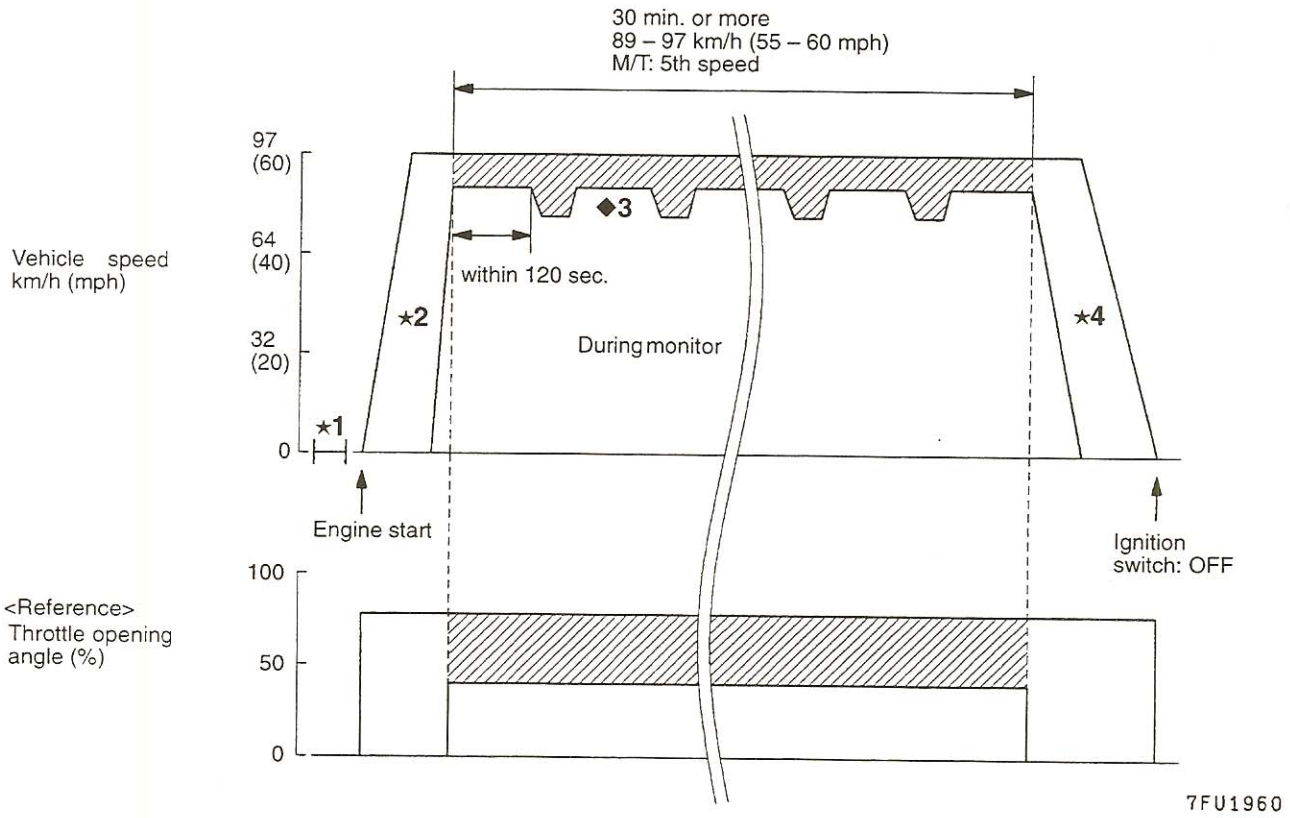
TSB Revision

Fuel trim monitor (P0170, P0173)

Test requirements/procedure

1. All of the following requirements should be met when carrying out a drive test.
   (1) Engine coolant temperature: 80°C – 97°C (176 – 207°F) (Engine fully warmed up)
   (2) Atmospheric temperature: –10°C (14°F) or more, 60°C (140°F) or less
   (3) Condition of A/T:
   - Selector lever position: D range
   - Overdrive switch: ON
   - Pattarn select switch: OFF
2. One trip monitor will be completed by driving according to the steps below (from start to switch off). It will take 35 minutes.
   ★1: After warming up the engine, turn off the ignition switch.
   ★2: Start the engine, and accelerate to 89 – 97 km/h (55 – 60 mph).
   ◆3: Drive between 89 and 97 km/h (55 and 60 mph) for 30 minutes or more during monitor. Moreover, do not drive the vehicle at the constant speed range for 120 seconds or more. (Accelerate or decelerate lightly within the 120 seconds. Brake may be applied, but avoid decelerating or accelerating suddenly).
   ★4: Decelerate and stop the vehicle. Then turn off the ignition switch.

Drive cycle pattern



Caution
Vehicle speed and throttle opening angle should be within the shaded rage.

TSB Revision

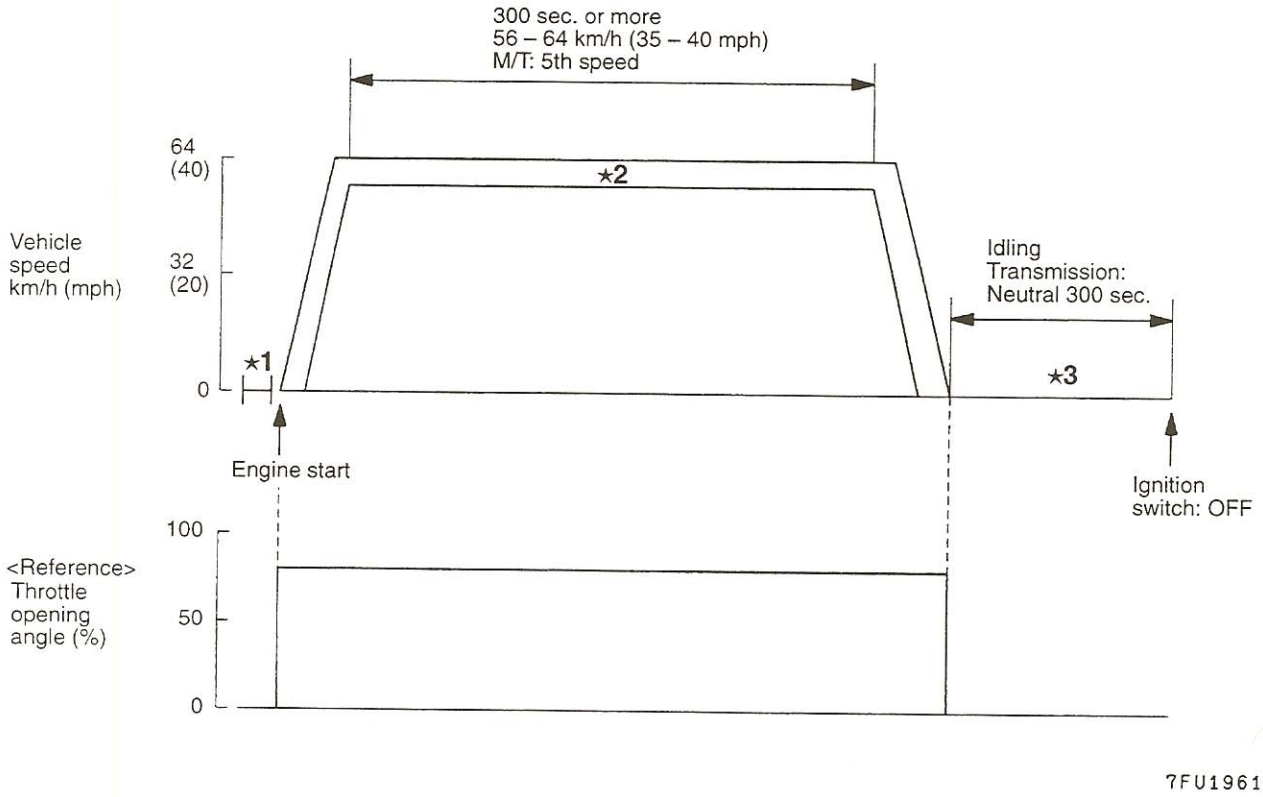
Other monitors

- Misfire (P0300, P0301, P0302, P0303, P0304, P0305, P0306)
- Evaporative emission control system (P0440)
- Idle air control system (P0505)
- Manifold differential pressure sensor (P1400)
- Excessive time to enter closed loop fuel control (P0125)
- Throttle position sensor (P0120)
- Barometric pressure sensor (P0105)
- Intake air temperature sensor (P0110)
- Crankshaft position sensor (P0335)
- Camshaft position sensor (P0340)
- Volume air flow sensor (P0100)
- Engine coolant temperature sensor (P0115)
- Closed throttle position switch (P0510)
- O_2 sensor circuit (P0130, P0136, P0150, P0156)
- O_2 sensor heater circuit (P0135, P0141, P0155, P0161)
- EGR solenoid (P0403)
- Evaporative emission purge solenoid (P0443)
- Evaporative emission purge ventilation solenoid (P0446)
- Injector circuit (P0201, P0202, P0203, P0204, P0205, P0206)
- Serial communication link <A/T> (P1600)
- Power steering pressure sensor circuit range/performance (P0551)

Test requirements/procedure

1. All of the following requirements should be met when carrying out a drive test.
   (1) Engine coolant temperature: 80°C (176°F) or more (Engine fully warmed up)
   (2) Atmospheric temperature: 5°C (41°F) or more
   (3) Condition of A/T:
   - Selector lever position: D range
   - Overdrive switch: ON
   - Pattarn select switch: OFF
2. One trip monitor will be completed by driving according to the steps below (from start to switch off). It will take approx. 10 minutes.
   ★1: After warming up, turn off the ignition switch.
   ★2: Start the engine, accelerate to 56 – 64 km/h (35 – 40 mph), continue driving for 300 seconds or more at that speed range and stop. Moreover, brake or throttle may be applied for this period.
   ★3: After stopping the vehicle, continue idling for 300 seconds or more, and then turn off the ignition switch. Moreover, the vehicle should be set to the following conditions for idling.
   - A/C switch: OFF
   - Lights and all accessories: OFF
   - Transmission: Neutral (A/T for P range)
   - Steering wheel: Straight-forward position

Drive cycle pattern



NOTE
Drive according to the graph above.

DIAGNOSIS CHART (FAULT TREE)

13110060070

DTC No.	Diagnostic items	Check items (Remedy)	Memory
P0100	Volume Air Flow Circuit Malfunction	• Harness and connector (If harness and connector are normal, replace volume air flow sensor assembly.)	Retained (Refer to P.13A-25.)
P0105	Barometric Pressure Circuit Malfunction	• Harness and connector (If harness and connector are normal, replace volume air flow sensor assembly.)	Retained (Refer to P.13A-25.)
P0110	Intake Air Temperature circuit Malfunction	• Harness and connector • Intake air temperature sensor	Retained (Refer to P.13A-26.)
P0115	Engine Coolant Temperature Circuit Malfunction	• Harness and connector • Engine coolant temperature sensor	Retained (Refer to P.13A-26.)
P0120	Throttle position Circuit Malfunction	• Harness and connector • Throttle position sensor • Closed throttle position switch	Retained (Refer to P.13A-27.)
P0125	Excessive Time to Enter Closed Loop Fuel Control*	• O_2 sensor (front) • O_2 sensor harness and connector • Injector	Retained (Refer to P.13A-27.)
P0130	O_2 Sensor Circuit Malfunction (Bank 1 Sensor 1)	• Harness and connector (If harness and connector are normal, replace O_2 sensor front.) <Right bank: California>	Retained (Refer to P.13A-28.)
P0135	O_2 Sensor Heater Circuit Malfunction (Bank 1 Sensor 1)	• Harness and connector • O_2 Sensor (front) heater <Right bank: California>	Retained (Refer to P.13A-28.)
P0136	O_2 Sensor Circuit Malfunction (Bank 1 Sensor 2)	• Harness and connector • O_2 Sensor (rear) <Right bank: California>	Retained (Refer to P.13A-29.)
P0141	O_2 Sensor Heater Circuit Malfunction (Bank 1 Sensor 2)	• Harness and connector • O_2 Sensor (rear) heater <Right bank: California>	Retained (Refer to P.13A-29.)
P0150	O_2 Sensor Circuit Malfunction (Bank 2 Sensor 1) <California>	• Harness and connector (If harness and connector are normal, replace left bank O_2 sensor front.)	Retained (Refer to P.13A-30.)
P0155	O_2 Sensor Heater Circuit Malfunction (Bank 2 Sensor 1) <California>	• Harness and connector • Left bank O_2 Sensor (front) heater	Retained (Refer to P.13A-30.)
P0156	O_2 Sensor Circuit Malfunction (Bank 2 Sensor 2) <California>	• Harness and connector • Left bank O_2 Sensor (rear)	Retained (Refer to P.13A-31.)
P0161	O_2 Sensor Heater Circuit Malfunction (Bank 2 Sensor 2) <California>	• Harness and connector • Left bank O_2 Sensor (rear) heater	Retained (Refer to P.13A-31.)

TSB Revision

DTC No.	Diagnostic items	Check items (Remedy)	Memory
P0170	Fuel Trim Malfunction (Bank 1)	• Volume air flow sensor output frequency • Injector • Fuel pressure • Intake air leaks • Engine coolant temperature sensor • Intake air temperature sensor • Barometric pressure sensor • O_2 Sensor • Exhaust manifold cracked	Retained (Refer to P.13A-31.)
P0173	Fuel Trim Malfunction (Bank 2) <California>		Retained (Refer to P.13A-32.)
P0201	Injector Circuit Malfunction – Cylinder 1	• Harness and connector • Injector	Retained (Refer to P.13A-32.)
P0202	Injector Circuit Malfunction – Cylinder 2		
P0203	Injector Circuit Malfunction – Cylinder 3		
P0204	Injector Circuit Malfunction – Cylinder 4		
P0205	Injector Circuit Malfunction – Cylinder 5		
P0206	Injector Circuit Malfunction – Cylinder 6		
P0300	Random Misfire Detected	• Ignition coil • Ignition power transistor • Spark plug • Ignition circuit • Injector • O_2 Sensor • Compression pressure • Timing belt • Crankshaft position sensor • Air intake • Fuel pressure • Crankshaft position sensor circuit and connector	Retained (Refer to P.13A-32.)
P0301	Cylinder 1 Misfire Detected		Retained (Refer to P.13A-33.)
P0302	Cylinder 2 Misfire Detected		
P0303	Cylinder 3 Misfire Detected		
P0304	Cylinder 4 Misfire Detected		
P0305	Cylinder 5 Misfire Detected		
P0306	Cylinder 6 Misfire Detected		
P0335	Crankshaft Position sensor Circuit Malfunction	• Harness and connector (If harness and connector are normal, replace crankshaft position sensor.)	Retained (Refer to P.13A-33.)
P0340	Camshaft Position sensor Circuit Malfunction	• Harness and connector (If harness and connector are normal, replace camshaft position sensor.)	Retained (Refer to P.13A-33.)
P0400	Exhaust Gas Recirculation Flow Malfunction <Federal>	• Harness and connector • EGR valve • EGR solenoid • EGR valve control vacuum • Manifold differential pressure sensor	Retained (Refer to P.13A-34.)
P0403	Exhaust Gas Recirculation Solenoid Malfunction <Federal>	• Harness and connector • EGR solenoid	Retained (Refer to P.13A-34.)

TSB Revision

DTC No.	Diagnostic items	Check items (Remedy)	Memory
P0420	Catalyst System Efficiency Below Threshold (Bank 1) <Federal>	• Exhaust manifold (Replace the catalytic converter if there is no cracks, etc.)	Retained (Refer to P.13A-34.)
P0421	Warm Up Catalyst Efficiency Below Threshold (Bank 1) <California>	• Exhaust manifold (Replace the catalytic converter if there is no cracks, etc.)	Retained (Refer to P.13A-35.)
P0431	Warm Up Catalyst Efficiency Below Threshold (Bank 2) <California>	• Exhaust manifold (Replace the catalytic converter if there is no cracks, etc.)	Retained (Refer to P.13A-35.)
P0442	Evaporative Emission Control System Leak Detected	• Harness and connector • Evaporative emission purge solenoid • Evaporative emission ventilation solenoid • Vacuum hoses routing	Retained (Refer to P.13A-36.)
P0443	Evaporative Emission Control System Purge Control Valve Circuit Malfunction	• Harness and connector • Evaporative emission purge solenoid	Retained (Refer to P.13A-36.)
P0446	Evaporative Emission Control System Vent Control Malfunction	• Harness and connector • Evaporative emission ventilation solenoid	Retained (Refer to P.13A-37.)
P0450	Evaporative Emission Control System Pressure Sensor Malfunction	• Harness and connector • Fuel tank differential pressure sensor	Retained (Refer to P.13A-37.)
P0455	Evaporative Emission Control System Leak Detected (Gross Leak)	• Harness and connector • Evaporative emission ventilation solenoid	Retained (Refer to P.13A-38.)
P0500	Vehicle Speed Sensor Malfunction	• Harness and connector • Vehicle speed sensor	Retained (Refer to P.13A-38.)
P0505	Idle Control System Malfunction	• Harness and connector • Idle air control motor	Retained (Refer to P.13A-39.)
P0510	Closed Throttle Position Switch Malfunction	• Harness and connector • Closed throttle position switch	Retained (Refer to P.13A-39.)
P0551	Power Steering Pressure Sensor Circuit Range/Performance	• Harness and connector • Power steering pressure switch	Retained (Refer to P.13A-40.)
P0705	Transmission Range Sensor Circuit Malfunction (RPNDL Input)	• Harness and connector • Park/Neutral position switch	Retained (Refer to P.13A-40.)
P1400	Manifold Differential Pressure (MDP) Sensor Circuit Malfunction	• Harness and connector • MDP sensor	Retained (Refer to P.13A-41.)

TSB Revision

DTC No.	Diagnostic items	Check items (Remedy)	Memory
P1600	Serial Communication Link Malfunction	• Harness and connector	Retained (Refer to P.13A-41.)
P1715	PG Assembly Malfunction	• Harness and connector • Pulse generator	Retained (Refer to P.13A-42.)
P1750	Solenoid Assembly Malfunction	• Harness and connector • Converter clutch solenoid • Shift control solenoid • Pressure control solenoid	Retained (Refer to P.13A-42.)
P1791	Engine Coolant Temperature Level Input Circuit (to TCM) Malfunction	• Harness and connector	Retained (Refer to P.13A-42.)

NOTE
1. Do not replace the engine control module (ECM) until a thorough terminal check reveals there are no short/open circuits.
2. After the ECM detects a malfunction, a diagnostic trouble code is recorded when the engine is next started and the same malfunction is re-detected. However, for items marked with a "*", the diagnostic trouble code is recorded on the first detection of the malfunction.
3. O_2 : Heated oxygen sensor
4. Sensor 1: indicates sensors which are mounted closest to the engine.
5. Sensor 2: indicates sensors which are mounted next-closest to the engine.

TSB Revision

DIAGNOSTIC DETECTION LOGIC

13110070080

DTC No.	Title	Probable causes
P0100	Volume Air Flow Circuit Malfunction	
Background • While the engine is running, the volume air flow sensor outputs a pulse signal which corresponds to the volume of air flow. • The engine control module checks whether the frequency of the this signal output by the volume air flow sensor while the engine is running is at or above the set value. Check Area • Engine speed is higher than 500 r/min. Judgement Criteria • Sensor output frequency has continued to be 3.3 Hz or lower for 4 sec. Check Area • Throttle position sensor voltage is 2 V or lower. • Engine speed is lower than 2000 r/min. Judgement Criteria • Sensor output frequency has continued to be 1200 Hz or higher for 4 sec. Check Area • Throttle position sensor voltage is 1.5 V or higher. • Engine speed is higher than 4000 r/min. Judgement Criteria • Sensor output frequency has continued to be 100 Hz or lower for 4 sec.		• Volume air flow sensor failed. • Open or shorted volume air sensor circuit, or loose connector. • Engine control module failed. (Refer to P.13A-63.)

DTC No.	Title	Probable causes
P0105	Barometric Pressure Circuit Malfunction	
Background • The barometric pressure sensor outputs a voltage which corresponds to the barometric pressure. • The engine control module checks whether this voltage is within a specified range. Check Area • Ignition Switch: ON • 60 sec. or more have passed since the starting sequence was completed. • Battery voltage is higher than 8 V. Judgement Criteria • Sensor output voltage has continued to be 4.5 V or higher [corresponding to a barometric pressure of 114 kPa (17 psi) or higher] for 4 sec., or • Sensor output voltage has continued to be 1.95 V or lower [corresponding to a barometric pressure of 50 kPa (7.4 psi) or lower] for 4 sec.		• Barometric pressure sensor failed. • Open or shorted barometric pressure sensor circuit, or loose connector. • Engine control module failed. (Refer to P.13A-71.)

TSB Revision

DTC No.	Title	Probable causes
P0110	Intake Air Temperature Circuit Malfunction	
Background • The intake air temperature sensor converts the intake air temperature to a voltage and outputs it. • The engine control module checks whether the voltage is within a specified range. Check Area • 60 sec. or more have passed since the starting sequence was completed. Judgement Criteria • Sensor output voltage has continued to be 4.6 V or higher [corresponding to an intake air temperature of –45°C (–49°F) or lower] for 4 sec., or • Sensor output voltage has continued to be 0.2 V or lower [corresponding to an intake air temperature of 125°C (257°F) or higher] for 4 sec.		• Intake air temperature sensor failed. • Open or shorted intake air temperature sensor circuit, or loose connector. • Engine control module failed. (Refer to P.13A-68.)

DTC No.	Title	Probable causes
P0115	Engine Coolant Temperature Circuit Malfunction	
Background • The engine coolant temperature sensor converts the engine coolant temperature to a voltage and outputs it. • The engine control module checks whether the voltage is within a specified range. In addition, it checks the engine coolant temperature (signal) does not drop while the engine is warming up. Check Area, Judgement Criteria • Sensor output voltage has continued to be 4.6 V or higher [corresponding to a coolant temperature of –45°C (–49°F) or lower] for 4 sec., or • Sensor output voltage has continued to be 0.1 V or lower [corresponding to a coolant temperature of 140°C (284°F) or higher] for 4 sec. Check Area, Judgement Criteria • Sensor output voltage increased from a value lower than 1.6 V to a value higher than 1.6 V [Coolant temperature decreases from a higher than 40°C (104°F) temperature to a lower than 40°C (104°F) temperature.]. • Then the sensor output voltage has continued to be 1.6 V or higher for 5 min. Check Area • The engine coolant temperature is approx. 40°C (104°F) or less immediately after starting the engine. Judgement Criteria • About 60 – 300 sec. have passed for the engine coolant temperature to rise to about 40°C (104°F) after starting sequence was completed.		• Engine coolant temperature sensor failed. • Open or shorted engine coolant temperature sensor circuit, or loose connector. • Engine control module failed. (Refer to P.13A-73.)

TSB Revision

DTC No.	Title	Probable causes
P0120	Throttle Position Circuit Malfunction	
Background • The throttle position sensor outputs a voltage which corresponds to the throttle valve opening angle. • The engine control module checks whether the voltage is within a specified range. In addition, it checks that the voltage output does not become too large while the engine is idling. Check Area, Judgement Criteria • With the closed throttle position switch set to ON, the sensor output voltage has continued to be 2 V or higher for 4 sec., or • Sensor output voltage has continued to be 0.2 V or lower for 4 sec. Check Area • Engine speed is between 500 and 3000 r/min. • Volumetric efficiency is 30 % or less. Judgement Criteria • Sensor output voltage has continued to be 4.6 V or higher for 4 sec. Check Area • Engine speed is between 500 and 4000 r/min. • Volumetric efficiency is 50 % or more. Judgement Criteria • Sensor output voltage has continued to be 1.0 V or lower for 4 sec.		• Throttle position sensor failed or misadjusted. • Open or shorted throttle position sensor circuit, or loose connector. • Closed throttle position switch malfunction. • Closed throttle position switch signal wire shorted. • Engine control module failed. (Refer to P.13A-76.)

DTC No.	Title	Probable causes
P0125	Excessive Time to Enter Closed Loop Fuel Control	
Background • The MFI system reduces exhaust emissions by means of closed-loop fuel control. • The engine control module checks the time taken until closed-loop fuel control commences. Check Area Engine coolant temperature is higher than 80°C (176°F). • Intake air temperature is –10°C (14°F) or more. • Atmospheric pressure is 76 kPa (11 psi) or more. • Engine speed is between about 1800 and 3500 r/min. • Volumetric efficiency is 16 – 62 %. • Engine operating within the air-fuel ratio feedback zone. • Monitoring time: 128 sec. Judgement Criteria • Multiport fuel injection system doesn't enter the closed loop control within about 30 sec. • Monitored only once per trip.		• Heated oxygen sensor failed, • Injector failed. • Fuel pressure regulator failed • Fuel pump failed • Fuel filter is clogged • Intake system vacuum leak • Exhaust leak • Engine control module failed. (Refer to P.13A-131.)

TSB Revision

DTC No.	Title	Probable causes
P0130	Oxygen Sensor Circuit Malfunction (Bank 1 Sensor 1)	
Background • When the oxygen sensor begins to deteriorate,the oxygen sensor signal response becomes poor. • The engine control module forcibly varies the air/fuel mixture to make it leaner and richer, and checks the response speed of the oxygen sensor. In addition, the engine control module also checks for an open circuit in the oxygen sensor output line. Check Area • Coolant temperature sensor: normal • Heated oxygen sensor signal voltage has continued to be 0.1 V or lower for 3 min. or more after the starting sequence was completed. • Engine coolant temperature is higher than 80°C (176°F). • Engine speed is higher than 1200 r/min. • Volumetric efficiency is 25 % or more. • Intake air temperature is –10°C (14°F) or more. • Atmospheric pressure is 76 kPa (11 psi) or more. Judgement Criteria • Input voltage supplied to the engine control module interface circuit is not lower than 4.5 V when 5 V is applied to the heated oxygen sensor output line via a resistor. Check Area • Coolant temperature sensor: normal • Engine coolant temperature is higher than 50°C (122°F). • Engine speed is between 1250 and 3000 r/min. • Volumetric efficiency is 25 – 60 %. • Intake air temperature is –10°C (14°F) or more. • Atmospheric pressure is 76 kPa (11 psi) or more. • Under the closed loop air-fuel control. • Monitoring time: 8 sec. Judgement Criteria • When the air-fuel ratio is forcibly changed (lean to rich and rich to lean), the heated oxygen sensor signal doesn't provide response within 0.995 sec. • Monitored only once per trip. NOTE If the H02S test result for the scan tool's OBD-II test mode indicates that the sensor switch time is longer than the judgment criteria, it probably means that the oxygen sensor has deteriorated. In addition, if the switch time is too short, it probably means that there is an open circuit or short circuit in the harness wire. In addition, the sensor switch time is displayed as "0 second" when the heated oxygen sensor signal voltage has not been changed at all (lean/rich) after the erasure of the DTC.		• Heated oxygen sensor deteriorated. • Open circuit in oxygen sensor output line. • Engine control module failed. (Refer to P.13A-99.) <Federal> (Refer to P.13A-103.) <California>

DTC No.	Title	Probable causes
P0135	Oxygen Sensor Heater Circuit Malfunction (Bank 1 Sensor 1)	
Background • The engine control module checks whether the heater current is within a specified range when the heater is energized. Check Area • Battery voltage is between 11 and 16 V. Judgement Criteria • Heater current of the front heated oxygen sensor heater (Bank 1 Sensor 1) has continued to be lower than 0.2 A or higher than 3.5 A for 6 sec. • Monitored only once per trip.		• Open or shorted oxygen sensor heater circuit. • Open circuit in oxygen sensor heater. • Engine control module failed. (Refer to P.13A-99.) <Federal> (Refer to P.13A-103.) <California>

TSB Revision

DTC No.	Title	Probable causes
P0136	Oxygen Sensor Circuit Malfunction (Bank 1 Sensor 2)	
Background • The engine control module checks for an open circuit in the heated oxygen sensor output line. Check Area • Coolant temperature sensor: normal • Heated oxygen sensor signal voltage has continued to be 0.1 V or lower for 3 min. or more after the starting sequence was completed. • Engine coolant temperature is higher than 80°C (176°F). • Engine speed is higher than 1200 r/min. • Volumetric efficiency is 25 % or more. • Intake air temperature is –10°C (14°F) or more. • Atmospheric pressure is 76 kPa (11 psi) or more. • Monitoring time: 7 – 10 sec. Judgement Criteria • Input voltage supplied to the engine control module interface circuit is higher than 4.5 V when 5 V is applied to the heated oxygen sensor output line via a resistor. • Making the air-fuel ratio 15 % richer doesn't result in raising the heated oxygen sensor output voltage beyond 0.1 V.		• Heated oxygen sensor failed. • Engine control module failed. • Open circuit in heated oxygen sensor output line. (Refer to P.13A-99.) <Federal> (Refer to P.13A-103.) <California>

DTC No.	Title	Probable causes
P0141	Oxygen Sensor Heater Circuit Malfunction (Bank 1 Sensor 2)	
Background • The engine control module checks whether the heater current is within a specified range when the heater is energized. Check Area • Battery voltage is between 11 and 16 V. Judgement Criteria • Heater current of the front heated oxygen sensor heater (Bank 1 Sensor 2) has continued to be lower than 0.2 A or higher than 3.5 A for 6 sec. • Monitored only once per trip.		• Open shorted oxygen sensor heater circuit. • Open circuit in oxygen sensor heater. • Engine control module failed. (Refer to P.13A-99.) <Federal> (Refer to P.13A-103.) <California>

TSB Revision

DTC No.	Title	Probable causes
P0150	Oxygen Sensor Circuit Malfunction (Bank 2 Sensor 1) <California>	• Heated oxygen sensor deteriorated. • Open circuit in oxygen sensor output line. • Engine control module failed. (Refer to P.13A-103.)

Background
- When the oxygen sensor begins to deteriorate,the oxygen sensor signal response becomes poor.
- The engine control module forcibly varies the air/fuel mixture to make it leaner and richer, and checks the response speed of the oxygen sensor.
  In addition, the engine control module also checks for an open circuit in the oxygen sensor output line.

Check Area
- Coolant temperature sensor: normal
- Heated oxygen sensor signal voltage has continued to be 0.1 V or lower for 3 min. or more after the starting sequence was completed.
- Engine coolant temperature is higher than 80°C (176°F).
- Engine speed is higher than 1200 r/min.
- Volumetric efficiency is 25 % or more.
- Intake air temperature is –10°C (14°F) or more.
- Atmospheric pressure is 76 kPa (11 psi) or more.

Judgement Criteria
- Input voltage supplied to the engine control module interface circuit is not lower than 4.5 V when 5 V is applied to the heated oxygen sensor output line via a resistor.

Check Area
- Coolant temperature sensor: normal
- Engine coolant temperature is higher than 50°C (122°F).
- Engine speed is between 1250 and 3000 r/min.
- Volumetric efficiency is 25 – 60 %.
- Intake air temperature is –10°C (14°F) or more.
- Atmospheric pressure is 76 kPa (11 psi) or more.
- Under the closed loop air-fuel control.
- Monitoring time: 8 sec.

Judgement Criteria
- When the air-fuel ratio is forcibly changed (lean to rich and rich to lean), the heated oxygen sensor signal doesn't provide response within 0.995 sec.
- Monitored only once per trip.

NOTE
If the H02S test result for the scan tool's OBD-II test mode indicates that the sensor switch time is longer than the judgment criteria, it probably means that the oxygen sensor has deteriorated. In addition, if the switch time is too short, it probably means that there is an open circuit or short circuit in the harness wire.
In addition, the sensor switch time is displayed as "0 second" when the heated oxygen sensor signal voltage has not been changed at all (lean/rich) after the erasure of the DTC.

DTC No.	Title	Probable causes
P0155	Oxygen Sensor Heater Circuit Malfunction (Bank 2 Sensor 1) <California>	• Open or shorted oxygen sensor heater circuit. • Open circuit in oxygen sensor heater. • Engine control module failed. (Refer to P.13A-103.)

Background
- The engine control module checks whether the heater current is within a specified range when the heater is energized.

Check Area
- Battery voltage is between 11 and 16 V.

Judgement Criteria
- Heater current of the front heated oxygen sensor heater (Bank 1 Sensor 1) has continued to be lower than 0.2 A or higher than 3.5 A for 6 sec.
- Monitored only once per trip.

TSB Revision

DTC No.	Title	Probable causes
P0156	Oxygen Sensor Circuit Malfunction (Bank 2 Sensor 2) <California>	
Background • The engine control module checks for an open circuit in the heated oxygen sensor output line. Check Area • Coolant temperature sensor: normal • Heated oxygen sensor signal voltage has continued to be 0.1 V or lower for 3 min. or more after the starting sequence was completed. • Engine coolant temperature is higher than 80°C (176°F). • Engine speed is higher than 1200 r/min. • Volumetric efficiency is 25 % or more. • Intake air temperature is –10°C (14°F) or more. • Atmospheric pressure is 76 kPa (11 psi) or more. • Monitoring time: 7 – 10 sec. Judgement Criteria • Input voltage supplied to the engine control module interface circuit is not lower than 4.5 V when 5 V is applied to the heated oxygen sensor output line via a resistor. • Making the air-fuel ratio 15 % richer doesn't result in raising the heated oxygen sensor output voltage beyond 0.1 V.		• Heated oxygen sensor failed. • Engine control module failed. • Open circuit in heated oxygen sensor output line. (Refer to P.13A-103.)

DTC No.	Title	Probable causes
P0161	Oxygen Sensor Heater Circuit Malfunction (Bank 2 Sensor 2) <California>	
Background • The engine control module checks whether the heater current is within a specified range when the heater is energized. Check Area • Battery voltage is between 11 and 16 V. Judgement Criteria • Heater current of the front heated oxygen sensor heater (Bank 1 Sensor 2) has continued to be lower than 0.2 A or higher than 3.5 A for 6 sec. • Monitored only once per trip.		• Open shorted oxygen sensor heater circuit. • Open circuit in oxygen sensor heater. • Engine control module failed. (Refer to P.13A-103.)

DTC No.	Title	Probable causes
P0170	Fuel Trim Malfunction (Bank 1)	
Background • If a malfunction occurs in the fuel system, the fuel compensation value becomes too large or too small. • The engine control module checks whether the fuel compensation value is within a specified range. Check Area • Under the closed loop air-fuel ratio control. • Intake air temperature is –10°C (14°F) or more. • Atmospheric pressure is 76 kPa (11 psi) or more. Judgement Criteria • Long-range fuel correction has continued to be higher than +12.5 % or lower than –12.5 % for 10 sec. • Short-range fuel correction has continued to be higher than +11.9 % or lower than –10.0 % for 10 sec.		• Volume air flow sensor failed. • Injector failed. • Incorrect fuel pressure. • Air drawn in from gaps in gasket seals, etc. • Heated oxygen sensor failed. • Engine coolant temperature sensor failed. • Engine control module failed. • Intake air temperature sensor failed. • Barometric pressure sensor failed. • Exhaust leak • Use of incorrect fuel (Refer to P.13A-132.)

TSB Revision

DTC No.	Title	Probable causes
P0173	Fuel Trim Malfunction (Bank 2) <California>	
Background • If a malfunction occurs in the fuel system, the fuel compensation value becomes too large or too small. • The engine control module checks whether the fuel compensation value is within a specified range. Check Area • Under the closed loop air-fuel ratio control. • Intake air temperature is –10°C (14°F) or more. • Atmospheric pressure is 76 kPa (11 psi) or more. Judgement Criteria • Long-range fuel correction has continued to be higher than +12.5 % or lower than –12.5 % for 10 sec. • Short-range fuel correction has continued to be higher than +13.1 % or lower than –11.3 % for 10 sec.		• Volume air flow sensor failed. • Injector failed. • Incorrect fuel pressure. • Air drawn in from gaps in gasket seals, etc. • Heated oxygen sensor failed. • Engine coolant temperature sensor failed. • Engine control module failed. • Intake air temperature sensor failed. • Barometric pressure sensor failed. • Exhaust leak • Use of incorrect fuel (Refer to P.13A-133.)

DTC No.	Title	Probable causes
P0201-P0206	Injector Circuit Malfunction Cylinder 1 – Cylinder 6	
Background • A surge voltage is generated when the injectors are driven and the current flowing to the injector coil is shut off. • The engine control module checks this surge voltage. Check Area • Engine speed is between 50 and 1000 r/min. • Throttle position sensor output voltage is lower than 1.16 V. • Monitoring time: 4 sec. Judgement Criteria • Injector coil surge voltage (system voltage + 2 V) has not been detected for 4 sec.		• Injector failed. • Open or shorted injector circuit, or loose connector. • Engine control module failed. (Refer to P.13A-105.)

DTC No.	Title	Probable causes
P0300	Random Misfire Detected	
Background • If a misfiring occurs while the engine is running, the engine speed suddenly changes. • The engine control module checks for changes in the engine speed. Check Area • 5 sec. or more have passed after the engine was started. • Engine speed is between 500 and 6000 r/min. • Engine coolant temperature is –10°C (14°F) or more. • Intake air temperature is –10°C (14°F) or more. • Atmospheric pressure is 76 kPa (11 psi) or more. • Running free from suden accelerations/decelerations such as shift change. Judgement Criteria (change in the angular acceleration of the crankshaft is used for misfire detection.) • Misfire has occurred more frequently than allowed during the last 200 revolutions [when the catalyst temperature is higher than 950°C (1742°F)]. or • Misfire has occurred more frequently than the allowed number of times (2%) during 1000 motor revolutions. (Misfire exceeding 1.5 times the limit of emission standard.)		• Ignition system related part(s) failed. • Poor crankshaft position sensor signal. • Incorrect air/fuel ratio. • Low compression pressure. • Engine coolant temperature sensor failed • Timing belt teeth jumped • Injector failed • EGR valve failed • Engine control module failed. (Refer to P.13A-134.)

TSB Revision

DTC No.	Title	Probable causes
P0301-P0306	Cylinder 1 – Cylinder 6 Misfire Detected	
Background • If a misfiring occurs while the engine is running, the engine speed suddenly changes. • The engine control module checks for changes in the engine speed. Check Area • 5 sec. or more have passed after the engine was started. • Engine speed is between 500 and 6000 r/min. • Engine coolant temperature is –10°C (14°F) or more. • Intake air temperature is –10°C (14°F) or more. • Atmospheric pressure is 76 kPa (11 psi) or more. • Running free from suden accelerations/decelerations such as shift change. Judgement Criteria (change in the angular acceleration of the crankshaft is used for misfire detection.) • Misfire has occurred more frequently than allowed during the last 200 revolutions [when the catalyst temperature is higher than 950°C (1742°F)]. or • Misfire has occurred more frequently than the allowed number of times (2%) during 1000 motor revolutions. (Misfire exceeding 1.5 times the limit of emission standard.)		• Ignition system related part(s) failed. • Low compression pressure • Injector failed • Engine control module failed. (Refer to P.13A-134.)

DTC No.	Title	Probable causes
P0335	Crankshaft Position Sensor Circuit Malfunction	
Background • When the engine is running, the crankshaft position sensor outputs a pulse signal. • The engine control module checks whether the pulse signal is input while the engine is cranking. Check Area • Engine is being cranked. Judgement Criteria • Sensor output voltage has not changed (no pulse signal is input) for 4 sec. Check Area, Judgement Criteria • Normal signal pattern has not been input for cylinder identification from the crankshaft position sensor signal and camshaft position sensor signal for 4 sec.		• Crankshaft position sensor failed. • Open or shorted crankshaft position sensor circuit, or loose connector. • Engine control module failed. (Refer to P.13A-86.)

DTC No.	Title	Probable causes
P0340	Camshaft Position Sensor Circuit Malfunction	
Background • When the engine is running, the camshaft position sensor output a pulse signal. • The engine control module checks whether the pulse signal is input. Check Area, Judgement Criteria • Sensor output voltage has not changed (no pulse signal is input) for 4 sec. Check Area, Judgement Criteria • Normal signal pattern has not been input for cylinder identification from the crankshaft position sensor signal and camshaft position sensor signal for 4 sec.		• Camshaft position sensor failed. • Open or shorted camshaft position sensor circuit, or loose connector. • Engine control module failed. (Refer to P.13A-82.)

TSB Revision

DTC No.	Title	Probable causes
P0400	Exhaust Gas Recirculation Flow Malfunction	
Background • When the EGR solenoid switches from OFF to ON while the engine is running, EGR gas flows. • The engine control module checks how the EGR gas flow signal changes. Check Area • Engine coolant temperature is higher than 80°C (176°F). • Engine speed is between 1000 and 2000 r/min. <M/T> or 940 and 2000 r/min. <A/T>. • Intake air temperature is 5°C (41°F) or more. • Atmospheric pressure is 76 kPa (11 psi) or more. • Closed throttle position switch: ON • Volumetric efficiency is 18 % or less <M/T> or 28 % or less <A/T>. • Monitoring time: 2 sec. Judgement Criteria • The fluctuation in the intake system is low when the EGR solenoid is turned on. • Monitored only once per trip.		• EGR valve does not open. • EGR control vacuum is too low. • EGR solenoid failed. • Open or shorted EGR solenoid circuit, or loose connector. • Manifold differential pressure sensor failed. • Engine control module failed. (Refer to P.13A-135.)

DTC No.	Title	Probable causes
P0403	Exhaust Gas Recirculation Solenoid Malfunction	
Background • The engine control module checks current flows in the EGR solenoid drive circuit when the solenoid is ON and OFF. Check Area • Battery voltage is higher than 10 V. Judgement Criteria • Solenoid coil surge voltage (system voltage + 2 V) is not detected when the EGR solenoid is turned on/off.		• EGR solenoid failed. • Open or shorted evaporative EGR solenoid circuit, or loose connector. • Engine control module failed. (Refer to P.13A-126.)

DTC No.	Title	Probable causes
P0420	Catalyst System Efficiency Below Threshold (Bank 1) <Federal>	
Background • The signal from the heated oxygen sensor which follows the catalytic converter differs from that which precedes the catalytic converter. That is because the catalytic converter purifies exhaust gas. When the catalytic converter has deteriorated, the signal from the heated oxygen sensor which follows the catalytic converter becomes similar to that which precedes the catalytic converter. • The engine control module checks the outputs of the heated oxygen sensor signals. Check Area • Engine speed is higher then 3000 r/min. • Volume air flow sensor output frequency is between 50 and 300 Hz. • Intake air temperature is –10°C (14°F) or more. • Atmospheric pressure is 76 kPa (11 psi) or more. • Closed throttle position switch: OFF • Under the closed loop air-fuel ratio control. • Monitoring time: 140 sec. Judgement Criteria • Fault in the oxygen sensor (rear) signal and oxygen sensor (front) signal.		• Catalytic converter deteriorated. • Heated oxygen sensor failed • Engine control module failed. (Refer to P.13A-135.)

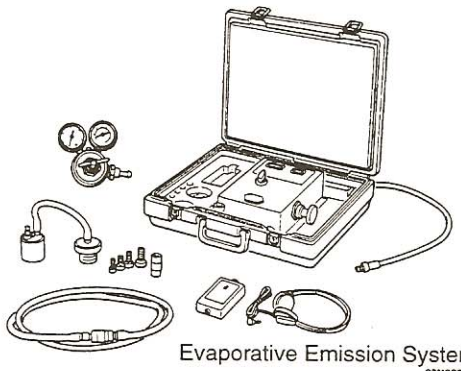
TSB Revision

DTC No.	Title	Probable causes
P0421	Warm Up Catalyst Efficiency Below Threshold (Bank 1) <California>	
Background • The signal from the heated oxygen sensor which follows the catalytic converter differs from that which precedes the catalytic converter. That is because the catalytic converter purifies exhaust gas. When the catalytic converter has deteriorated, the signal from the heated oxygen sensor which follows the catalytic converter becomes similar to that which precedes the catalytic converter. • The engine control module checks the outputs of the heated oxygen sensor signals. Check Area • Engine speed is higher then 3000 r/min. • Volume air flow sensor output frequency is between 50 and 300 Hz. • Closed throttle position switch: OFF • Under the closed loop air-fuel ratio control. • Monitoring time: 140 sec. Judgement Criteria • Fault in the oxygen sensor (rear) signal and oxygen sensor (front) signal.		• Catalytic converter deteriorated. • Heated oxygen sensor failed • Engine control module failed. (Refer to P.13A-136.)

DTC No.	Title	Probable causes
P0431	Warm Up Catalyst Efficiency Below Threshold (Bank 2) <California>	
Background • The signal from the heated oxygen sensor which follows the catalytic converter differs from that which precedes the catalytic converter. That is because the catalytic converter purifies exhaust gas. When the catalytic converter has deteriorated, the signal from the heated oxygen sensor which follows the catalytic converter becomes similar to that which precedes the catalytic converter. • The engine control module checks the outputs of the heated oxygen sensor signals. Check Area • Engine speed is higher then 3000 r/min. • Volume air flow sensor output frequency is between 50 and 300 Hz. • Closed throttle position switch: OFF • Under the closed loop air-fuel ratio control. • Monitoring time: 140 sec. Judgement Criteria • Fault in the oxygen sensor (rear) signal and oxygen sensor (front) signal.		• Catalytic converter deteriorated. • Heated oxygen sensor failed • Engine control module failed. (Refer to P.13A-136.)

TSB Revision

DTC No.	Title	Probable causes
P0442	**Evaporative Emission Control System Leak Detected**	
Background • The engine control module turns the evaporative emission ventilation solenoid on in order to shut off the outside air port of the evaporative emission canister. Next, the evaporative emission purge solenoid is driven at the specified duty (approximately 25%) to generate a negative pressure in the fuel tank and purge line, etc. When a negative pressure is generated in the fuel tank and purge line, etc., the evaporative emission purge solenoid turns off and the fuel tank and purge line, etc. are sealed. After they are sealed, monitoring of pressure differences inside the fuel tank starts, and if there is a large drop in pressure over a given time (if the negative pressure is leaking out into the atmosphere and the pressure has approached barometric pressure), the engine control module judges that there is a leak in the fuel tank, purge line or vapor line. Furthermore, if the fuel tank internal pressure does not drop even if the evaporative emission purge solenoid is driven while the outside air port of the canister is shut off (because of a blockage in the purge line or because the fuel tank filler tube cap has not been tightened correctly), the engine control module judges that there is a problem with the system and the check engine/malfunction indicator lamp illuminates. Check Area • Engine coolant temperature is higher than 60°C (140°F). • Engine speed is between 1600 and 3500 r/min. • Power steering fluid pressure switch: OFF • Atmospheric pressure is 76 kPa (11 psi) or more. • Volumetric efficiency is 20 – 80 %. • Intake air temperature is –10°C (14°F) or more. • The pressure increase when the evaporative emission purge solenoid and evaporative emission ventilation solenoid are closed is 50 mmAg or less. • The pressure fluctuation is 68 mmAg or less. • Monitoring time: 50 – 100 sec. Judgement Criteria • Internal pressure of the fuel tank has changed more than 100 mmAg in 20 sec. after the tank and vapor line were closed.	• Improper tightening of the fuel tank filler tube cap. • Fuel vent valve failed. • Purge line or vapor line clogged. • Fuel tank, purge line or vapor line seal failed. • Evaporative emission purge solenoid No.1 failed. • Evaporative emission purge solenoid No.2 failed. • Evaporative emission ventilation solenoid failed. • Fuel tank differential pressure sensor failed. • Engine coolant temperature sensor failed • Intake air temperature sensor failed • Power steering pressure switch failed • Use of incorrect fuel (contaminated with water, kerosene, alcohol, etc.) (Refer to P.13A-141.) • Improper relief pressure of fuel tank filler tube cap. • Defective seal of evaporative emission canister. • Evaporative emission canister clogged.



Evaporative Emission System Tester
03M0060

DTC No.	Title	Probable causes
P0443	**Evaporative Emission Control System Purge Control Valve Circuit Malfunction**	
Background • The engine control module checks whether current flows in the evaporative emission purge solenoid drive circuit when the solenoid is driven. Check Area • Battery voltage is higher than 10 V. Judgement Criteria • Solenoid coil surge voltage (system voltage + 2 V) is not detected when the EVAP purge solenoid is turned on/off.	• Evaporative emission purge solenoid failed. • Open or shorted evaporative emission purge solenoid circuit, or loose connector. • Engine control module failed. (Refer to P.13A-122.)

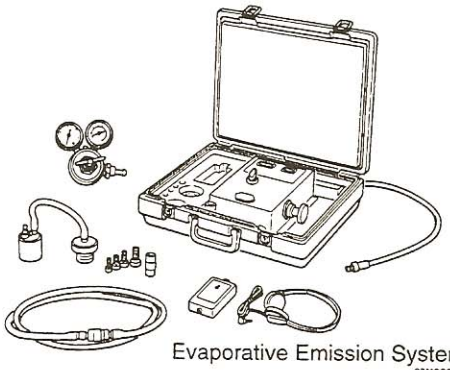
TSB Revision

DTC No.	Title	Probable causes
P0446	Evaporative Emission Control System Vent Control Malfunction <California>	
Background • The engine control module checks current flows in the evaporative emission vent solenoid drive circuit when the solenoid is ON and OFF. Check Area • Battery voltage is higher than 10 V. Judgement Criteria • Solenoid coil surge voltage (system voltage + 2 V) is not detected when the EVAP emission vent solenoid is turned on/off.		• Evaporative emission vent solenoid failed. • Open or shorted evaporative emission vent solenoid circuit, or loose connector. • Engine control module failed. (Refer to P.13A-124.)

DTC No.	Title	Probable causes
P0450	Evaporative Emission Control System Pressure Sensor Malfunction <California>	
Background • The fuel tank differential pressure sensor outputs the voltage in proportion to the pressure (differential pressure against the barometric pressure) in the fuel tank. • The engine control module checks whether the output voltage of the fuel tank differential pressure sensor is within the specified range. Check Area • Engine speed is higher than 1500 r/min. • Volumetric efficiency is 25 – 80 %. Judgement Criteria • The sensor output voltage has continued to be not lower than 4.5 V even though the intake air temperature is 5° – 45°C (41° – 113°F) and the purge solenoid has been driven at 100% duty. or • The sensor output voltage has been not higher than 0.5 V for 10 seconds even though the intake air temperature has been 5°C (41°F) or more and the purge solenoid has been turned off. Check Area • A voltage fluctuation of 0.2 V or more has occurred 20 times or more. • Idle switch: ON Judgement Criteria • Voltage fluctuation (0.2 V or more) has occurred 20 times or more each time the engine is run at idle, and this occurs repeatedly for 15 idling operations or more.		• Fuel tank differential pressure sensor failed. • Open or shorted fuel tank differential pressure sensor circuit, or loose connector. • Engine control module failed. • Fuel vent valve or fuel vapor line blocked (Refer to P.13A-128.)

TSB Revision

DTC No.	Title	Probable causes
P0455	Evaporative Emission Control System Leak Detected	
Background • The engine control module turns the evaporative emission ventilation solenoid on in order to shut off the outside air port of the evaporative emission canister. Next, the evaporative emission purge solenoid is driven at the specified duty (approximately 25%) to generate a negative pressure in the fuel tank and purge line, etc. When a negative pressure is generated in the fuel tank and purge line, etc., the evaporative emission purge solenoid turns off and the fuel tank and purge line, etc. are sealed. After they are sealed, monitoring of pressure differences inside the fuel tank starts, and if there is a large drop in pressure over a given time (if the negative pressure is leaking out into the atmosphere and the pressure has approached barometric pressure), the engine control module judges that there is a leak in the fuel tank, purge line or vapor line. Furthermore, if the fuel tank internal pressure does not drop even if the evaporative emission purge solenoid is driven while the outside air port of the canister is shut off (because of a blockage in the purge line or because the fuel tank filler tube cap has not been tightened correctly), the engine control module judges that there is a problem with the system and the check engine/malfunction indicator lamp illuminates. Check Area • Engine coolant temperature is higher than 60°C (140°F). • Engine speed is between 1600 and 3500 r/min. • Power steering fluid pressure switch: OFF • Atmospheric pressure is 76 kPa (11 psi) or more. • Volumetric efficiency is 20 – 80 %. • Intake air temperature is –10°C (14°F) or more. • The pressure increase when the evaporative emission purge solenoid and evaporative emission ventilation solenoid are closed is 50 mmAg or less. • The pressure fluctuation is 68 mmAg or less. • Monitoring time: 50 – 100 sec. Judgement Criteria • Internal pressure of the fuel tank has changed more than 100 mmAg in 20 sec. after the tank and vapor line were closed.		• Improper tightening of the fuel tank filler tube cap. • Fuel vent valve failed. • Purge line or vapor line clogged. • Fuel tank, purge line or vapor line seal failed. • Evaporative emission purge solenoid No.1 failed. • Evaporative emission purge solenoid No.2 failed. • Evaporative emission ventilation solenoid failed. • Fuel tank differential pressure sensor failed. • Engine coolant temperature sensor failed • Intake air temperature sensor failed • Power steering pressure switch failed • Use of incorrect fuel (contaminated with water, kerosene, alcohol, etc.) (Refer to P.13A-141.) • Improper relief pressure of fuel tank filler tube cap. • Defective seal of evaporative emission canister. • Evaporative emission canister clogged.



Evaporative Emission System Tester
03M0060

DTC No.	Title	Probable causes
P0500	Vehicle Speed Sensor Malfunction	
Background • The vehicle speed sensor outputs a pulse signal while the vehicle is driven. • The engine control module checks whether the pulse signal is output. Check Area • Closed throttle position switch: OFF • Engine speed is higher than 3000 r/min. • Volumetric efficiency is 70 % or more. Judgement Criteria • Sensor output voltage has not changed (no pulse signal is input) for 4 sec.		• Vehicle speed sensor failed. • Open or shorted vehicle speed sensor circuit, or loose connector. • Engine control module failed. (Refer to P.13A-91.)

TSB Revision

DTC No.	Title	Probable causes
P0505	Idle Control System Malfunction	
Background • If there is a malfunction of the IAC system, the actual engine speed will not be identical to the target engine speed. • The engine control module checks the difference between the actual engine speed and the target engine speed. Check Area • Under the closed loop idle speed control. Judgement Criteria • Actual idle speed has continued to be higher than the target idle speed by 300 r/min. or more for 10 sec. Check Area • During idle speed closed loop control • The highest temperature at the last drive is 45°C (114°F) or more. • Long-term fuel trim is –8% to +8%. • Engine coolant temperature is approx. 80°C (176°F) or more. • Battery voltage is 10 V or more. • Atmospheric pressure is 76 kPa (11 psi) or more. • Intake air temperature is –10°C (14°F) or more. Judgment Criteria • Actual idle speed has been minimum 200 r/min. higher than the target idle speed for 10 sec. Check Area • During idle speed closed loop control • Power steering switch is off. • Volumetric efficiency is 40 % or less. • Atmospheric pressure is 76 kPa (11 psi) or more. • Intake air temperature is –10°C (14°F) or more. Judgment Criteria • Actual idle speed has been minimum 100 r/min. lower than the target idle speed for 10 sec.		• Idle air control motor failed. • Open or shorted idle air control motor circuit, or loose connector. • Engine control module failed. (Refer to P.13A-111.)

DTC No.	Title	Probable causes
P0510	Closed Throttle Position Switch Malfunction	
Background • While the engine is idling without pressing the accelerator pedal, "ON" signal can be input from the closed throttle position switch to the engine control module. • The engine control module is used for checking the input signal during the engine idling. Check Area • Throttle position sensor output voltage is 2.0 V or more. Judgment Criteria • Closed throttle position switch has been turned on. Check Area • Repeat the *1 drive and *2 stop 15 times or more. *1 drive: Engine speed is 1500 r/min. or more, volume air flow sensor output frequency is more 100 Hz for 2 seconds or more. *2 stop: Engine speed is 800 r/min. or less. Judgment Criteria • Closed throttle position switch remains off.		• Closed throttle position switch failed. • Open or shorted closed throttle position switch circuit, or loose connector. • Engine control module failed. (Refer to P.13A-79.)

TSB Revision

DTC No.	Title	Probable cause
P0551	**Power Steering Pressure Sensor Circuit Range/Performance**	
Background • The steering wheel will be set to the straight-ahead position for a while during driving. At that time the power steering pressure switch will be turned off. • The engine control module checks whether the power steering pressure switch is turned off during drive. Check Area • Engine coolant temperature is 10°C (50°F) or more. • Repeat *1 drive and *2 stop 10 times or more. *1: Engine speed is 2500 r/min. or more, volumetric efficiency is more than 55 % for 2 seconds or more. *2: Engine speed is 800 r/min. or less. Judgment Criteria • Power steering pressure switch remains on.		• Power steering pressure switch failed. • Open or shorted power steering pressure switch circuit, or loose connector • Engine control module failed. (Refer to P.13A-93.)

DTC No.	Title	Probable causes
P0705	**Transmission Range Sensor Circuit Malfunction (RPNDL Input)**	
Background • When a malfunction of the park/neutral position switch is detected, the transmission control module outputs a malfunction signal to the engine control module. Check Area, Judgement Criteria • Park/Neutral position switch fail signal is input to the engine control module from the transmission control module.		• Park/neutral position switch failed. • Open or shorted park/neutral position switch circuit, or loose connector. • Engine control module failed. (Refer to P.13A-89.)

TSB Revision

DTC No.	Title	Probable causes
P1400	Manifold Differential Pressure Sensor Circuit Malfunction <Federal>	• Manifold differential pressure sensor failed. • Open or shorted manifold differential pressure sensor circuit, or loose connector. • Engine control module failed. (Refer to P.13A-97.)

Background
- The manifold differential pressure sensor outputs a voltage which corresponds to the negative pressure in the intake manifold.
- The engine control module checks whether the voltage output by the manifold differential pressure sensor is within a specified range.

Check Area
- 8 min. or more have passed after the engine was started. However, only when the engine coolant temperature at starting the engine is 0°C (32°F) or less.
- Engine coolant temperature is 45°C (113°F) or more.
- Intake air temperature is 5°C (41°F) or more.
- Atmospheric pressure is 76 kPa (11 psi) or more.
- Volumetric efficiency is 30 – 55 %.

Judgement Criteria
- Sensor output voltage has continued to be 4.6 V [corresponding to an absolute pressure of 118 kPa (17 psi)] or higher for 4 sec.

or
- Sensor output voltage has continued to be 0.1 V [corresponding to an absolute pressure of 2.4 kPa (0.3 psi)] or lower for 4 sec.

Check Area
- 8 min. or more have passed after the engine was started. However, only when the engine coolant temperature at starting the engine is 0°C (32°F) or less.
- Engine coolant temperature is 45°C (113°F) or more.
- Intake air temperature is 5°C (41°F) or more.
- Atmospheric pressure is 76 kPa (11 psi) or more.
- Volumetric efficiency is 30 % or less.

Judgement Criteria
- Sensor output voltage has continued to be 4.2 V [corresponding to an absolute pressure of 108 kPa (16 psi)] or higher for 4 sec.

Check Area
- 8 min. or more have passed after the engine was started. However, only when the engine coolant temperature at starting the engine is 0°C (32°F) or less.
- Engine coolant temperature is 45°C (113°F) or more.
- Intake air temperature is 5°C (41°F) or more.
- Atmospheric pressure is 76 kPa (11 psi) or more.
- Volumetric efficiency is 70 % or more.

Judgement Criteria
- Sensor output voltage has continued to be 1.8 V [corresponding to an absolute pressure of 46 kPa (6.7 psi)] or lower for 4 sec.

DTC No.	Title	Probable cause
P1600	Serial Communication Link Malfunction (with 4 A/T)	• Automatic transmission control system failed. • Open or short circuit, or loose connector in communication line between engine control module and transmission control module. • Transmission control module failed. • Engine control module failed. (Refer to P.13A-144.)

Background
- The engine control module receives various messages from the transmission control module via communication line.
- The engine control module monitors a defective message signal due to open circuit in communication line and transmission control module failure.

Check Area
- 2 seconds or more have passed immediately after the engine started.

Judgement Criteria
- Defective communication line (TCM to ECM) with the transmission control module (TCM).
- Transmission control module (TCM) failed.

TSB Revision

DTC No.	Title	Probable causes
P1715	PG Assembly Malfunction	
Background • The transmission control module monitors the pulse signals of the input shaft speed sensor and output shaft speed sensor. • When the input shaft speed sensor and/or output shaft speed sensor are failed, the transmission control module inputs the input shaft speed sensor and/or output shaft speed sensor failed signal to the engine control module. Check Area, Judgement Criteria • Input shaft speed sensor and/or output shaft speed sensor fail signal is input to the engine control module from the transmission control module.		• Input shaft speed sensor. • Output shaft speed sensor. • Engine control module failed. (Refer to P.13A-141.)

DTC No.	Title	Probable causes
P1750	Solenoid Assembly Malfunction	
Background • The transmission control module monitors the torque converter clutch solenoid, shift control solenoid. • When some one of these solenoids failed, the transmission control module inputs these failed signals to the engine control module. Check Area, Judgement Criteria • Torque converter clutch solenoid, shift control solenoid or fail signal is input to the engine control module from the transmission control module.		• Torque converter clutch solenoid failed. • Shift control solenoid failed. • Engine control module failed. (Refer to P.13A-145.)

DTC No.	Title	Probable cause
P1791	Engine Coolant Temperature Level Input Circuit (to TCM) Malfunction	
Background • The transmission control module uses the engine coolant temperature which is input from the engine control module to carry out shift control. • If no engine coolant temperature signal is input from the engine control module, the transmission control module sends a trouble code to the engine control module. Check Area, Judgement Criteria • Communication line trouble signal (engine coolant temperature signal is not being input from engine control module) is input from the transmission control module (TCM) to the engine control module (ECM).		• Open or short circuit, or loose connector communication line between engine control mod and transmission control module. • Transmission control module failed. • Engine control module failed. (Refer to P.13A-145.)

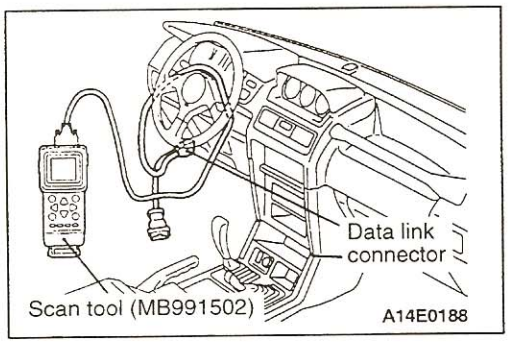
TSB Revision

FAIL-SAFE/BACKUP FUNCTION QUICK REFERENCE TABLE

13110080052

When the main sensor malfunctions are detected by the on-board diagnostic, the vehicle is controlled by means of the pre-set control logic to maintain safe conditions for driving.

Malfunctioning item	Control contents during malfunction
Volume air flow sensor	(1) Uses the throttle position sensor (TPS) signal and engine speed signal (crankshaft position sensor signal) to take readings of the basic injector drive time and basic ignition timing from the pre-set mapping. (2) Fixes the idle air control motor in the appointed position so idle air control is not performed.
Intake air temperature sensor	Controls the intake air temperature to 25°C (77°F).
Throttle position sensor (TPS)	No increase in fuel injection amount during acceleration due to the throttle position sensor signal.
Engine coolant temperature sensor	Controls the engine coolant temperature to 80°C (176°F). (This control will be continued until the ignition switch is turned to OFF even though the sensor signal returns to normal.)
Camshaft position sensor	Injects fuel simultaneously into all cylinders. (However, when the No. 1 cylinder top dead center is not detected at all after the ignition switch is turned to ON.)
Barometric pressure sensor	Controls the barometric pressure to 101 kPa (30 in.Hg).
Heated oxygen sensor (front)	Air/fuel ratio closed loop control is not performed.
Heated oxygen sensor (rear)	The air/fuel ratio closed loop control will be made by using only the signal of the heated oxygen sensor (front) which is located at the front of catalytic converter.
Misfire detection	The ECM stops supplying fuel to the cylinder with the highest misfiring rate if a misfiring that could damage the catalytic converter is detected.



READING OF DIAGNOSTIC TROUBLE CODES

13110090062

READINESS TEST STATUS

The ECM records whether a good or bad judgment has been made about the main diagnostic items given below after the completion of a previous monitoring operation. This record can be read using the scan tool. (When using the scan tool, the word "Complete" appears on the display if the judgment operation has been completed.)
Furthermore, this record is reset if the battery terminals are disconnected or if the DTC is erased.
If a readiness test status has been reset, you will need to drive the vehicle once or twice according to the OBD-II Drive Cycle for the relevant diagnostic item in order to set the status back to "Complete".

- Catalyst: P0420, P0421, P0431
- Evaporative system: P0442, P0455
- Heated oxygen sensor: P0130, P0136, P0150, P0156
- Heated oxygen sensor heater: P0135, P0141, P0155, P0161
- EGR system: P0400

TSB Revision

HOW TO READ AND ERASE DIAGNOSTIC TROUBLE CODES

Caution

1. **When battery positive voltage is low, no detection of failure is possible. Be sure to check the battery for voltage and other conditions before starting the test.**
2. **Diagnostic items are erased if the battery or the engine control module connector is disconnected. Do not disconnect the battery before the diagnostic result is completely read.**
3. **Be sure to connect or disconnect the scan tool with the ignition switch turned off. If the scan tool is disconnected while the ignition switch is at the ON position, an ABS diagnostic trouble code may be stored and the ABS warning lamp may thus illuminate.**

(1) Connect the scan tool to the data link connector.
(2) Turn the ignition switch to ON.
(3) Take a reading of the diagnostic output.
(4) Repair the problem location while referring to the diagnostic chart.
(5) After turning the ignition switch once to OFF, turn it back to ON.
(6) Erase the diagnostic trouble code.
(7) Check again that the condition is normal.

PROVISIONAL DTCs [MUT-II OBD-II Test Mode – Results (Mode 5)]

MUT-II will display the Provisional DTCs reported by ECM if the ECM detects some malfunction for "Misfire", "Fuel System" and "Comprehensive" monitoring during a SINGLE Driving Cycle.
The intended use of this data is to assist the technician after a vehicle repair, and after clearing diagnostic information, by reporting test result after a SINGLE Driving Cycle.
Note that the test results reported by this mode do not necessarily indicate a faulty component/system. If test results indicate a failure after ADDITIONAL (consecutive) driving, then the MIL will be illuminated and a DTC will set.

DIAGNOSTIC BY DIAGNOSTIC TEST MODE II (INCREASED SENSITIVITY)

When mode II is selected with MUT-II, the Check Engine/Malfunction Indicator Lamp will light when the ECM first detects the trouble. (Note that this is only for emission related trouble.) At the same time, the relevant diagnostic trouble codes will be registered.
In respect to the comprehensive component electrical faults (opens/shorts), the time for the DTC to be registered after the fault occurrence is shortened (4 sec. → 1 sec.)
With this, the confirmation of the trouble symptom and the confirmation after completing repairs can be reduced.
To return to the normal mode I after mode II has been selected once, the ignition switch must be turned OFF once or mode I must be reselected with the MUT-II. The DTC, readi test status and freeze frame data, etc., will be erased w mode I is returned to, so record these if necessary.

TSB Revision

(1) Using the scan tool, changeover the diagnostic test mode of the engine control module to DIAGNOSTIC TEST MODE II. (INCREASED SENSITIVITY)
(2) Road test the vehicle.
(3) Read the diagnostic trouble code in the same manner as "READ OUT OF DIAGNOSTIC TROUBLE CODE" and repair the malfunctioning part.
(4) Turn OFF the ignition switch to change the ECM from the diagnostic test mode II to the diagnostic test mode I.

NOTE
Turning OFF the ignition switch will cause the ECM to changeover from the diagnostic test mode II to diagnostic test mode I.

CHECK CHART CLASSIFIED BY PROBLEM SYMPTOMS

13110100062

Items	Starting Will not start	Starting Fires up and dies, Hard starting	Idling stability Idling instability (rough idling)	Idling stability Incorrect idle speed	Idling stability Engine stall	Reference page
Power supply (MFI relay) and ignition switch-IG	1 (1)					13A-57
Engine control module power ground	2 (2)					13A-59
Fuel pump	3 (3)	1 (1)			1 (1)	13A-60
Volume air flow sensor					11 (10)	13A-63
Intake air temperature sensor			5			13A-68
Barometric pressure sensor			7			13A-71
Engine coolant temperature sensor		(3)	6 (5)	1 (1)	5 (5)	13A-73
Throttle position sensor						13A-76
Closed throttle position switch			3 (3)	2 (2)	4 (4)	13A-79
Camshaft position sensor	5 (5)	6 (7)			8 (7)	13A-82
Crankshaft position sensor	6 (6)	7 (8)			9 (8)	13A-86
Ignition switch-ST and Park/Neutral position switch	4 (4)	3 (4)		5		13A-89
Vehicle speed sensor					6	13A-91
Power steering pressure switch				3		13A-93
Air conditioning switch and compressor clutch relay				4		13A-95
Heated oxygen sensor			9			<Federal> 13A-99 <California> 13A-103
Injectors	8 (8)	2 (2)	2 (2)		3 (3)	13A-105
Idle air control motor (stepper motor)		4 (5)	1 (1)	6 (3)	2 (2)	13A-111
Ignition coil and ignition power transistor	7 (7)				10 (9)	13A-116
Evaporative emission purge solenoid			8			13A-122
EGR solenoid						13A-126
Fuel pressure		5 (6)	4 (4)		7 (6)	13A-147

NOTE
The numbers in the chart indicate check order [( ): cold engine, without ( ): warm engine].

TSB Revision

Items	Driving	Driving	Driving	Driving	Driving	Driving	Stopping	Reference page
	Hesitation, Sag	Poor acceleration	Stumble	Shock	Surge	Knocking	Run-on (dieseling)	
Power supply (MFI relay) and ignition switch-IG								13A-57
Engine control module power ground								13A-59
Fuel pump	1 (1)	1 (1)						13A-60
Volume air flow sensor	9 (9)		5 (5)	5 (5)		3 (3)		13A-63
Intake air temperature sensor	5 (5)	4 (4)				1 (1)		13A-68
Barometric pressure sensor	8 (8)	6 (6)				2 (2)		13A-71
Engine coolant temperature sensor	7 (7)	5 (5)	4 (4)		3 (3)			13A-73
Throttle position sensor	6 (6)		3 (3)	4 (4)				13A-76
Closed throttle position switch								13A-79
Camshaft position sensor				2 (2)				13A-82
Crankshaft position sensor				3 (3)				13A-86
Ignition switch-ST and Park/Neutral position switch								13A-89
Vehicle speed sensor				6				13A-91
Power steering pressure switch								13A-93
Air conditioning switch and compressor clutch relay								13A-95
Heated oxygen sensor								<Federal> 13A-99 <California> 13A-103
Injectors	2 (2)	2 (2)	1 (1)		1 (1)		1	13A-105
Idle air control motor (stepper motor)				7 (6)				13A-111
Ignition coil and ignition power transistor		7 (7)		1 (1)		4 (4)		13A-116
Evaporative emission purge solenoid								13A-122
EGR solenoid	4 (4)		6 (6)		4 (4)			*1 13A-126
Fuel pressure	3 (3)	3 (3)	2 (2)		2 (2)			13A-147

NOTE
The numbers in the chart indicate check order [( ): cold engine, without ( ): warm engine].

TSB Revision

PROBLEM SYMPTOMS TABLE (FOR YOUR INFORMATION)

13110110010

Item		Symptom
Starting	Won't start (no initial combustion)	The starter is used to crank the engine, but there is no combustion within the cylinders, and the engine won't start.
	Fires up and dies	There is combustion within the cylinders, but then the engine soon stalls.
	Hard starting	Engine starts after cranking
Iding stability	Hunting	Engine speed doesn't remain constant; changes at idling.
	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 idling.
	Incorrect idle speed	The engine doesn't idle at the correct speed.
	Engine stall (Die out)	This non-continuity in idling includes the following elements. The engine stalls when the foot is taken from the accelerator pedal, regardless of whether the vehicle is moving or not.
	Engine stall (Pass out)	This non-continuity in idling includes the following elements. The engine stalls when the accelerator pedal is depressed or while it is being used.
Driving	Hesitation and sag	"Hesitation" is the delay in response of the vehicle speed (engine rpm) 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 rpm) during such acceleration. Serious hesitation is called "sag." (Refer to Fig.1.)
	Poor acceleration	The inability to obtain an acceleration corresponding to the degree of throt opening, even though acceleration is smooth, or the inability to reach maximu speed.
	Stumble	Engine rpm increase is delayed when the accelerator pedal is initially depressed for acceleration from the stopped condition. (Refer to Fig.2.)
	Shock	The feeling of a comparatively large impact or vibration when the engine is accelerated or decelerated.
	Surge	This is slight acceleration and deceleration feel usually at steady, light throttle cruise must notable under light loads.
	Knocking	A sharp sound like a hammer striking the cylinder walls during driving and which adversely affects driving.
Stopping	Run-on (Dieseling)	The engine continues to run even after the ignition switch is turned OFF. This is called dieseling.

Fig.1

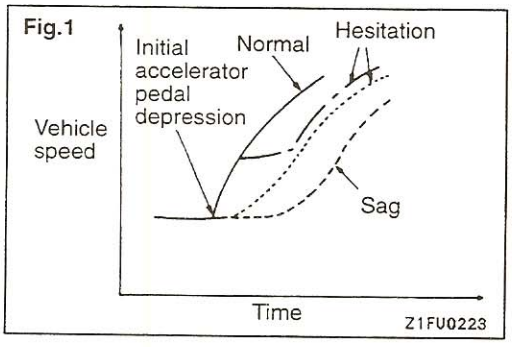
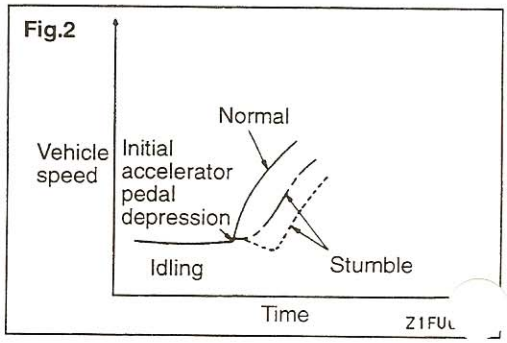


Fig.2



TSB Revision

ON-VEHICLE SERVICE

13100180454

BASIC IDLE SPEED ADJUSTMENT

NOTE
(1) The standard idling speed has been adjusted, by the speed adjusting screw (SAS), by the manufacturer, and there should usually be no need for readjustment.
(2) If the adjustment has been changed by mistake, the idle speed may become too high or the idle speed may drop too low when loads from components such as the A/C are placed on the engine. If this occurs, adjust by the following procedure.
(3) The adjustment, if made, should be made after first confirming that the spark plugs, the injectors, the idle air control motor, the compression pressure, etc., are all normal.

(1) The vehicle should be prepared as follows before the inspection and adjustment.
- Engine coolant temperature: 80 – 95°C (176 – 203°F)
- Lights and accessories: OFF
- Transmission: P range

(2) Connect the scan tool to the data link connector (16-pin).

NOTE
When the scan tool is connected, the diagnostic test mode control terminal should be grounded.

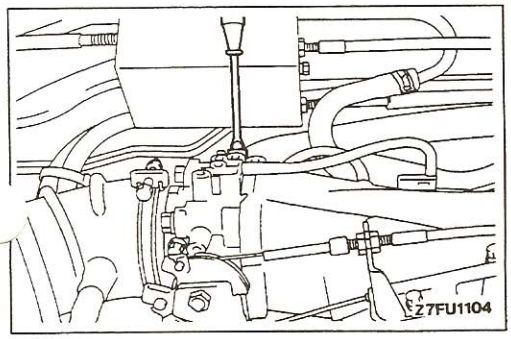
(3) Start the engine and run at idle.
(4) Select the item No.30 of the scan tool Actuator test.

NOTE
This holds the IAC motor at the basic step to adjust the basic idle speed.

(5) Check the idle speed.

Standard value: 700 ± 50 r/min

NOTE
(1) The engine speed may be 20 to 100 r/min lower than indicated above for a new vehicle [driven approximately 500 km (300 mile) or less], but no adjustment is necessary.
(2) If the engine stalls or the engine speed is low even though the vehicle has been driven approximately 500 km (300 mile) or more, it is probable that deposits are adhered to the throttle valve, so clean it. (Refer to P.13A-50.)



(6) If not within the standard value range, turn the speed adjusting screw (SAS) to make the necessary adjustment.

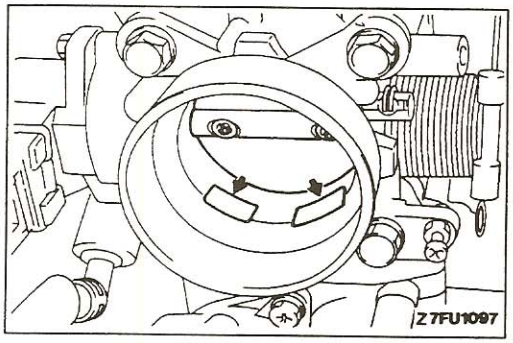
TSB Revision

NOTE
If the idling speed is higher than the standard value ra
even when the SAS is fully closed, check whethe.
not there is any indication that the fixed SAS has been moved. If there is an indication that it has been moved, adjust the fixed SAS.

(7) Press the scan tool clear key, and release the IAC motor Actuator test mode.

NOTE
Unless the IAC motor is released, the Actuator test mode will continue 27 minutes.

(8) Switch OFF the ignition switch.
(9) Disconnect the scan tool.
(10) Start the engine again and let it run at idle speed for about 10 minutes; check that the idling condition is normal.



THROTTLE BODY (THROTTLE VALVE AREA) CLEANING

13100100405

(1) Start the engine and warm it up until the temperature of the engine coolant reaches 80°C (176°F) or hig
then stop the engine.
(2) Disconnect the air intake hose at the throttle body side.
(3) Plug the bypass intake port inlet (arrow) into the throttle body.

Caution
Never let cleaning liquid get into the bypass intake.

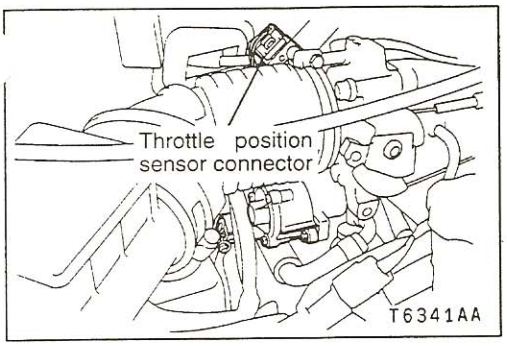
(4) Spray cleaning liquid from the intake port of the throttle body onto the valve, and then leave as is for about five minutes.
(5) Start the engine and race it a few times; then let it run at idle speed for about one minute.

NOTE
The engine idling speed is unstable (or the engine stalls), let the engine run with the throttle valve slightly open.

(6) If deposits are not removed from the throttle valve, repeat steps (4) and (5).
(7) Remove the plug from the bypass intake port inlet in the throttle body.
(8) Connect the air intake hose.
(9) Using the scan tool erase the diagnostic trouble code or disconnect the negative battery cable for more than 10 seconds and then connect it again.
(10) Adjust the basic idle speed. (Refer to P.13A-49.)

NOTE
If hunting of the idling engine occurs after adjustinc
basic idling speed, disconnect the negative battery cable from the battery terminal for more than 10 seconds, and then idle the engine again.

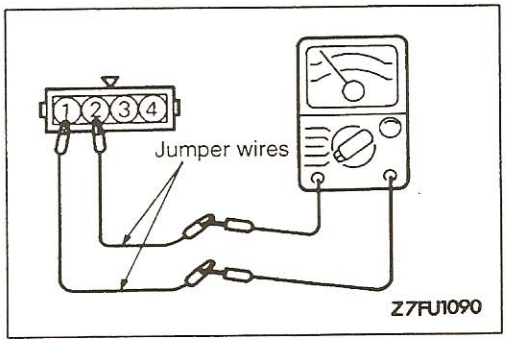
TSB Revision



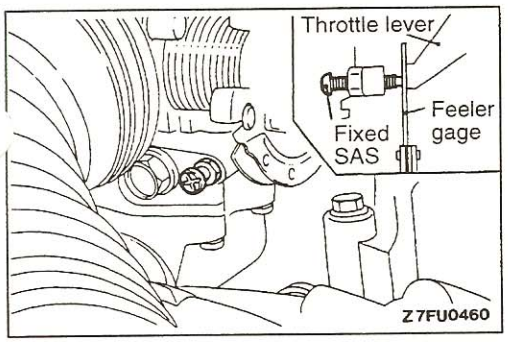
CLOSED THROTTLE POSITION SWITCH AND THROTTLE POSITION SENSOR ADJUSTMENT

13100130343

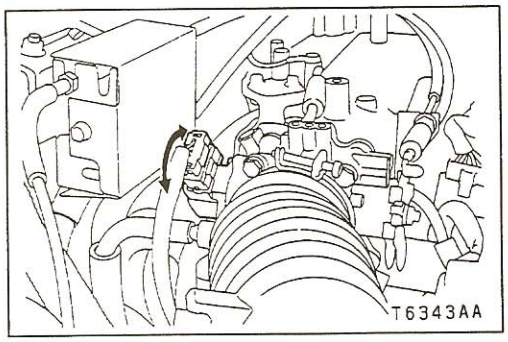
(1) Connect the scan tool to the data link connector. When not using the scan tool, proceed as follows.
   1) Disconnect the connector of the throttle position sensor.



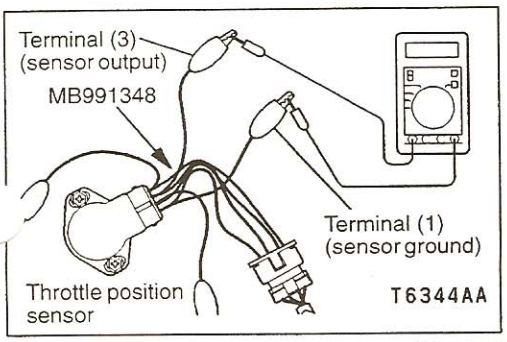
   2) Connect an ohmmeter between terminal 2 (closed throttle position switch) and 1 (sensor ground) by using jumper wires.



(2) Insert a feeler gage with a thickness of 0.65 mm (.0256 in.) between the fixed SAS and throttle lever.
(3) When using the scan tool, turn the ignition switch ON. (but do not start the engine.)



(4) Loosen the throttle position sensor mounting bolts and turn the throttle position sensor body fully clockwise.
(5) In this condition, make sure that the closed throttle position switch is ON. (There is continuity between terminals 1 and 2.)
(6) Slowly turn the throttle position sensor clockwise until the point at which the idle switch is turned off (continuity between terminals 1 and 2 changes to non-continuity) is found.
Tighten the throttle position sensor installation bolt at that position.

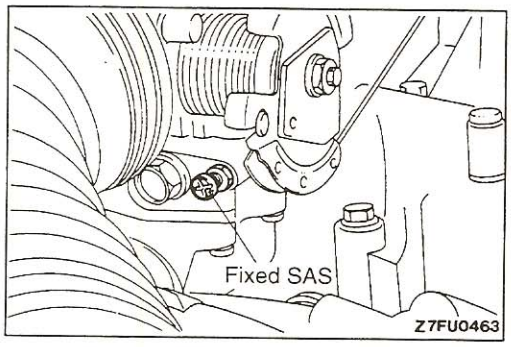


(7) When not using the scan tool, proceed as follows.
   1) Connect the special tool (test harness set) between the disconnected throttle position sensor connectors. (Connect all terminals, while being careful not to mistake the terminal numbers.)
   2) Connect a digital voltmeter between the throttle position sensor terminal 3 (sensor output) and terminal 1 (sensor ground.)
   3) Turn the ignition switch ON (but do not start the engine).
(8) Check the throttle position sensor output voltage.

TSB Revision

Standard value: 400–1,000 mV

(9) If the voltage is outside the standard value, check throttle position sensor and associated harnesses.
(10) Remove the feeler gage.
(11) Turn the ignition switch to OFF.



FIXED SAS ADJUSTMENT

13100150417

NOTE
1. The fixed SAS has been factory-adjusted. Never attempt to move it.
2. If the adjustment is incorrect, adjust by following the procedure given below.

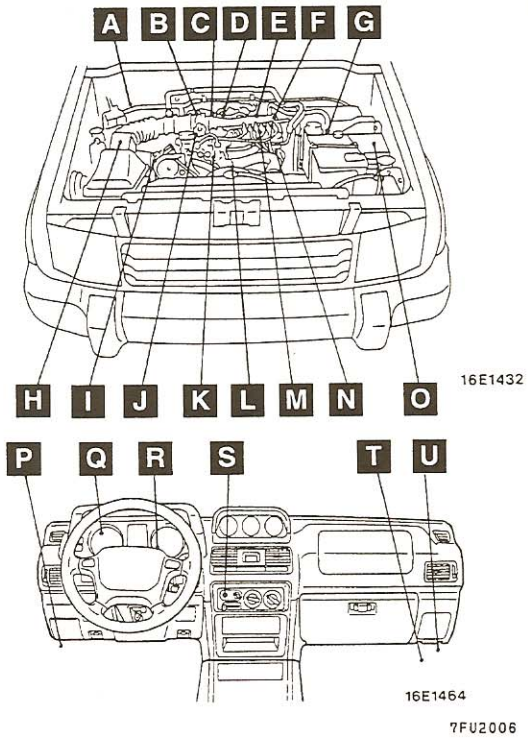
(1) Sufficiently slacken the accelerator cable.
(2) Loosen the lock nut on the fixed SAS.
(3) Sufficiently loosen the fixed SAS by turning it counterclockwise to fully close the throttle valve.
(4) Turn the fixed SAS clockwise slowly to find a point at which it contacts the throttle lever (where the throttle valve starts opening). From that point, tighten the fixed SAS further 1 1/4 turns.
(5) While holding the fixed SAS to prevent it from turni tighten the lock nut securely.
(6) Adjust the accelerator cable tension. (Refer to GROUP 17 – Auto-cruise Control System.)
(7) Adjust the basic idle speed.
(8) Adjust the closed throttle position switch and throttle position sensor (TPS). (Refer to P.13A-51.)

ON-VEHICLE INSPECTION OF MFI COMPONENTS

13110130139

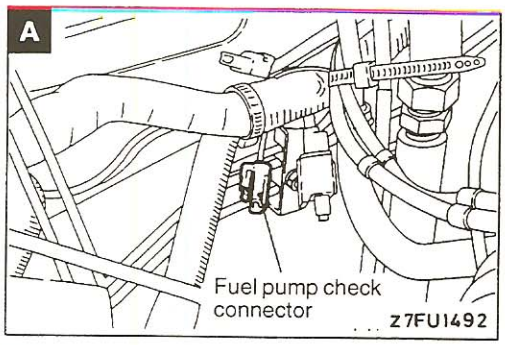
COMPONENT LOCATION

Name	Symbol	Name	Symbol
Air conditioning compressor clutch relay	O	Fuel tank differential pressure sensor	Y
Air conditioner switch	S	Heated oxygen sensor <Federal>	V
Camshaft position sensor	N	Heated oxygen sensor <California>	W
Check engine/malfunction indicator lamp	R	Idle air control motor	J
Crankshaft position sensor	L	Ignition coil (Ignition power transistor)	M
Data link connector	P	Injector	E
EGR solenoid	C	Manifold differential pressure sensor	F
Engine control module	T	Multiport fuel injection (MFI) relay/Fuel pump relay	U
Engine coolant temperature sensor	K	Park/Neutral position switch	X
Evaporative emission purge solenoid	D	Power steering pressure switch	I
		Throttle position sensor (with built-in closed throttle position switch)	B
Evaporative emission ventilation solenoid	G	Vehicle speed sensor	Q
Fuel pump check connector	A	Volume air flow sensor (with built-in intake air temperature sensor and barometric pressure sensor)	H

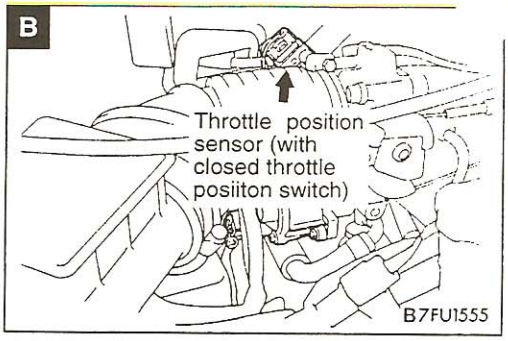


TSB Revision

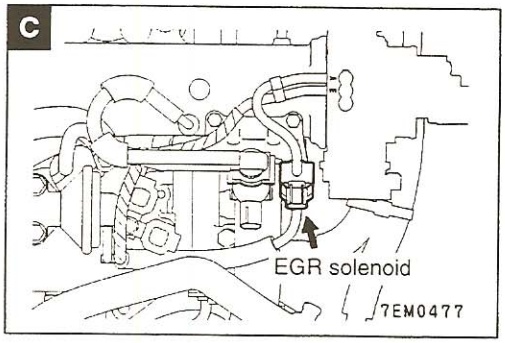
A



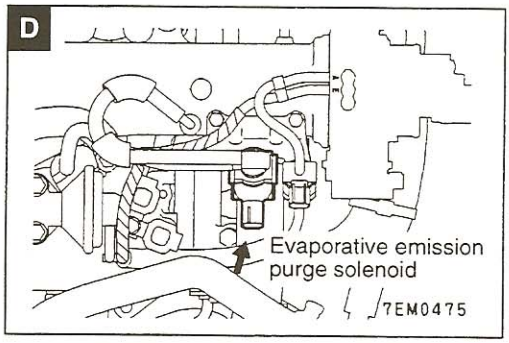
B



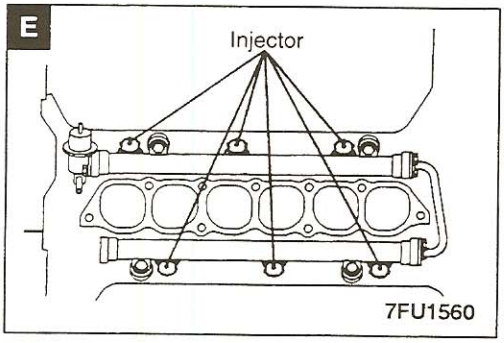
C



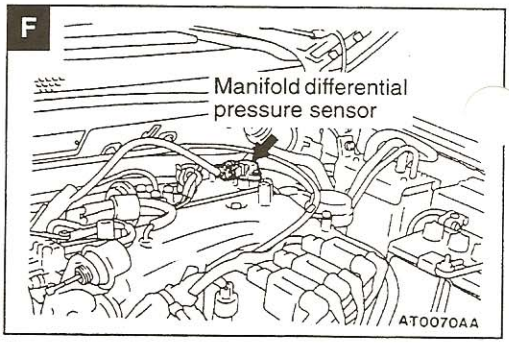
D



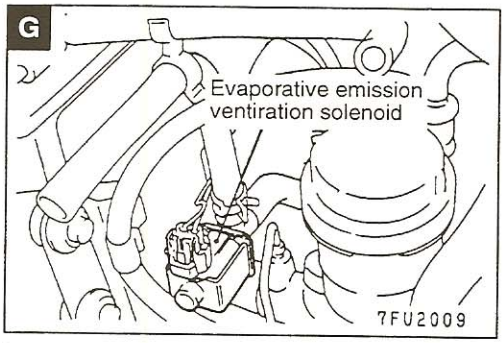
E



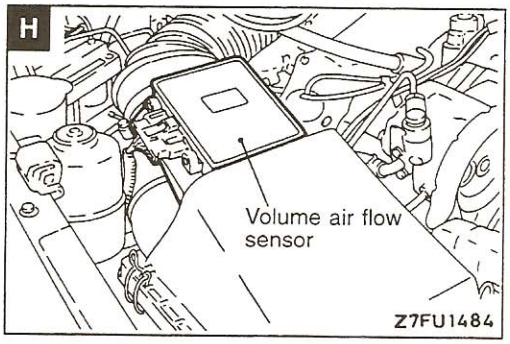
F



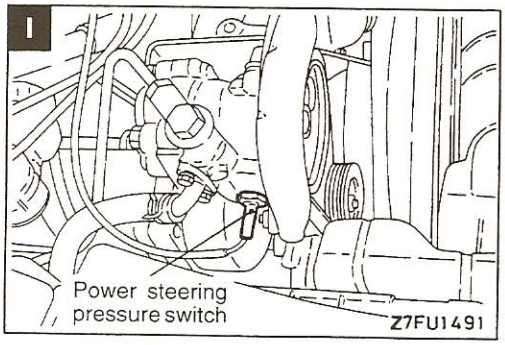
G



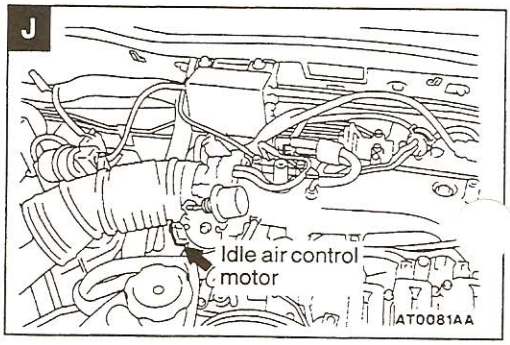
H



I

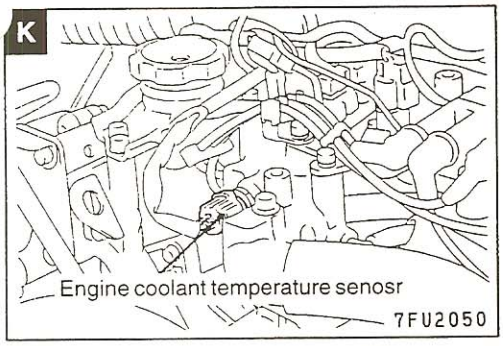


J

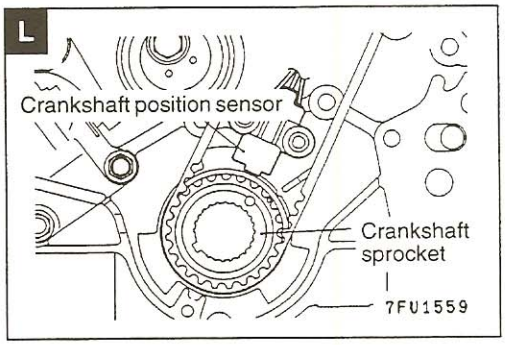


TSB Revision

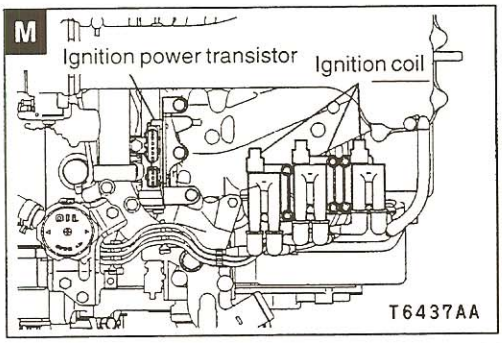
K



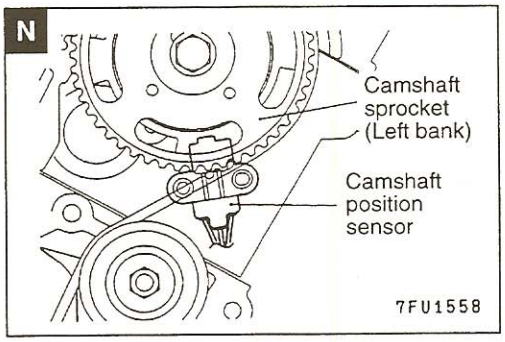
L



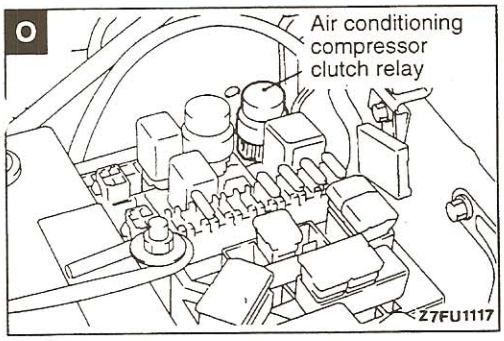
M



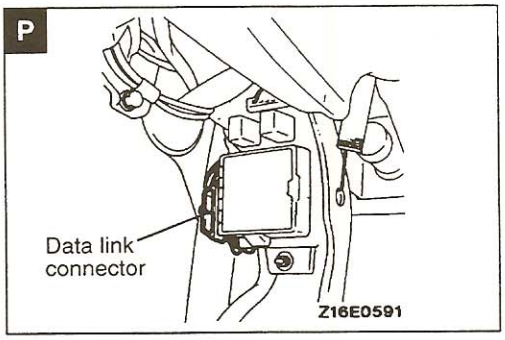
N



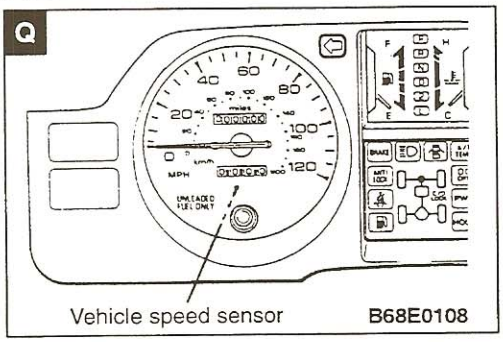
O



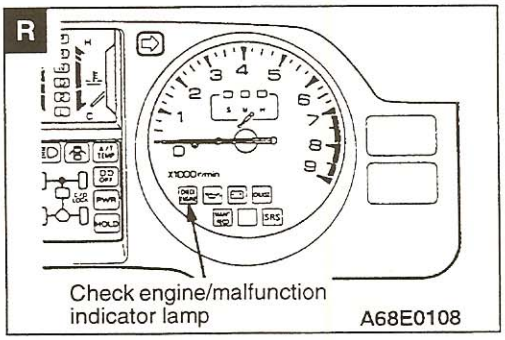
P



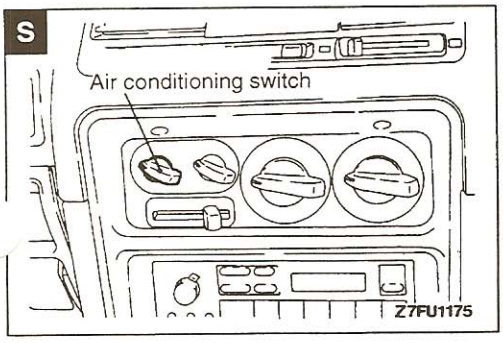
Q



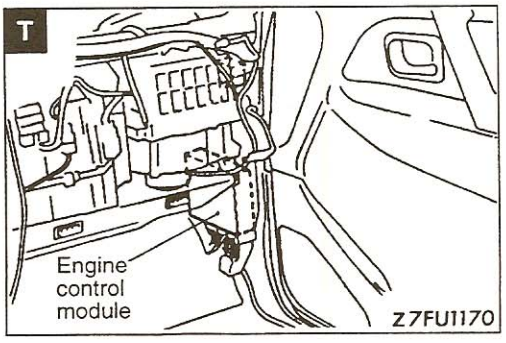
R



S

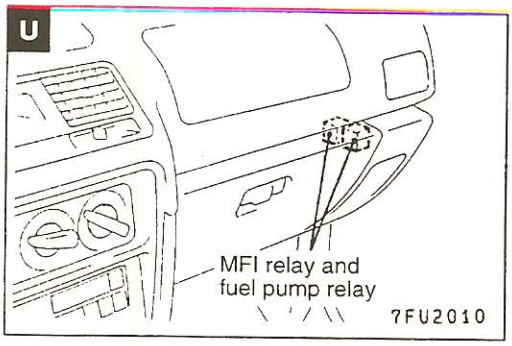


T

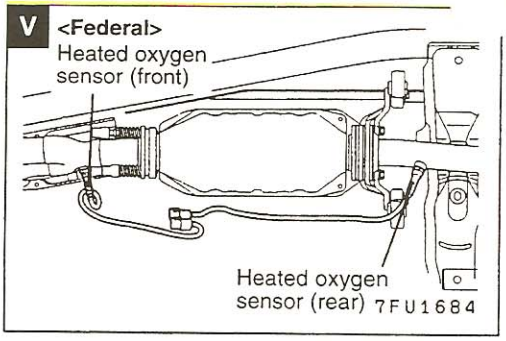


TSB Revision

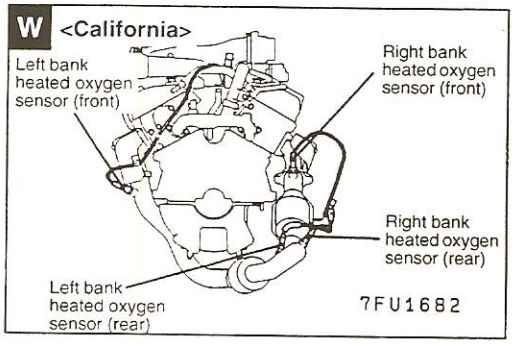
U



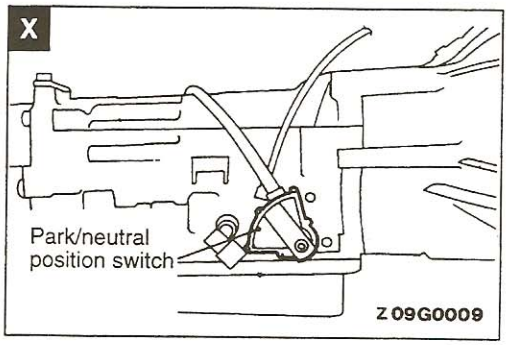
V <Federal>



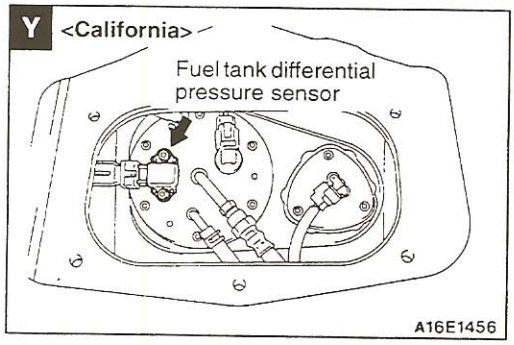
W <California>

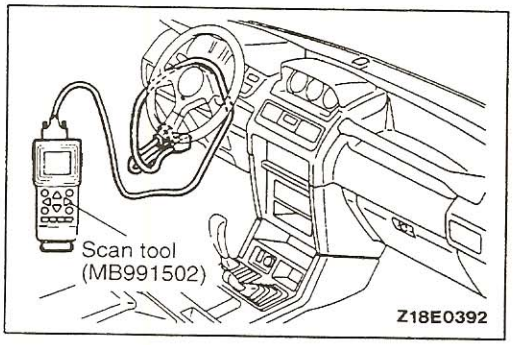


X



Y <California>





COMPONENT INSPECTION PROCEDURE

13110140033

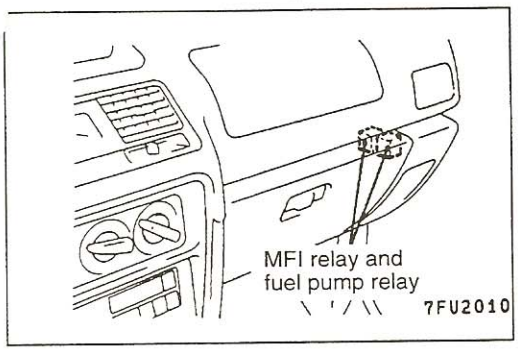
USING SCAN TOOL

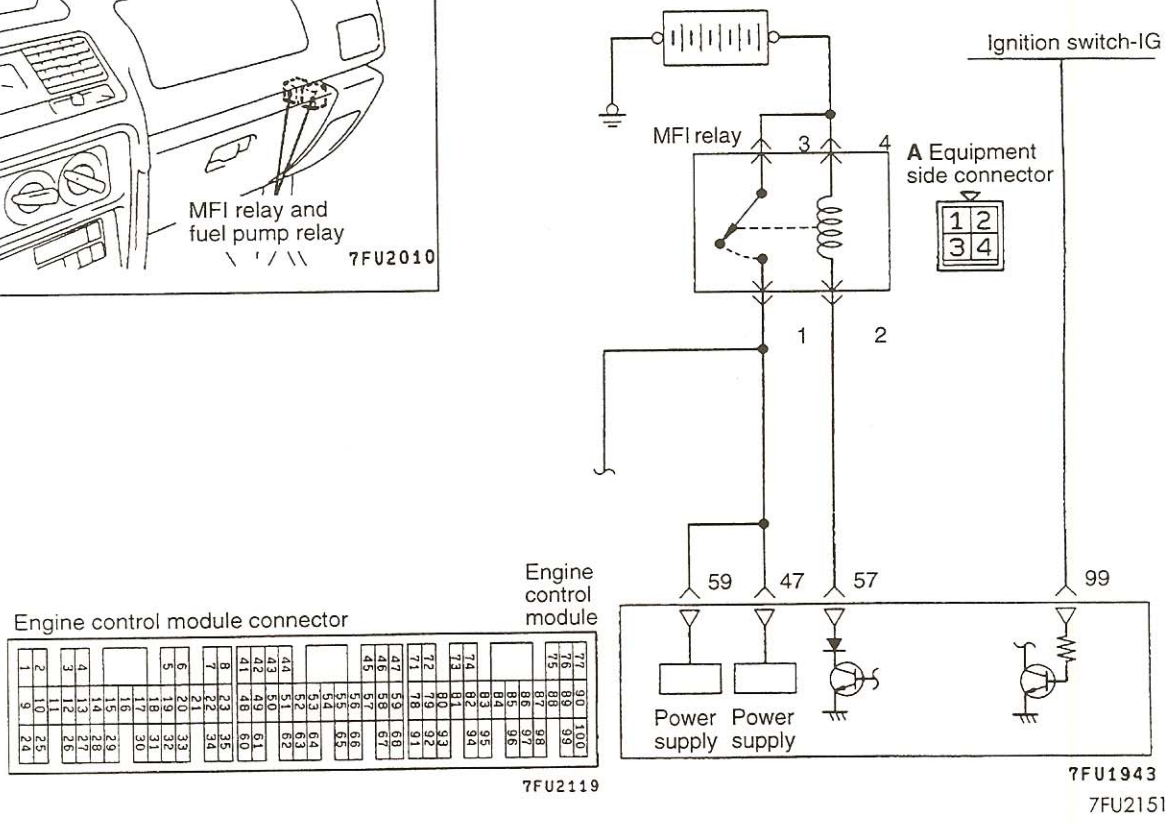
(1) Check by the data reading and actuator test function. If any abnormality is found, check the body harness, components, etc., and repair as necessary.
(2) After repairing, check again with the scan tool to make sure that the input and output signals are now normal.
(3) Erase the diagnostic trouble code.
(4) Disconnect the scan tool.
(5) Start the engine and perform running test, etc. to make sure that the troubles have been corrected.

TSB Revision

POWER SUPPLY (MFI RELAY) AND IGNITION SWITCH-IG

13110150111





OPERATION

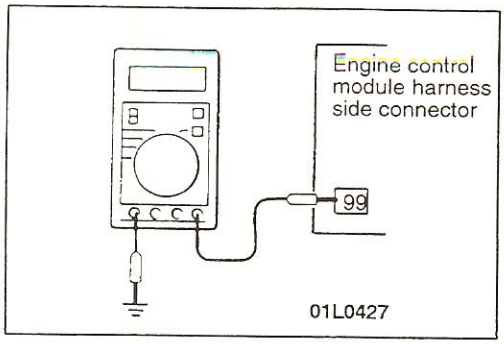
- While the ignition switch is ON, battery positive voltage is supplied to the engine control module, injectors, volume air flow sensor, etc.
- When the ignition switch is turned to the ON position, battery positive voltage is supplied from the ignition switch to the engine control module. When battery positive voltage is supplied to the engine control module, the power transistor is switched ON and current flows to the MFI relay coil.
- As a result, the MFI relay switch is switched ON, and power is supplied, by way of the MFI relay switch, from the battery to the engine control module.

INSPECTION

Using Scan Tool

Function	Item No.	Data display	Check conditions	Standard value V
Data reading	16	Engine control module power supply voltage	Ignition switch: ON	B+

TSB Revision



HARNESS INSPECTION

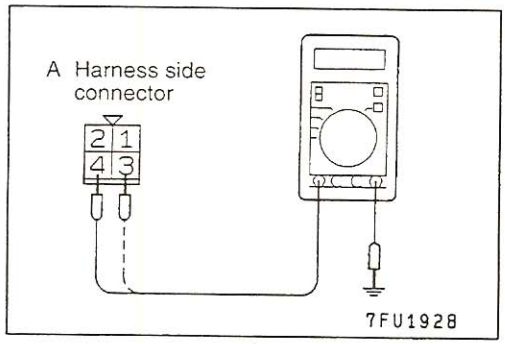
STEP 1. Measure the ignition switch-IG terminal input volt

- Engine control module connector: Disconnected

Voltage (V):
0 – 1 (Ignition switch: OFF)
Battery positive voltage (Ignition switch: ON)

OK: GO TO STEP 2

NG: Repair the harness. (99 – Ignition switch or inspect the ignition switch.)



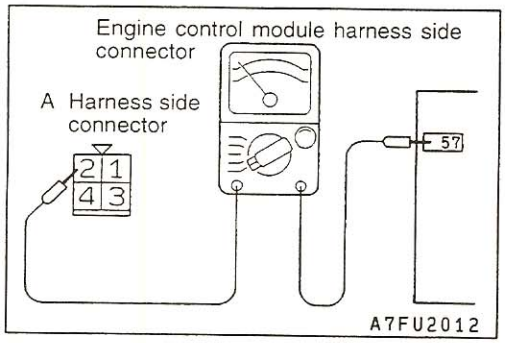
STEP 2. Measure the power supply voltage of the MFI relay.

- Ignition switch: OFF
- MFI relay connector: Disconnected

Voltage (V): Battery positive voltage

OK: GO TO STEP 3

NG: Repair the harness. (A3 – Battery, A4 – Battery)

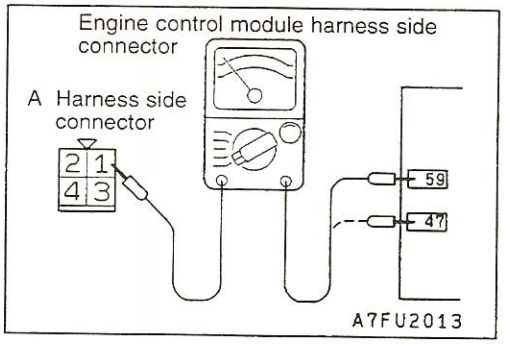


STEP 3. Check for an open circuit or a short-circuit to ground between the MFI relay and the engine control module.

- Engine control module connector: Disconnected
- MFI relay connector: Disconnected

OK: GO TO STEP 4

NG: Repair the harness. (A2 – 57)

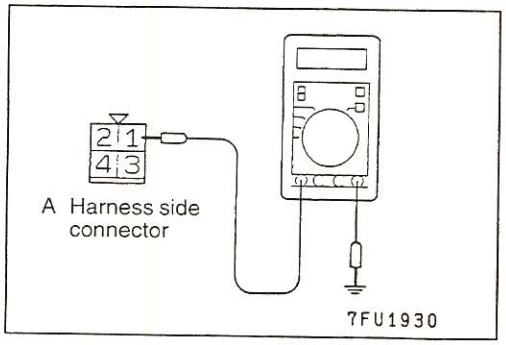


STEP 4. Check for an open circuit or a short-circuit to ground between the MFI relay and the engine control module.

- MFI relay connector: Disconnected
- Engine control module connector: Disconnected

OK: GO TO STEP 5

NG: Repair the harnesses. (A1 – 59, A1 – 47)



STEP 5. Measure the power supply voltage of the actuator.

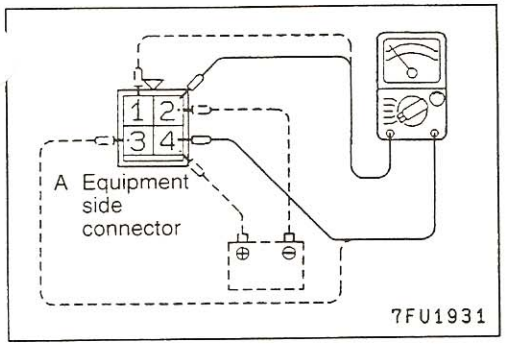
- MFI relay connector: Connected
- Engine control module connector: Connected

Voltage (V):
8 or higher (Engine: Cranking)
Battery positive voltage (Engine: Racing)

OK: STOP

NG: MFI relay or engine control module is defective.

TSB Revision



MULTIPORT FUEL INJECTION (MFI) RELAY CHECK

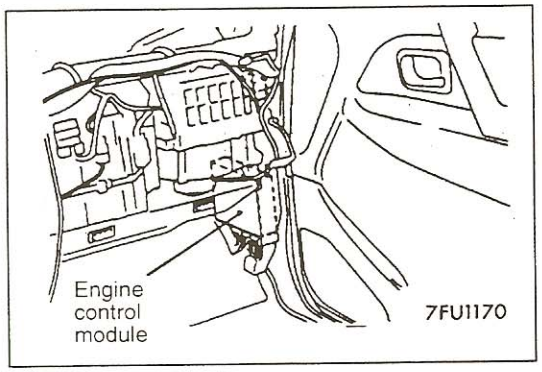
(1) Check for continuity between the MFI relay terminals.

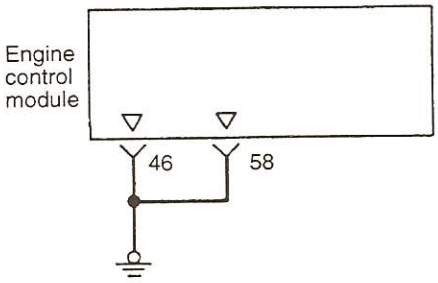
Battery voltage	Terminal No.			
	1	2	3	4
Not supplied		○		○
Supplied	○	⊖	○	⊕

(2) If there is a problem, replace the MFI relay.

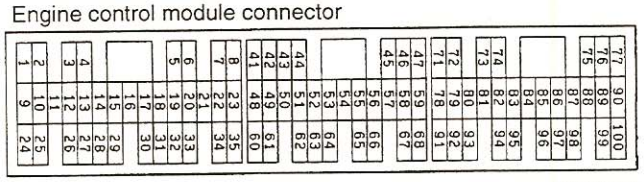
ENGINE CONTROL MODULE POWER GROUND

13110160084





Engine control module connector



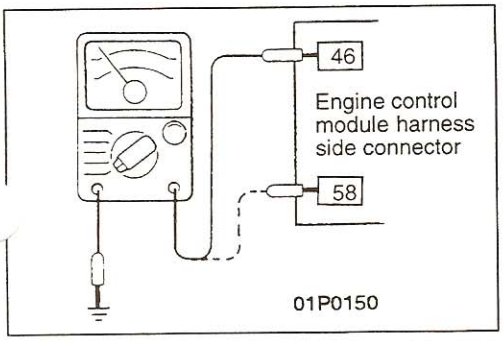
7FU2152

OPERATION

Grounds of the engine control module.

TROUBLESHOOTING HINTS

If there is incorrect or incomplete contact of the engine control module's ground line, the engine control module will not function correctly.



HARNESS INSPECTION

STEP 1. Check for continuity in the ground circuit.

- Engine control module connector: Disconnected

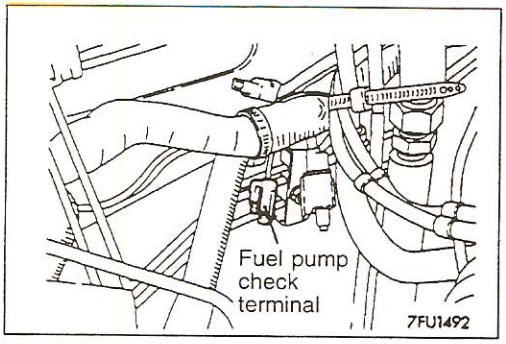
OK: STOP

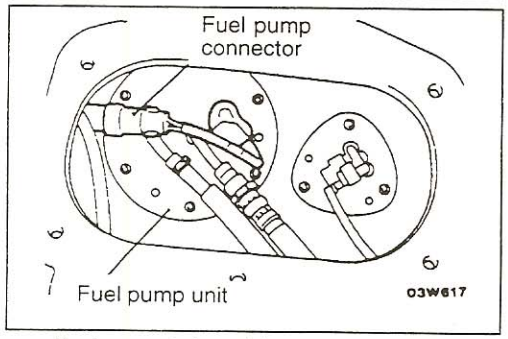
NG: Repair the harnesses. (46 – Ground, 58 – Ground)

TSB Revision

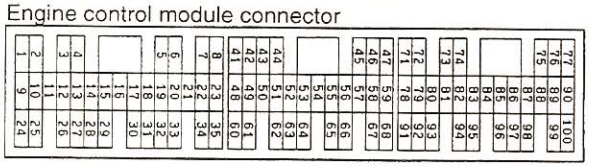
FUEL PUMP

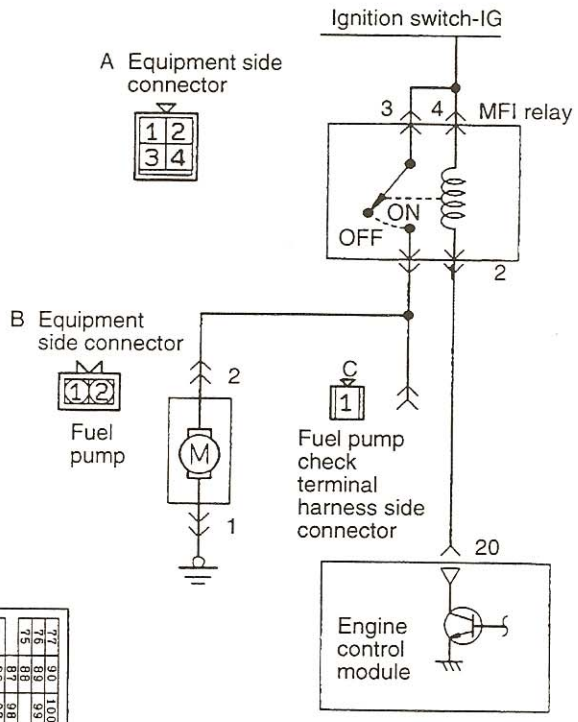
13110170155





Engine control module connector





OPERATION

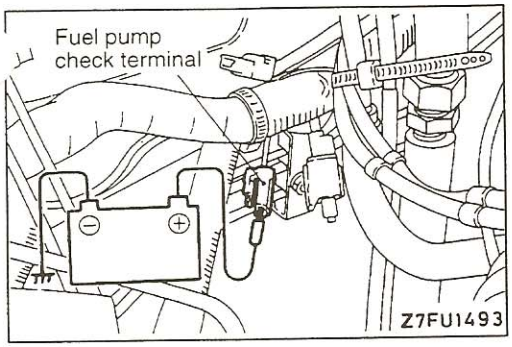
- The fuel pump is driven when the engine is cranking and while the engine is running.
- When the engine is cranking and while the engine is running, the engine control module turns the power transistor ON to supply power to the fuel pump relay coil. This causes the fuel pump relay switch to turn ON, and current is supplied from the ignition switch via the fuel pump relay switch to drive the fuel pump.

INSPECTION

Using Scan Tool

Function	Item No.	Activation	Check conditions	Check description	Normal condition
Actuator test	07	Activates the fuel pump and circulates the fuel.	• Engine cranking • Fuel pump forced activation Make the check under both of the above conditions.	Pinch the return hose and feel the pulsations of the fuel flow.	Pulsations can be felt.
				Listen close to the fuel tank for the sound of the pump operating.	Sound can be heard.

TSB Revision



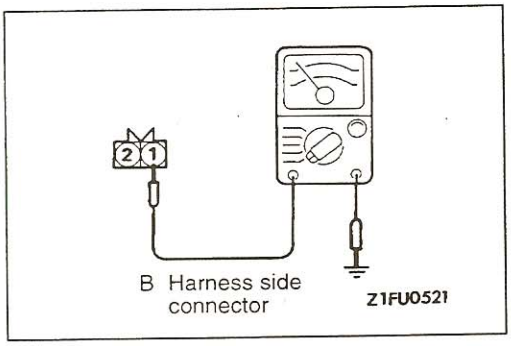
HARNESS INSPECTION

STEP 1. Check the fuel pump.

- Apply battery positive voltage to the checking terminal and operate the pump.

OK: GO TO STEP 4

NG: GO TO STEP 2

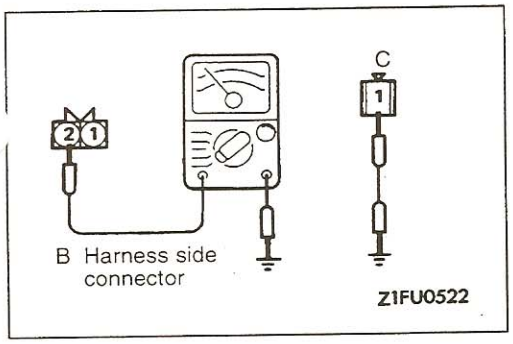


STEP 2. Check the ground circuit of the fuel pump.

- Fuel pump connector: Disconnected

OK: GO TO STEP 3

NG: Repair the harness. (B1 – Ground)

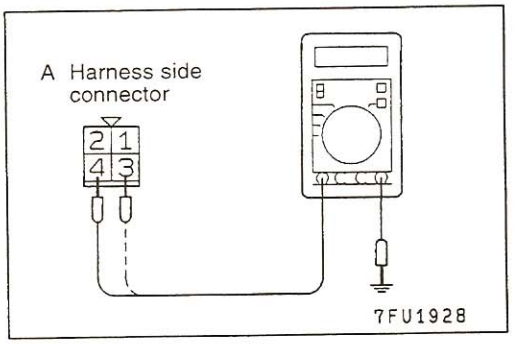


STEP 3. Check for continuity between the fuel pump and the checking terminal.

- Fuel pump connector: Disconnected
- Fuel pump relay connector: Disconnected

OK: GO TO STEP 4

NG: Repair the harness. (B2 – C1)



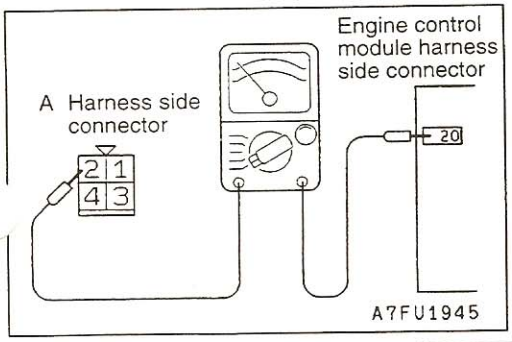
STEP 4. Measure the power supply voltage of the fuel pump relay.

- Fuel pump relay connector: Disconnected

Voltage (V):
0 (ignition switch: OFF)
Battery positive voltage (ignition switch: ON)

OK: GO TO STEP 5

NG: Repair the harness. (A3 – Ignition switch-IG, A4 – Ignition switch–IG) or check the ignition switch.



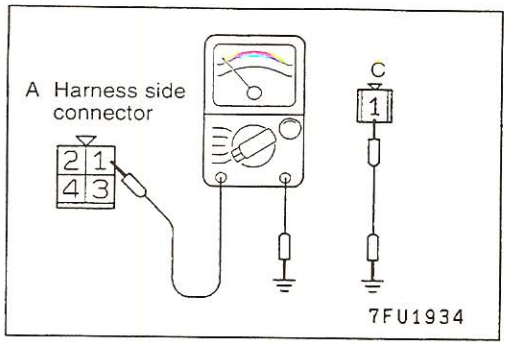
STEP 5. Check for an open circuit or a short-circuit to ground between the MFI relay and the engine control module.

- Fuel pump relay connector: Disconnected
- Engine control module connector: Disconnected

OK: GO TO STEP 6

NG: Repair the harness. (A2 – 20)

TSB Revision

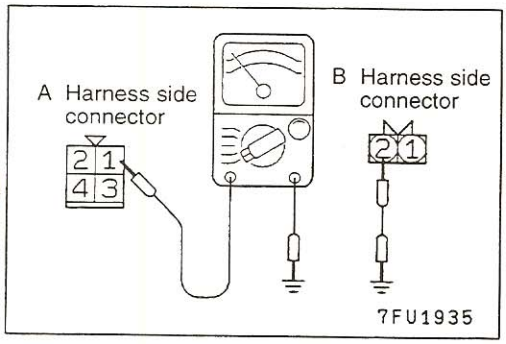


STEP 6. Check for continuity between the fuel pump and the checking terminal.

- Fuel pump connector: Disconnected
- Fuel pump relay connector: Disconnected

OK: GO TO STEP 7

NG: Repair the harness. (A1 – C1)

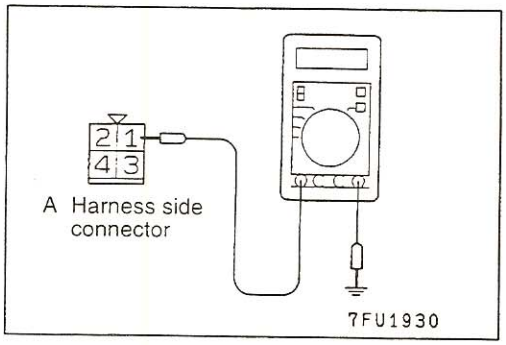


STEP 7. Check for an open circuit or a short-circuit to ground between the MFI relay and the fuel pump.

- Fuel pump relay connector: Disconnected
- Fuel pump connector: Disconnected

OK: GO TO STEP 8

NG: Repair the harness. (A1 – B2)



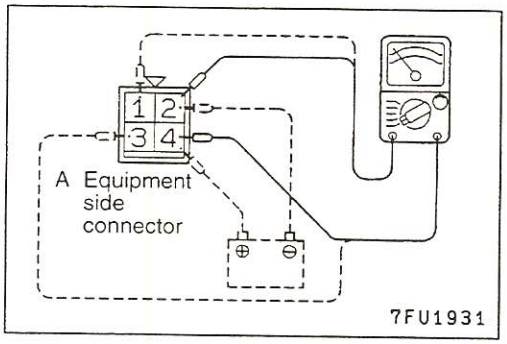
STEP 8. Measure the power supply voltage of the fuel pump.

- Fuel pump relay connector: Connected
- Engine control module connector: Connected

Voltage (V):
8 or higher (engine: Cranking)
Battery positive voltage (engine: Racing)

OK: STOP

NG: Fuel pump relay or engine control module is defective.



FUEL PUMP RELAY CHECK

(1) Check for continuity between the fuel pump relay terminals.

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

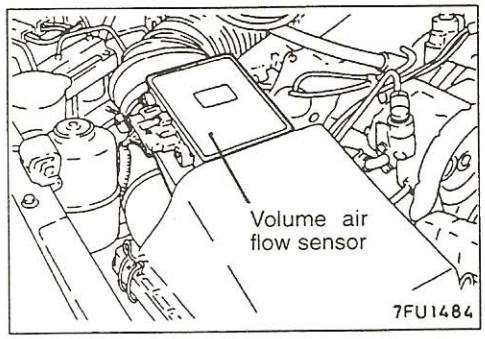
(2) If there is a problem, replace the fuel pump relay.

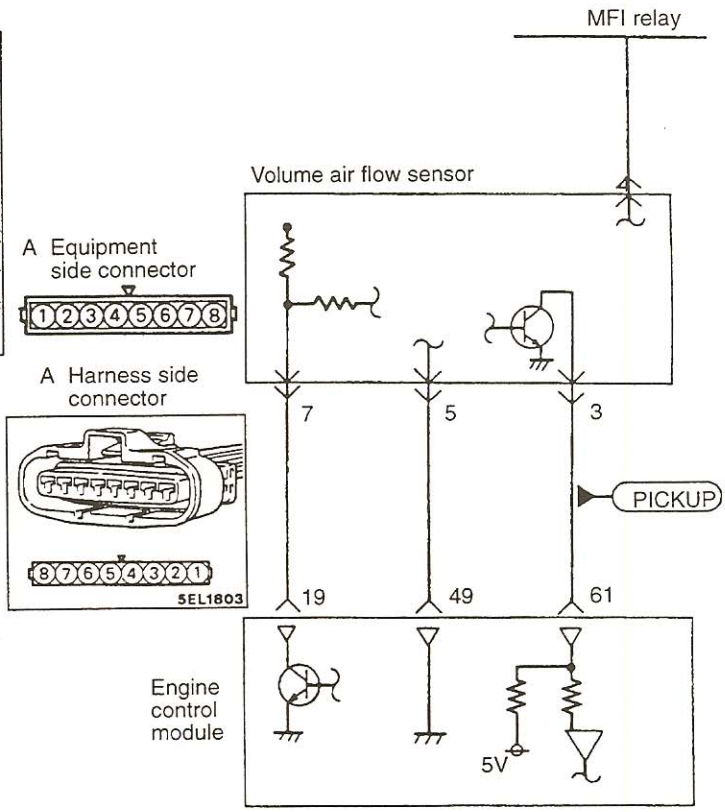
FUEL PUMP CHECK

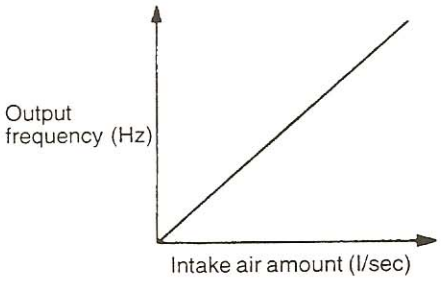
Refer to GROUP 13F – On-vehicle Service.

VOLUME AIR FLOW SENSOR

13110180097

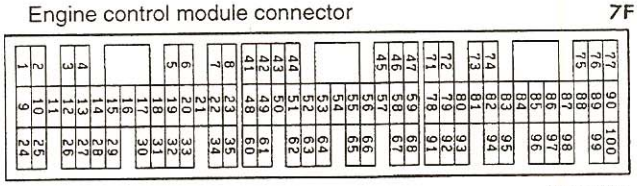






Engine control module connector

7FU0654



7FU2119

7FU2154

OPERATION

- The volume air flow sensor is incorporated within the air cleaner, it functions to convert the amount of engine air intake to pulse signals of a frequency proportional to the amount of engine air intake, and to input those signals to the engine control module. The engine control module then, based upon those signals, calculates the amount of fuel injection, etc.
- The power for the volume air flow sensor is supplied from the MFI relay to the volume air flow sensor, and is grounded at the engine control module. The volume air flow sensor, by intermitting the flow of the 5 V voltage applied from the engine control module, produces pulse signals.

TROUBLESHOOTING HINTS

Hint 1:

If the engine sometimes stalls, try starting the engine and shaking the volume air flow sensor harness. If the engine then stalls, incorrect or improper contact of the volume air flow sensor connector is the probable cause.

Hint 2:

If the volume air flow sensor output frequency is any value other than zero when the ignition switch is switched ON (but the engine is not started), a malfunction of the volume air flow sensor or of the engine control module is the probable cause.

TSB Revision

Hint 3:
If idling is possible even though the volume air flow sensor output frequency is outside the standard value, the cause is usually a malfunction other than of the volume air flow sensor.

[Examples]
(1) The flow of air within the volume air flow sen is disturbed. (Air duct disconnection or clogg air cleaner element.)
(2) Incomplete combustion inside a cylinder (Malfunction of spark plugs, ignition coil, injectors, compression pressure, etc.)
(3) Air is drawn into the intake manifold through a leaking gasket, etc.

INSPECTION

Using Scan Tool
<Volume air flow sensor>

Function	Item No.	Data display	Check conditions	Engine conditions	Standard value
Data reading	12	Frequency (Mass air flow rate)	• Engine coolant temperature: 80 – 95°C (176 – 203°F) • Lights and all accessories: OFF • Transmission: P range	Idling	25 – 51 Hz (3.7 – 7.6 g/s)
				2,500 r/min	80 – 120 Hz (11.9 – 17.9 g/s)
				Racing	Frequency (or air flow volume) increases by racing.

NOTE
When the vehicle is new [driven approximately 500 km (300 miles) or less], the volume air flow sensor output frequency may be approximately 10% higher than indicatedr above.

<Volume air flow sensor reset signal>

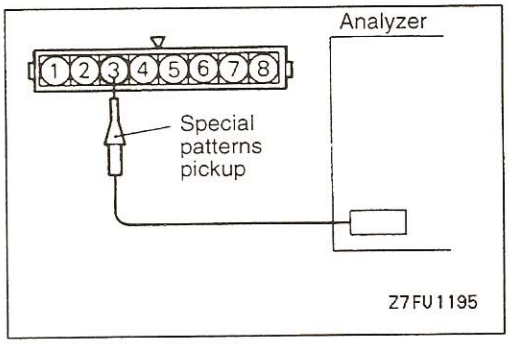
Function	Item No.	Data display	Inspection condition	Engine state	Normal display
Data list	34	Reset signal condition	• Engine warming up	Idling	ON
				2,500 r/min	OFF

<Volumetric efficiency>

Function	Item No.	Data display	Inspection condition	Engine condition	Standard value
Data list	37	Volumetric efficiency	• Engine coolant temperature: 80 – 95°C (176 – 203°F) • Lights, electrical cooling fan and all accessories: OFF • Transmission: P range	Idling	15–35%
				2,500 r/min	15–35%
				Racing	Volumetric efficiency increases according to amount of racing.

<Calculation load value>

Function	Item No.	Data display	Check conditions	Engine conditions	Standard value
Data reading	87	Calculation load value	• Engine: Warm	Idling	10 – 30 %
				2,500 r/min	10 – 30 %



Wave Pattern Inspection Using an Analyzer

Measurement method

(1) Disconnect the volume air flow sensor connector, and connect the special tool (test harness: MB991348) in between. (All terminals should be connected.)
(2) Connect the analyzer special patterns pickup to terminal (3) of the volume air flow sensor connector.

Alternative method (when test harness is not available)

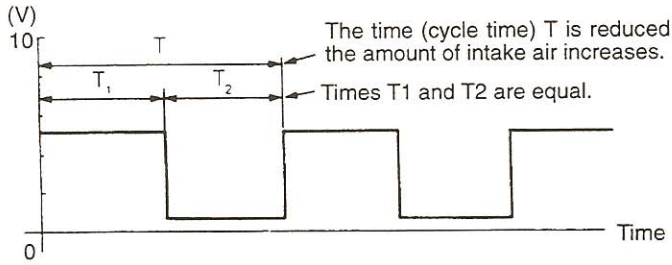
Connect the analyzer special patterns pickup to ECM terminal (90).

Standard wave pattern

Observation conditions

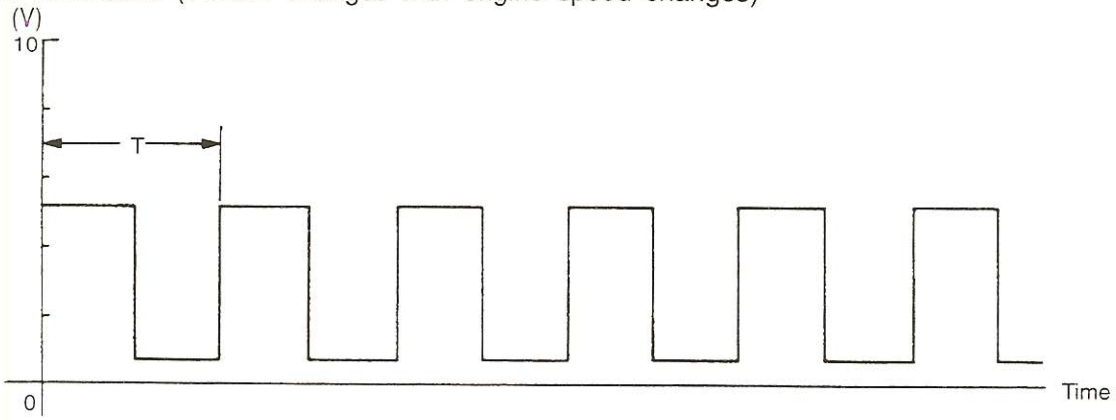
Function	Special patterns
Pattern height	Low
Pattern selector	Display
Engine r/min	Idling

Standard wave pattern



TSB Revision

Observation conditions (Pattern changes with engine speed changes)



Z7FU0880

Wave pattern observation points

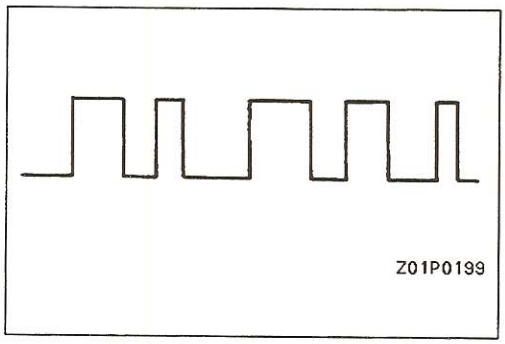
Check that cycle time T becomes shorter and the frequency increases when the engine speed is increased.

Examples of abnormal wave patterns

- Example 1

  Cause of problem
  Malfunction of sensor interface

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

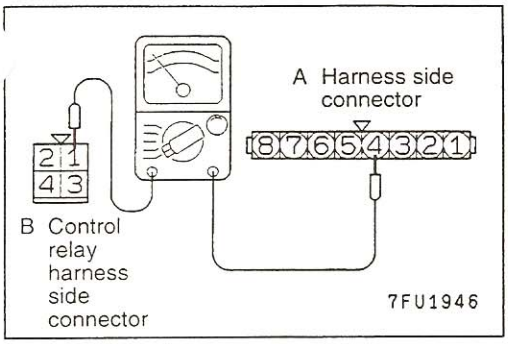


Z01P0199

- 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 volume air flow sensor is normal.



HARNESS INSPECTION

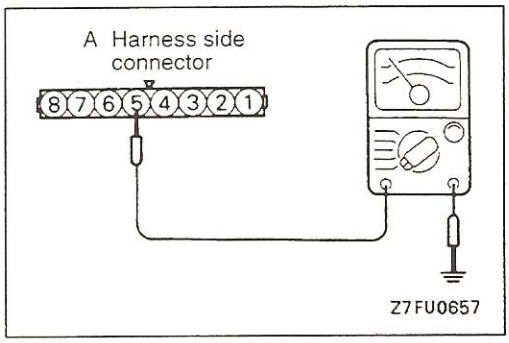
STEP 1. Check for continuity between the volume air flow sensor and the MFI relay.

- MFI relay connector: Disconnected
- Volume air flow sensor connector: Disconnected

NOTE
- Touch the ohmmeter probes to both ends of the harness.

OK: GO TO STEP 2

NG: Repair the harness. (A4 – B1)

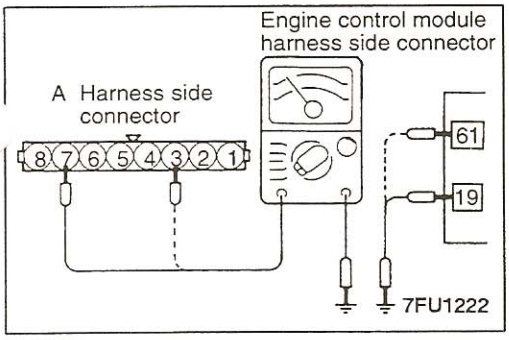


STEP 2. Check for continuity in the ground circuit.

- Volume air flow sensor connector: Disconnected

OK: GO TO STEP 3

NG: Repair the harness. (A5 – 49)

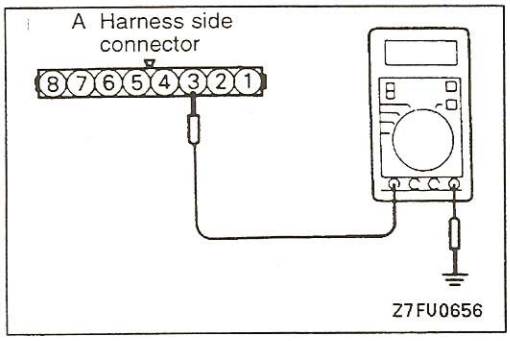


STEP 3. Check for an open or short-circuit between the volume air flow sensor and the engine control module.

- Volume air flow sensor connector: Disconnected
- Engine control module connector: Disconnected

OK: GO TO STEP 4

NG: Repair the harness. (A3 – 61, A7 – 19)



STEP 4. Measure the applied voltage

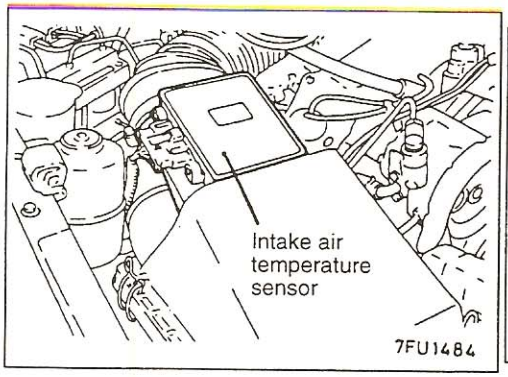
- Volume air flow sensor connector: Disconnected
- Engine control module connector: Connected
- Ignition switch: ON

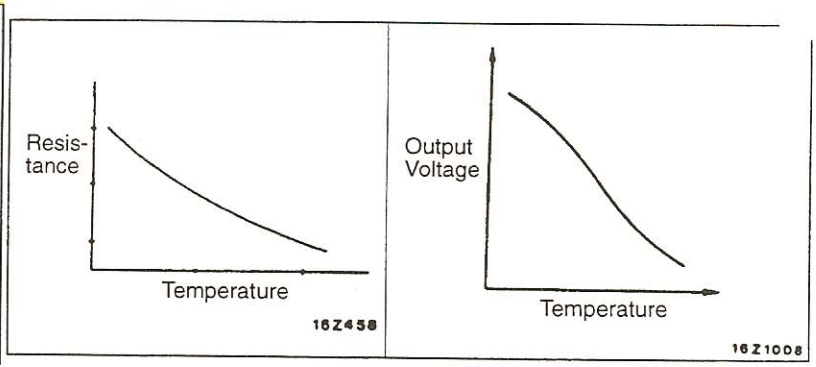
Voltage (V): 4.8 – 5.2

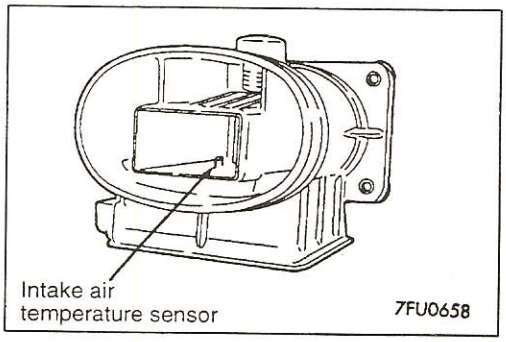
OK: STOP

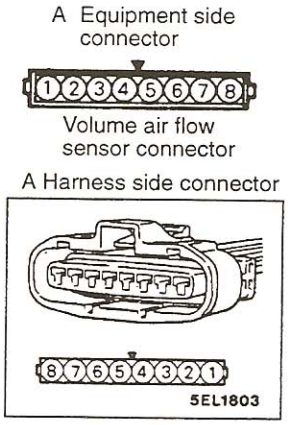
NG: Replace the engine control module.

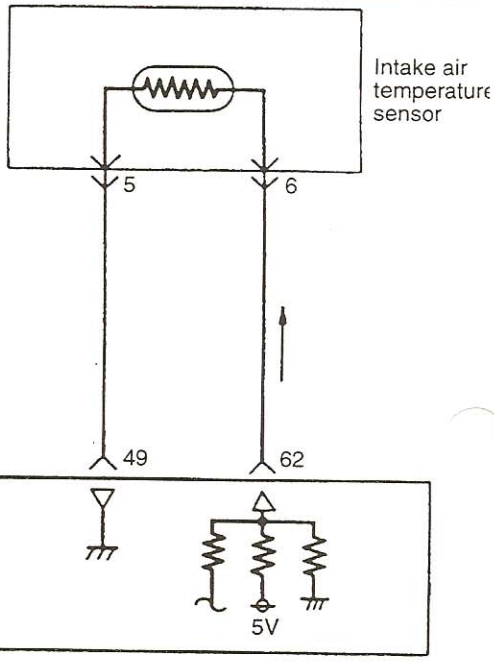
INTAKE AIR TEMPERATURE SENSOR

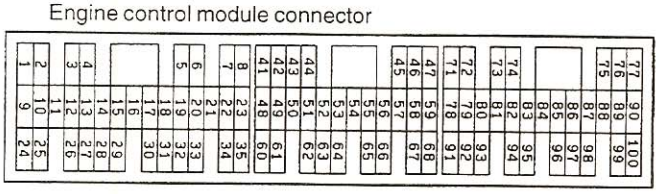












7FU2155

OPERATION

- The intake air temperature sensor functions to convert the temperature of the air drawn into the engine to a voltage, and to input that voltage as a signal to the engine control module. The engine control module, based upon those signals, then corrects the amount to fuel injection, etc.
- The 5 V power supply within the engine control module is supplied, by way of the resistance within the unit, to the intake air temperature sensor, it passes through the intake air temperature sensor, which is a type of resistor, and is grounded as the engine control module. Note that the resistance of the intake air temperature sensor decreases when the temperature of the intake air increases.
- The intake air temperature sensor terminal voltage becomes higher when the resistance of the intake air temperature sensor increases, and becomes lower when the resistance decreases. Consequently, the intake air temperature sensor terminal voltage varies in accordance with the temperature of the intake air, becoming lower when the temperature of the intake air increases.

TROUBLESHOOTING HINTS

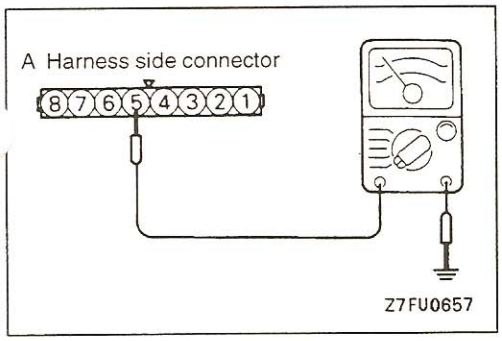
Because the intake air temperature of the intake air in the air cleaner, it indicates a temperature different than the temperature of the outside air when the engine is running.

TSB Revision

INSPECTION

Using Scan Tool

Function	Item No.	Data display	Check conditions	Intake air temperature °C (°F)	Standard valuE °C
Data reading	13	Sensor detection temperature	Ignition switch: ON or engine running	When –20 (–4)	–20
				When 0 (32)	0
				When 20 (68)	20
				When 40 (104)	40
				When 80 (176)	80



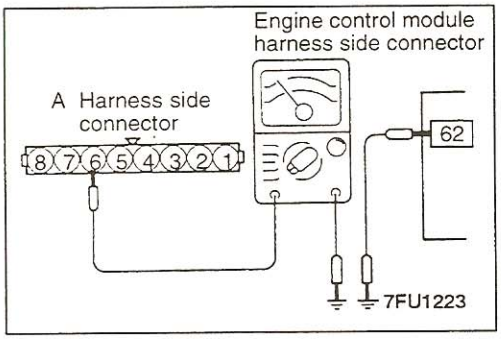
HARNESS INSPECTION

STEP 1. Check for continuity in the ground circuit.

- Volume air flow sensor connector: Disconnected

OK: GO TO STEP 2

NG: Repair the harness. (A5 – 49)

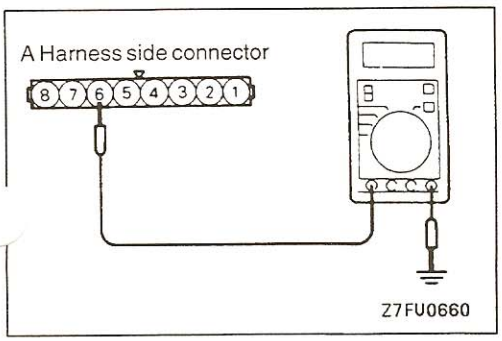


STEP 2. Check for an open or short-circuit between the intake air temperature sensor and the engine control module.

- Volume air flow sensor connector: Disconnected
- Engine control module connector: Disconnected

OK: GO TO STEP 3

NG: Repair the harness. (A6 – 62)



STEP 3. Measure the power supply voltage.

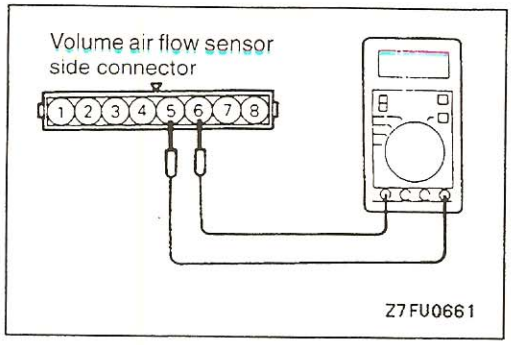
- Volume air flow sensor connector: Disconnected
- Ignition switch: ON
- Engine control module connector: Connected

Voltage (V): 4.5 – 4.9

OK: STOP

NG: Replace the engine control module.

TSB Revision

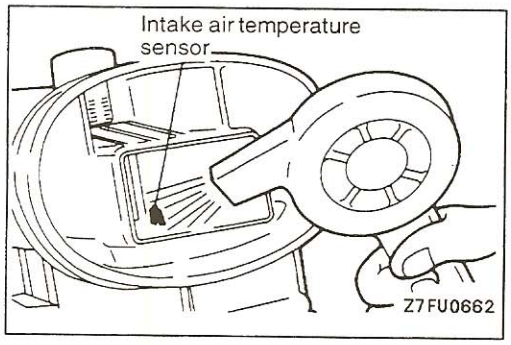


*INTAKE AIR TEMPERATURE CHECK

(1) Disconnect the volume air flow sensor connectors.
(2) Measure the resistance between terminal (5) and terminal (6).

Standard value:

Temperature °C (°F)	Resistance kΩ
0 (32)	6.0
20 (68)	2.7
80 (176)	0.4



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

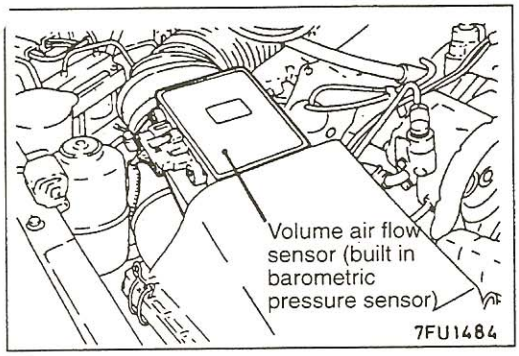
Temperature °C (°F)	Resistance kΩ
Higher	Smaller

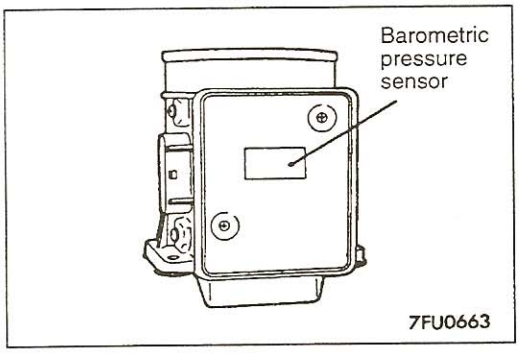
(4) If resistance does not decrease as heat increases or the resistance remains unchanged, replace the volume air flow sensor assembly.

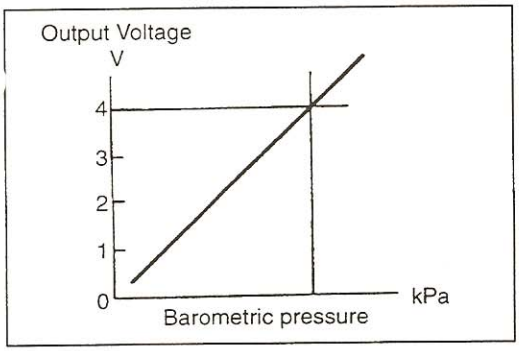
TSB Revision

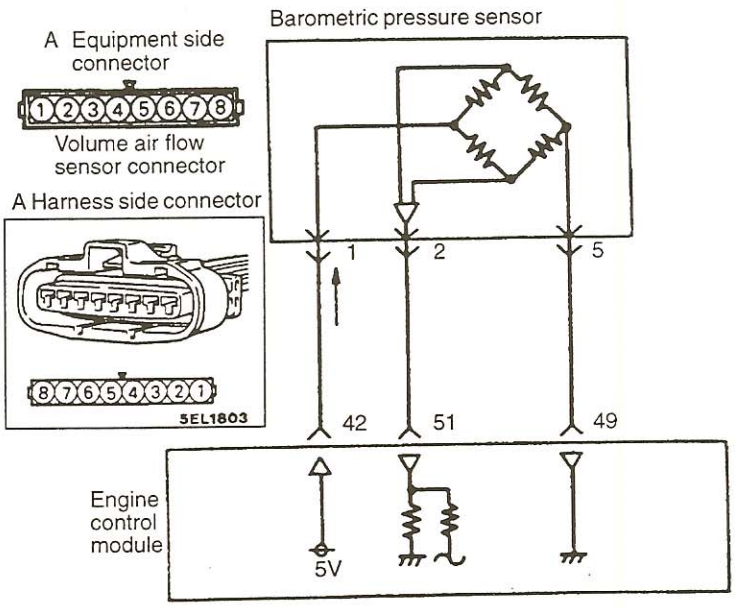
BAROMETRIC PRESSURE SENSOR

13110200090

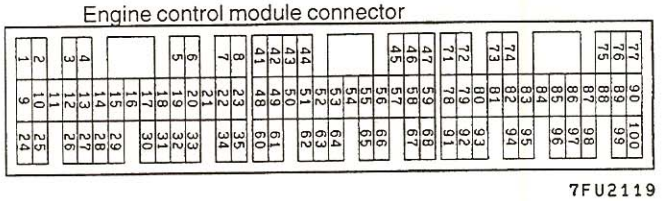








7FU0664



7FU2156

OPERATION

- The barometric pressure sensor functions to convert the barometric pressure to voltage, and to input that voltage (as signals) to the engine control module. The engine control module based upon those signals, then corrects the amount of fuel injection, etc.
- The 5 V power supply within the engine control module is supplied to the barometric pressure sensor; it passes through the circuitry within the sensor, and is grounded at the engine control module.
- The barometric-pressure sensor output voltage is supplied to the engine control module in proportion to the barometric pressure (absolute pressure).

TROUBLESHOOTING HINTS

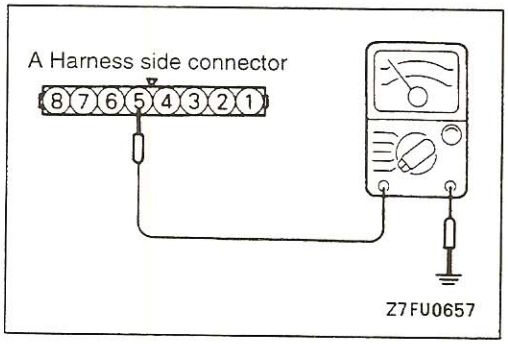
Hint 1:
If there is a malfunction of the barometric pressure sensor, drivability of the vehicle will become worse, particularly at high altitudes.

Hint 2:
If, during high-speed driving, there is a noticeable sharp drop of the displayed pressure of the barometric-pressure sensor, check for clogging of the air cleaner.

INSPECTION

Using Scan Tool

Function	Item No.	Data display	Check conditions	Altitude m (ft.)	Standard value kPa (mmHg)
Data reading	25	Sensor detection pressure	Ignition switch: ON	When at 0 (0)	101 (760)
				When at 600 (1,969)	95 (710)
				When at 1,200 (3,937)	88 (660)
				When at 1,800 (5,906)	81 (610)



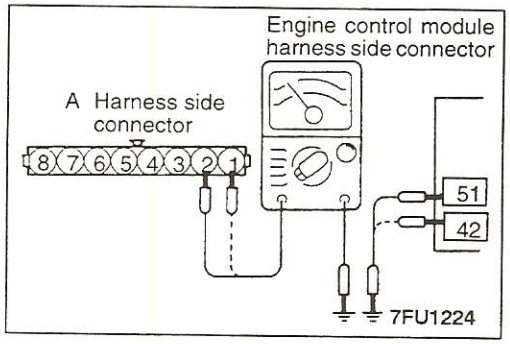
HARNESS INSPECTION

STEP 1. Check for continuity in the ground circuit.

- Volume air flow sensor connector: Disconnected

OK: GO TO STEP 2

NG: Repair the harnesses. (A5 – 49)

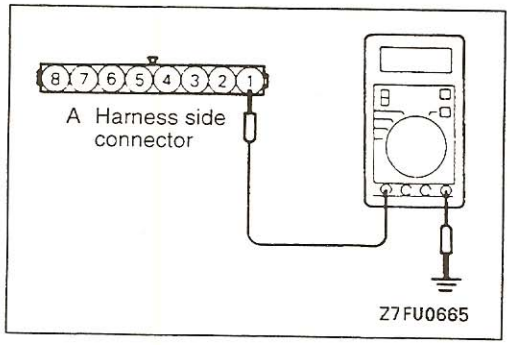


STEP 2. Check for an open or short-circuit between the barometric pressure sensor and the engine control module.

- Volume air flow sensor connector: Disconnected
- Engine control module connector: Disconnected

OK: GO TO STEP 3

NG: Repair the harnesses. (A1 – 42, A2 – 51)



STEP 3. Measure the power supply voltage of the barometric pressure sensor.

- Volume air flow sensor connector: Disconnected
- Ignition switch: ON
- Engine control module connector: Connected

Voltage (V): 4.8 – 5.2

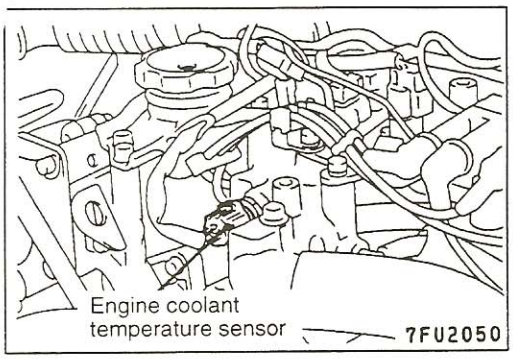
OK: STOP

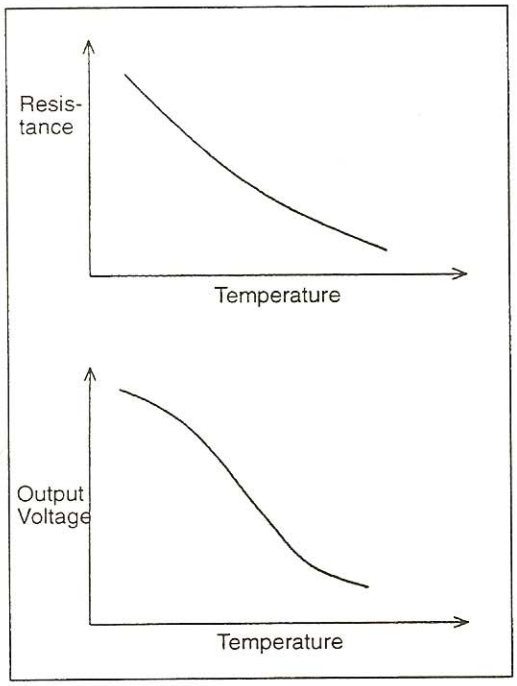
NG: Replace the engine control module.

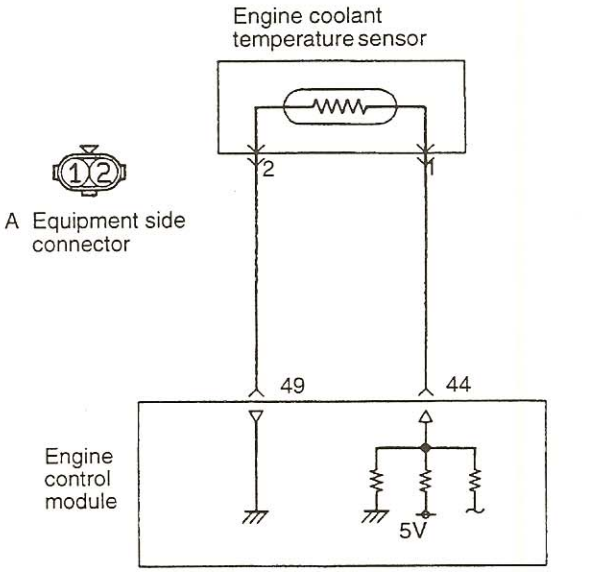
TSB Revision

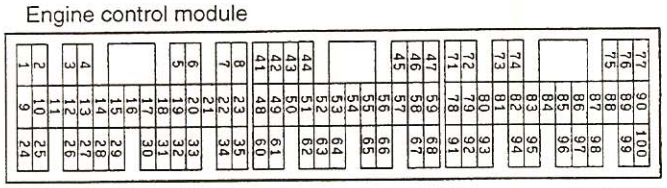
ENGINE COOLANT TEMPERATURE SENSOR

13110210109









7FU2157

TSB Revision

OPERATION

- The engine coolant temperature sensor functions to convert the barometric pressure to voltage, and to input that voltage (as signals) to the engine control module. The engine control module, based upon those signals, regulates the amount of fuel injection and the fast-idling speed when the engine is cold.
- The 5 V power supply within the engine control module is supplied, by way of the resistance within the unit, to the engine coolant temperature sensor; it passes through the engine coolant temperature sensor, which is a type of resistor, and is grounded at the engine control module. Note that the resistance of the engine coolant temperature sensor decreases when the temperature of the engine coolant increases.
- The engine coolant temperature sensor terminal voltage becomes higher when the resistance of the engine coolant temperature sensor increases, and becomes lower when the resistance decreases. Consequently, the engine coolant temperature sensor terminal voltage varies in accordance with the temperature of the engine coolant, becoming lower when the temperature of the engine coolant increases.

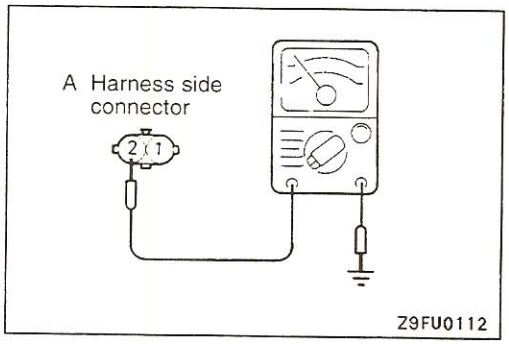
TROUBLESHOOTING HINTS

If, during engine warm-up, the fast-idling speed is not correct, or black smoke is emitted, the problem is usually a malfunction of the coolant temperature sensor.

INSPECTION

Using Scan Tool

Function	Item No.	Data display	Check conditions	Engine coolant temperature °C (°F)	Standard value °C
Data reading	21	Sensor detection temperature	Ignition switch: ON or engine running	When –20 (–4)	–20
				When 0 (32)	0
				When 20 (68)	20
				When 40 (104)	40
				When 80 (176)	80



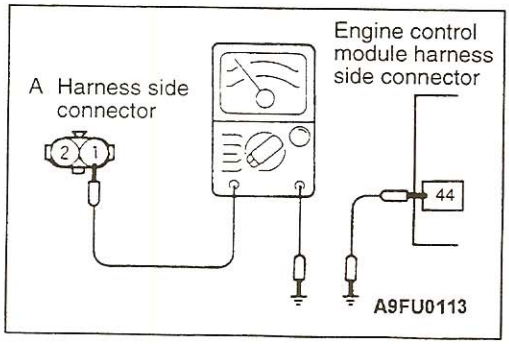
HARNESS INSPECTION

STEP 1. Check for continuity in the ground circuit.

- Engine coolant temperature sensor connector: Disconnected

OK: GO TO STEP 2

NG: Repair the harness. (A2 – 49)



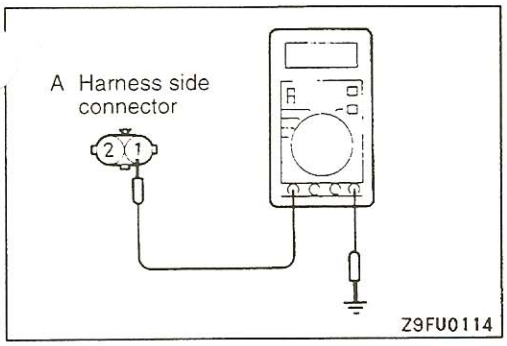
STEP 2. Check for an open or short-circuit between the engine coolant temperature sensor and the engine control module.

- Engine coolant temperature sensor connector: Disconnected
- Engine control module connector: Disconnected

OK: GO TO STEP 3

NG: Repair the harness. (A1 – 44)

TSB Revision



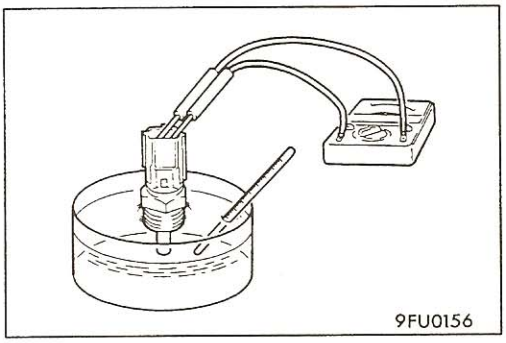
STEP 3. Measure the power supply voltage.

- Engine coolant temperature sensor connector: Disconnected
- Engine control module connector: Connected
- Ignition switch: ON

Voltage (V): 4.5 – 4.9 V

OK: STOP

NG: Replace the engine control module.



ENGINE COOLANT TEMPERATURE SENSOR CHECK

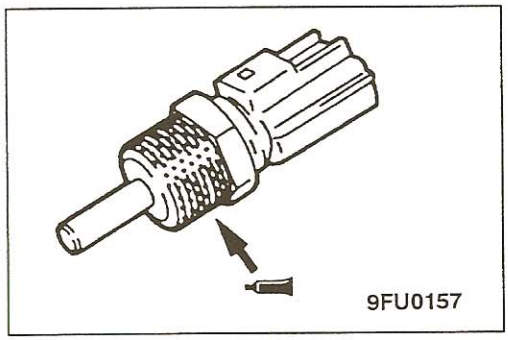
(1) Remove the engine coolant temperature sensor from the intake manifold.

(2) With temperature sensing portion of coolant temperature sensor immersed in hot water check resistance.

Standard value:

Temperature °C (°F)	Resistance kΩ
0 (32)	5.8
20 (68)	2.4
40 (104)	1.1
80 (176)	0.3

(3) If the resistance is outside the standard value greatly, replace the sensor.



(4) Apply specified sealant to the threaded portion.

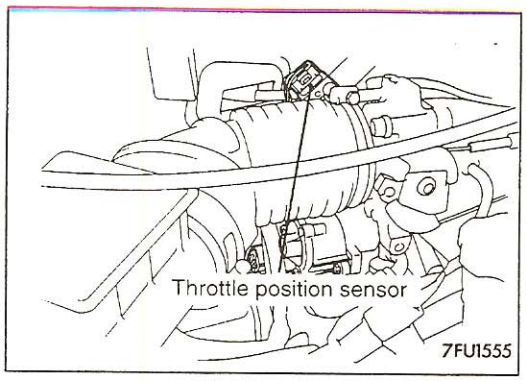
Specified sealant:
3M Nut Locking Part No. 4171 or equivalent

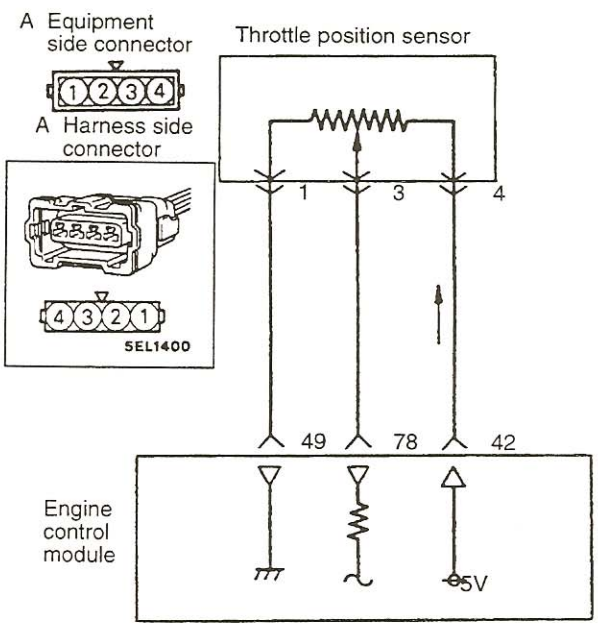
(5) Install the engine coolant temperature sensor and tighten it to the specified torque.

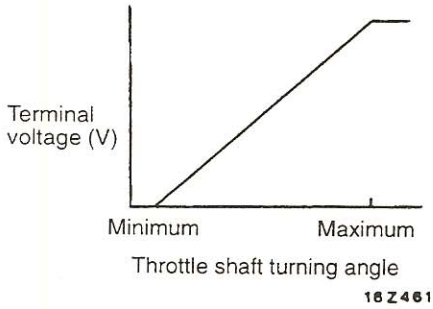
Sensor tightening torque: 30 Nm (22 ft.lbs)

THROTTLE POSITION SENSOR

13110220096

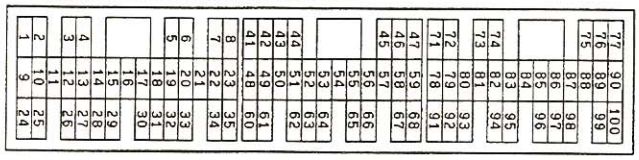






7FU0672

Engine control module connector



7FU2119

7FU2158

OPERATION

- The throttle position sensor functions to convert the degree of opening of the throttle valve to voltage, and to input that voltage (as signals) to the engine control module. The engine control module, based upon those signals, then regulates the amount of fuel injection, etc.
- The 5 V power supply within the engine control module is supplied to the throttle position sensor, after which it passes through the resistance within the sensor and is grounded as the engine control module.
- When the throttle valve shaft is rotated all the way from the idling position to the fully open position, the resistance between the throttle position sensor's variable-resistance terminal and the ground terminal also increases in accordance with that rotation, and, as a result, the voltage of the throttle position sensor's variable-resistance terminal also becomes higher in accordance with that rotation.

TROUBLESHOOTING HINTS

Hint 1:
The signals of the throttle position sensor are more important fore control of the automatic transmission than for control of the engine; shifting "impact shocks" are produced if there is a malfunction of the throttle position sensor.

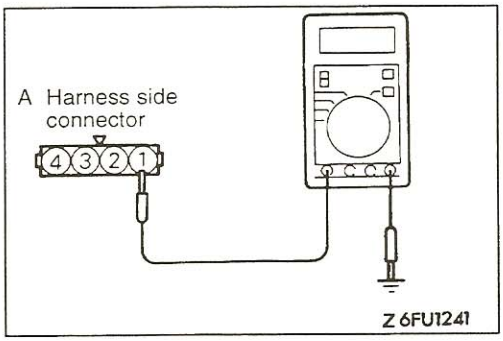
Hint 2:
If the voltage of the throttle position sensor is outside the standard value, check once again after making the throttle position sensor adjustment. In addition, if there are any indication that the fixed SAS has been moved, adjust the fixed SAS.

TSB Revision

INSPECTION

Jsing Scan Tool

Function	Item No.	Data display	Check conditions	Throttle valve	Standard value mV
Data reading	14	Sensor detection voltage	Ignition switch: ON	Set to the idling position.	300–1,000
				Open gradually.	Becomes higher proportionally to valve opening
				Open fully.	4,500–5,500



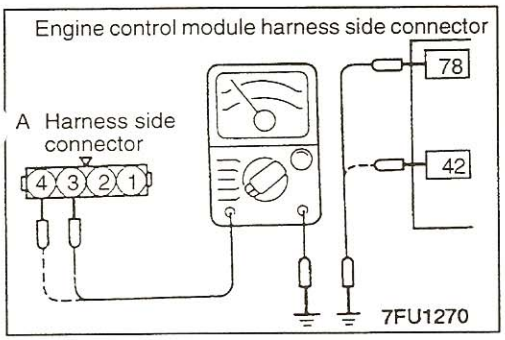
HARNESS INSPECTION

STEP 1. Check for continuity in the ground circuit.

- Throttle position sensor connector: Disconnected

OK: GO TO STEP 2

NG: Repair the harnesses. (A1 – 49)

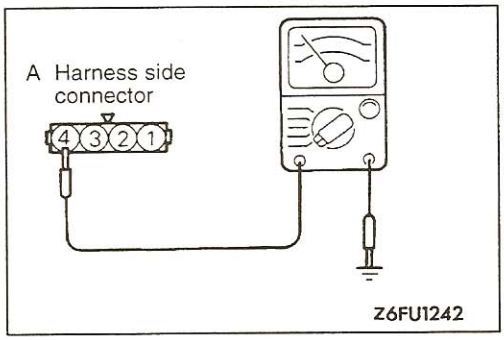


STEP 2. Check for an open or short-circuit between the throttle position sensor and the engine control module.

- Throttle position sensor connector: Disconnected
- Engine control module connector: Disconnected
- All control module connectors, such as the ECM connector, which use throttle position sensor output: Disconnected

OK: GO TO STEP 3

NG: Repair the harnesses. (A3 – 78, A4 – 42)



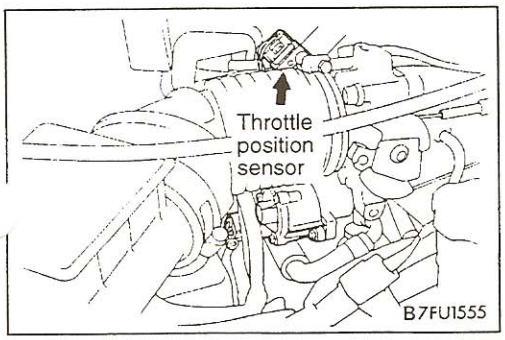
STEP 3. Measure the applied voltage.

- Throttle position sensor connector: Disconnected
- Engine control module connector: Connected
- Ignition switch: ON

Voltage (V): 4.8 – 5.2

OK: STOP

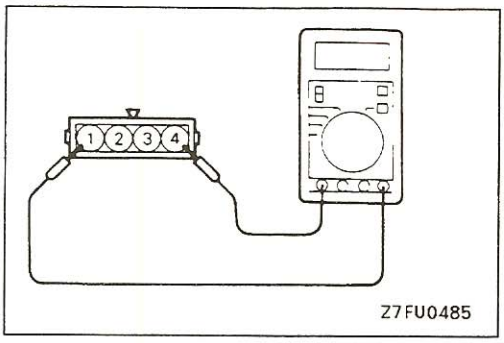
NG: Replace the engine control module.



THROTTLE POSITION SENSOR CHECK

(1) Disconnect the throttle position sensor connector.

TSB Revision

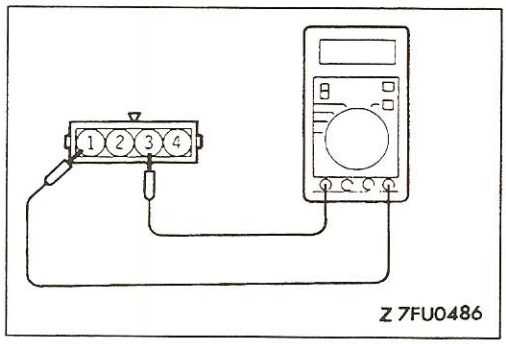


(2) Measure the resistance between terminal (1) (sensor ground) and terminal (4) (sensor power).

Standard value: 3.5–6.5 kΩ

(3) Connect a pointer type ohmmeter between terminal (1) (sensor ground) and terminal (3) (sensor output).

(4) Open the throttle valve slowly from the idle position to the full open position and check that the resistance changes smoothly in proportion with the throttle valve opening angle.



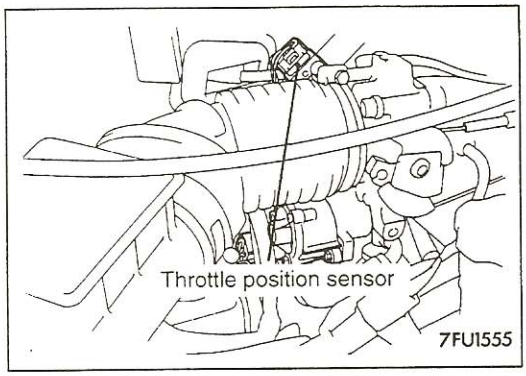
(5) If the resistance is outside the standard value, or fails to change smoothly, replace the throttle position sensor.

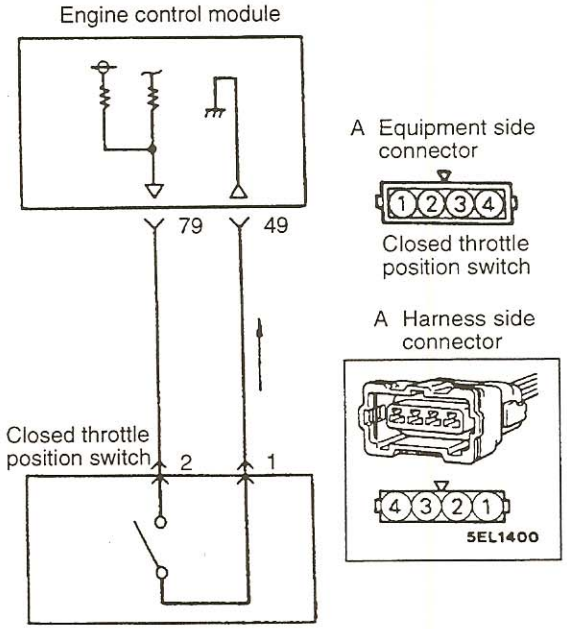
TPS installation torque: 2.0 Nm (1.5 ft.lbs.)

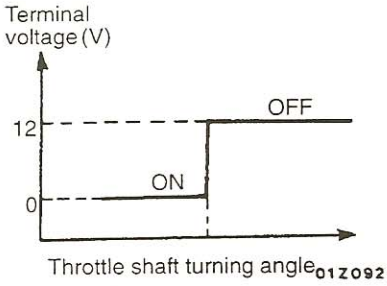
For the closed throttle position switch and throttle position sensor adjustment procedure, refer to P.13A-49.

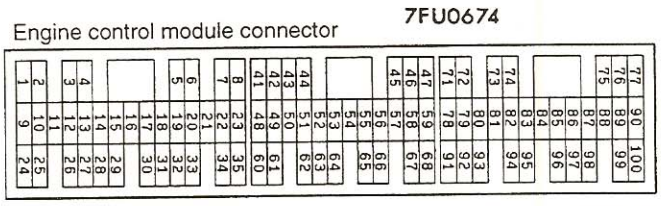
CLOSED THROTTLE POSITION SWITCH

13110230099









7FU2159

OPERATION

- The closed throttle position switch functions to convert (to HIGH/LOW-level voltage) data as to whether the accelerator is depressed or released, and to input that voltage (as signals) to the engine control module. The engine control module, based upon those signals, regulates the idle air control motor.
- Voltage within the engine control module is applied, by way of the resistance, to the closed throttle position switch. When the foot is taken off the accelerator, the closed throttle position switch is switched ON, so the current is grounded. As result, the closed throttle position switch terminal voltage changes from HIGH to LOW level.

TROUBLESHOOTING HINTS

If there is an abnormal condition of the closed throttle position switch output even though the results of the checking of the closed throttle position switch harness and of the component itself indicate a normal condition, the cause is probably one of the following.

(1) Incorrect adjustment of the accelerator cable or the cruise-control cable.
(2) Incorrect adjustment of the fixed SAS.

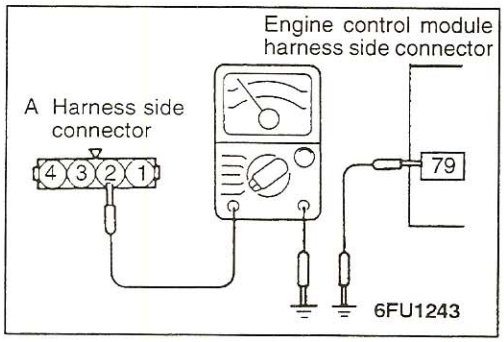
INSPECTION

Using Scan Tool

Function	Item No.	Data display	Check conditions	Throttle valve	Normal display
Data reading	26	Switch status	Ignition switch: ON (Operate the accelerator several times and check.)	Set to the idling position.	ON
				Open slightly.	OFF*

NOTE

*: The closed throttle position switch normally turns off when the voltage of the throttle position sensor is 50 – 100 mV higher than the voltage at the idle position. If the closed throttle position switch turns buck on after the throttle position sensor voltage has risen by 100 mV and the throttle valve has opened, the closed throttle position switch and the throttle position sensor need to be adjusted.



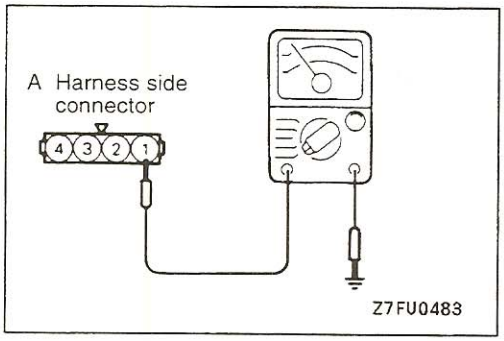
HARNESS INSPECTION

STEP 1. Check for an open or short-circuit between the closed throttle position switch and the engine control module.

- Engine control module connector: Disconnected
- Throttle position sensor connector: Disconnected

OK: GO TO STEP 2

NG: Repair the harness. (A2 – 79)

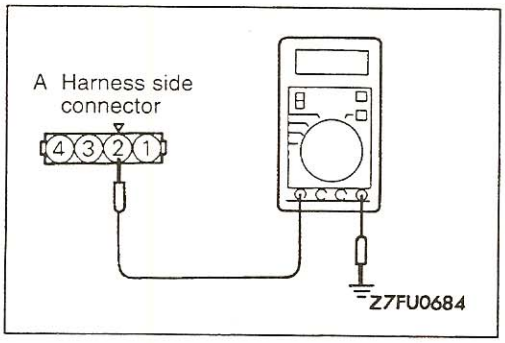


STEP 2. Check for continuity in the ground circuit.

- Throttle position sensor connector: Disconnected

OK: GO TO STEP 3

NG: Repair the harness. (A1 – 49)



STEP 3. Measure the power supply voltage of the closed throttle position switch.

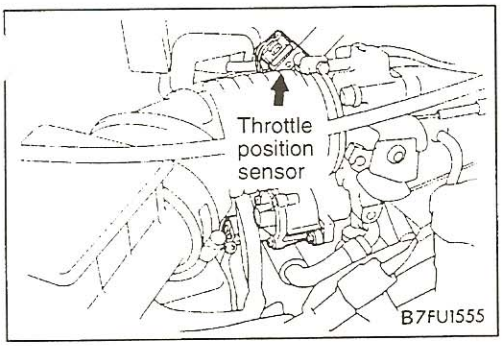
- Throttle position sensor connector: Disconnected
- Engine control module connector: Connected
- Ignition switch: ON

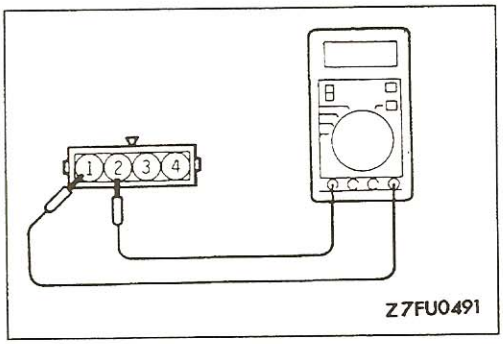
Voltage (V): 4 or higher

OK: STOP

NG: Replace the engine control module.

TSB Revision





CLOSED THROTTLE POSITION SWITCH CHECK

(1) With the accelerator pedal released, check that the throttle valve lever or the fixed SAS is pushed.

NOTE
If it is not pushed, adjust the fixed SAS. (Refer to P.13A-52.)

(2) Disconnect the throttle position sensor connector.

(3) Check for continuity between throttle position sensor connector terminal (1) (sensor ground) and terminal (2) (closed throttle position switch).

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

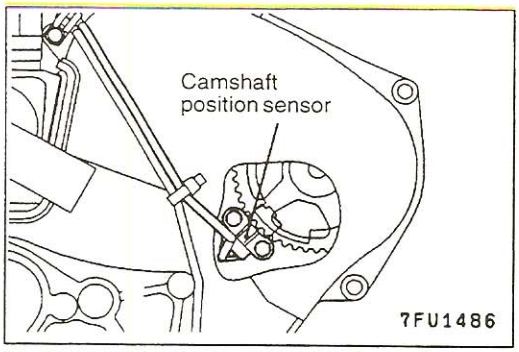
NOTE
If there is no continuity when the accelerator pedal is released, loosen the throttle position sensor installation screw; then, after turning all the way in the clockwise direction, check again.

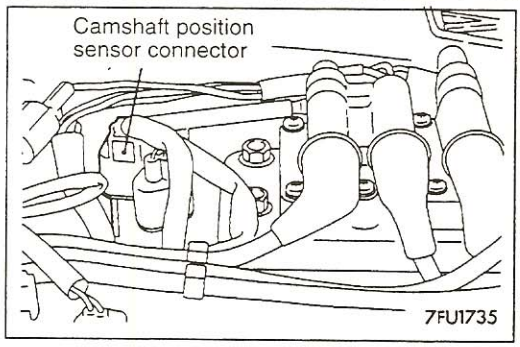
(4) Replace the throttle position sensor (with built-in closed throttle position switch) if there is a malfunction.

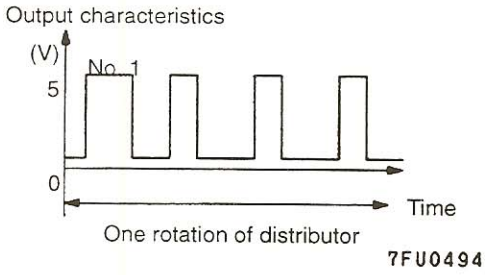
NOTE
For the closed throttle position switch and throttle position sensor adjustment procedure, refer to P.13A-51.

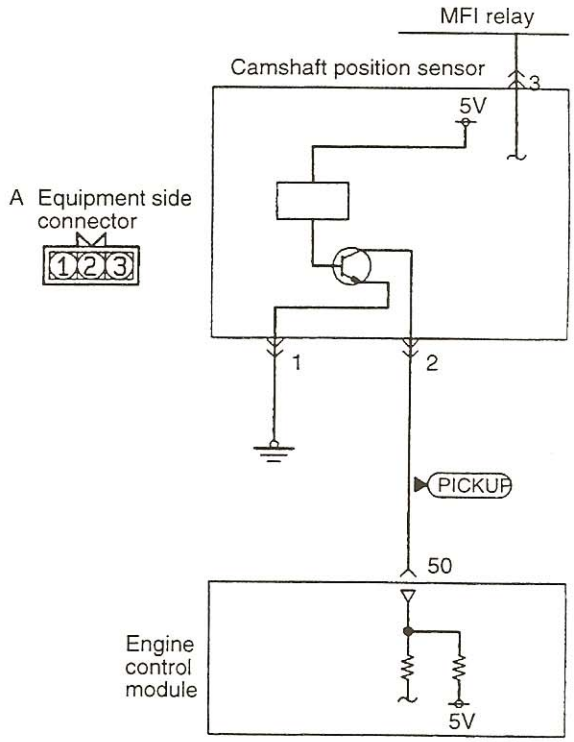
CAMSHAFT POSITION SENSOR

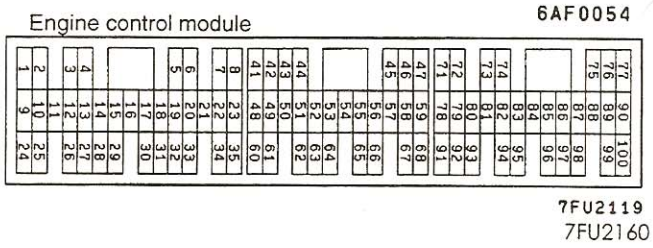
13110240115











OPERATION

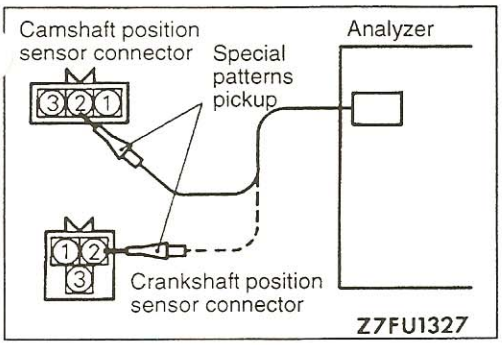
- The camshaft position sensor senses the top dead center on compression stroke, converts it into a pulse signal and inputs it to the engine control module, which then computes the fuel injection sequence, etc. based on the input signal.
- Power to the camshaft position sensor is supplied from the multiport fuel injection relay and is grounded to the body. The camshaft position sensor generates a pulse signal as it repeatedly connects to and disconnects from the 5 V voltage supplied from the engine control module and ground.

TROUBLESHOOTING HINTS

Hint 1:
If the camshaft position sensor does not function correctly, correct sequential injection is not being carried out, so that the engine may stall, run irregularly at idle or fail to accelerate normally.

Hint 2:
If the sensor outputs a pulse signal when the ignition switch is turned ON (without starting the engine), the cause is probably a malfunction of the camshaft position sensor or engine control module.

TSB Revision



INSPECTION

Wave Pattern Inspection using an Analyzer

Measurement method

(1) Disconnect the connector of the camshaft position sensor, and connect the special tool (test harness: MB991348) across the disconnected connector parts. (Connect the tool to all terminals.)
(2) Connect the special patterns pickup of the analyzer to the terminal (2) of the camshaft position sensor connector.
(3) Disconnect the connector of the crankshaft position sensor, and connect the special tool (test harness: MD998478) across the disconnected connector parts.
(4) Connect the special patterns pickup of the analyzer to the terminal (2) of the crankshaft position sensor connector.

Alternative method (when test harness is not available)

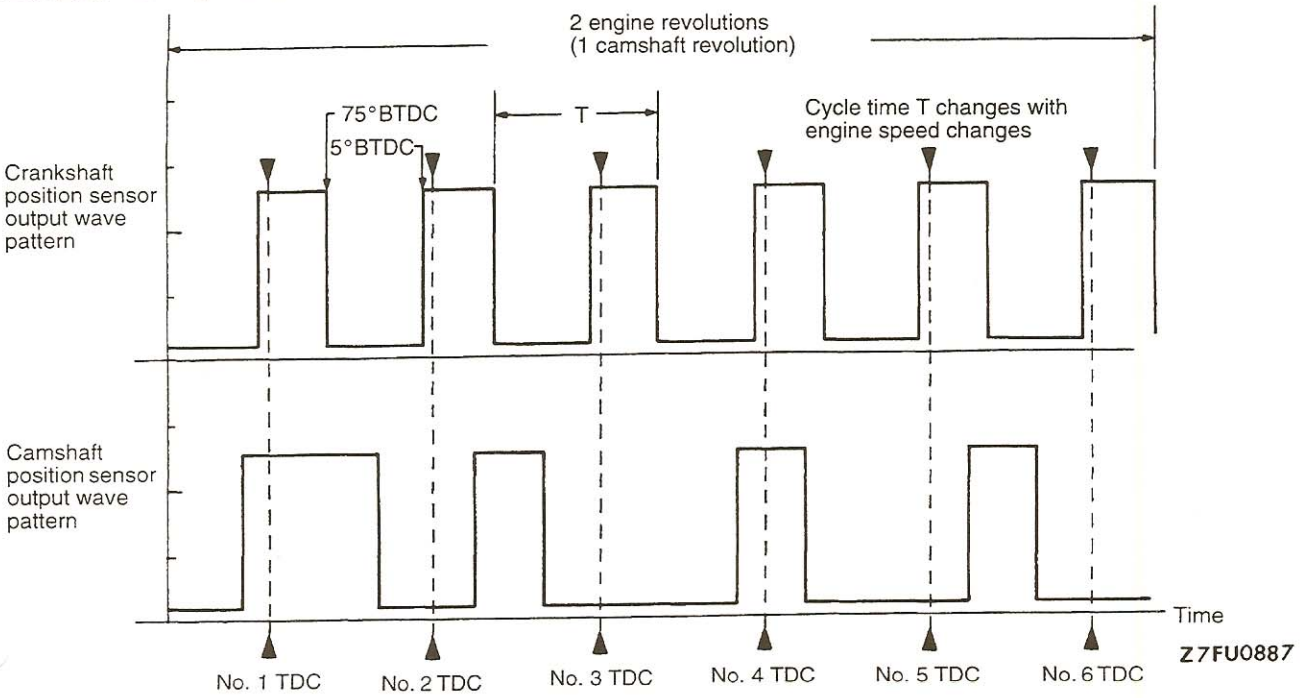
(1) Connect the analyzer special patterns pickup to ECM terminal (88) for the camshaft position sensor.
(2) Connect the analyzer special patterns pickup to ECM terminal (89) for the crankshaft position sensor.

Standard wave pattern

Observation conditions

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

Standard wave pattern

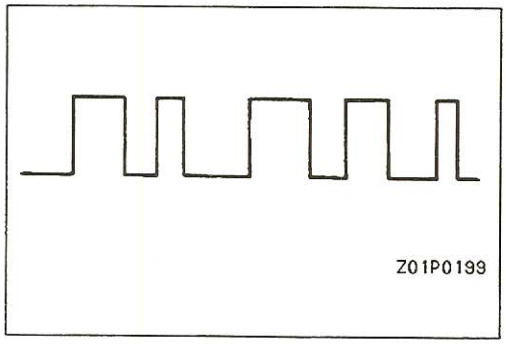


TDC: Compression top dead center

TSB Revision

Wave pattern observation points

Check that cycle time T becomes shorter and the freque increases when the engine speed is increased.

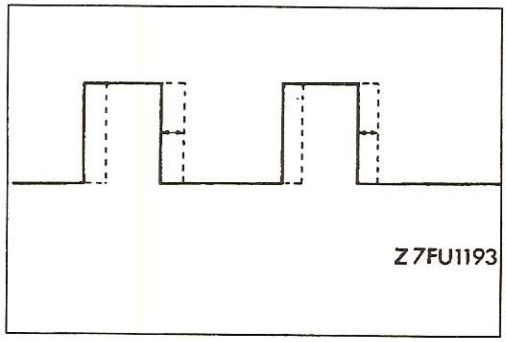


Examples of abnormal wave patterns

- Example 1

  Cause of problem
  Malfunction of sensor interface

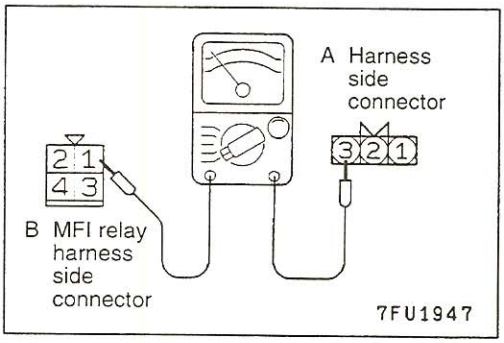
  Wave pattern characteristics
  Short wave pattern is output even when the engine is not started.



- Example 2

  Cause of problem
  Loose timing belt
  Abnormality in sensor disk

  Wave pattern characteristics
  Wave pattern is displaced to the left or right.



HARNESS INSPECTION

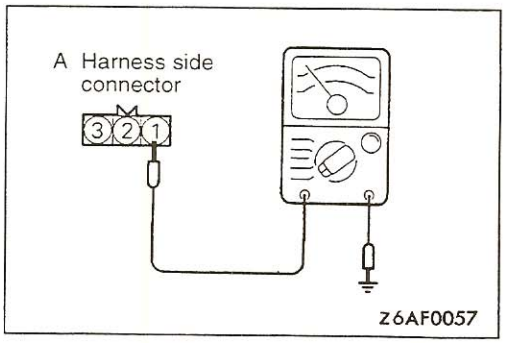
STEP 1. Check for continuity between the camshaft position sensor and the MFI relay.

- MFI relay connector: Disconnected
- Camshaft position sensor connector: Disconnected

NOTE
- Insert the probes of the circuit tester into both ends of the harness.

OK: GO TO STEP 2

NG: Repair the harness. (A3 – B1)



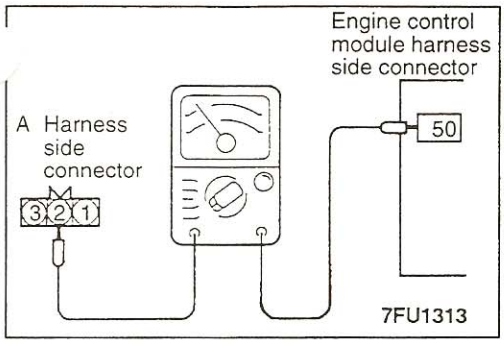
STEP 2. Check for continuity in the ground circuit.

- Camshaft position sensor connector: Disconnected

OK: GO TO STEP 3

NG: Repair the harness. (A1 – Ground)

TSB Revision

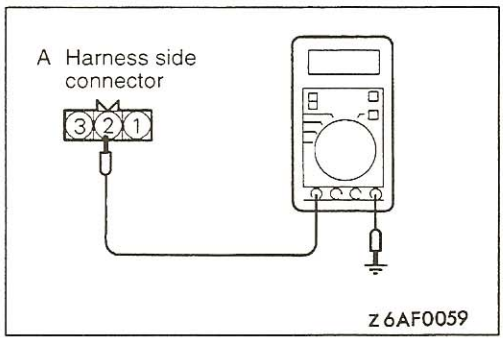


STEP 3. Check for an open circuit or a short-circuit to ground between the camshaft position sensor and engine control module.

- Engine control module connector: Disconnected
- Camshaft position sensor connector: Disconnected

OK: GO TO STEP 4

NG: Repair the harness. (A2 – 50)



STEP 4. Measure the applied voltage.

- Camshaft position sensor connector: Disconnected
- Engine control module connector: Connected
- Ignition switch: ON

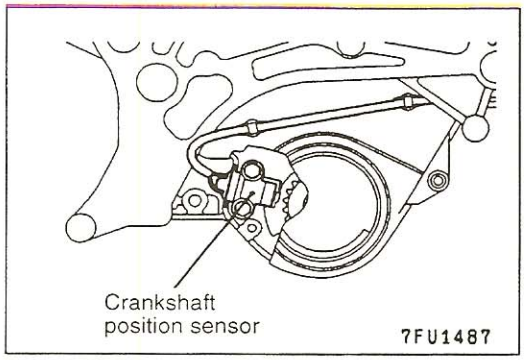
Voltage (V): 4.8 – 5.2

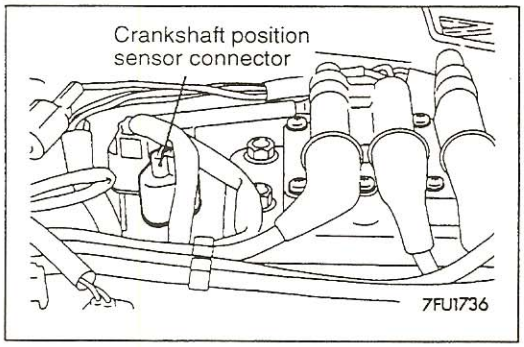
OK: STOP

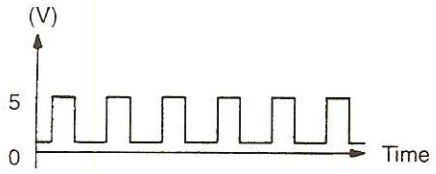
NG: Replace the engine control module.

CRANKSHAFT POSITION SENSOR

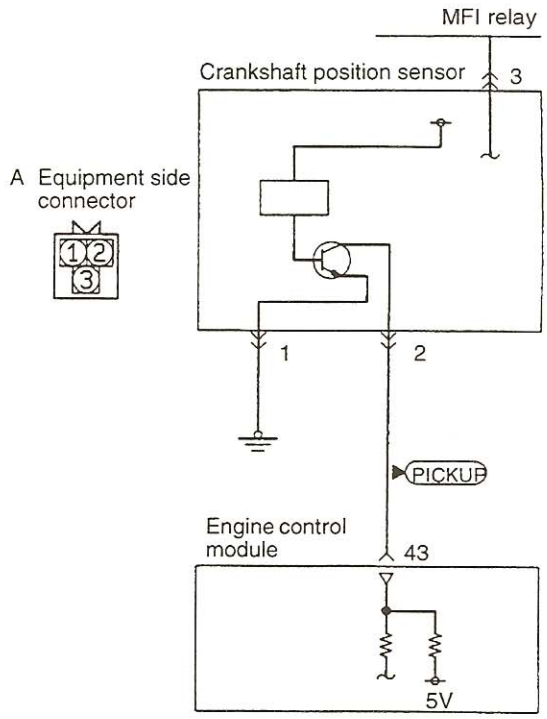
13110250101





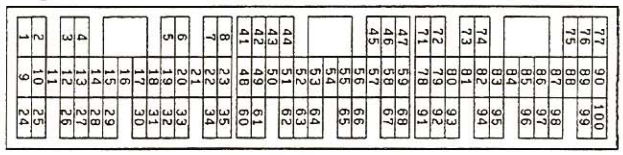


7FU0682



Engine control module connector

6AF0060



7FU2119

7FU2161

OPERATION

- The crankshaft position sensor functions to detect the crank angle (position) of each cylinder, and to convert those data to pulse signals, which are then input to the engine control module. The engine control module, based upon those signals, calculates the engine rpm, and also regulates the fuel injection timing and the ignition timing.
- The power for the crankshaft position sensor is supplied from the MFI relay and is grounded to the vehicle body. The crankshaft position sensor, by intermitting the flow (to ground) of the 5 V voltage applied from the engine control module, produces pulse signals.

TSB Revision

TROUBLESHOOTING HINTS

Hint 1:
If an impact is suddenly felt during driving or the engine suddenly stalls during idling, try shaking the crankshaft position sensor during idling. If the engine stalls, the cause is probably improper or incomplete contact of the crankshaft position sensor's connector.

Hint 2:
If the crankshaft position sensor output r/min is 0 r/min during cranking when the engine cannot be started, the cause is probably a malfunction of the crankshaft position sensor or a broken timing belt.

Hint 3:
If the indicated value of the crankshaft position sensor output r/min is 0 r/min during cranking when the engine cannot be started, the cause is probably a failure of the ignition coil's primary current to intermittently pulse correctly, so a malfunction of the ignition system circuitry, the ignition coil and/or the power transistor is the probable cause.

Hint 4:
If idling is possible even though the crankshaft position sensor indicated r/min is outside the standard value, the cause is usually a malfunction of something other than the crankshaft position sensor.

Examples:
(1) Malfunction of engine coolant temperature sensor
(2) Malfunction of idle air control motor
(3) Incorrect adjustment of the standard idling speed.

INSPECTION

Using Scan Tool

Function	Item No.	Data display	Check conditions	Check description	Normal condition
Data reading	22	Cranking r/min	• Engine is being cranked. • Tachometer connected. (The tachometer is used to check the intermittent pulsation of the ignition coil's primary current.)	Compare the cranking r/min and the r/min indicated by the scan tool.	Both agree.

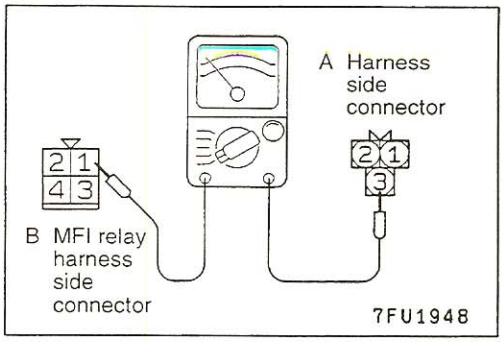
Function	Item No.	Data display	Check conditions	Engine coolant temperature °C (°F)	Standard value r/min
Data reading	22	Idling r/min	• Engine: Idling • Closed throttle position switch: ON	When –20 (–4)	1,300 – 1,500
				When 0 (32)	1,300 – 1,500
				When 20 (68)	1,300 – 1,500
				When 40 (104)	1,040 – 1,240
				When 80 (176)	600–800

NOTE
When idling to warm up from an engine coolant temperature of approx. –20°C (–4°F), if the idling revolution is lower than the standard value even when the IAC motor is fully opened, the air volume limiter built in the throttle body could be defective.

Wave Pattern Inspection Using an Analyzer

Refer to P.13A-83.

TSB Revision



HARNESS INSPECTION

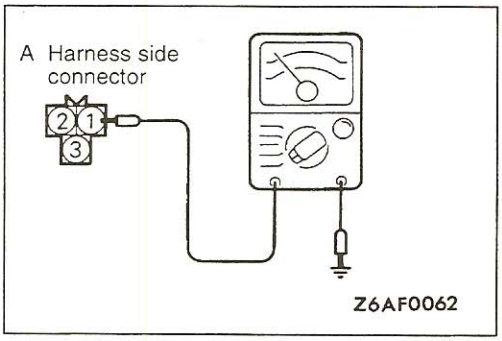
STEP 1. Check for continuity between the crankshaft position sensor and the MFI relay.

- MFI relay connector: Disconnected
- Crankshaft position sensor connector: Disconnected

NOTE
- Touch the ohmmeter problems to both ends of the harness.

OK: GO TO STEP 2

NG: Repair the harness. (A3 – B1)

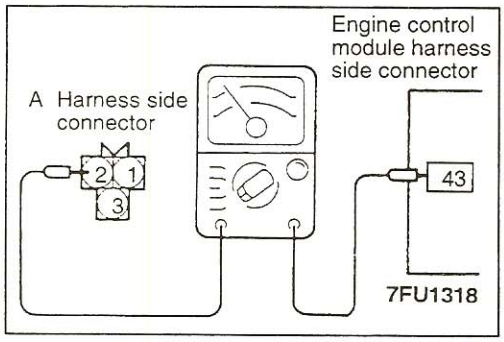


STEP 2. Check for continuity in the ground circuit.

- Crankshaft position sensor connector: Disconnected

OK: GO TO STEP 3

NG: Repair the harness. (A1 – Ground)

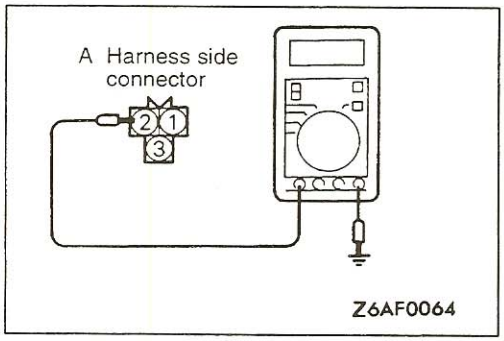


STEP 3. Check for an open circuit or a short-circuit to ground between the crankshaft position sensor and the engine control module.

- Engine control module connector: Disconnected
- Crankshaft position sensor connector: Disconnected

OK: GO TO STEP 4

NG: Repair the harness. (A2 – 43)



STEP 4. Measure the applied voltage.

- Crankshaft position sensor connector: Disconnected
- Engine control module connector: Connected
- Ignition switch: ON

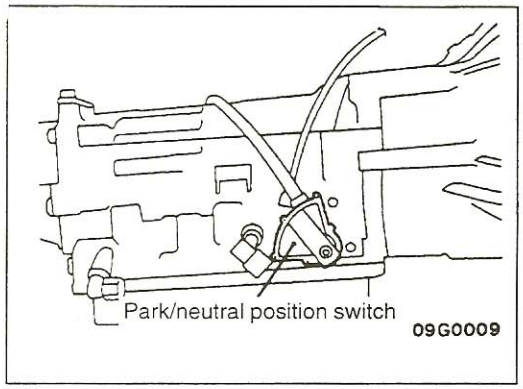
Voltage (V): 4.8 – 5.2

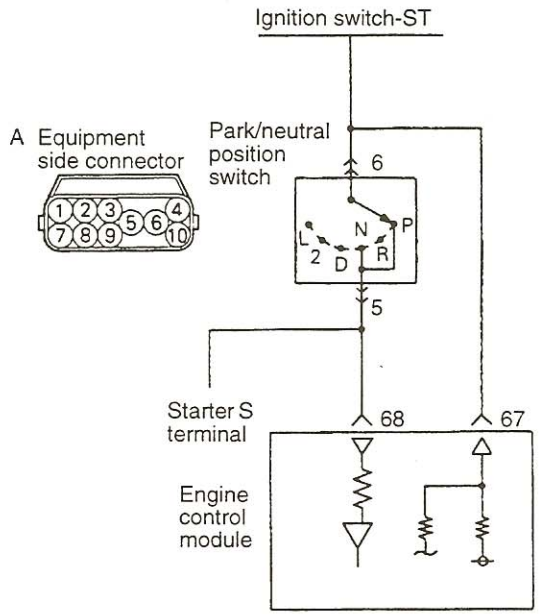
OK: STOP

NG: Replace the engine control module.

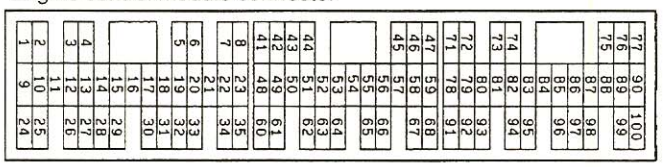
IGNITION SWITCH-ST AND PARK/NEUTRAL POSITION SWITCH

13110270114





Engine control module connector



7FU2162

OPERATION

- The ignition switch-ST inputs HIGH signals to the engine control module during engine cranking. The engine control module regulates fuel injection during starting, etc. based on those signals.
- When the ignition switch is set to START, the battery positive voltage during engine cranking is applied to the engine control module by way of the ignition switch and the park/neutral position switch, and the engine control module thus detects the fact that the engine is cranking. Note that battery positive voltage is not applied to the engine control module if the selector lever is in a position other than P or N.
- The park/neutral position switch functions to convert the voltage to HIGH level or LOW level depending upon whether the selector lever is in the P or N position or is at some position other than P or N, and inputs the result to the engine control module. The engine control module, based upon those signals, then regulates the operation of the idle air control motor.
- Battery positive voltage inside the engine control module is applied via the resistance to the park/neutral position switch. When the selector lever is placed in the P or N position, continuity is created, between the engine control module's park/neutral position switch terminal and the ground via the starter motor, and the terminal voltage becomes low.

TROUBLESHOOTING HINTS

If the output of the park/neutral position switch is abnormal even though the results of the checking of the park/neutral position switch harness and of the component itself are normal, the cause is probably improper adjustment of the control cable.

TSB Revision

INSPECTION

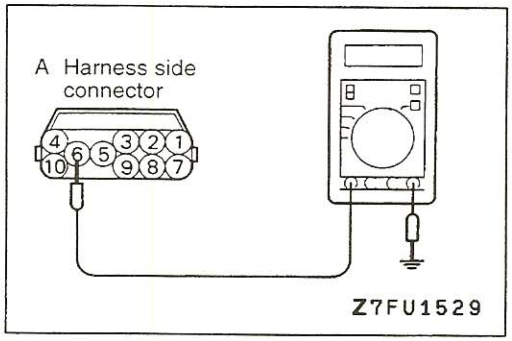
Using Scan Tool

Ignition switch-ST

Function	Item No.	Data display	Check conditions	Engine	Normal display
Data reading	18	Switch status	• Ignition switch: ON	Stopped	OFF
				Cranking	ON

Park/neutral position switch

Function	Item No.	Data display	Check conditions	Selector lever position	Normal display
Data reading	29	Shift position	• Ignition switch: ON	P or N	P or N
				D, 2, L or R	D, 2, L or R



HARNESS INSPECTION

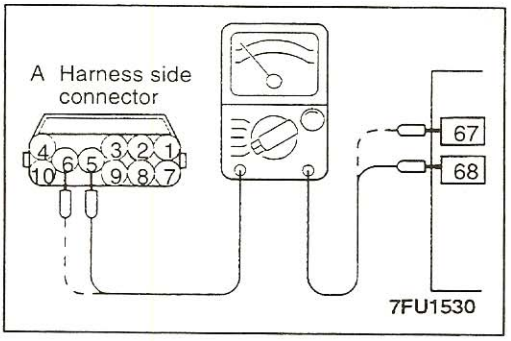
STEP 1. Measure the power supply voltage of the park/neutral position switch.

- Engine control module connector: Disconnected
- Park/neutral position switch connector: Disconnected
- Ignition switch: START

Voltage (V): Battery positive voltage

OK: GO TO STEP 2

NG: Check the power supply circuit.



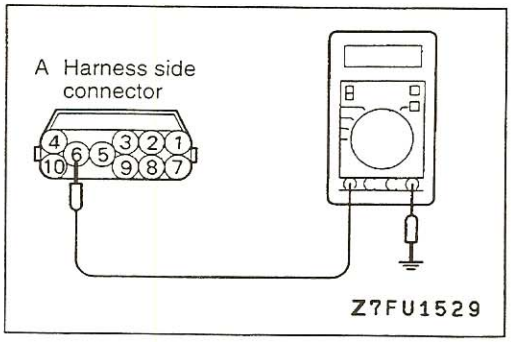
STEP 2. Check for continuity between the park/neutral position switch and the engine control module.

- Engine control module connector: Disconnected
- Park/neutral position switch connector: Disconnected

NOTE
- Touch the ohmmeter probes to both ends of the harness.

OK: GO TO STEP 3

NG: Repair the harnesses. (A5 – 68, A6 – 67)



STEP 3. Measure the park/neutral position switch terminal input voltage.

- Engine control module connector: Connected
- Park/neutral position switch connector: Disconnected
- Ignition switch: ON

Voltage (V): Battery positive voltage

OK: STOP

NG: Replace the engine control module.

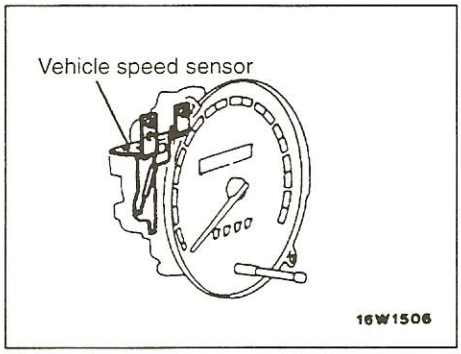
TSB Revision

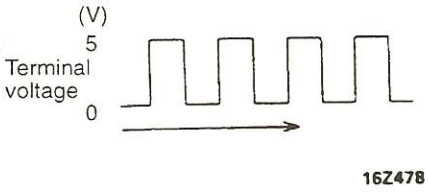
PARK/NEUTRAL POSITION SWITCH CHECK

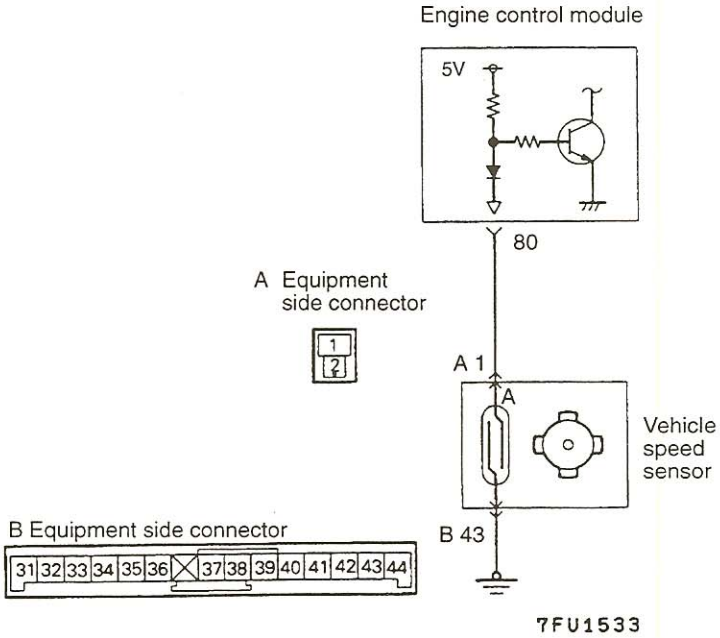
Refer to GROUP 23A – On-vehicle Service.

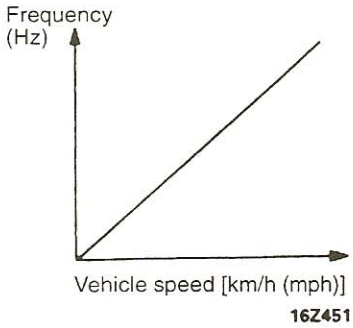
VEHICLE SPEED SENSOR

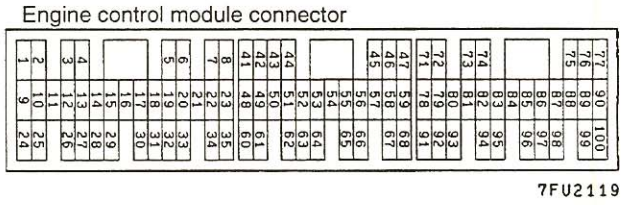
13110280117











7FU2163

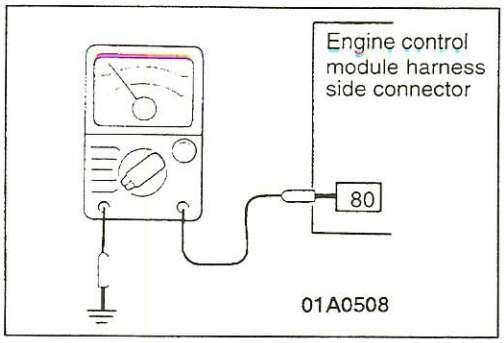
OPERATION

- The vehicle speed sensor is incorporated within the speedometer; it converts vehicle speed data to pulse signals and inputs those signals to the engine control module. The engine control module, based upon those signals, regulates the idle air control motor, etc.
  The vehicle speed sensor, by intermitting by the lead switch the flow (to ground) of the approximately 5 V voltage applied from the engine control module, produces vehicle speed signals.

TROUBLESHOOTING HINTS

If there is damaged or disconnected wiring or a short-circuit in the vehicle speed sensor signal circuit, the engine may stall when the vehicle speed is reduced and the vehicle is stopped.

TSB Revision



HARNESS INSPECTION

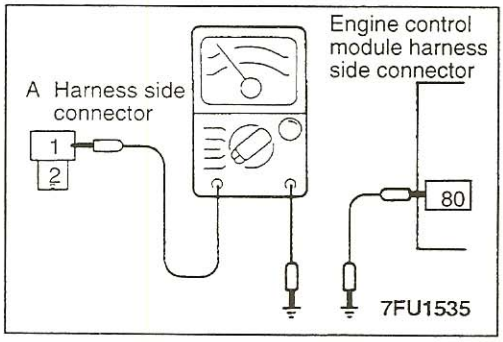
STEP 1. Check for continuity in the vehicle speed ser output circuit.

- Engine control module connector: Disconnected
- Move the vehicle.

Continuity: Continuity and no-continuity are repeated alternately.

OK: GO TO STEP 4

NG: GO TO STEP 2

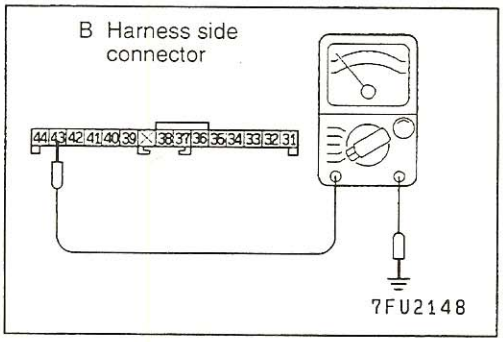


STEP 2. Check for an open or short-circuit between the vehicle speed sensor and the engine control module.

- Engine control module connector: Disconnected
- Vehicle speed sensor connector: Disconnected

OK: GO TO STEP 3

NG: Repair the harness. (A1 – 80)

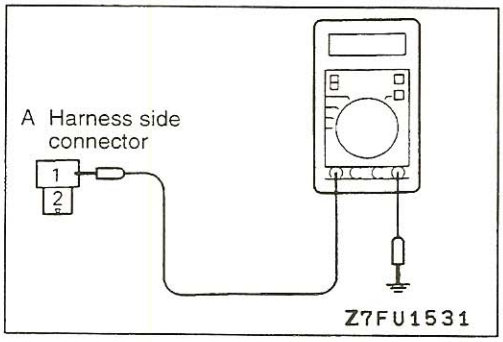


STEP 3. Check for continuity in the ground circuit.

- Vehicle speed sensor connector: Disconnected

OK: GO TO STEP 4

NG: Repair the harness. (B43 – Ground)



STEP 4. Measure the applied voltage.

- Vehicle speed sensor connector: Disconnected
- Engine control module connector: Connected
- Ignition switch: ON

Voltage (V): 4.5 – 4.9

OK: STOP

NG: Replace the engine control module.

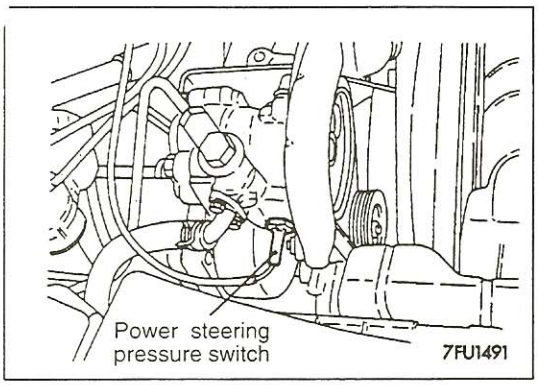
VEHICLE SPEED SENSOR CHECK

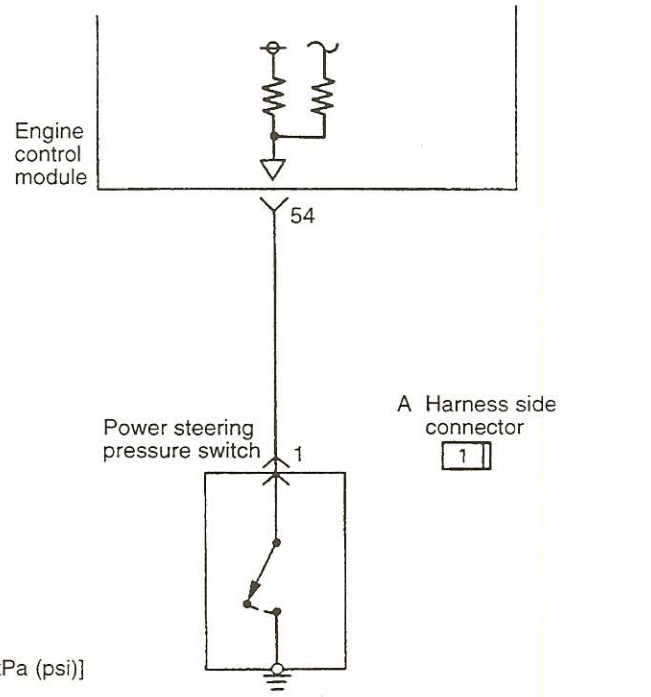
Refer to GROUP 54 – Meters and Gages.

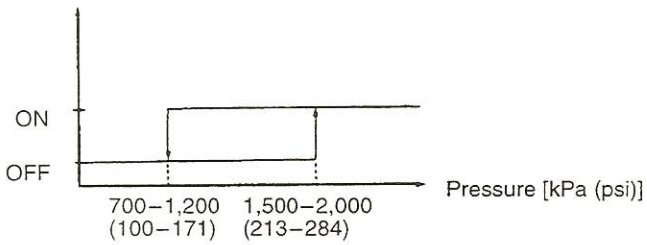
TSB Revision

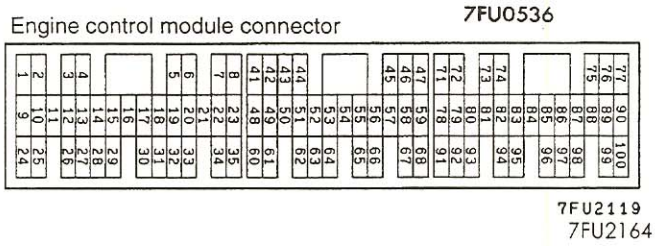
POWER STEERING PRESSURE SWITCH

13110290097









OPERATION

- The power steering pressure switch converts presence/absence of power steering load into low/high voltage and inputs it to the engine control module, which then controls the idle air control motor based on this signal.
- The battery positive voltage in the engine control module is applied through a resistor to the power steering pressure switch. Steering operation causes the power steering fluid pressure to increase, turning the switch on. As a result, continuity is produced between the battery positive terminal and the ground. This causes the power steering fluid pressure terminal voltage to go from high to low.

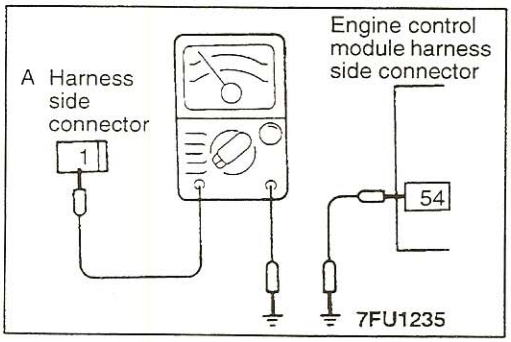
INSPECTION

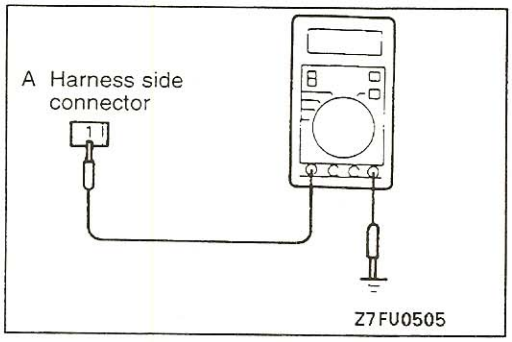
Using Scan Tool

Function	Item No.	Data display	Check condition	Steering wheel	Normal display
Data reading	27	Switch state	Engine: Idling	Steering wheel neutral position (wheels straight-ahead direction)	OFF
				Steering wheel half turn	ON

Checking Fluid Pressure

Steering wheel	Oil pump delivery pressure (ref. value)
Straight forward	700–1,200 kPa (100–171 psi)
Turned	1,500–2,000 kPa (213–284 psi)





HARNESS INSPECTION

STEP 1. Check for an open or short-circuit between the power steering pressure switch and the engine control module.

- Power steering pressure switch connector: Disconnected
- Engine control module connector: Disconnected

OK: GO TO STEP 2

NG: Repair the harness. (A1 – 54)

STEP 2. Measure the applied voltage.

- Power steering pressure switch connector: Disconnected
- Engine control module connector: Connected
- Ignition switch: ON

Voltage (V): Battery positive voltage

OK: STOP

NG: Replace the engine control module.

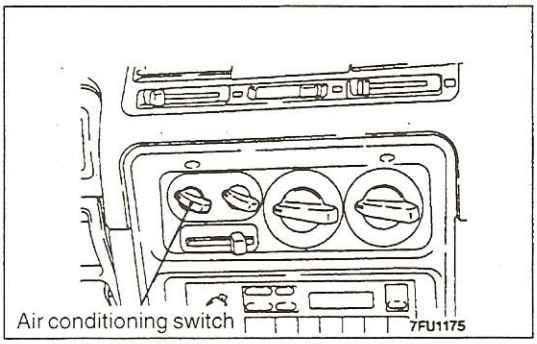
POWER STEERING PRESSURE SWITCH CHECK

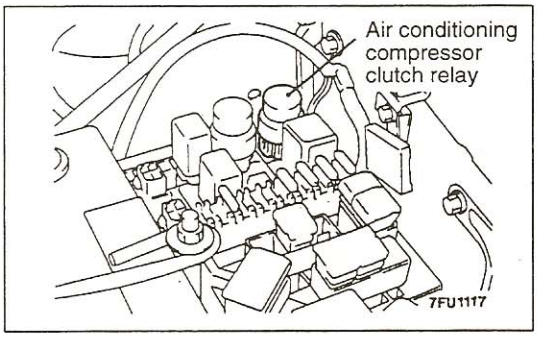
Refer to GROUP 37A – On-vehicle Service.

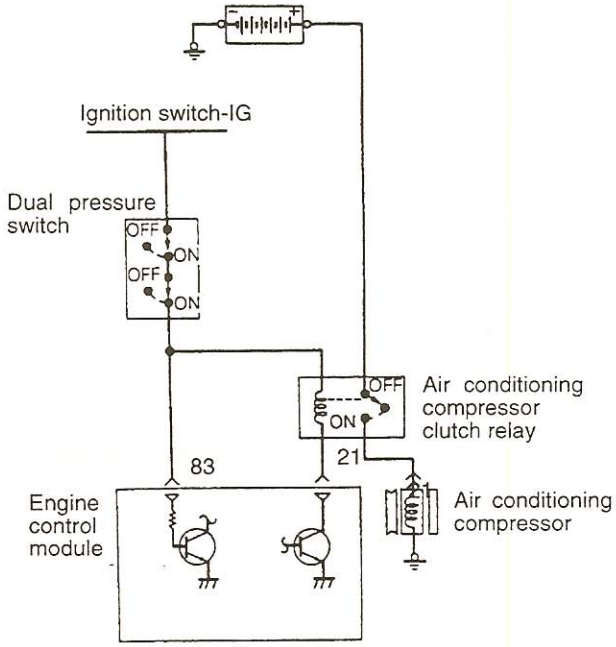
TSB Revision

AIR CONDITIONING SWITCH AND COMPRESSOR CLUTCH RELAY

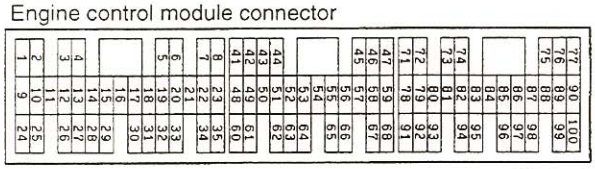
13110300097







Engine control module connector



7FU2165

OPERATION

- The air conditioning switch applies battery positive voltage to the engine control module when the air conditioning is switched ON.
- When the air conditioning signals are input, the engine control module activates the idle air control motor, and also switches ON the power transistor. As a result, current flows to the compressor clutch relay coil and the relay switch is switched ON; the air conditioning compressor's magnetic clutch is activated.

TROUBLESHOOTING HINTS

If the air conditioning compressor's magnetic clutch is not activated when the air conditioning switch is switched on during idling, the cause is probably a malfunction of the air conditioning control system.

TSB Revision

INSPECTION

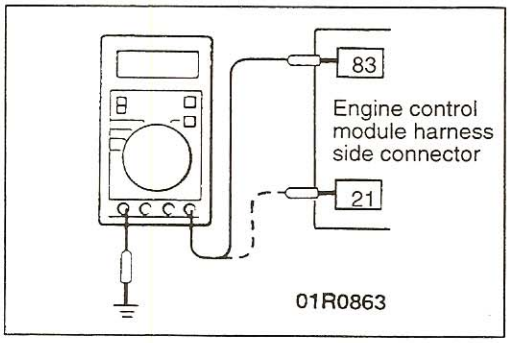
Using Scan Tool

<Air conditioning switch>

Function	Item No.	Data display	Check conditions	Air conditioning switch	Normal display
Data reading	28	Switch status	• Engine idling (The air conditioning compressor should be activated when the air conditioning switch is switched on.)	OFF	OFF
				ON	ON

<Air conditioning compressor clutch relay>

Function	Item No.	Data display	Check conditions	Air conditioning switch	Normal display
Data reading	49	Air conditioning compressor clutch relay status	Engine: Idling after having warmed up	OFF	OFF (Compressor clutch not activated)
				ON	ON (Compressor clutch not activated)



HARNESS INSPECTION

STEP 1. Measure the power supply voltage of the air conditioning circuit.

- Engine control module connector: Disconnect
- Ignition switch: ON
- Air conditioning switch: ON

Voltage (V): 6 or higher

OK: STOP

NG: Check the air conditioning circuit.

AIR CONDITIONING SWITCH CHECK

Refer to GROUP 55 – Heater Control Assembly.

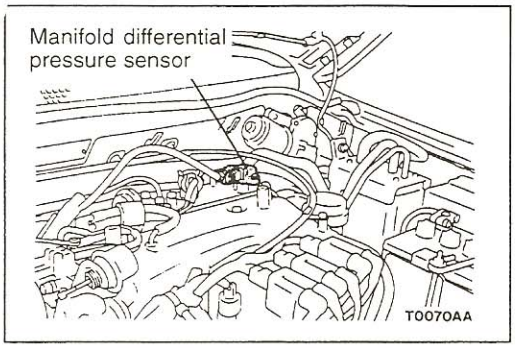
AIR CONDITIONING COMPRESSOR CLUTCH RELAY CHECK

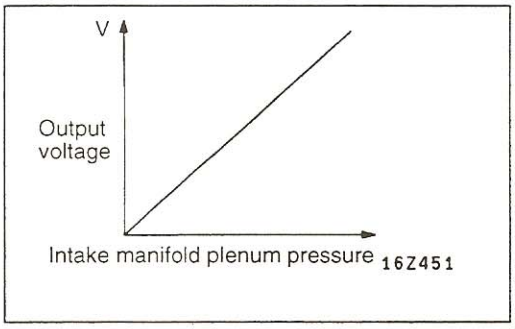
Refer to GROUP 55 – On-vehicle Service.

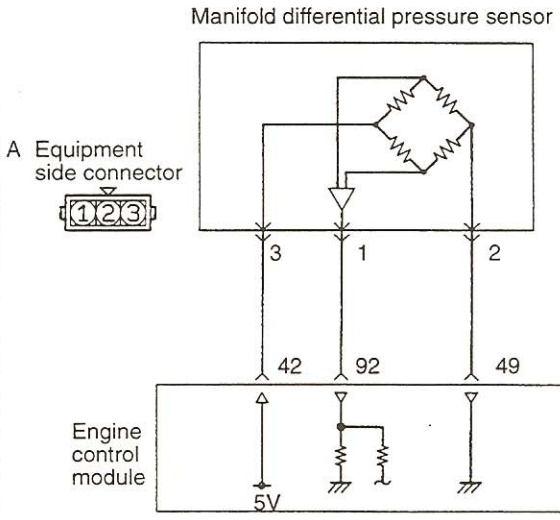
TSB Revision

MANIFOLD DIFFERENTIAL PRESSURE (MDP) SENSOR

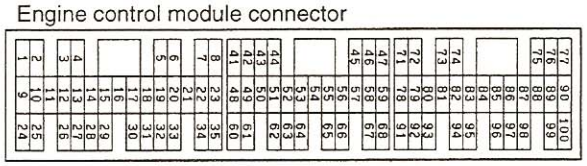
13110440065







Engine control module connector



7FU2166

OPERATION

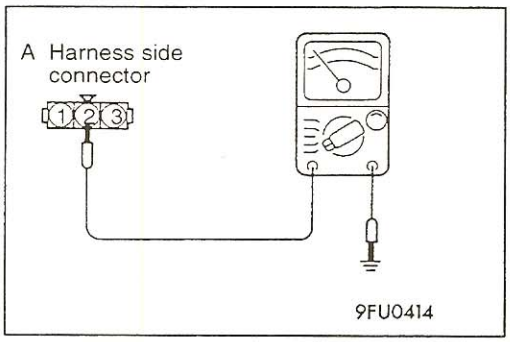
- The manifold differential pressure sensor converts air pressures in the intake manifold plenum into voltage signals and send them to the engine control module.
  The engine control module monitors the EGR system using this signals and generates the diagnostic trouble code if there is an abnormality in the EGR system.
- 5 V of power is supplied to the manifold differential pressure sensor from the engine control module, and the sensor circuit ground is located in the engine control module.
- The manifold differential pressure sensor output voltage is proportioned to the intake manifold plenum pressure and sent to the engine control module.

TSB Revision

INSPECTION

Using Scan Tool

Function	Item No.	Data display	Check condition	Engine state	Standard value
Data reading	95	Intake manifold plenum pressure	Engine: Warm-up	Idling	20.6 – 34.0 kPa



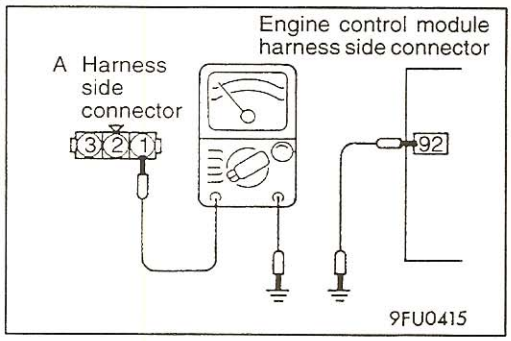
HARNESS INSPECTION

STEP 1. Check for continuity of the ground circuit.

- Manifold differential pressure sensor connector: Disconnected

OK: GO TO STEP 2

NG: Repair the harness. (A2 – 49)

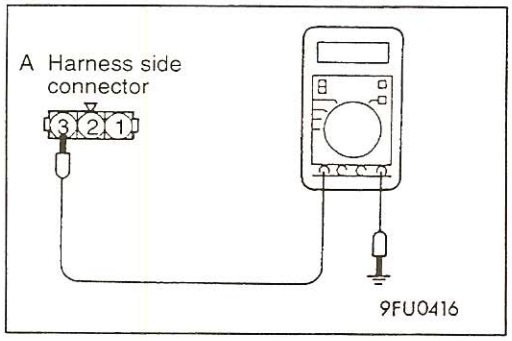


STEP 2. Check for open-circuit, or short-circuit to ground, between the engine control module and the manifold differential pressure sensor

- Manifold differential pressure sensor connector: Disconnected
- Engine control module connector: Disconnected

OK: GO TO STEP 3

NG: Repair the harness. (A1 – 92)



STEP 3. Measure the sensor feed voltage to the manifold differential pressure sensor.

- Manifold differential pressure sensor connector: Disconnected
- Engine control module connector: Connected
- Ignition switch: ON

Voltage: 4.8 – 5.2 V

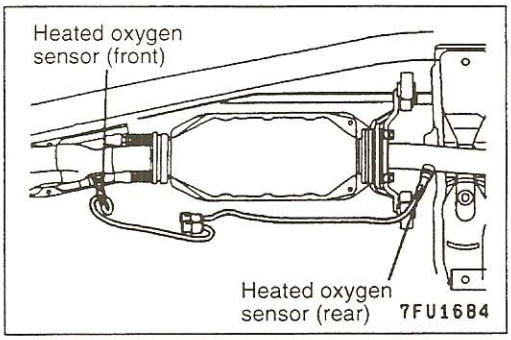
OK: STOP

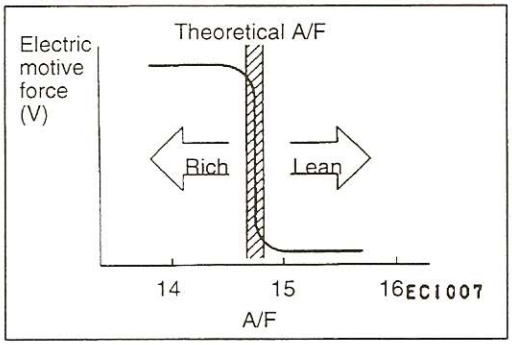
NG: Replace the engine control module.

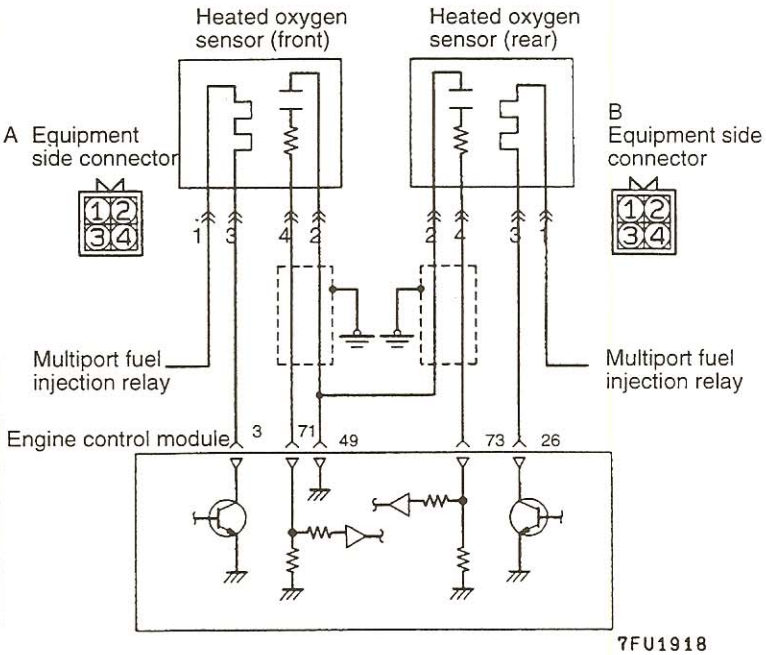
TSB Revision

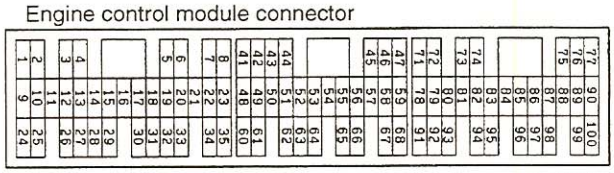
HEATED OXYGEN SENSOR <Federal>

13110340174









7FU2167

OPERATION

- The heated oxygen sensor functions to detect the concentration of oxygen in the exhaust gas; it converts those data to voltage, and inputs the resulting signals to the engine control module.
- If the air/fuel mixture ratio is richer than the theoretical air/fuel mixture ratio (i.e., if the concentration of oxygen in the exhaust gas is low), a voltage of approximately 1 V is output; if the air/fuel mixture ratio in leaner than the theoretical air/fuel mixture ratio (i.e., if the concentration is dense), a voltage of approximately 0 V is output.
- The engine control module, based upon those signals, regulates the amount of fuel injection so that the air/fuel mixture ratio becomes the theoretical air/fuel mixture ratio.
- Battery positive voltage is supplied, by way of the MFI relay, to the heated oxygen sensor heater. As a result, the sensor element is heated by the heater, so that the heated oxygen sensor shows excellent response even if the temperature of the exhaust gas is low.

TROUBLESHOOTING HINTS

Hint 1:
The exhaust gas purification performance will worsen it there is a malfunction of the heated oxygen sensor.
Hint 2:
If the heated oxygen sensor output voltage is outside the standard value even though the results of the checking of the heated oxygen sensor are normal, the cause is probably a malfunction of a component related to mixture control.

[Examples]
(1) Malfunction of injector
(2) Air is drawn into the intake manifold from a leaking gasket, etc.
(3) Malfunction of volume air flow sensor, intake air temperature sensor, barometric pressure sensor or engine coolant temperature sensor

TSB Revision

INSPECTION

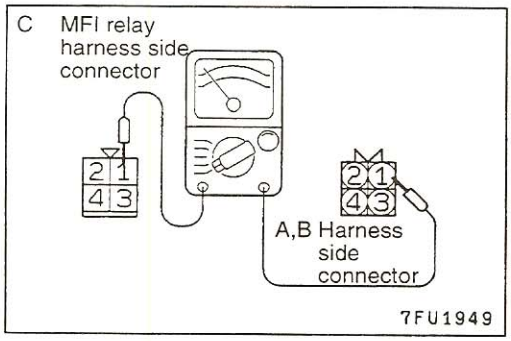
Using Scan Tool

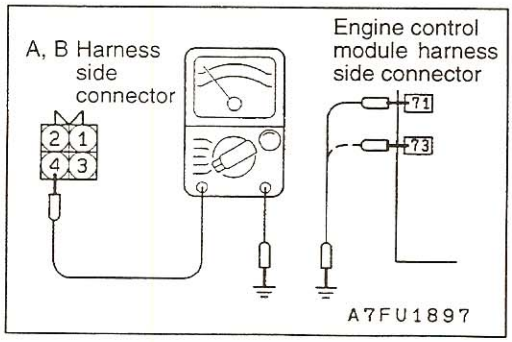
<Heated Oxygen Sensor (front)>

Function	Item No.	Data display	Check condition	Engine condition	Standard value
Data reading	11	Sensor detection voltage	Engine: Warm-up (Make the mixture lean by engine speed reduction, and rich by racing)	When sudden deceleration from 4,000 r/min	200 mV or lower
				When engine is suddenly raced	600–1,000 mV
			Engine: Warm-up (Using the heated oxygen sensor signal, check the air/fuel mixture ratio and also check the condition of control by the engine control module.	Idle speed	Changes repeatdly between 400 mV or lower and 600–1,000 mV
				2,500 r/min	

<Heated Oxygen Sensor (rear)>

Function	Item No.	Data display	Check condition	Engine state	Standard value
Data reading	59	Sensor voltage	• Transmission: L range • Accelerate the vehicle with wide open throttle.	3,500 r/min	600–1,000 mV





HARNESS INSPECTION

STEP 1. Check for continuity between the heated oxygen sensor and the MFI relay.

- MFI relay connector: Disconnected
- Heated oxygen sensor connector: Disconnected

NOTE
- Touch the ohmmeter probes to both ends of the harness.

OK: GO TO STEP 2

NG: Repair the harness. (A1 – C1, B1 – C1)

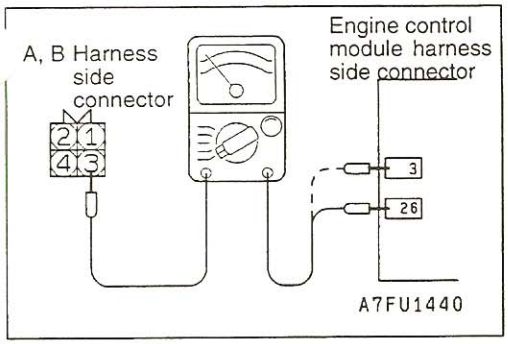
STEP 2. Check for an open circuit or a short-circuit to ground between the heated oxygen sensor and the engine control module.

- Heated oxygen sensor connector: Disconnected
- Engine control module connector: Disconnected

OK: GO TO STEP 3

NG: Repair the harness. (A4 – 71, B4 – 73)

TSB Revision

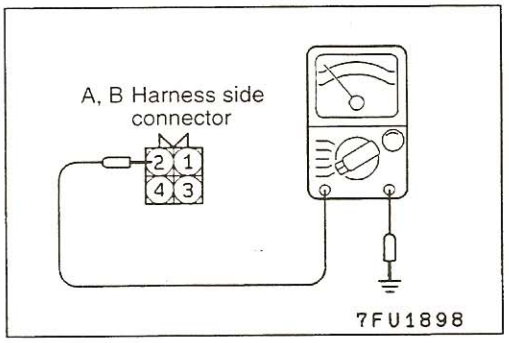


STEP 3. Check for an open circuit or a short-circuit to ground between the heated oxygen sensor and the engine control module.

- Heated oxygen sensor connector: Disconnected
- Engine control module connector: Disconnected

OK: GO TO STEP 4

NG: Repair the harness. (A3 – 3, B3 – 26)

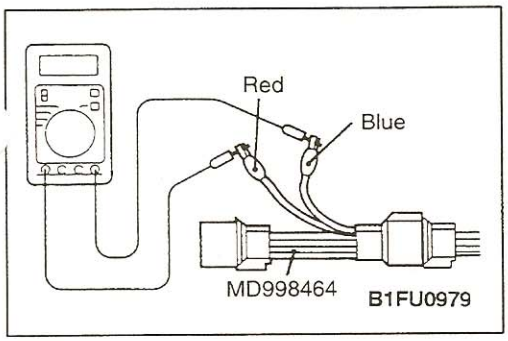


STEP 4. Check for continuity in the ground circuit.

- Heated oxygen sensor connector: Disconnected
- Engine control module connector: Disconnected

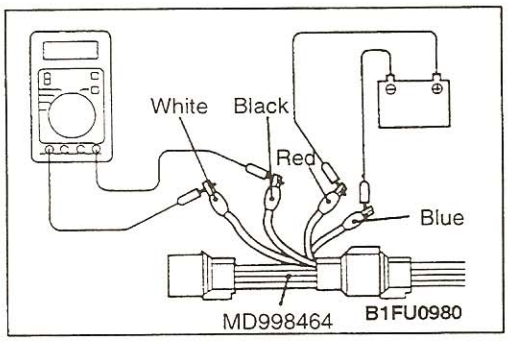
OK: STOP

NG: Repair the harness. (A2 – 49, B2 – 49)



HEATED OXYGEN SENSOR CHECK
<Heated oxygen sensor (front)>

(1) Disconnect the connector to the heated oxygen sensor, then use the special tool (test harness) to make connections with the connection on the heated oxygen sensor side.
(2) Check that there is continuity between terminal (1) (red clip of the special tool) and terminal (3) (blue clip) of the heated oxygen sensor connector [approx. 11–18 Ω at a temperature of 20°C (68°F)].
(3) If there is no continuity, replace the heated oxygen sensor.



(4) Warm up the engine until the coolant temperature is 80°C (176°F) or higher.
(5) Using jumper wires, connect terminal (1) (red clip of the special tool) and terminal (3) (blue clip) of the heated oxygen sensor with the positive battery terminal and negative battery terminal respectively.

Caution
When connecting the jumper wires, be careful not to connect them to the wrong terminals, since this could damage the heated oxygen sensor.

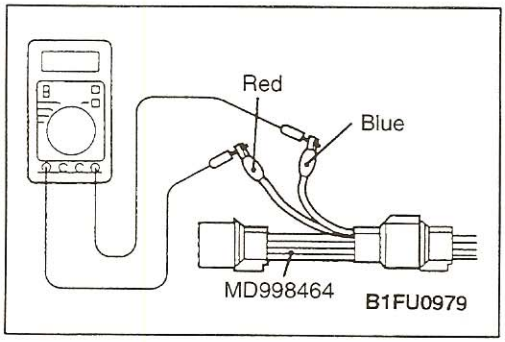
(6) Connect a digital voltmeter to terminal (2) (black clip of the special tool) and terminal (4) (white clip).
(7) While repeatedly racing the engine, measure the heated oxygen sensor's output voltage.

Standard value:

Engine	Heated Oxygen Sensor Output Voltage	Remarks
During racing	0.6–1.0 V	If the air-fuel ratio becomes rich while repeatedly racing the engine, the output of the heated oxygen sensor will be 0.6–1.0 V if it is normal.

(8) If the measurements are not as specified, the cause is probably a malfunction of the heated oxygen sensor.

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



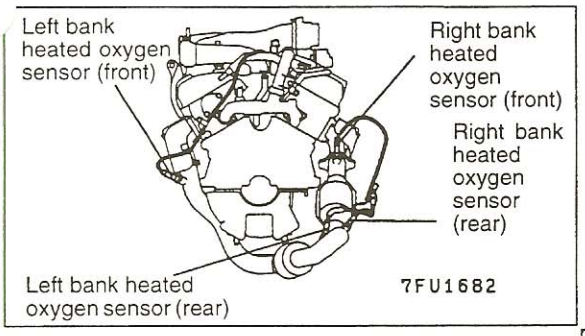
<Heated oxygen sensor (rear)>

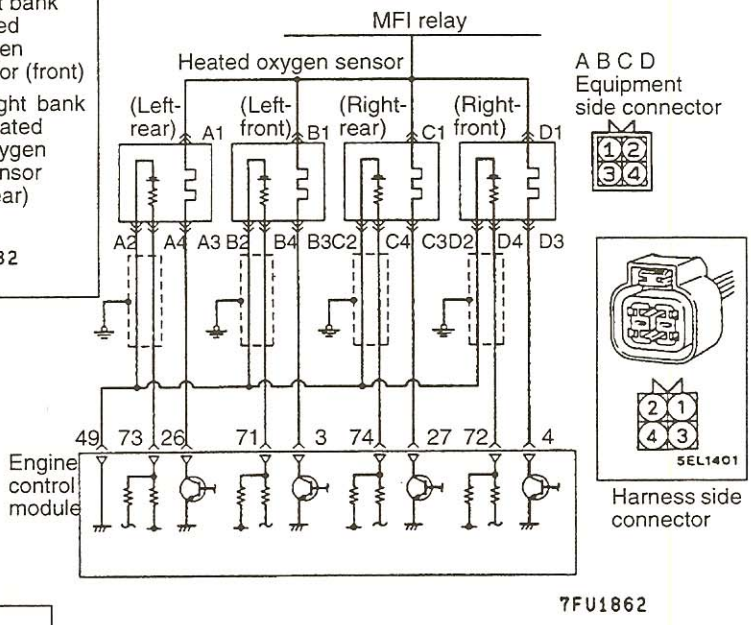
(1) Disconnect the connector to the heated oxygen sensor, then use the special tool (test harness) to make connections with the connection on the heated oxy sensor side.
(2) Check that there is continuity between terminal (1) (red clip of the special tool) and terminal (3) (blue clip) of the heated oxygen sensor connector [approx. 11–18 Ω at a temperature of 20°C (68°F)].
(3) If there is no continuity, replace heated oxygen sensor.

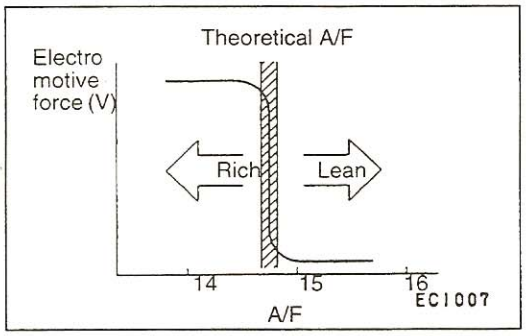
NOTE
1. If the scan tool dose not display the standard value although no abnormality is found by the abovementioned continuity test and harness check, replace the heated oxygen sensor.
2. For removal and installation of the oxygen senosr, refer to GROUP 15 – Exhaust Pipe, Muffler and Catalytic Converter.

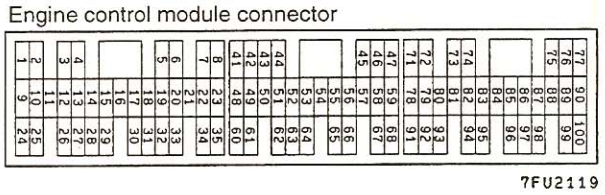
HEATED OXYGEN SENSOR <California>

13110340181









7FU2168

OPERATION

Refer to P.13A-99.

TROUBLESHOOTING HINTS

Refer to P.13A-99.

INSPECTION

Using Scan Tool

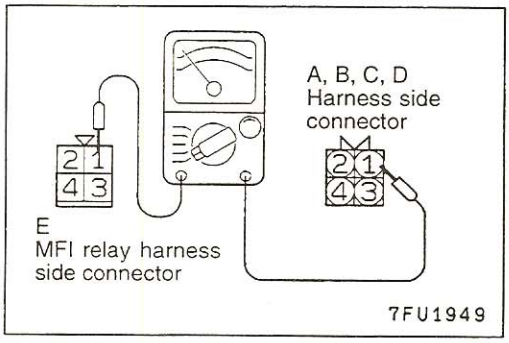
<Heated Oxygen Sensor (front)>

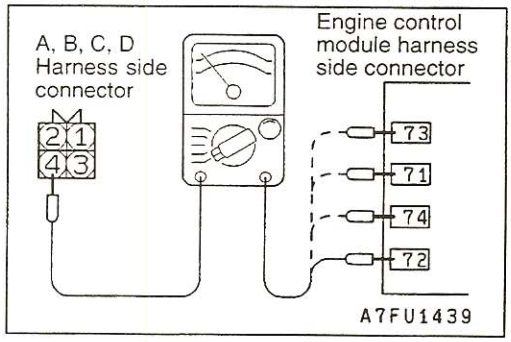
Function	Item No.	Data display	Check condition	Engine condition	Standard value
Data reading	11 (Right bank) 39 (Left bank)	Sensor detection voltage	Engine: Warm-up (Make the mixture lean by engine speed reduction, and rich by racing)	When sudden deceleration from 4,000 r/min	200 mV or lower
				When engine is suddenly raced	600–1,000 mV
			Engine: Warm-up (Using the heated oxygen sensor signal, check the air/fuel mixture ratio, and also check the condition of control by the engine control module)	Idling	Changes repeatdly between 400 mV or lower and 600–1,000 mV
				2,500 r/min	

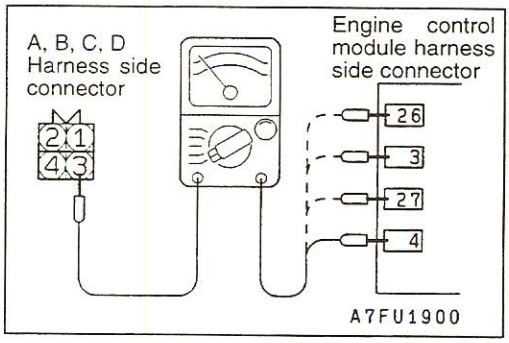
TSB Revision

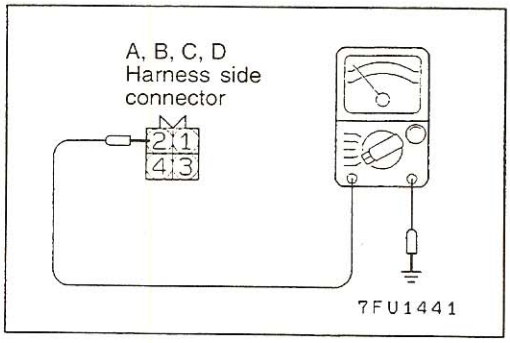
<Heated Oxygen Sensor (rear)>

Function	Item No.	Data display	Check condition	Engine state	Standard valu
Data reading	59 (Right bank) 69 (Left bank)	Sensor voltage	• Transmission: L range • Drive with wide open throttle	3,500 r/min	600–1,000 mV









HARNESS INSPECTION

STEP 1. Check for continuity between heated oxygen sensor and MFI relay.

- MFI relay connector: Disconnected
- Heated oxygen sensor connector: Disconnected

NOTE
Insert the probes of the circuit tester into both ends of the harness.

OK: GO TO STEP 2

NG: Repair the harness. (A, B, C, D1 – E3)

STEP 2. Check for an open-circuit, or a short-circuit to ground, between the engine control module and the heated oxygen sensor.

- Heated oxygen sensor connector: Disconnected
- Engine control module connector: Disconnected

OK: GO TO STEP 3

NG: Repair the harness. (A4 – 73, B4 – 71, C4 – 74, D4 – 72)

STEP 3. Check for an open-circuit, or a short-circuit to ground, between the engine control module and the heated oxygen sensor.

- Heated oxygen sensor connector: Disconnected
- Engine control module connector: Disconnected

OK: GO TO STEP 4

NG: Repair the harness. (A3 – 26, B3 – 3, C3 – 27, D3 – 4)

STEP 4. Check for continuity of the ground circuit.

- Heated oxygen sensor connector: Disconnected

OK: STOP

NG: Repair the harness. (A2, B2, C2, D2 – 49)

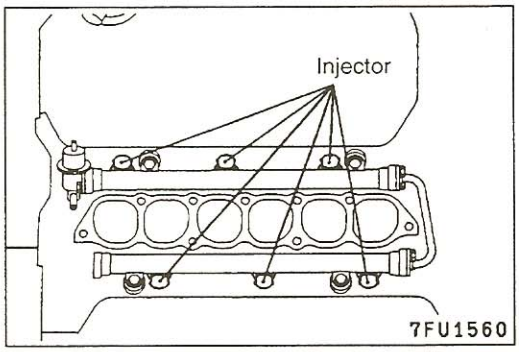
TSB Revision

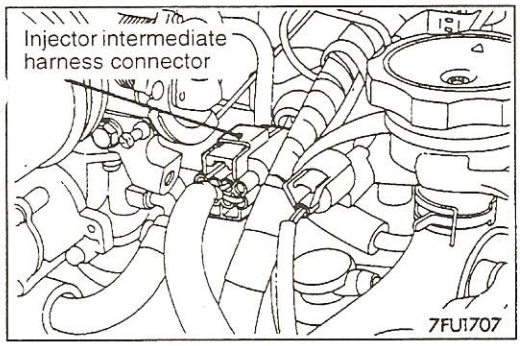
HEATED OXYGEN SENSOR CHECK

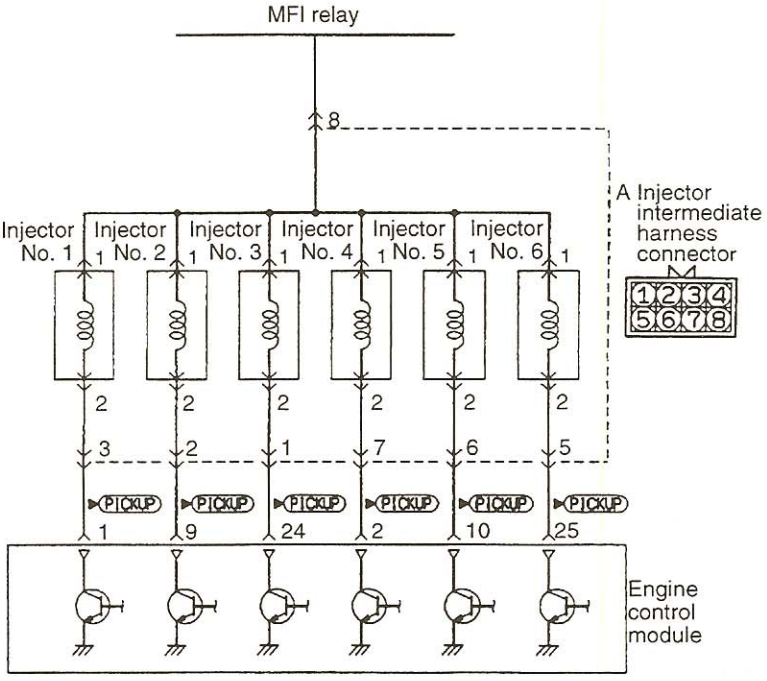
Refer to P.13A-101.

INJECTORS

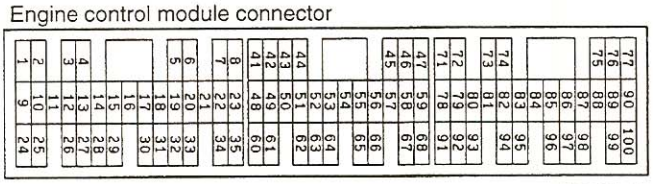
13110350122







Engine control module connector



7FU2119
7FU2169

OPERATION

- The injector is an injection nozzle with a solenoid which injects fuel according to the injection signal coming from the engine control module.
  The injector has a fixed nozzle opening area and the fuel pressure against manifold inside pressure is regulated to a fixed level. Therefore, the volume of fuel injected by the injector is determined by the time during which the needle valve is open, namely, by the time during which the solenoid coil is energized.
- The battery positive voltage is applied through the MFI relay to this injector. When the engine control module turns on the power transistor in the unit, the solenoid coil is energized to open the injector valve, which then injects fuel.

TSB Revision

TROUBLESHOOTING HINTS

Hint 1:
If there is a problem with starting while the engine is warm, perform the combustion test and check for leakage of the injectors.

Hint 2:
If the engine can't be started and the injectors are not activated during cranking, the cause is probably a malfunction such as described below, not a problem with the injectors.
(1) Malfunction of power supply circuit or ground circuit of engine control module
(2) Malfunction of MFI relay
(3) Malfunction of crankshaft position sensor and/or camshaft position sensor

Hint 3:
If there is a cylinder for which the idling condition does not change when, during idling, the fuel injection of the injectors is cut off in seque. check that cylinder as described below.
(1) Check the injector and harness.
(2) Check the spark plugs and the high-tension cable.
(3) Check the compression pressure.

Hint 4:
If the injector activation time is outside the standard value even though the results of the checking of the injector's harness and of the injector itself are normal, the cause is probably one of the following.
(1) Incomplete combustion inside a cylinder (Malfunction of spark plugs, ignition coil, compression pressure, etc.)
(2) Increased engine resistance

INSPECTION

Using Scan Tool

<Drive time>

Function	Item No.	Data display	Check conditions	Engine coolant temperature °C (°F)	Standard value ms
Data reading	41	Activation time*1	Engine cranking	When 0 (32)*2	11 – 17
				When 20 (68)	28 – 42
				When 80 (176)	7.4 – 11.2

TSB Revision

Function	Item No.	Data display	Check conditions	Engine condition	Standard value ms
Data reading	41	Activation time*3	• Engine coolant temp: 85–95°C (185–203°F) • Lights and all accessories: OFF • Transmission: P range	Idling	2.1 – 3.3
				2,500 r/min	1.9 – 3.1
				When raced suddenly	Increases.

NOTE
*1: Indicates the injector-activation time when the power source voltage is 11 V and the cranking speed is 250 r/min or less.
*2: At a coolant temperature of 0°C (32°F), there is synchronous injection for all six cylinders.
*3: For a new vehicle [driven approximately 500 km (300 miles) or less] the injector-activation may be about ten percent longer then indicated above.

<Long-term fuel trim>

Function	Item No.	Data display	Chekc condition	Engine state	Standard value
Data reading	81	Appropriate range	Engine: after warm-up	Idling	–12.5 – 12.5 %

<Short-term fuel trim>

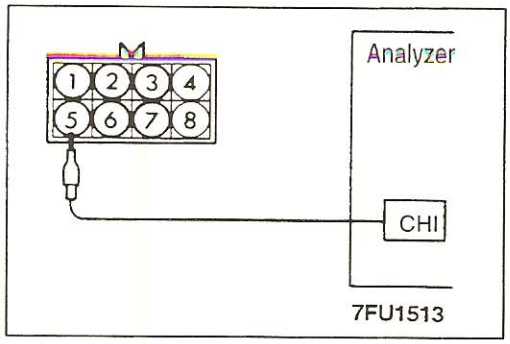
Function	Item No.	Data display	Chekc condition	Engine state	Standard value
Data reading	82	Appropriate range	Engine: after warm-up (during closed loop con-trol)	No load 2,500 r/min	–30 – 25 %

<Fuel control condition>

Function	Item No.	Data display	Chekc condition	Engine state	Standard value
Data reading	86	Control condition	Engine: after warm-up	2,500 r/min	Closed loop
				Racing	Open loop

Function	Item No.	Drive content	Check condition	Normal condition
Actuator test	01	No. 1 injector shut off	Engine: Idling after having warmed up (Shut off the injectors in sequence after engine has warmed up, and check the idling condition)	Changing from the idling condition (becoming less stable or stalling)
	02	No. 2 injector shut off		
	03	No. 3 injector shut off		
	04	No. 4 injector shut off		
	05	No. 5 injector shut off		
	06	No. 6 injector shut off		

TSB Revision



Wave Pattern Inspection Using an Analyzer

Measurement method

(1) Disconnect the injector intermediate harness, and connect the special tool (harness connector MD998474).
(2) Connect the oscilloscope probes according to the details given in the table below.

	No. 1 cylinder	No. 2 cylinder	No. 3 cylinder	No. 4 cylinder	No. 5 cylinder	No. 6 cylinder
Male connector side terminal (2)	3	2	1	7	6	5
Clip (lead wire)	Green (green and black)	White (white)	Blue (blue)	Yellow (yellow)	Red (red)	Black (black)

Alternative method (when test harness is not available)

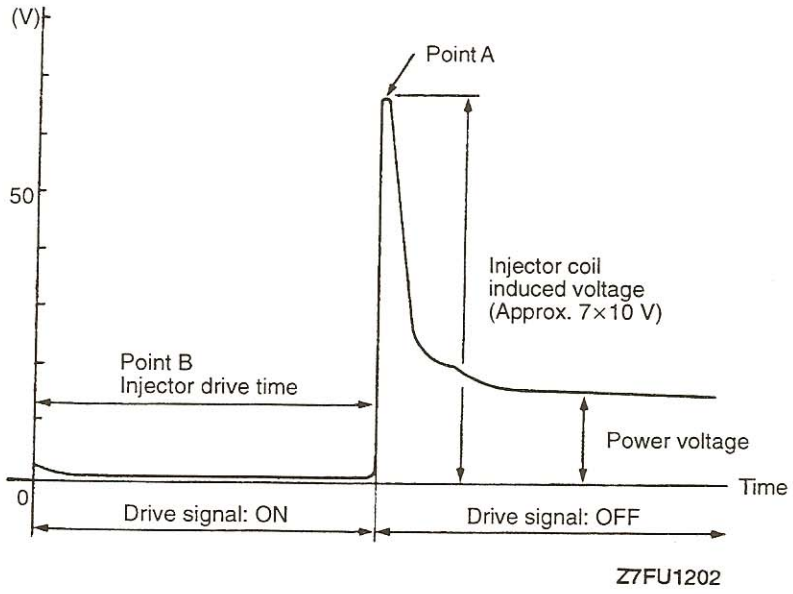
Connect the analyzer special patterns pickup to ECM terminals (1), (2), (3), (14), (15) and (16).

Standard wave pattern

Observation conditions

Function	Special patterns
Pattern height	Variable
Variable knob Pattern selector	Display
Engine r/min	Idling

Standard wave pattern

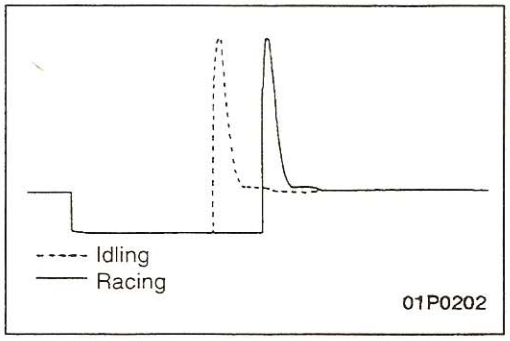


TSB Revision

Wave pattern observation points

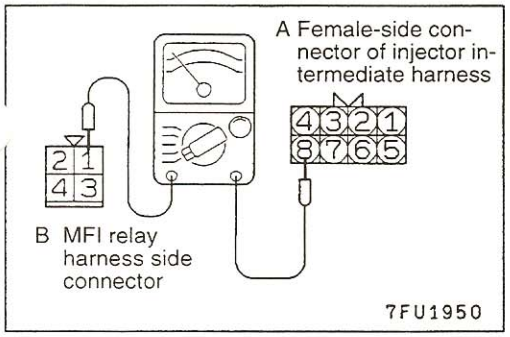
Point A: Height of injector coil induced voltage

Contrast with standard wave pattern	Probable cause
Injector coil induced voltage is low or doesn't appear at all.	Short-circuit in the injector solenoid



Point B: Injector drive time

- The injector drive timing will synchronized with the scan tool display.
- When the engine is suddenly raced, the drive time will be greatly extended at first, but the drive time will soon match the engine speed.



HARNESS INSPECTION

STEP 1. Check for continuity between the injectors and the MFI relay.

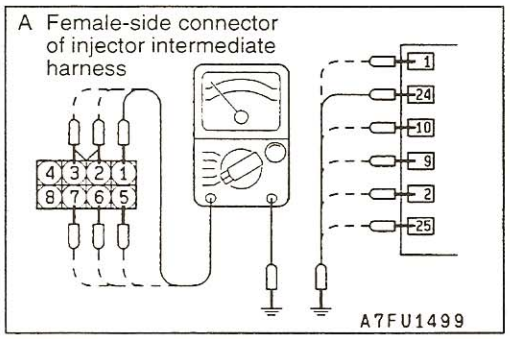
- Injector intermediate harness connector: Disconnected
- MFI relay connector: Disconnected

NOTE

- Touch the ohmmeter probes to both ends of the harness.

OK: GO TO STEP 2

NG: Repair the harness. (A8 – B1)

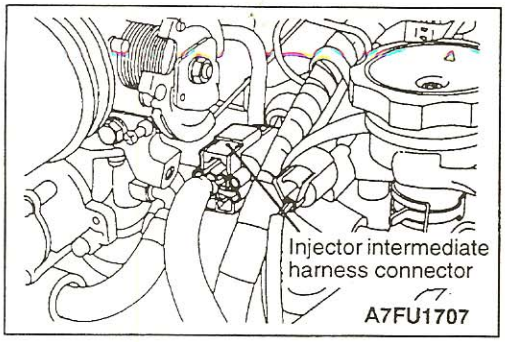


STEP 2. Check for an open circuit or a short-circuit to ground between the injector and the engine control module.

- Engine control module connector: Disconnected
- Injector intermediate harness connector: Disconnected

OK: STOP

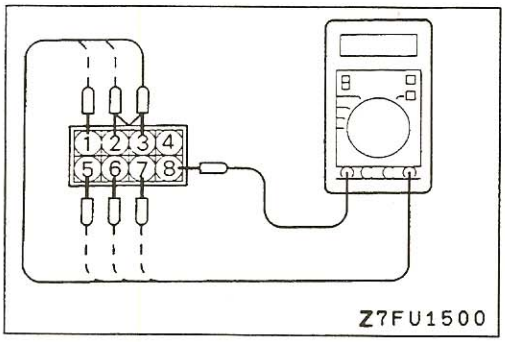
NG: Repair the harness. (A1 – 24, A2 – 9, A3 – 1, A5 – 25, A6 – 10, A7 – 2)



INJECTOR CHECK

Measuring Resistance Between Terminals

(1) Disconnect the injector intermediate harness.



(2) Measure the resistance between the terminals.

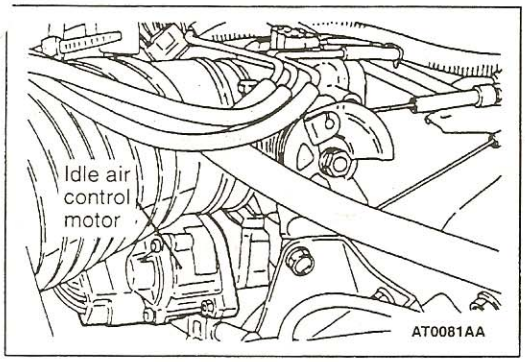
Injector No.	Measurement terminal	Resistance
No. 1	8–3	13–16 Ω (20°C)
No. 2	8–2	
No. 3	8–1	
No. 4	8–7	
No. 5	8–6	
No. 6	8–5	

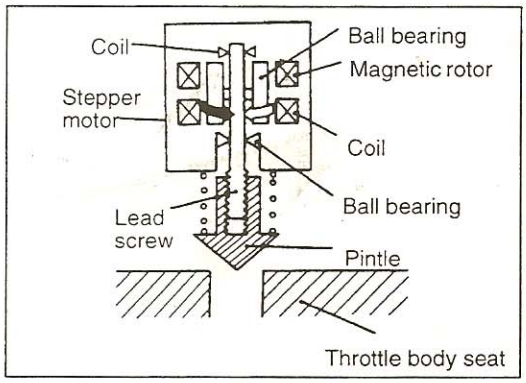
(3) Connect the injector intermediate harness.

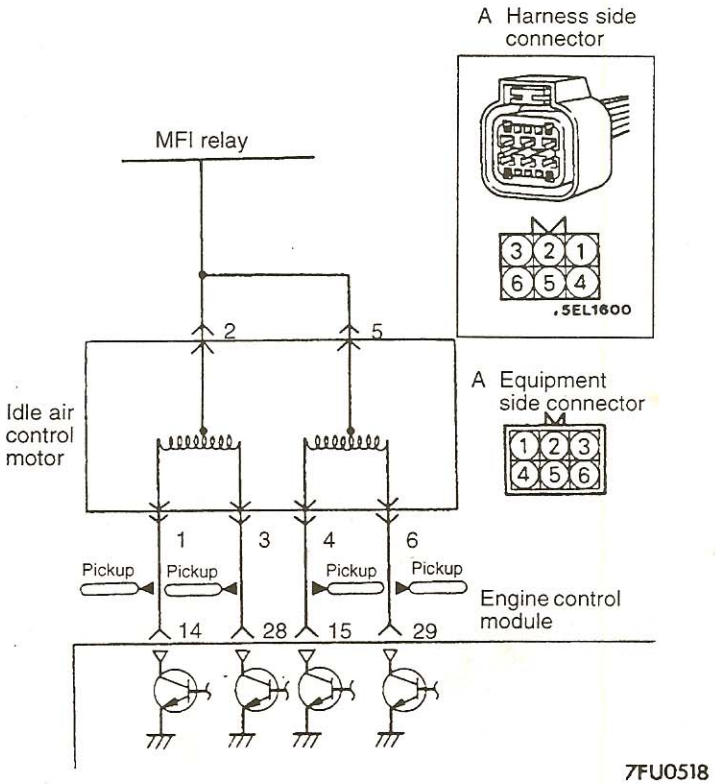
TSB Revision

IDLE AIR CONTROL MOTOR (STEPPER MOTOR)

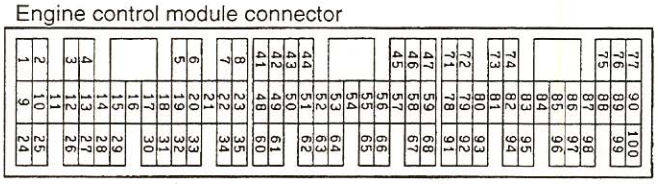
13110360095







Engine control module connector



7FU2170

OPERATION

- The amount of air taken in during idling is regulated by the opening and closing of the servo valve located in the air passage that bypasses the throttle valve.
- The servo valve is opened or closed by the activation of the stepper motor (incorporated within the idle air control motor in the forward or reverse direction.
- Battery positive voltage is supplied, by way of the MFI relay, to the coil of the stepper motor. The engine control module switches ON the power transistors (located within the engine control module) in sequential order, and, when current flows to the stepper motor coil, the stepper motor is activated in the forward or reverse direction.

TSB Revision

TROUBLESHOOTING HINTS

Hint 1:
If the number of stepper motor steps increases to 100–120 steps or decreases to 0 step, the cause is probably a malfunction of the stepper motor or damaged or disconnected wiring of the harness.

Hint 2:
If the number of stepper motor steps is outside the standard value even through the results of the checking of the harness of the idle air control motor and of the component itself indicate no abnormal condition, the cause is probably one of the following.
(1) Incorrect adjustment of the standard idling speed.
(2) Deposits adhering to the throttle valve.
(3) Air drawn into the intake manifold from a leaking gasket, etc.
(4) Incomplete combustion inside a cylinder (Malfunction of spark plugs, ignition coil, injectors, compression pressure, etc.)

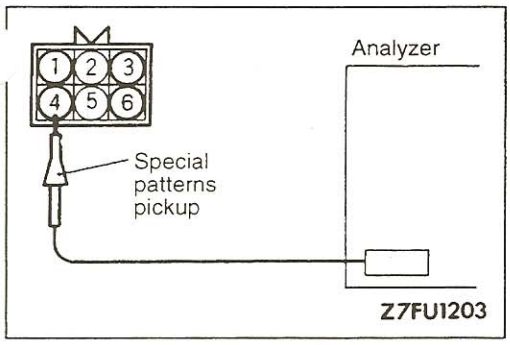
INSPECTION

Using Scan Tool

Function	Item No.	Data display	Check conditions	Load conditions	Standard value STEP
Data reading	45	Stepper motor steps	• Engine coolant temperature: 85–95°C (185–203°F) • Lights and all accessories: OFF • Transmission: P range • Closed throttle position switch: ON (The compressor clutch should be activated when the air conditioning switch is switched on.) • Engine: Idling	• Air conditioning switch: OFF	2–25
				• Air conditioning switch: OFF → ON	Increase by 10–70
				• Air conditioning switch: OFF • Selector lever: N → D position	Increase by 5–50

NOTE
When the vehicle is new [driven approximately 500 km (300 miles) or less] the number of steps may be about 30 steps greater than the standard value indicated above.

Caution
When the select lever is shifted to the D position, the brakes must be used to prevent the vehicle from moving forward.



Wave Pattern Inspection Using an Analyzer

Measurement method

(1) Disconnect the stepper motor connector, and connect the special tool (test harness: MB998463) in between.
(2) Connect the analyzer special patterns pickup to the stepper motor-side connector terminal (1) (red clip on the special tool), terminal (3) (green clip), terminal (4) (black clip) and terminal (6) (yellow clip) respectively.

Alternative method (when test harness is not available)

Connect the analyzer special patterns pickup to ECM terminals (4), (5), (17) and (18).

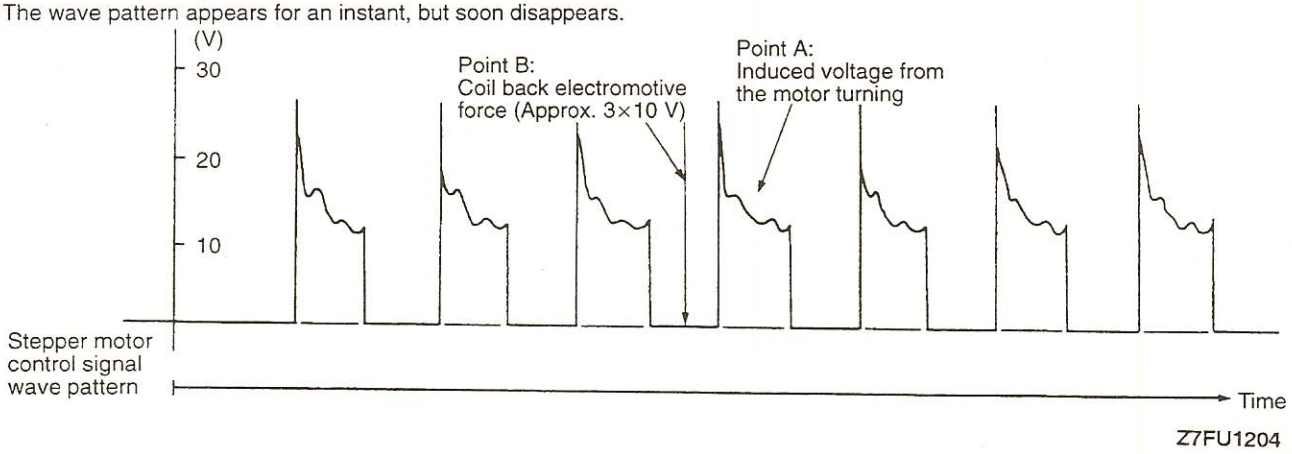
Standard wave pattern

Observation conditions

Function	Special patterns
Pattern height	High
Pattern selector	Display
Engine condition	Turn the ignition switch from OFF to ON (without starting the engine).
	While the engine is idling, turn the air conditioning switch to ON.
	Immediately after starting the warm engine (approx. 1 minute)

Standard wave pattern

The wave pattern appears for an instant, but soon disappears.



Wave pattern observation points

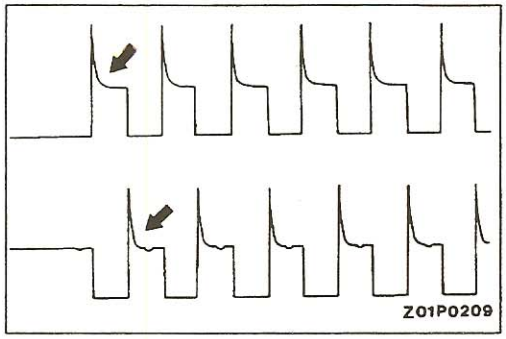
Check that the standard wave pattern appears when the stepper motor is operating.
Point A: Presence or absence of induced voltage from the motor turning. (Refer to the abnormal wave pattern.)

Contrast with standard wave pattern	Probable cause
Induced voltage does not appear or is extremely small.	Malfunction of motor

Point B: Height of coil back electromotive force

Contrast with standard wave pattern	Probable cause
Coil back electromotive force does not appear or is extremely small.	Short-circuit in the coil

TSB Revision



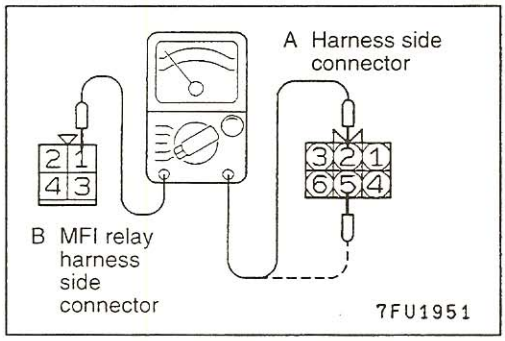
Examples of abnormal wave patterns

Cause of problem

Malfunction of motor (Motor is not operating)

Wave pattern characteristics

Induced voltage from the motor turning does not appear.



HARNESS INSPECTION

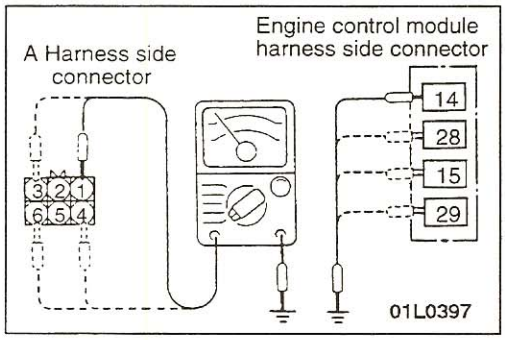
STEP 1. Check for continuity between the idle air control motor and the MFI relay.

- Idle air control motor connector: Disconnected
- MFI relay connector: Disconnected

NOTE
- Touch the ohmmeter probes to both ends of the harness.

OK: GO TO STEP 2

NG: Repair the harnesses. (A2 – B1, A5 – B1)

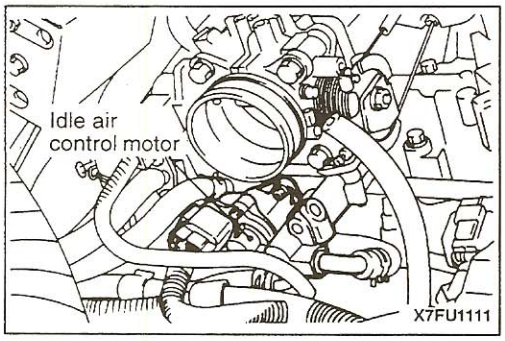


STEP 2. Check for an open circuit or a short-circuit to ground between the idle air control motor and the engine control module.

- Engine control module connector: Disconnected
- Idle air control motor connector: Disconnected

OK: STOP

NG: Repair the harnesses. (A1 – 14, A3 – 28, A4 – 15, A6 – 29)

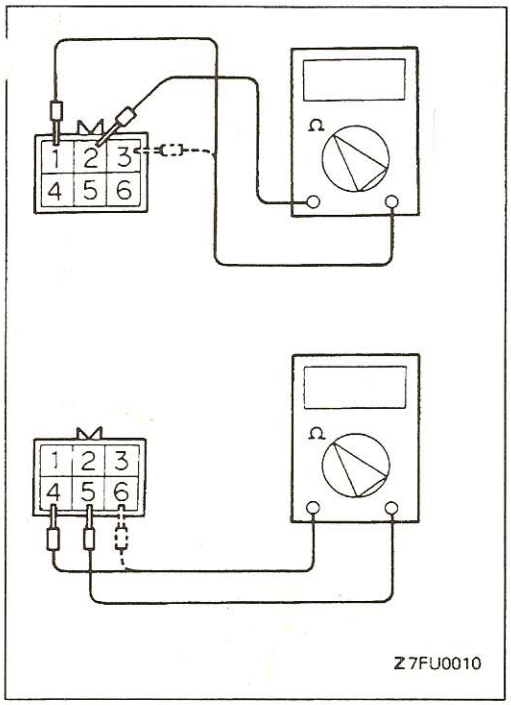


IDLE AIR CONTROL MOTOR CHECK

Checking Operation Sound

(1) Check that the operating sound of the stepper motor can be heard over the idle air control motor when the ignition switch is turned to the ON position (without starting the engine).

(2) If no operating sound can be heard, check the stepper motor drive circuit. (If the circuit is good, a defective stepper motor or engine control module is suspected.)



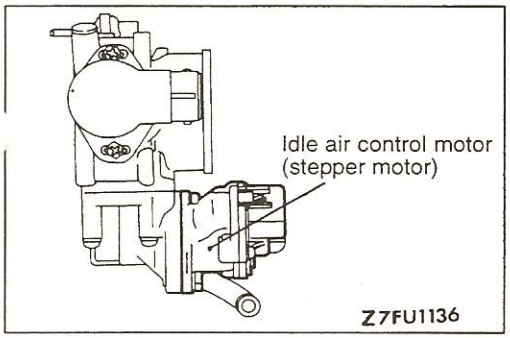
Checking Coil Resistance

(1) Disconnect the idle air control motor connector and connect the special tool (test harness).
(2) Measure the resistance between terminal (2) (White clip of the special tool) of the connector at the idle air control motor side and terminal (1) (red clip) or terminal (3) (blue clip).

Standard value: 28–33 Ω [at 20°C (68°F)]

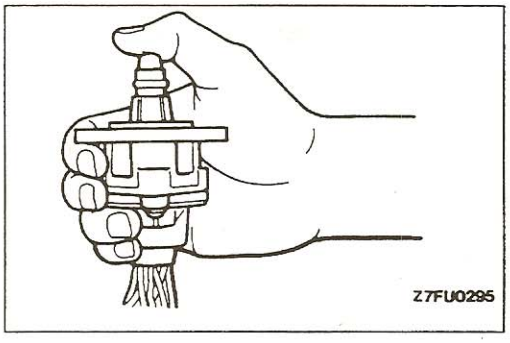
(3) Measure the resistance between terminal (5) (green clip of the special tool) of the connector sat the idle air control motor side and terminal (6) (yellow clip) or terminal (4) (black clip).

Standard value: 28–33 Ω [at 20°C (68°F)]

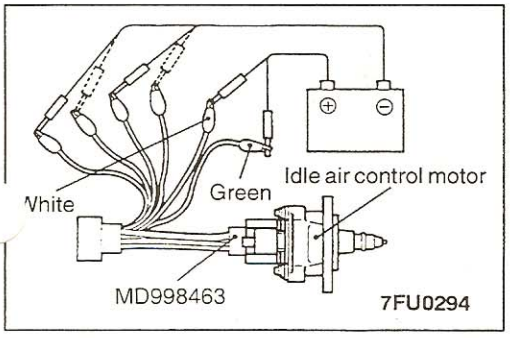


Checking the operation

(1) Remove the throttle body.
(2) Remove the stepper motor.



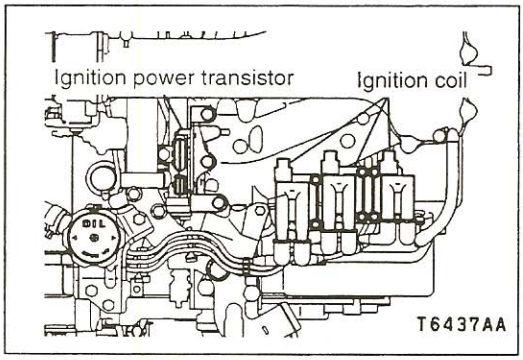
(3) Connect the special tool (test harness) to the idle air control motor connector.
(4) Connect the positive terminal of a power source (approx 6 V) to the white clip or the green clip.
(5) While holding the idle air control motor as shown in the illustration, connect the negative power source terminal to each clip in the sequence described below, and check whether or not there is vibration (a feeling of very slight shaking of the stepper motor) as a result of activation of the stepper motor.
   1) Connect the negative power source terminal to the red and black clips.
   2) Connect the negative power source terminal to the blue and black clips.
   3) Connect the negative power source terminal to the blue and yellow clips.
   4) Connect the negative power source terminal to the red and yellow clips.
   5) Connect the negative power source terminal to the red and black clips.
   6) Repeat the test in the reverse (5–1) sequence.
(6) If vibration is felt as a result of this test, the stepper motor can be considered to be normal.

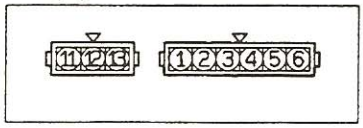


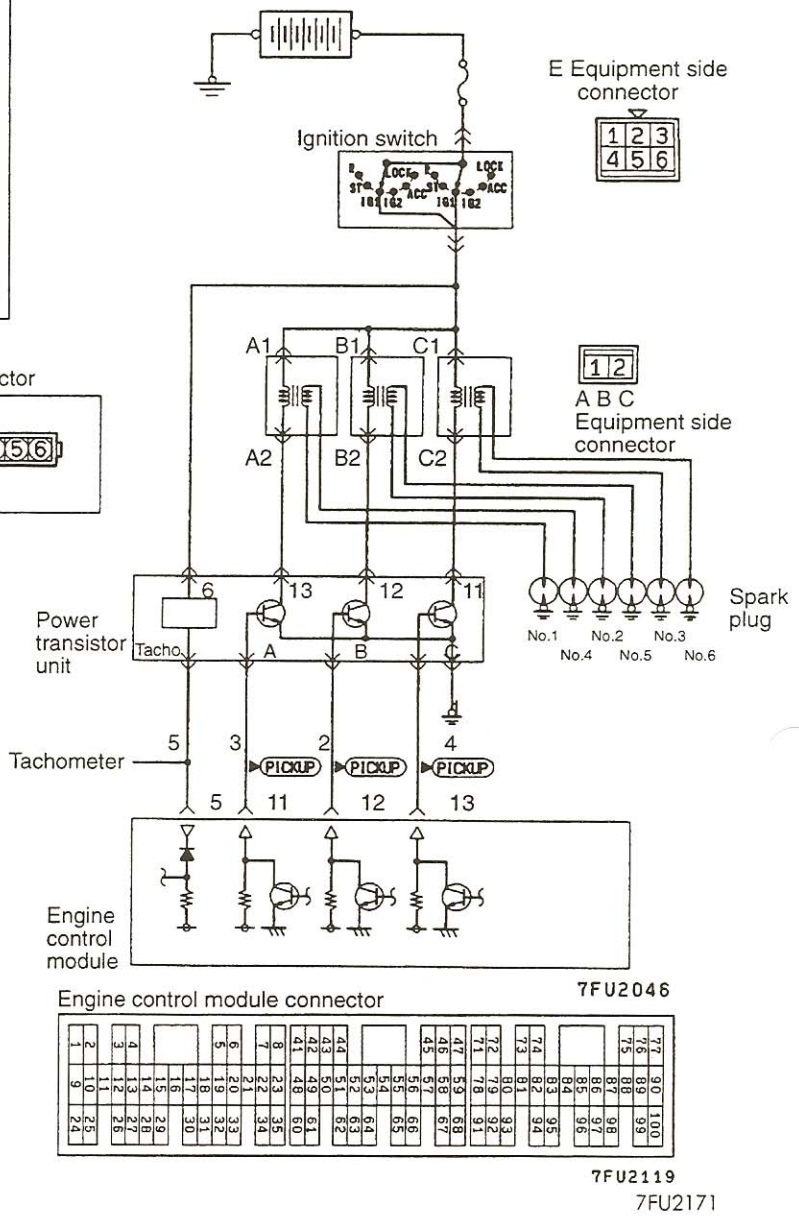
TSB Revision

IGNITION COIL AND IGNITION POWER TRANSISTOR

13110370128







OPERATION

- When the ignition power transistor unit A is turned on by the signal from the engine control module, primary current flows to the ignition coil A. When the ignition power transistor unit A is turned off, the primary current is shut off and a high voltage is induced in the secondary coil A, causing the ignition plugs of No. 1 and No. 4 cylinders to spark. When the ignition power transistor unit B is turned off, the ignition plugs of No. 2 and No. 5 cylinder spark. In addition, when the ignition power transistor unit C is turned off, the ignition plugs of No. 3 and No. 6 cylinders spark.
- When the engine control module turns off the transistor in the unit, the battery positive voltage in the unit is applied to the ignition power transistor unit to turn it on. When the eng control module turns on the transistor in unit, the ignition power transistor unit is turned off.

TSB Revision

INSPECTION

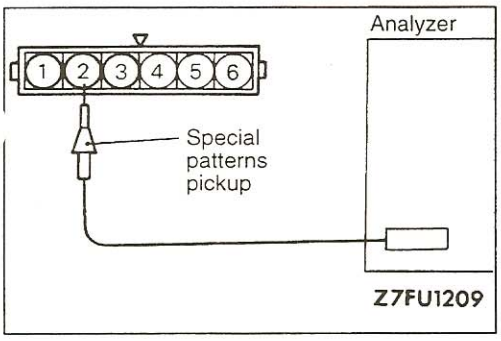
Using Scan Tool

<Spark Advance>

Function	Item No.	Data display	Check condition	Engine state	Standard value
Data reading	44	Ignition advance	• Engine: Warmed up • Timing light: Set (set timing light to check actual ignition timing)	Idling	7–23°BTDC
				2,500 r/min	30–50°BTDC

<Standard Ignition Timing>

Function	Item No.	Drive	Check condition	Normal condition
Actuator test	17	Set to ignition timing adjustment mode.	• Engine: Idling • Timing light: Set	Actual ignition timing: 5°BTDC±3°



Wave Pattern Inspection Using an Analyzer

- Ignition coil primary signal
  Refer to GROUP 16 – Ignition System.
- Ignition power transistor control signal

Measurement method

(1) Disconnect the connector of the power transistor, and connect the special tool (test harness: MB991348) across the disconnected connector parts.
(2) Sequentially connect the special patterns pickup of the analyzer to each of terminal (1) (No.3 – No.6), terminal (2) (No.2 – No.5) and terminal (3) (No.1 – No.4) of the ignition power transistor unit connector.

Alternative method (when test harness is not available)

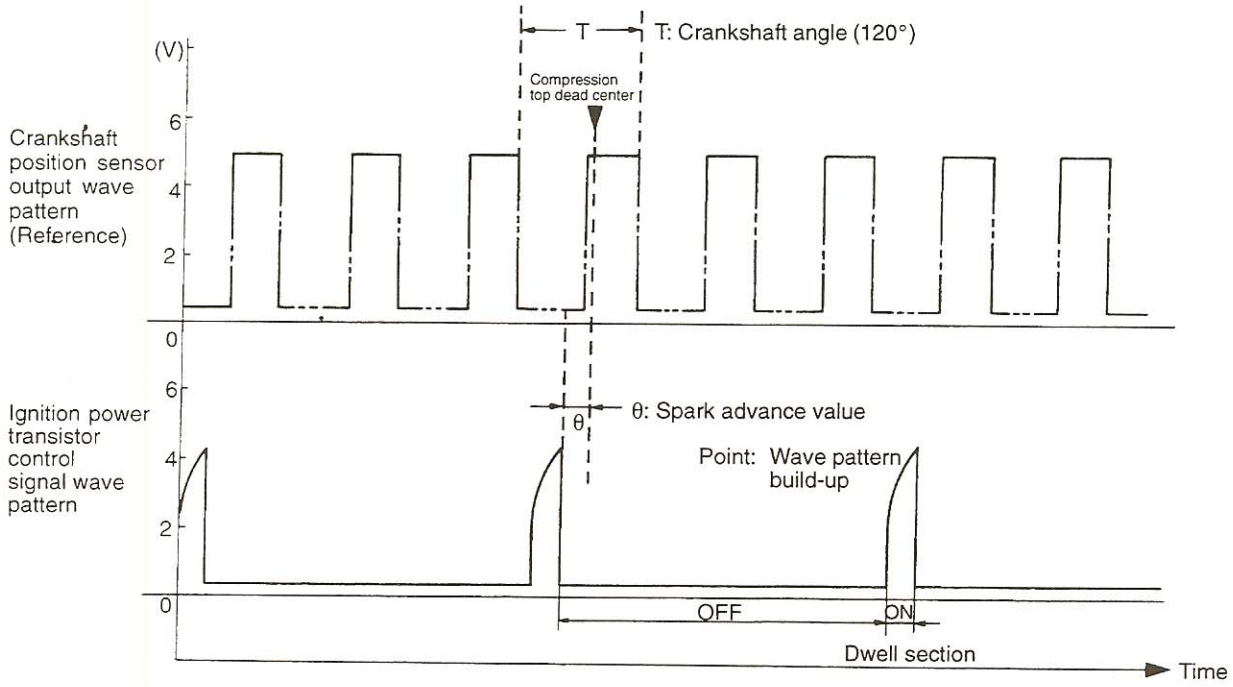
Connect the analyzer special patterns pickup to ECM terminals (10), (11) and (23) for the ignition power transistor.

Standard wave pattern

Observation conditions

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

Standard wave pattern



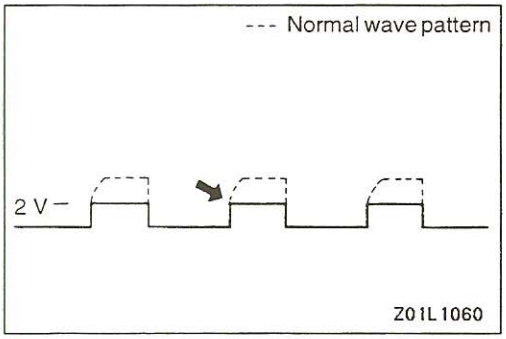
7FU1210

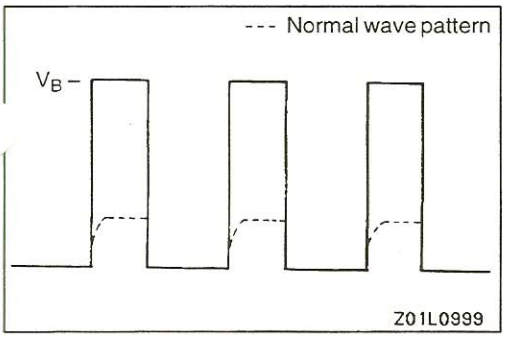
TSB Revision

Wave pattern observation points

'oint: Condition of wave pattern build-up 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. 2 V to approx. 4.5 V at the top right	Normal
Rectangular wave of approx. 2 V	Open circuit in ignition primary circuit
Rectangular wave at power voltage	Malfunction of ignition power transistor





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 2 V too low.

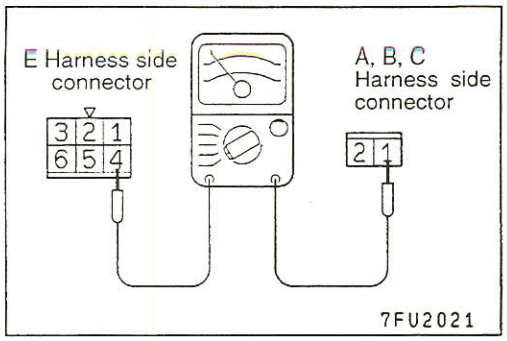
- Example 2
  Wave pattern during engine cranking

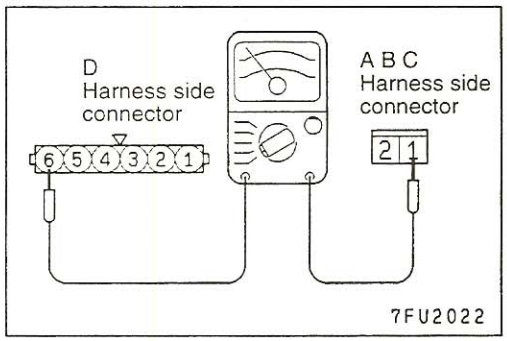
  Cause of problem

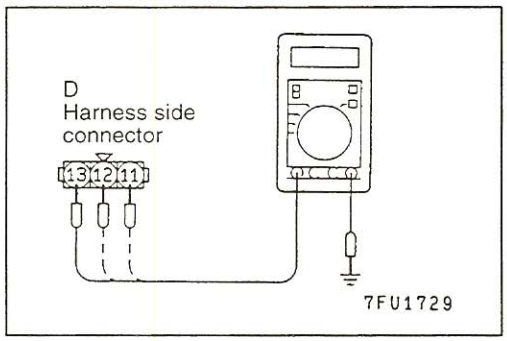
  Malfunction of ignition power transistor

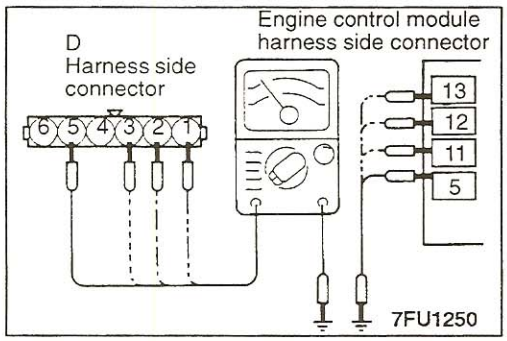
  Wave pattern characteristics

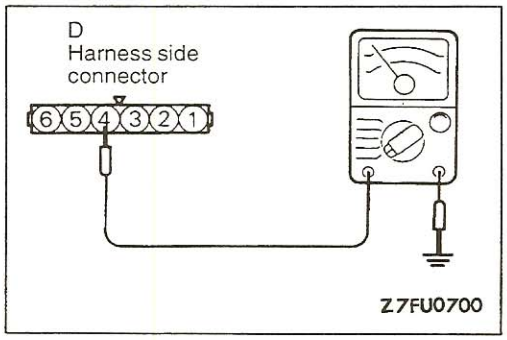
  Power voltage results when the ignition power transistor is on.











HARNESS INSPECTION

STEP 1. Check for continuity between the ignition c and the ignition switch-IG.

- Ignition switch connector: Disconnected
- Ignition coil connector: Disconnected

NOTE
- Touch the ohmmeter problems to both ends of the harness.

OK: GO TO STEP 2

NG: Repair the harnesses. (A1 – E2, B1 – E2, C1 – E2)

STEP 2. Check for continuity between the ignition power transistor unit and the ignition coil.

- Ignition coil connector: Disconnected
- Ignition power transistor connector: Disconnected

OK: GO TO STEP 3

NG: Repair the harnesses. (A1 – D6, B1 – D6, C1 – D6)

STEP 3. Measure the power supply voltage of the ignition coil.

- Ignition power transistor: Disconnected
- Ignition switch: ON

Voltage (V): Battery positive voltage

OK: GO TO STEP 4

NG: Repair the harnesses. (D11, D12, D13 – Ignition coil)

STEP 4. Check for an open circuit or a short-circuit to ground between the ignition power transistor and the engine control module.

- Ignition power transistor connector: Disconnected
- Engine control module connector: Disconnected

OK: GO TO STEP 5

NG: Repair the harnesses. (D1 – 13, D2 – 12, D3 – 11, D5 – 5)

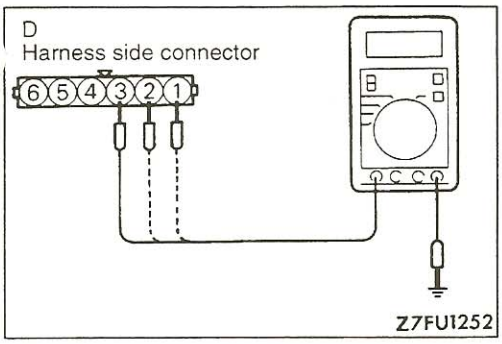
STEP 5. Check for continuity in the ground circuit of the ignition power transistor.

- Ignition power transistor connector: Disconnected

OK: GO TO STEP 6

NG: Repair the harnesses. (D4 – Ground)

TSB Revision



STEP 6. Measure the ignition power transistor control signal voltage.

- Ignition power transistor connector: Disconnected
- Ignition switch: START

Voltage (V): 0.5 – 4.0

OK: STOP

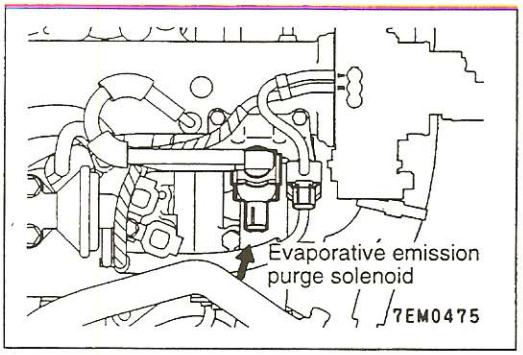
NG: Repair the harnesses. (D1 – 13, D2 – 12, D3 – 11)

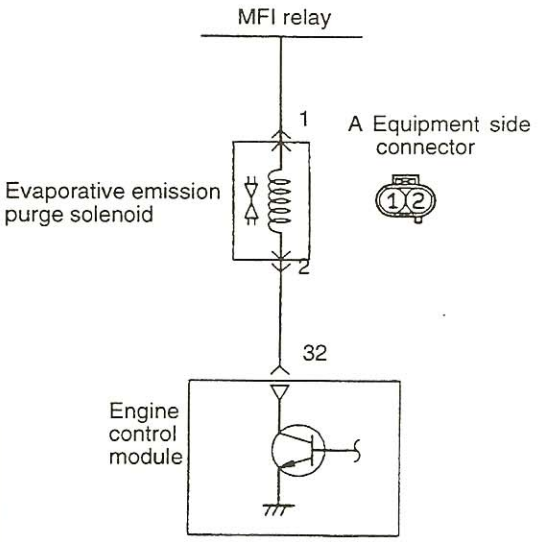
IGNITION COIL AND IGNITION POWER TRANSISTOR CHECK

Refer to GROUP 16 – Ignition System.

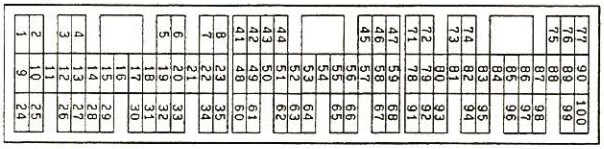
EVAPORATIVE EMISSION PURGE SOLENOID

13110390148





Engine control module connector



OPERATION

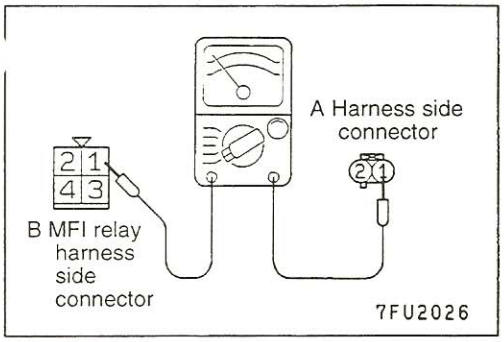
- The evaporative emission purge solenoid is an duty control type of solenoid; it functions to regulate the introduction of purge air from the evaporative emission canister to the intake manifold plenum.
- Battery positive voltage is supplied, by way of the MFI relay, to the evaporative emission purge solenoid. When the engine control module switches on the ignition power transistor within the unit, current flows to the coil, and purge air is introduced.

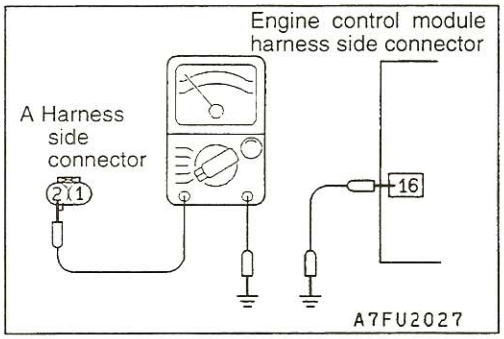
INSPECTION

Using Scan Tool

Function	Item No.	Drive content	Check condition	Normal state
Actuator test	08	EVAP purge solenoid from OFF to ON	Ignition switch: ON	Operating sound is heard when driven

TSB Revision





HARNESS INSPECTION

STEP 1. Check for continuity between the evaporative emission purge solenoid and the MFI relay.

- Evaporative emission purge solenoid connector: Disconnected
- MFI relay connector: Disconnected

NOTE
- Touch the ohmmeter probes to both ends of the harness.

OK: GO TO STEP 2

NG: Repair the harness. (A1 – B1)

STEP 2. Check for an open circuit or a short-circuit to ground between the evaporative emission purge solenoid and the engine control module.

- Evaporative emission purge solenoid connector: Disconnected
- Engine control module connector: Disconnected

OK: STOP

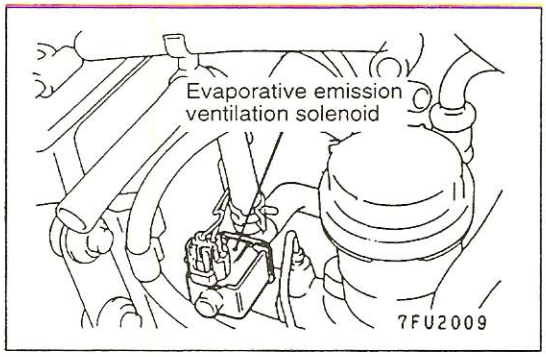
NG: Repair the harness. (A2 – 16)

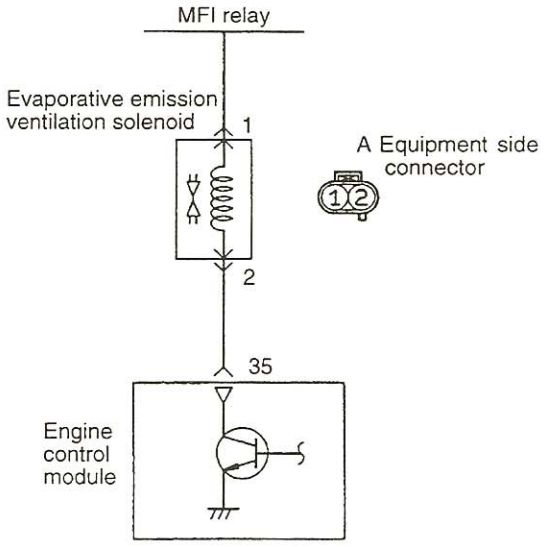
EVAPORATIVE EMISSION PURGE SOLENOID CHECK

Refer to GROUP 17 – Engine Emission Control System.

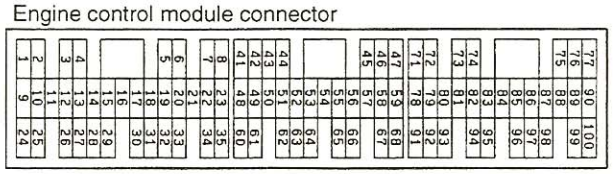
EVAPORATIVE EMISSION VENTILATION SOLENOID

13110450037





Engine control module connector



7FU2173

OPERATION

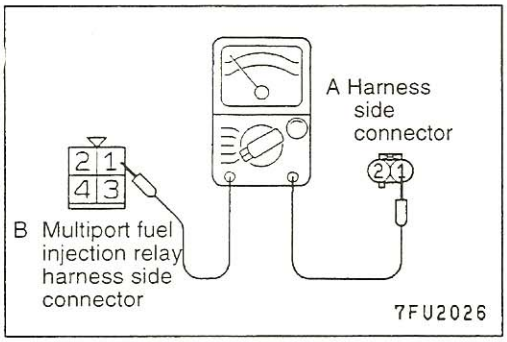
- The evaporative emission ventilation solenoid is a ON – OFF type solenoid valve and installed to monitor the leak in the fuel tank and purge line. Normally it opens the atmospheric release opening and closes during the leak monitoring.
- Through the MFI relay the battery power is supplied to the evaporative emission ventilation solenoid. If the ECM switches on the power transistor in the module, the current flows in the coil and close the EVAP canister atmospheric release opening.

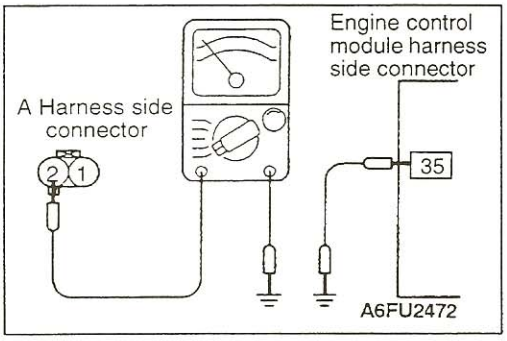
INSPECTION

Using Scan Tool

Function	Item No.	Drive content	Check condition	Normal state
Actuator test	29	Solenoid valve from OFF to ON	Ignition switch: ON	Operating sound is heard when driven

TSB Revision





HARNESS INSPECTION

STEP 1. Check for continuity between evaporative emission ventilation solenoid and multiport fuel injection relay.

- Evaporative emission ventilation solenoid connector: Disconnected
- Multiport fuel injection relay connector: Disconnected

NOTE
- Touch the ohmmeter probes to both ends of the harness.

OK: GO TO STEP 2

NG: Repair the harness. (A1 – B1)

STEP 2. Check for an open circuit, or a short circuit to ground, between the evaporative emission ventilation solenoid and the engine control module.

- Evaporative emission ventilation solenoid connector: Disconnected
- Engine control module connector: Disconnected

OK: STOP

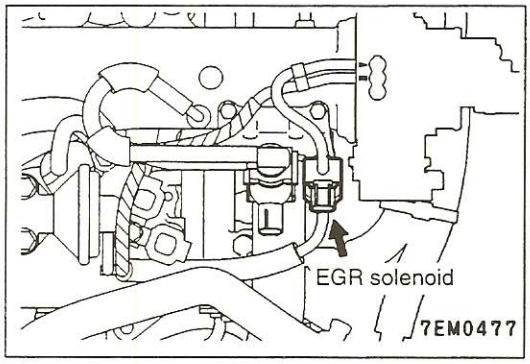
NG: Repair the harness. (A2 – 35)

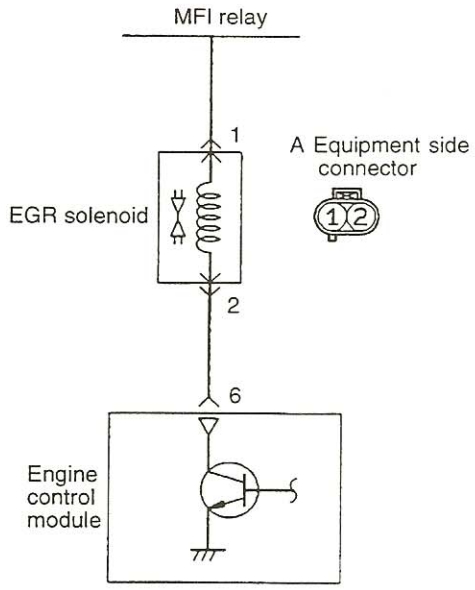
EVAPORATIVE EMISSION VENTILATION SOLENOID CHECK

Refer to GROUP 13F – Fuel Line and Vapor Line.

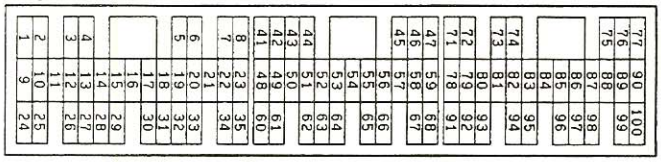
EGR SOLENOID

13110400094





Engine control module connector



OPERATION

- THE EGR solenoid is a duty control type solenoid. It makes control by leaking EGR valve operating nagative pressure to the throttle body A port.
- Power supply from the battery is sent through the MFI relay to the EGR solenoid. When the engine control module turns off the power transistor inside the module, current no longer flows through the coil and EGR valve operating negative pressure leaks.

TROUBLESHOOTING HINT

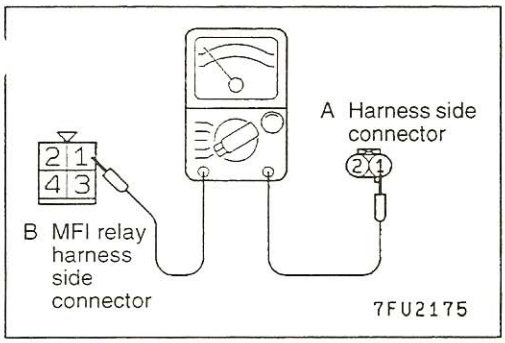
If the results of EGR solenoid on-vehicle and off vehicle inspections are normal but the diagnostic trouble code for EGR system failure is displayed, check the EGR valve, vacuum hose and EGR passage for blockage.

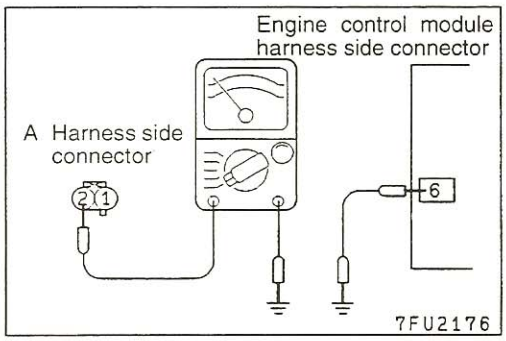
INSPECTION

Using Scan Tool

Function	Item No.	Drive content	Check condition	Normal condition
Actuator test	10	Turn solenoid from off to on	Ignition switch: ON	Operation sound can be heard during activation

TSB Revision





HARNESS INSPECTION

STEP 1. Check for continuity between the EGR solenoid and the MFI relay.

- EGR solenoid connector: Disconnected
- MFI relay connector: Disconnected

NOTE
- Touch the circuit tester probes to both ends of the harness.

OK: GO TO STEP 2

NG: Repair the harness. (A1 – B1)

STEP 2. Check for an open circuit or a short-circuit to ground between the EGR solenoid and the engine control module.

- EGR solenoid connector: Disconnected
- Engine control module connector: Disconnected

OK: STOP

NG: Repair the harness. (A2 – 6)

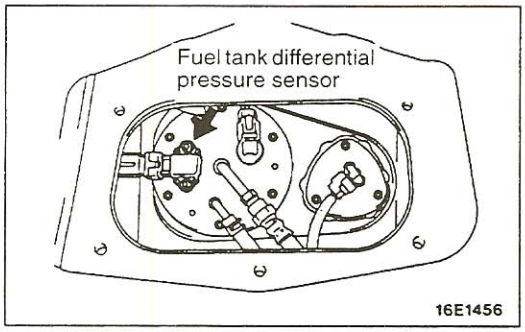
EGR SOLENOID CHECK

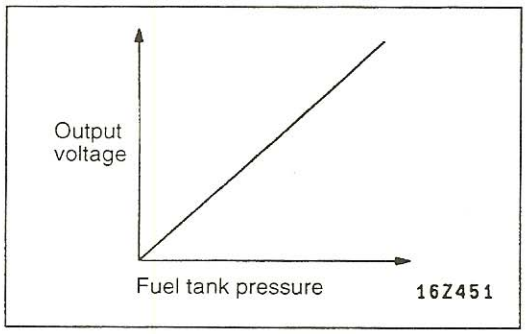
Refer to GROUP 17 – Engine Emission Control System.

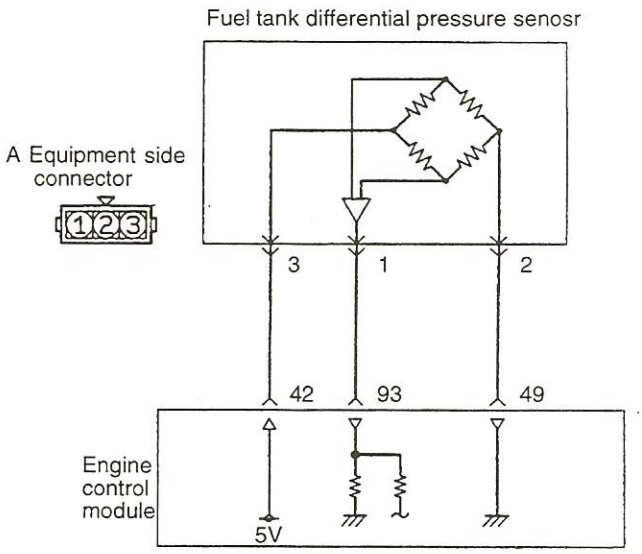
TSB Revision

FUEL TANK DIFFERENTIAL PRESSURE SENSOR

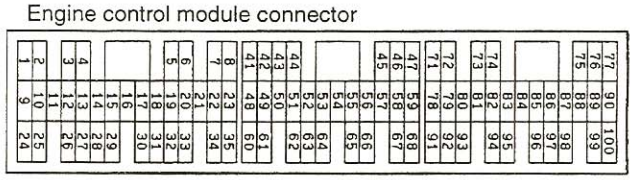
13110460047







Engine control module connector



7FU2177

OPERATION

- Fuel tank differential pressure sensor will convert the pressure in the fuel tank to voltage and input it to the engine control module.
- 5 V of power is supplied to the fuel tank differential pressure sensor from the engine control module, and the sensor circuit ground is located in the engine control module.
- The fuel tank differential pressure sensor output voltage is proportioned to the fuel tank pressure and sent to the engine control module.

TROUBLESHOOTING HINT

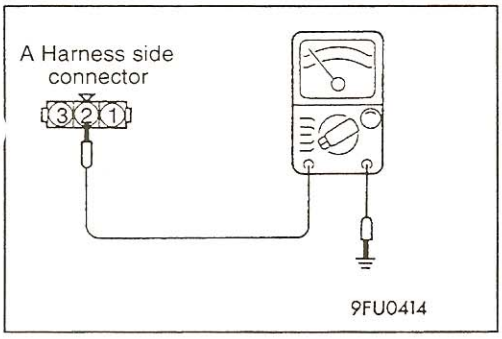
- If parts such as the fuel vent valve, vapor line, purge line, evaporative emission ventilation solenoid or evaporative emission purge solenoid become blocked, DTC P0450 will be set. Thus, if DTC P0450 is output, it is necessary to check for these blockages.

TSB Revision

INSPECTION

Using Scan Tool

Function	Item No.	Data display	Check condition	Standard value
Data reading	73	Fuel tank internal pressure	• Ignition switch: ON • Fuel tank filler tube cap removed	–3.3 – 3.3 kPa
Data reading	73	Fuel tank internal pressure	• Remove the fuel tank filler tube cap and then install the fuel filler neck adapter. • Connect a hand pump to the end of the fuel filler neck adapter hose and apply pressure. Caution Do not apply more than 7.0 kPa (0.86 psi) of pressure.	The pressure leaks and does not rise above 5.9 kPa (0.86 psi). (If it rises above this value, check for blockages.)



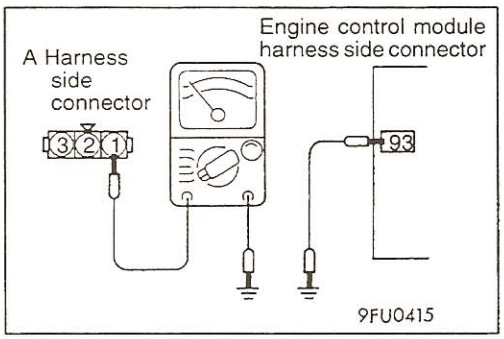
HARNESS INSPECTION

STEP 1. Check for continuity of the ground circuit

- Fuel tank differential pressure sensor connector: Disconnected

OK: GO TO STEP 2

NG: Repair the harness (A2 – 49)

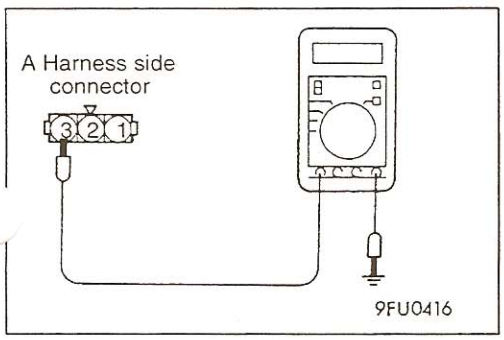


STEP 2. Check for open-circuit, or short-circuit to ground between the engine control module and the manifold absolute pressure sensor.

- Fuel tank differential pressure sensor connector: Disconnected
- Engine control module connector: Disconnected

OK: GO TO STEP 3

NG: Repair the harness (A1 – 93)



STEP 3. Measure the sensor impressed voltage to the manifold absolute pressure sensor.

- Fuel tank differential pressure sensor connector: Disconnected
- Engine control module connector: Connected
- Ignition switch: ON

Voltage (V): 4.8 – 5.2 V

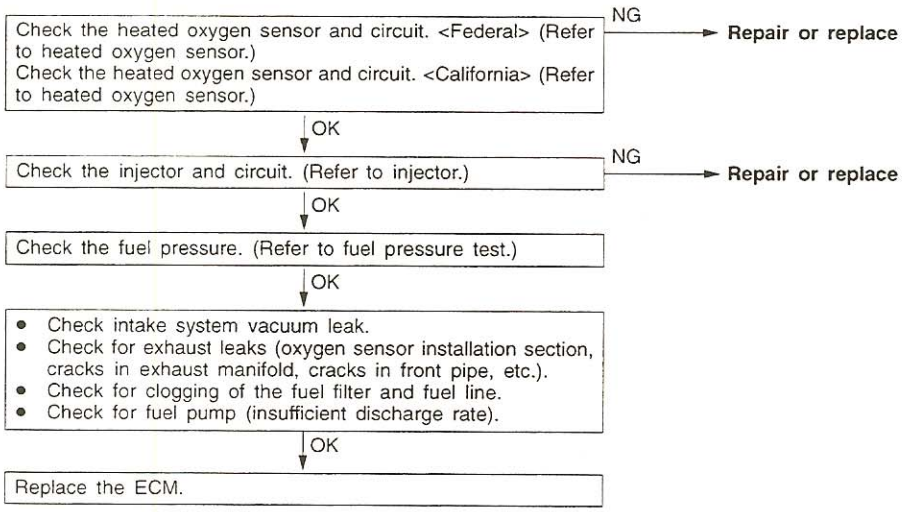
OK: STOP

NG: Replace the engine control module.

TSB Revision

P0125 EXCESSIVE TIME TO ENTER CLOSED LOOP FUEL CONTROL (OBD-II Main Monitor Diagnostic Procedure)

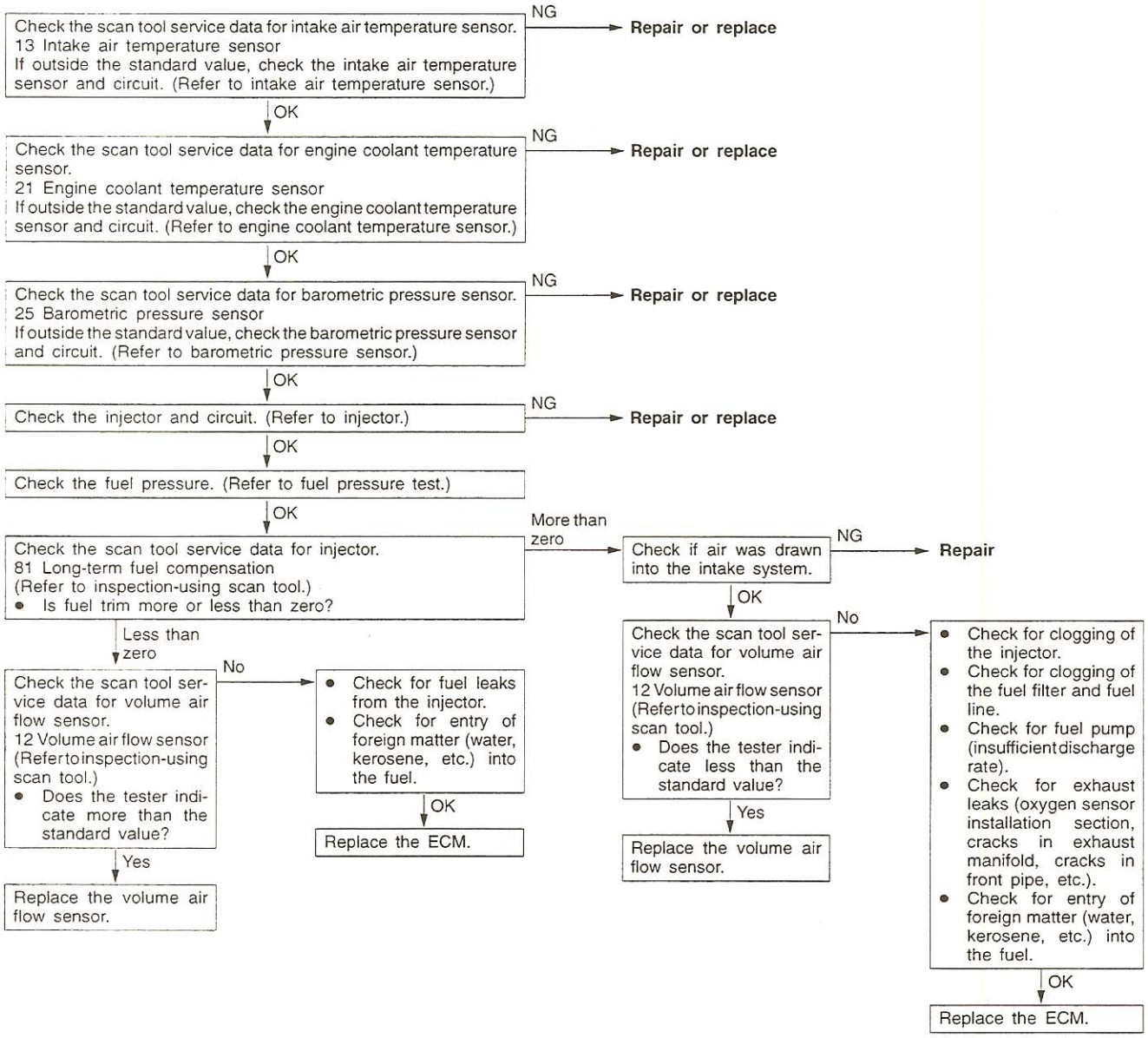
1311069



TSB Revision

P0170 FUEL TRIM MALFUNCTION (BANK 1) (OBD-II Main Monitor Diagnostic Procedure)

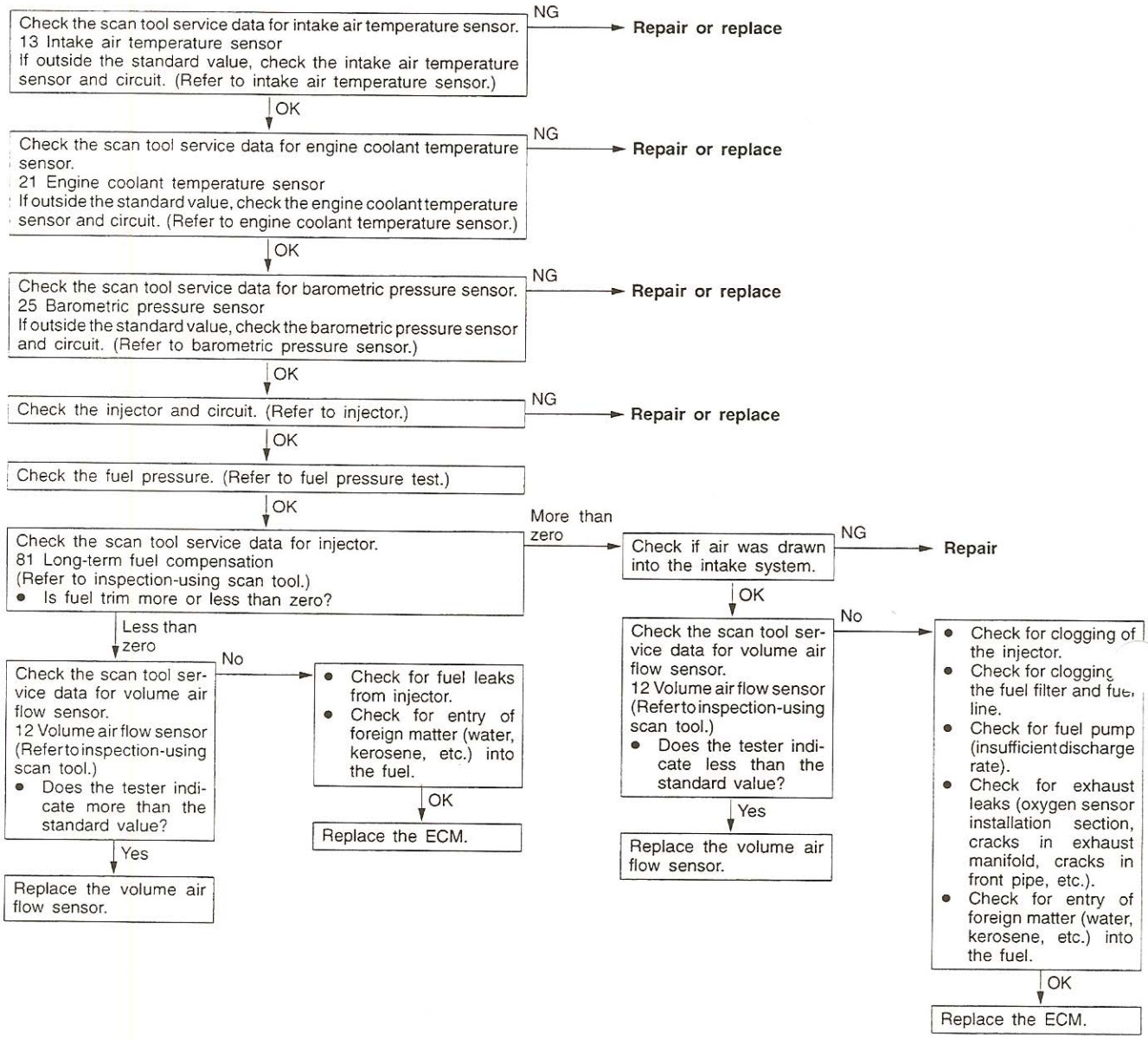
13110680061



TSB Revision

P0173 FUEL TRIM MALFUNCTION (BANK 2) <California> (OBD-II Main Monitor Diagnostic Procedure)

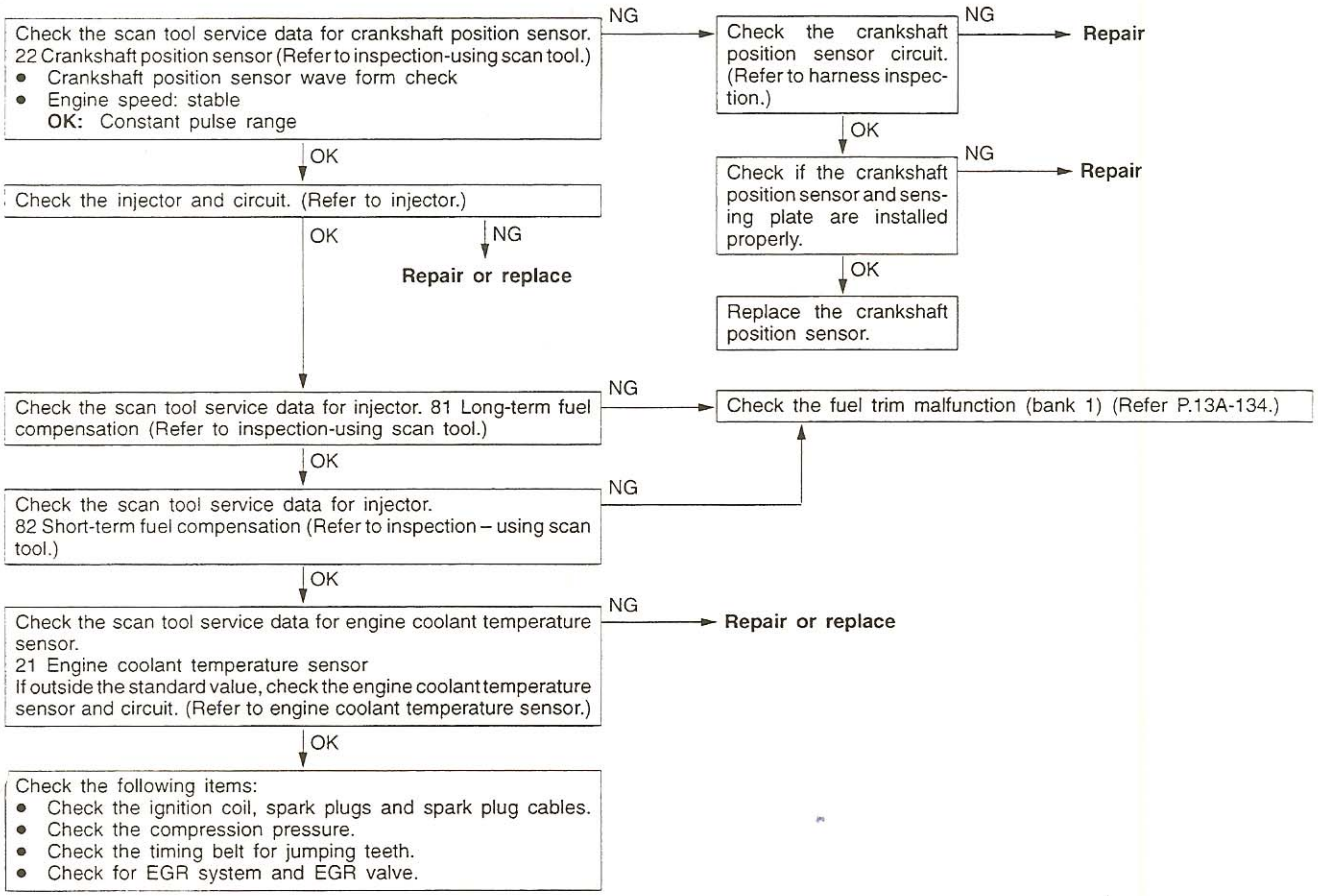
131106



TSB Revision

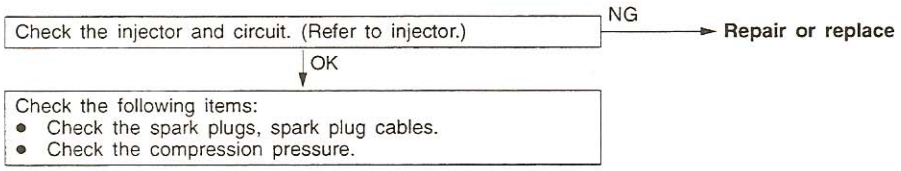
P0300 RANDOM MISFIRE DETECTED (OBD-II Main Monitor Diagnostic Procedure)

13110660065



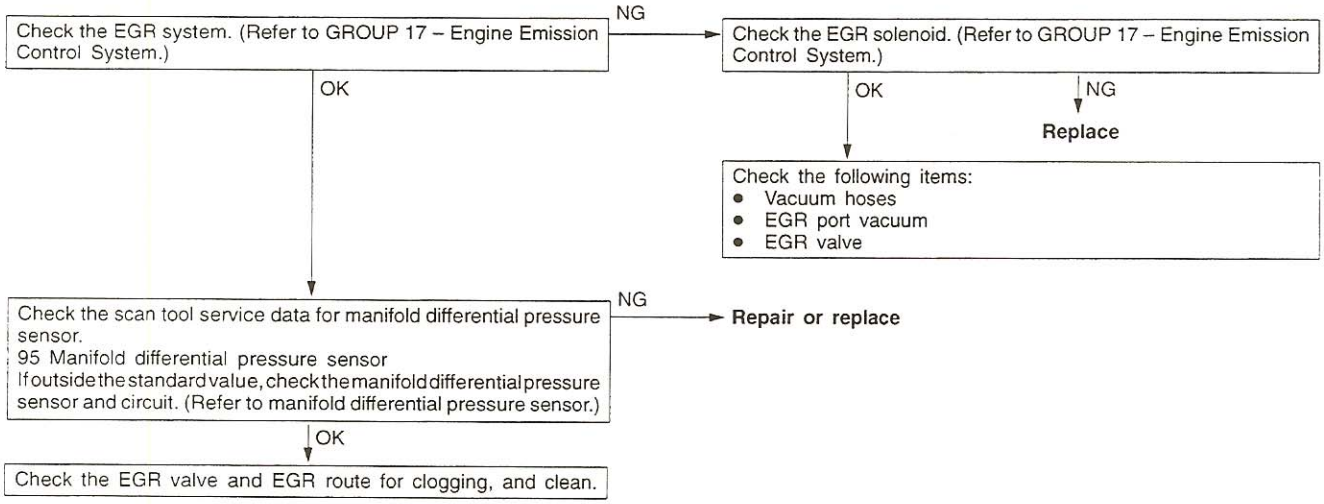
P0301 – P0306 CYLINDER 1 – CYLINDER 6 MISFIRE DETECTED (OBD-II Main Monitor Diagnostic Procedure)

13110650055



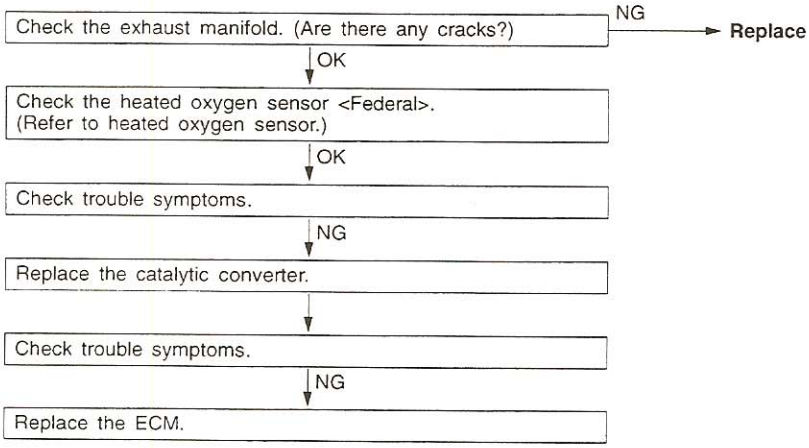
P0400 EXHAUST GAS RECIRCULATION FLOW MALFUNCTION (OBD-II Main Monitor Diagnostic Procedure)

131106



P0420 CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 1) <Federal> (OBD-II Main Monitor Diagnostic Procedure)

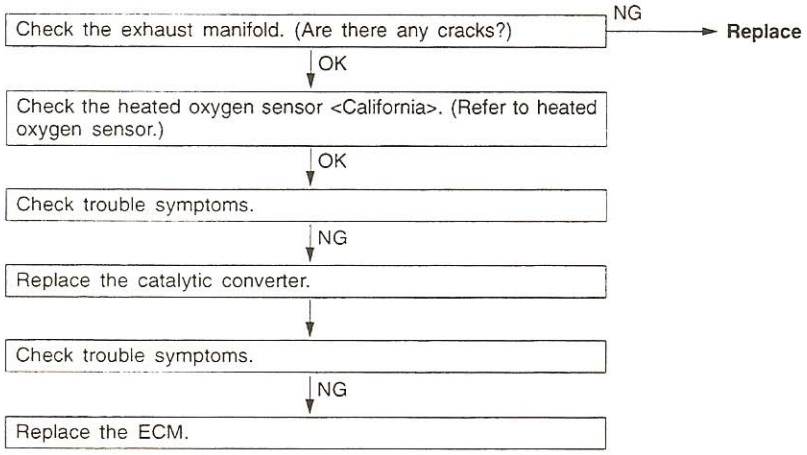
13110630035



TSB Revision

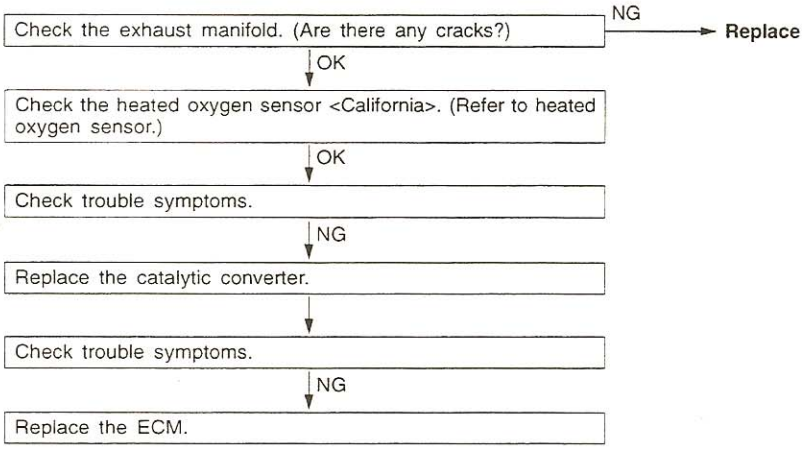
P0421 WARM UP CATALYST EFFICIENCY BELOW THRESHOLD (BANK 1) <California> (OBD-II Main Monitor Diagnostic Procedure)

13110620063



P0431 WARM UP CATALYST EFFICIENCY BELOW THRESHOLD (BANK 2) <California> (OBD-II Main Monitor Diagnostic Procedure)

13110610060



P0442 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (OBD-II Main Monitor Diagnostic Procedure)

131105

Check of OFLV
Loosen the fuel filler cap, push the flapper with the finger to operate the OFLV, and then tighten the fuel filler cap.
Loosen the fuel filler cap again and check the OFLV.
OK: Distance between the tip of the fuel filler neck and that of the OFLV is 28 mm or more.

NG → Replace the fuel filler neck.

↓

Disconnect the hose connected between the EVAP ventilation solenoid and the air filter at the air filter end and blank the hose end.

↓

Vacuum applying operation
To perform a leak test, apply vacuum by the following procedure.
Note
Do not apply a vacuum of 3.9kPa (0.57psi) or more.
A vacuum of 3.9kPa (0.57psi) or more can crack the fuel tank.
Be sure to use the scan tool (MUT-II) to check the pressure value.
1. Disconnect the purge hose connected between EVAP purge solenoid and EVAP canister from the pipe over the air intake plenum.
2. Use a three-way joint to connect a hand vacuum pump between the hose and the pipe.
3. Set the scan tool (MUT-II) to display data list 73 Fuel tank differential pressure sensor.
4. Watch the scan tool (MUT-II) reading while applying vacuum up to 2.9kPa (0.42psi) with the hand vacuum pump.

Remarks
If fuel level in the fuel tank is low, it may be necessary to operate the hand vacuum pump good many times (50 times or more).
In such cases, vacuum can be easily applied by the following procedure.
1. Start the engine and warm it up until the engine coolant temperature increases above 60°C (140°F).
2. A service personnel will race the engine at 1600 – 2000 r/min. The other personnel will watch the scan tool (MUT-II) readings and disconnect the EVAP purge solenoid connector when vacuum reaches 2.9kPa (0.42psi) and inform the drive of it. Immediately on receiving the information, the driver will decrease the engine speed to an idle speed.

Vacuum does not reach 2.9kPa (0.42psi). → Check for clogging or a large leak. (Refer to P.13A-137, INSPECTION PROCEDURE AA.)

↓ Vacuum reaches 2.9kPa (0.42psi).

Leakage test
- After elapse of 20 seconds, check the scan tool (MUT-II) reading.
  OK: Change in increase of pressure is 0.4kPa (0.057psi) or less. (Vacuum is 2.5kPa (0.36psi) or more.)

Remarks
If the temperature of the coolant in the fuel tank is high, the fuel pressure rise due to the vapor pressure may occur, causing the pressure to rise to 0.4kPa (0.057psi) or more without any leak. Therefore, perform a leakage check with the fuel temperature kept at 40°C (104°F) or less.

NG → Check for a small leak. (Refer to P.13A-137, INSPECTION PROCEDURE BB.)

↓ OK

Perform sensor and EVAP purge control system check (purge flow check). (Refer to P.13A-138, INSPECTION PROCEDURE CC.)

TSB Revision

INSPECTION PROCEDURE AA

Check for clogging or a large leak

Remove the fuel tank filler tube cap and install the fuel filler neck adapter. In addition, blank the end of the hose to prevent leakage from the fuel filler neck adapter.

↓

Repeat the vacuum applying operation. (Refer to P.13A-136.)

→ Vacuum reaches 2.9kPa (0.42psi). → Replace the fuel tank filler tube cap.

↓ Vacuum does not reach 2.9kPa (0.42psi).

Connect the evaporative emission system tester or equivalent in place of the hand vacuum pump to the three-way joint and apply pressure up to 3.4kPa (0.49psi). After elapse of 2 minutes, check the pressure indication.
OK: Pressure drop is less than 1.4kPa (0.2psi). (Pressure is 2.0kPa (0.29psi) or more.)

→ OK → Check for clogging. (Refer to P.13A-138, INSPECTION PROCEDURE DD.)

↓ NG

Check for wrong hose routing and disconnected hose.

→ NG → **Repair**

↓ OK

1. Remove the tire and splash shield.
2. Disconnect from the canister the vapor hose connected between the canister and the fuel vent valve.
3. Connect a hand vacuum pump to the disconnected vapor hose end.
4. Disconnect the vapor hose connected between the canister and the fuel vent valve from the fuel vent valve nipple and blank the end of the hose.

↓

Apply a vacuum of 6kPa (0.9psi) to check for the condition of vacuum.
OK: Vacuum is maintained.

→ NG → Repair the pipe connected between the canister and the fuel vent valve.

↓ OK

1. Connect a hand vacuum pump to the fuel vent valve nipple from which the vapor hose has been disconnected.
2. Set the scan tool (MUT-II) to display Data list 73 Fuel tank differential pressure sensor.
3. Watch the scan tool (MUT-II) reading while applying vacuum up to 2.9kPa (0.42psi) with the hand vacuum pump.

→ Vacuum has reached 2.9kPa (0.42psi). → Perform the ventilation and purge line check. (Refer to P.13A-139, INSPECTION PROCEDURE EE.)

↓ Vacuum does not reach 2.9kPa (0.42psi).

Replace the fuel filler neck and the hose connected between the fuel vent valve and the fuel cut-off valve. Watch the scan tool (MUT-II) reading again while applying vacuum up to 2.9kPa (0.42psi) with a hand vacuum pump.

↓ Vacuum does not reach 2.9kPa (0.42psi).

Replace the fuel tank.

INSPECTION PROCEDURE BB

Check for a small leak

Loosen the fuel tank filler tube cap and install the fuel filler neck adapter. In addition, blank the end of the hose to prevent leakage from the fuel filler neck adapter.

↓

Make a leakage test again. (Refer to P.13A-136.)
OK: Pressure rise is 0.4kPa (0.057psi) or less. (Vacuum is 2.5kPa (0.36psi) or more.)

→ OK → Replace the fuel tank filler tube cap.

↓ OK

Connect the evaporative emission system tester or equivalent in place of the hand vacuum pump to the three-way joint. While applying pressure, locate a leaky point with the ultrasonic leak detector.

→ Leaky point has been detected. → Repair the leaky point

↓ No leaky point → Perform the troubleshooting again.

TSB Revision

INSPECTION PROCEDURE CC

Sensor and EVAP purge control system check (purge flow check)

Perform EVAP purge control system check (purge flow check). (Refer to GROUP 17 EVAP purge control system check (purge flow check).)
- NG → Repair
- OK ↓

SCAN TOOL Data list
21 Engine coolant temperature sensor. (Refer to P.13A-73.)
- NG → Check the engine coolant temperature sensor circuit malfunction. (Refer to P.13A-26, DIAGNOSTIC DETECTION LOGIC P0115.)
- OK ↓

SCAN TOOL Data list
13 Intake air temperature sensor (Refer to P.13A-68.)
- NG → Check the intake air temperature sensor circuit malfunction. (Refer to P.13A-26, DIAGNOSTIC DETECTION LOGIC P0110.)
- OK ↓

SCAN TOOL Data list
27 Power steering pressure switch (Refer to P.13A-93.)
- NG → Check the power steering pressure sensor circuit range/performance. (Refer to P.13A-40, DIAGNOSTIC DETECTION LOGIC P0551.)
- OK ↓

Perform OBD-2 drive cycle test. (Refer to P.13A-12.)
- NG ↓

Perform leakage check again.
1. Disconnect the vapor hose from the fuel cut-off valve and blank the hose end.
2. Disconnect from the pipe over the air intake plenum the purge hose connected between the EVAP purge solenoid and the EVAP canister.
3. Use a three-way joint to connect a hand vacuum pump between the hose and the pipe.
4. Apply a vacuum of 6kPa (0.9psi) and check the condition of vacuum.
   OK: Vacuum is maintained.

- OK → Check for leakage from the fuel tank.
- NG ↓

Connect to the three-way joint the evaporative emission system tester or equivalent in place of the hand vacuum pump. While applying pressure, locate a leaky point with a ultrasonic leak detector.
- Leaky point has been detected. → Repair the leaky point
- No leaky point → Repeat the troubleshooting.

INSPECTION PROCEDURE DD

Ventilation and purge line check

1. Disconnect from the canister the purge hose connected between the EVAP purge solenoid and the canister and connect a hand vacuum pump to the hose end.
2. Apply a vacuum of 6kPa (0.9psi) to check the condition of vacuum.
   OK: Vacuum is maintained.

- NG → Check for leakage from the EVAP purge solenoid. If the EVAP purge solenoid is normal, replace the purge hose connected between the EVAP purge solenoid and the canister.
- OK ↓

1. Disconnect from the canister the purge hose connected between the EVAP ventilation solenoid and the canister and connect a hand vacuum pump to the hose end.
2. Apply a vacuum of 6kPa (0.9psi) to check the condition of vacuum.
   OK: Vacuum is maintained.

- NG → Check for leakage from the EVAP ventilation solenoid. If the EVAP purge solenoid is normal, replace the ventilation hose connected between the EVAP ventilation solenoid and the canister.
- OK ↓

Replace the canister.

TSB Revision

INSPECTION PROCEDURE EE

Check for clogging

1. Remove the tire and splash shield.
2. Disconnect from the canister the vapor hose connected between the canister and the fuel vent valve.
3. Connect a hand vacuum pump to the disconnected vapor hose end.
4. Operate the hand vacuum pump several times and apply vacuum.
   OK: Vacuum leaks.

OK ↓

NG ↓

Remove the vapor hose connected between the canister and the fuel vent valve from the fuel vent valve nipple.
OK: Vacuum leaks

NG → Repair the clogged line between the canister and the fuel vent valve.

OK ↓

Check the fuel tank filler tube assembly (Refer to GROUP 13F – Fuel Tank.) If the assembly is normal, repair the clogged line between the fuel vent valve and the fuel cut-off valve.

1. Disconnect from the canister the purge hose connected between the EVAP purge solenoid and the canister and connect a hand vacuum pump to the hose end.
2. Disconnect from the pipe over the air intake plenum the purge hose connected between EVAP purge solenoid and EVAP canister.
3. Operate the hand vacuum pump several times to apply vacuum.
   OK: Vacuum leaks

NG → Repair the clogged line between the canister and the EVAP purge solenoid.

OK ↓

Replace the canister.

P0455 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (Gross Leak) (OBD-II Main Monitor Diagnostic Procedure)

131107

Check of OFLV
Loosen the fuel filler cap, push the flapper with the finger to operate the OFLV, and then tighten the fuel filler cap.
Loosen the fuel filler cap again and check the OFLV.
OK: Distance between the tip of the fuel filler neck and that of the OFLV is 28 mm or more.

NG → Replace the fuel filler neck.

↓

Disconnect the hose connected between the EVAP ventilation solenoid and the air filter at the air filter end and blank the hose end.

↓

Vacuum applying operation
To perform a leak test, apply vacuum by the following procedure.
Note
Do not apply a vacuum of 3.9kPa (0.57psi) or more.
A vacuum of 3.9kPa (0.57psi) or more can crack the fuel tank.
Be sure to use the scan tool (MUT-II) to check the pressure value.
1. Disconnect the purge hose connected between EVAP purge solenoid and EVAP canister from the pipe over the air intake plenum.
2. Use a three-way joint to connect a hand vacuum pump between the hose and the pipe.
3. Set the scan tool (MUT-II) to display data list 73 Fuel tank differential pressure sensor.
4. Watch the scan tool (MUT-II) reading while applying vacuum up to 2.9kPa (0.42psi) with the hand vacuum pump.

Remarks
If fuel level in the fuel tank is low, it may be necessary to operate the hand vacuum pump good many times (50 times or more).
In such cases, vacuum can be easily applied by the following procedure.
1. Start the engine and warm it up until the engine coolant temperature increases above 60°C (140°F).
2. A service personnel will race the engine at 1600 – 2000 r/min. The other personnel will watch the scan tool (MUT-II) readings and disconnect the EVAP purge solenoid connector when vacuum reaches 2.9kPa (0.42psi) and inform the drive of it. Immediately on receiving the information, the driver will decrease the engine speed to an idle speed.

Vacuum does not reach 2.9kPa (0.42psi). → Check for clogging or a large leak. (Refer to P.13A-137, INSPECTION PROCEDURE AA.)

↓ Vacuum reaches 2.9kPa (0.42psi).

Leakage test
- After elapse of 20 seconds, check the scan tool (MUT-II) reading.
  OK: Change in increase of pressure is 0.4kPa (0.057psi) or less. (Vacuum is 2.5kPa (0.36psi) or more.)

Remarks
If the temperature of the coolant in the fuel tank is high, the fuel pressure rise due to the vapor pressure may occur, causing the pressure to rise to 0.4kPa (0.057psi) or more without any leak. Therefore, perform a leakage check with the fuel temperature kept at 40°C (104°F) or less.

↓ OK

Perform sensor and EVAP purge control system check (purge flow check). (Refer to P.13A-137, INSPECTION PROCEDURE BB.)

TSB Revision

INSPECTION PROCEDURE AA

Check for clogging or a large leak

Remove the fuel tank filler tube cap and install the fuel filler neck adapter. In addition, blank the end of the hose to prevent leakage from the fuel filler neck adapter.

↓

Repeat the vacuum applying operation. (Refer to P.13A-136.)

→ Vacuum reaches 2.9kPa (0.42psi). → Replace the fuel tank filler tube cap.

↓ Vacuum does not reach 2.9kPa (0.42psi).

Connect the evaporative emission system tester or equivalent in place of the hand vacuum pump to the three-way joint and apply pressure up to 3.4kPa (0.49psi). After elapse of 2 minutes, check the pressure indication.
OK: Pressure drop is less than 1.4kPa (0.2psi). (Pressure is 2.0kPa (0.29psi) or more.)

→ OK → Check for clogging. (Refer to P.13A-138, INSPECTION PROCEDURE CC.)

↓ NG

Check for wrong hose routing and disconnected hose.

→ NG → **Repair**

↓ OK

1. Remove the tire and splash shield.
2. Disconnect from the canister the vapor hose connected between the canister and the fuel vent valve.
3. Connect a hand vacuum pump to the disconnected vapor hose end.
4. Disconnect the vapor hose connected between the canister and the fuel vent valve from the fuel vent valve nipple and blank the end of the hose.

↓

Apply a vacuum of 6kPa (0.9psi) to check for the condition of vacuum.
OK: Vacuum is maintained.

→ NG → Repair the pipe connected between the canister and the fuel vent valve.

↓ OK

1. Connect a hand vacuum pump to the fuel vent valve nipple from which the vapor hose has been disconnected.
2. Set the scan tool (MUT-II) to display Data list 73 Fuel tank differential pressure sensor.
3. Watch the scan tool (MUT-II) reading while applying vacuum up to 2.9kPa (0.42psi) with the hand vacuum pump.

→ Vacuum has reached 2.9kPa (0.42psi). → Perform the ventilation and purge line check. (Refer to P.13A-138, INSPECTION PROCEDURE DD.)

↓ Vacuum does not reach 2.9kPa (0.42psi).

Replace the fuel filler neck and the hose connected between the fuel vent valve and the fuel cut-off valve. Watch the scan tool (MUT-II) reading again while applying vacuum up to 2.9kPa (0.42psi) with a hand vacuum pump.

↓ Vacuum does not reach 2.9kPa (0.42psi).

Replace the fuel tank.

TSB Revision

INSPECTION PROCEDURE BB

Sensor and EVAP purge control system check (purge flow check)

Perform EVAP purge control system check (purge flow check). (Refer to GROUP 17 EVAP purge control system check (purge flow check).)
- NG → Repair
- OK ↓

SCAN TOOL Data list
21 Engine coolant temperature sensor. (Refer to P.13A-73.)
- NG → Check the engine coolant temperature sensor circuit malfunction. (Refer to P.13A-26, DIAGNOSTIC DETECTION LOGIC P0115.)
- OK ↓

SCAN TOOL Data list
13 Intake air temperature sensor (Refer to P.13A-68.)
- NG → Check the intake air temperature sensor circuit malfunction. (Refer to P.13A-26, DIAGNOSTIC DETECTION LOGIC P0110.)
- OK ↓

SCAN TOOL Data list
27 Power steering pressure switch (Refer to P.13A-93.)
- NG → Check the power steering pressure sensor circuit range/performance. (Refer to P.13A-40, DIAGNOSTIC DETECTION LOGIC P0551.)
- OK ↓

Perform OBD-2 drive cycle test. (Refer to P.13A-12.)
- NG ↓

Perform leakage check again.
1. Disconnect the vapor hose from the fuel cut-off valve and blank the hose end.
2. Disconnect from the pipe over the air intake plenum the purge hose connected between the EVAP purge solenoid and the EVAP canister.
3. Use a three-way joint to connect a hand vacuum pump between the hose and the pipe.
4. Apply a vacuum of 6kPa (0.9psi) and check the condition of vacuum.
   OK: Vacuum is maintained.

- OK → Check for leakage from the fuel tank.
- NG ↓

Connect to the three-way joint the evaporative emission system tester or equivalent in place of the hand vacuum pump. While applying pressure, locate a leaky point with a ultrasonic leak detector.
- Leaky point has been detected. → Repair the leaky point
- No leaky point → Repeat the troubleshooting.

INSPECTION PROCEDURE CC

Ventilation and purge line check

1. Disconnect from the canister the purge hose connected between the EVAP purge solenoid and the canister and connect a hand vacuum pump to the hose end.
2. Apply a vacuum of 6kPa (0.9psi) to check the condition of vacuum.
   OK: Vacuum is maintained.

- NG → Check for leakage from the EVAP purge solenoid. If the EVAP purge solenoid is normal, replace the purge hose connected between the EVAP purge solenoid and the canister.
- OK ↓

1. Disconnect from the canister the purge hose connected between the EVAP ventilation solenoid and the canister and connect a hand vacuum pump to the hose end.
2. Apply a vacuum of 6kPa (0.9psi) to check the condition of vacuum.
   OK: Vacuum is maintained.

- NG → Check for leakage from the EVAP ventilation solenoid. If the EVAP purge solenoid is normal, replace the ventilation hose connected between the EVAP ventilation solenoid and the canister.
- OK ↓

Replace the canister.

TSB Revision

INSPECTION PROCEDURE DD

Check for clogging

1. Remove the tire and splash shield.
2. Disconnect from the canister the vapor hose connected between the canister and the fuel vent valve.
3. Connect a hand vacuum pump to the disconnected vapor hose end.
4. Operate the hand vacuum pump several times and apply vacuum.
   OK: Vacuum leaks.

OK ↓

NG ↓

Remove the vapor hose connected between the canister and the fuel vent valve from the fuel vent valve nipple.
OK: Vacuum leaks

NG → Repair the clogged line between the canister and the fuel vent valve.

OK ↓

Check the fuel tank filler tube assembly (Refer to GROUP 13F – Fuel Tank.) If the assembly is normal, repair the clogged line between the fuel vent valve and the fuel cut-off valve.

1. Disconnect from the canister the purge hose connected between the EVAP purge solenoid and the canister and connect a hand vacuum pump to the hose end.
2. Disconnect from the pipe over the air intake plenum the purge hose connected between EVAP purge solenoid and EVAP canister.
3. Operate the hand vacuum pump several times to apply vacuum.
   OK: Vacuum leaks

NG → Repair the clogged line between the canister and the EVAP purge solenoid.

OK ↓

Replace the canister.

P1600 SERIAL COMMUNICATION LINK MALFUNCTION (OBD-II Main Monitor Diagnostic Procedure)

13110710043

Check the harness wire between the ECM and the transmission control module connector.

NG → **Replace**

OK ↓

Automatic transmission control system may be defective. Follow the automatic transmission troubleshooting. (Refer to GROUP 23A – Troubleshooting.)

OK ↓

Replace the ECM.

TSB Revision

P1715 PG ASSEMBLY MALFUNCTION (OBD-II Main Monitor Diagnostic Procedure)

131105

Check according to the diagnostic trouble code for automatic transmission. (Refer to GROUP 23A – Troubleshooting.)

P1750 SOLENOID ASSEMBLY MALFUNCTION (OBD-II Main Monitor Diagnostic Procedure)

13110550058

Check according to the diagnostic trouble code for automatic transmission. (Refer to GROUP 23A – Troubleshooting.)

P1791 ENGINE COOLANT TEMPERATURE LEVEL INPUT CIRCUIT (TO TCM) MALFUNCTION (OBD-II Main Monitor Diagnostic Procedure)

13110720046

Check the harness wire between the ECM and the transmission control module connector.
- NG → **Replace**
- OK ↓

Replace the ECM.

IM240 TEST FAILURE

13110730049

INSPECTION PROCEDURE 1

Transient, mass emission tailpipe test failure	Probable cause
The test is failed when the air-fuel ratio is not controlled to the theoretical air-fuel ratio due to the feedback control by oxygen sensor signals, or when the EGR flow rate is insufficient or the catalyst has deteriorated.	• Malfunction of the air-fuel ratio control system • Malfunction of the EGR system • Deteriorated catalyst

NOTE
If the three-way catalyst temperature is low when checking the exhaust gas, the three-way catalyst can sufficiently perform for cleaning the emission. Thus, warm up the engine sufficiently before checking the exhaust gas, and check immediately.

Has the engine been warmed up sufficiently before checking the exhaust gas? (Confirm with owner)
- No → Sufficiently warm up the engine, and then check the exhaust gas.
- Yes ↓

- Check all vacuum hoses and connectors.
- Check electrical wires and connectors for obvious problems.
- Check the exhaust system for missing or damage parts

NG → **Repair**

OK ↓

Has the drive-ability failed?
- Yes → Refer to P.13A-46, CHECK CHART CLASSIFIED BY PROBLEM SYMPTOMS.
- No ↓

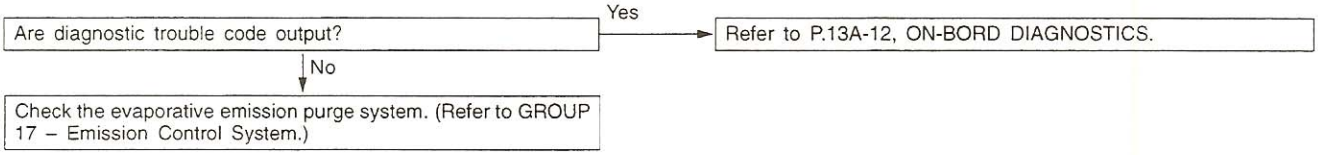
Are diagnostic trouble code output?
- Yes → Refer to P.13A-12, ON-BORD DIAGNOSTICS.
- No ↓

Check the ignition timing. (Refer to GROUP 11A – On-vehicle Service.)
- NG → Check that the crankshaft position sensor and timing belt cover are installed properly.
- OK ↓

Refer to P.13A-146, INSPECTION PROCEDURE 4.

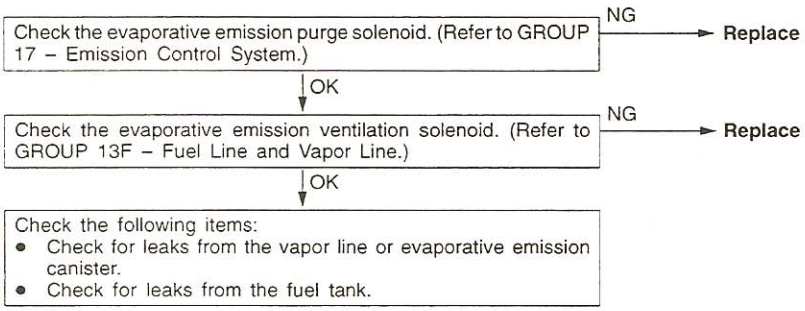
INSPECTION PROCEDURE 2

Evaporative canister purge flow test failure	Probable cause
The test is failed when the pure line or purge port is clogged or if the evaporative emission purge solenoid fails.	• Purge line or purge port is clogged • Malfunction of evaporative emission purge solenoid (No.1) • Malfunction of evaporative emission purge solenoid (No.2) • Evaporative emission canister is clogged



INSPECTION PROCEDURE 3

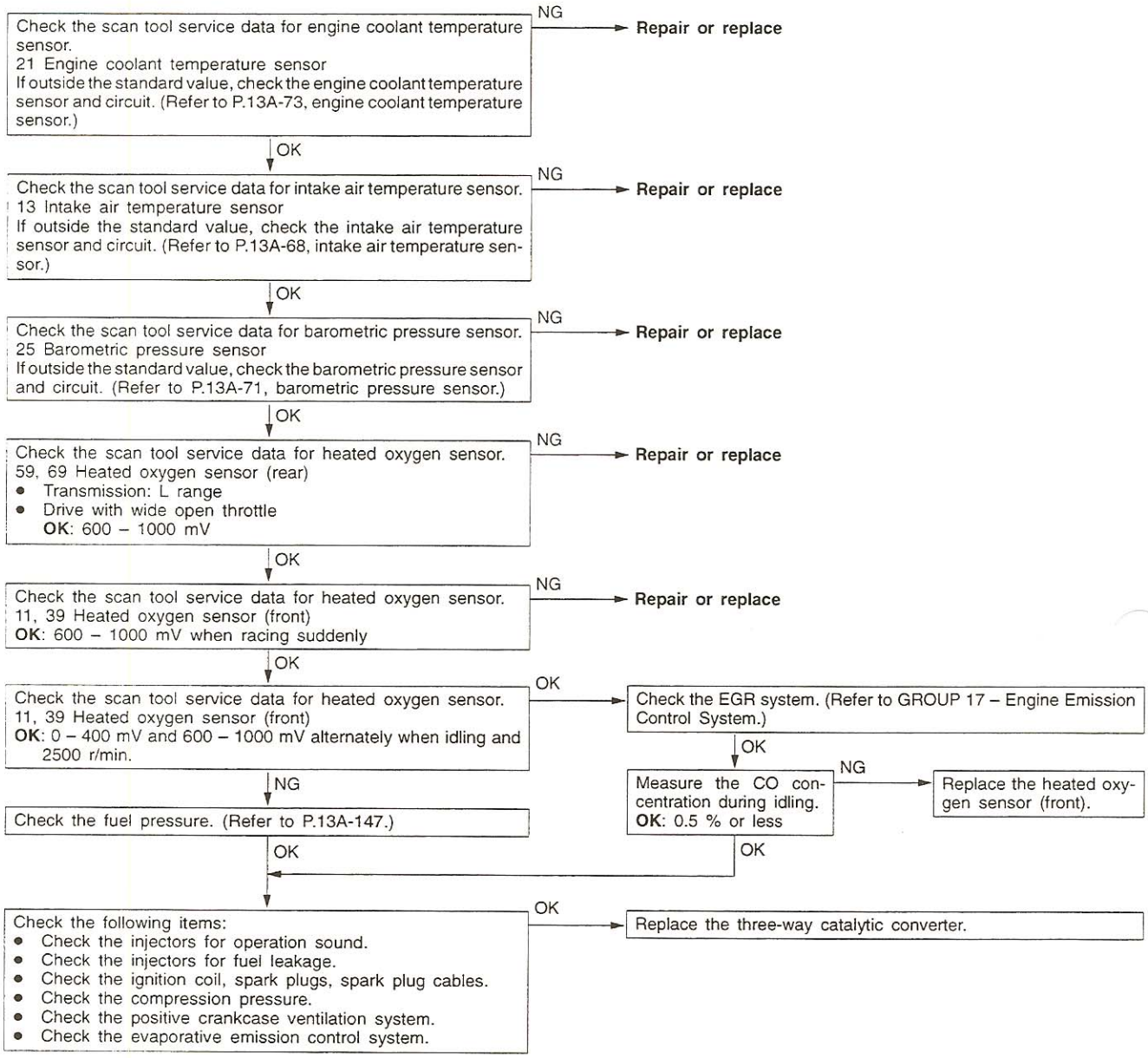
Evaporative system pressure test failure	Probable cause
The test is failed if there is a leak from the fuel tank or vapor line.	• Improper tightening of fuel tank filler tube cap • Broken seal in fuel tank, vapor line evaporative emission canister



TSB Revision

INSPECTION PROCEDURE 4

Transient, mass emission tailpipe test failure



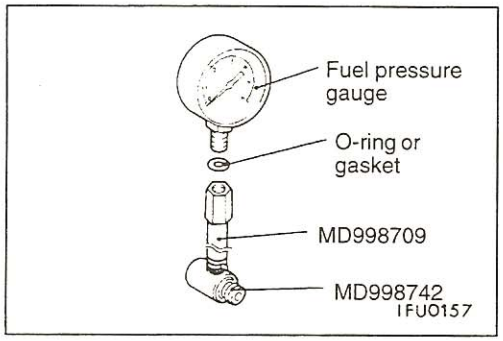
TSB Revision

FUEL PRESSURE TEST

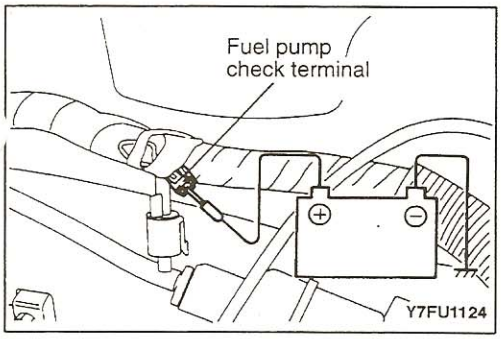
13110420113

(1) Reduce the internal pressure of the fuel pipes and hoses.
(2) Remove the fuel pressure regulator at the fuel rail side.

Caution
Cover the fuel pressure regulator with a shop towel to prevent splash of fuel that could be caused by some residual pressure in the fuel pipe line.

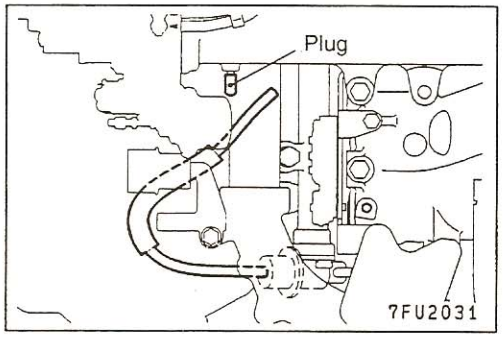


(3) Connect a fuel pressure gage to the special tool, placing an adequate O-ring or gasket between the gage end special tool prevent fuel leaks.
(4) After carrying out step (3), install the special tool between the fuel rail and the fuel pressure regulator.



(5) Connect a jumper wire to the terminal for activation of the fuel pump and to the positive battery terminal to activate the fuel pump. With fuel pressure applied, check that there is no fuel leakage from the fuel pressure gage and the special tool connection part.
(6) Disconnect the jumper wire from the terminal for activation of the fuel pump to stop the fuel pump.
(7) Start the engine and let it idle.
(8) Measure the fuel pressure during idling.

Standard value: Approx. 270 kPa (38 psi) at curb idle



(9) Disconnect the vacuum hose (blue stripe) from the air intake fitting manifold and then plug the nipple. Measure the fuel pressure in this condition.

Standard value:
330–350 kPa (47–50 psi) at curb idle speed

(10) Check that the fuel pressure during idling does not decrease even after the engine is raced a few times.
(11) Use a finger to gently press the fuel return hose while repeatedly racing the engine, and check that there is fuel pressure in the return hose also.

NOTE
There will be no fuel pressure in the return hose if there is insufficient fuel flow.

(12) If the fuel pressure measured in steps (9) to (12) is outside the standard value range, check for the probable cause by referring to the following table, and then make the appropriate repair.

Condition	Probable cause	Remedy
• Fuel pressure is too low. • Fuel pressure drops during racing. • No fuel pressure in fuel return hose.	Fuel filter is clogged.	Replace the fuel filter.
	Malfunction of valve seat inside the fuel pressure regulator, or fuel leakage to return side caused by spring deterioration.	Replace the fuel pressure regulator.
	Low fuel pump discharge pressure.	Replace the fuel pump.
Fuel pressure is too high.	The valve inside the fuel pressure regulator is sticking.	Replace the fuel pressure regulator.
	Clogging of the fuel return hose and/or the pipe.	Clean or replace the hose and/or pipe.
Fuel pressure does not change when vacuum hose is connected and disconnected.	Damaged vacuum hose or clogged nipple.	Replace the vacuum hose, or clean the nipple.

(13) Stop the engine and check for a change of the value indicated by the fuel pressure gage. The condition is normal if there is no decrease in the indicated value within two minutes. If there is a decrease in the indicated value, monitor the speed of the decrease, and, referring to the following table, determine the cause of the problem and make the appropriate repair.

Condition	Probable cause	Remedy
After the engine is stopped, the fuel pressure drops gradually.	Injector leakage.	Replace the injector.
	Leakage at the fuel pressure regulator valve seat.	Replace the fuel pressure regulator.
There is a sudden sharp drop of the fuel pressure immediately after the engine is stopped.	The check valve (within the fuel pump) is not closed.	Replace the fuel pump.

(14) Reduce the internal pressure of the fuel pipes and hose. (Refer to GROUP 13F – On-vehicle Service.)

(15) Disconnect the fuel pressure gage and the special tool from the fuel rail.

Caution
Because there will be some residual pressure in the fuel pipe line, use a shop towel to cover so that fuel doesn't splatter.

(16) Replace the O-ring at the end of the high-pressure fuel hose with a new one.

(17) After connecting the high-pressure fuel hose to the fuel rail, tighten the installation bolt to the specified torque.

Tightening torque: 5 Nm (3.6 ft.lbs)

(18) Check that there is no fuel leakage.
1) Apply battery positive voltage to the terminal for activation of the fuel pump so as to activate the pump.
2) With fuel pressure applied, check for leakage of the fuel line.

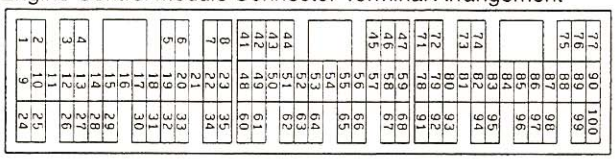
TSB Revision

ENGINE CONTROL MODULE TERMINAL VOLTAGE CHECK

13110430093

Terminal Voltage Check Chart

Engine Control Module Connector Terminal Arrangement



7FU2119

Terminal No.	Check item	Check condition (Engine condition)		Standard value	Remarks
60	Backup power supply	Ignition switch: OFF		B+	–
47	Power supply	Ignition switch: ON		B+	–
59					
99	Ignition switch-IG	Ignition switch: ON		B+	–
57	MFI relay (power supply)	Ignition switch: OFF		B+	–
		Ignition switch: ON		0 – 3 V	
20	Fuel pump relay	Ignition switch: ON		B+	–
		Engine: Idling		0 – 3 V	
42	Sensor applied voltage	Ignition switch: ON		4.5–5.5 V	–
61	Volume air flow sensor	Engine: Idling		2.2–3.2 V	–
		Engine: 2,500 r/min			
19	Volume air flow sensor reset signal	Engine: Idling		0–1 V	–
		Engine: 3,000 r/min		6–9 V	
62	Intake air temperature sensor	Ignition switch: ON	Air intake temperature of 0°C (32°F)	3.2–3.8 V	–
			Air intake temperature of 20°C (68°F)	2.3–2.9 V	
			Air intake temperature of 40°C (104°F)	1.5–2.1 V	
			Air intake temperature of 80°C (176°F)	0.4–1.0 V	
51	Barometric pressure sensor	Ignition switch: ON	Altitude of 0 m (0 ft.)	3.7–4.3 V	–
			Altitude of 1,200 m (3,937 ft.)	3.2–3.8 V	
44	Engine coolant temperature sensor	Ignition switch: ON	Coolant temperature of 0°C (32°F)	3.2–3.8 V	–
			Coolant temperature of 20°C (68°F)	2.3–2.9 V	
			Coolant temperature of 40°C (104°F)	1.3–1.9 V	
			Coolant temperature of 80°C (176°F)	0.3–0.9 V	
78	Throttle position sensor	Ignition switch: ON	Idling	0.3–1.0 V	–
			Wide open throttle	4.5–5.5 V	

TSB Revision

Terminal No.	Check item	Check condition (Engine condition)		Standard value	Remarks
79	Closed throttle position switch	Ignition switch: ON	Set the throttle valve to the idle position	0–1 V	–
			Slightly open the throttle valve.	4 V or higher	
50	Camshaft position sensor	Engine: Cranking		0.2–3.0 V	–
		Engine: Idling			
43	Crankshaft position sensor	Engine: Cranking		0.2–3.0 V	–
		Engine: Idling			
68	Ignition switch-ST	Engine: Cranking		8 V or higher	–
67	Park/neutral position switch	Ignition switch: ON	Set the selector lever to P or N.	0–3 V	–
			Set the selector lever to D, 2, L or R.	8–14 V	
80	Vehicle speed sensor	• Ignition switch: ON • Move the vehicle slowly forward		0 ↔ 5 V (Repeat the variation.)	–
54	Power steering pressure switch	Engine: Idling after having warmed up	Set the steering wheel to the straight-forward	B+	–
			Half turn the steering wheel.	0–3 V	
83	Air conditioning switch	Engine: Idling	Turn the air conditioning switch to OFF.	0 – 3 V	–
			Turn the air conditioning switch to ON (Air conditioning compressor is operating)	B+	
21	Air conditioning compressor clutch relay	• Engine: Idling • Air conditioning switch: OFF → ON (Air compressor is operating)		Changes from B+ or temporarily 6 V higher to 0–3 V as A/C clutch cycles	–
71	Heated oxygen sensor (Front)	Engine: Warmed up, 2,500 r/min (Check using a digital type voltmeter)		0 ↔ 0.8 V (Changes repeatedly)	Left-bank side for California
72	Right bank heated oxygen sensor (Front)	Engine: Warmed up, 2,500 r/min (Check using a digital type voltmeter)		0 ↔ 0.8 V (Changes repeatedly)	California
73	Heated oxygen sensor (rear)	• Transmission: L range • Driving with the throttle widely open • Engine: 3,500 r/min or more		0.6 – 1.0 V	Left-bank side for California
74	Right bank heated oxygen sensor (Rear)	• Transmission: L range • Driving with the throttle widely open • Engine: 3,500 r/min or more		0.6 – 1.0 V	California
3	Heated oxygen sensor heater (Front)	Engine: Warmed up, idle		0 – 3 V	Left-bank side for California
		Engine: 5,000 r/min		B+	

TSB Revision

Terminal No.	Check item	Check condition (Engine condition)	Standard value	Remarks
4	Right bank heated oxygen sensor heater (Front)	Engine: Warmed up, idle	0 – 3 V	California
		Engine: 5,000 r/min	B+	
26	Heated oxygen sensor heater (Rear)	Engine: Warmed up, idle	0 – 3 V	Left-bank side for California
		Engine: 5,000 r/min	B+	
27	Right bank heated oxygen sensor heater (Rear)	Engine: Warmed up, idle	0 – 3 V	California
		Engine: 5,000 r/min	B+	
35	Evaporative emission ventilation solenoid	Ignition switch: ON	B+	–
		Drive the vehicle at constant speed of 55 mph after warming up the engine (OBD-II with monitor condition)	Temporarily 0 – 3 V	
93	Fuel tank differential pressure sensor	Engine: Idle	1.2 – 3.8 V	–
1	No. 1 Injector	Engine: While engine is idling after having warmed up, rapidly depress the accelerator pedal	From 1 1–14 V, momentarily drops slightly	–
9	No. 2 Injector			
24	No. 3 Injector			
2	No. 4 Injector			
10	No. 5 Injector			
25	No. 6 Injector			
14	Stepper motor coil <A1>	Engine: Warmed up Check immediately after hot restart	Changes repeatedly between B+ and 0–3 V	–
28	Stepper motor coil <A2>			
15	Stepper motor coil <B1>			
29	Stepper motor coil <B2>			
11	Ignition power transistor unit A	Engine: 3,000 r/min	0.3–3 V	–
12	Ignition power transistor unit B			
13	Ignition power transistor unit C			
16	Evaporative emission purge solenoid	Ignition switch: ON	B+	–
		Engine: Warmed up, 3,000 r/min	0–3 V	
45	Engine ignition signal	Engine: 3,000 r/min	0.3–3 V	–

TSB Revision

Terminal No.	Check item	Check condition (Engine condition)	Standard value	Remarks
22	Check engine/ malfunction indicator lamp	Ignition switch: OFF → ON	Changes from 0–3 V to 9–13 V (after several seconds have elapsed)	–
6	EGR solenoid	Ignition switch: ON	B+	–
		Engine: While engine is idling after having warmed up, rapidly depress the accelerator pedal	Tempo-rarily drops slightly from B+	
92	Manifold differ-ential pressure sensor	Engine: Idling	0.8 – 2.4 V	–
		• Engine: Idling • Suddenly depress the accelerator pedal	Rises from 0.8 – 2.4 V suddenly	

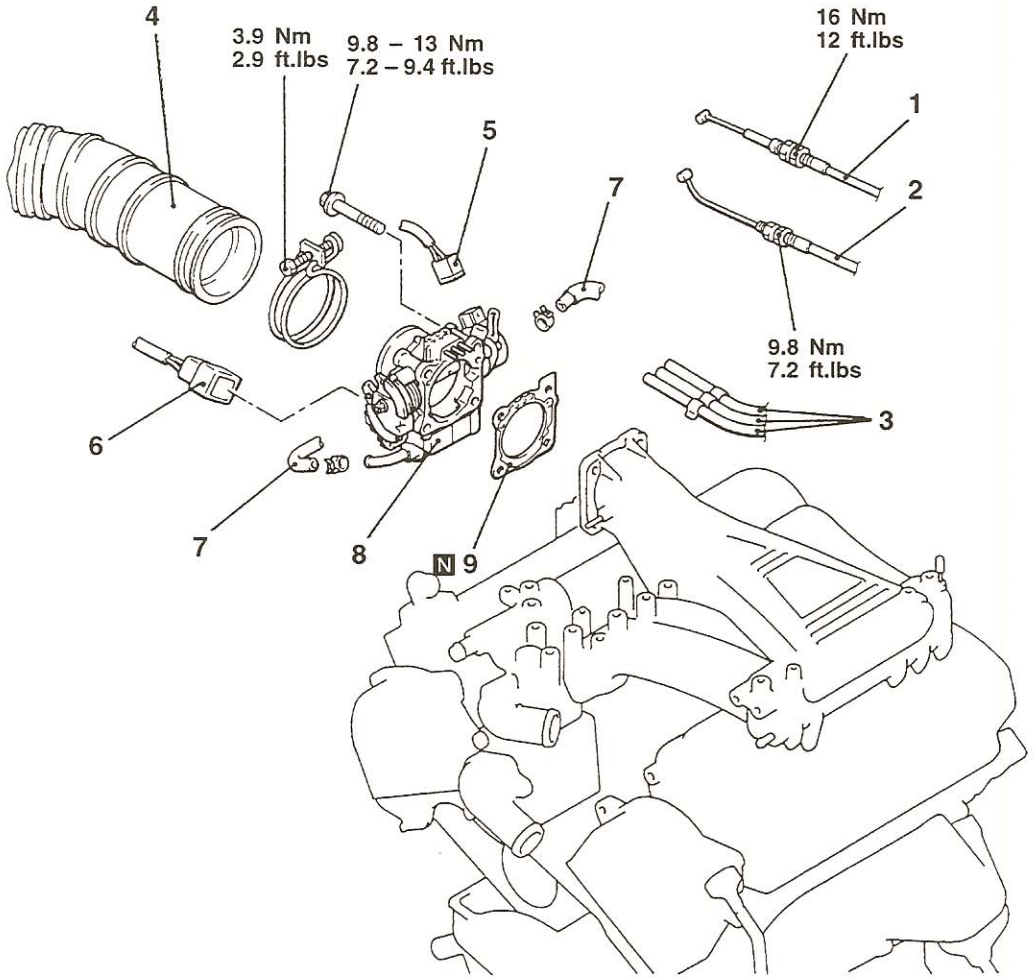
THROTTLE BODY

13100770392

REMOVAL AND INSTALLATION

Pre-removal Operation
- Engine Coolant Draining
  (Refer to GROUP 00 – Maintenance Service.)

Post-installation
- Engine Coolant Supplying
  (Refer to GROUP 00 – Maintenance Service.)
- Accelerator Cable Adjustment
  (Refer to GROUP 17 – On-vehicle Service.)
- Throttle cable Adjustment
  (Refer to GROUP 23A – On-vehicle Service.)

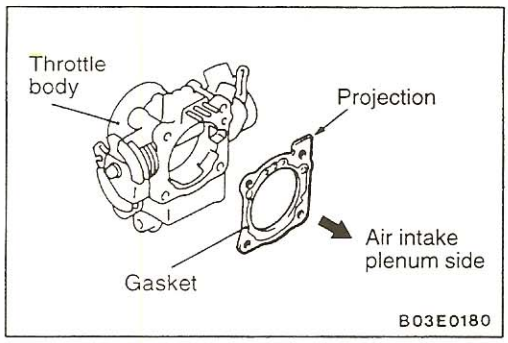


Removal steps

1. Throttle cable connection
2. Accelerator cable connection
3. Vacuum hose conneciton
4. Air intake hose connection
6. Throttle positon sensor connector
7. IAC motor connector
8. Water hose connection
9. Throttle body

▶A◀ 9. Gasket

TSB Revision



INSTALLATION SERVICE POINT

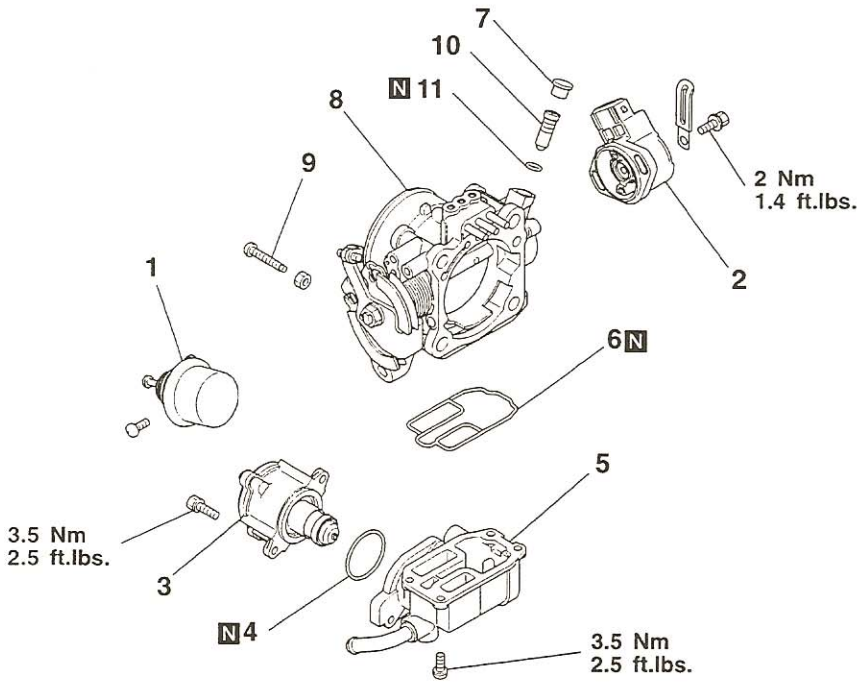
▶A◀ GASKET INSTALLATION

Install the gasket with the projection in the position shown in the illustration.

Caution
If the gasket installation direction is incorrect, it may result in faulty idling or other trouble.

DISASSEMBLY AND REASSEMBLY

13100970372



Disassembly steps

1. Dash pot
◀A▶ ▶A◀ 2. Throttle position sensor
3. Idle air control motor
4. O-ring
5. Fast idle air valve
6. O-ring
7. Cap
◀B▶ 8. Throttle body
9. Fixed SAS
10. Speed adjusting screw
11. O-ring

NOTE
1. The fixed SAS and the speed adjusting screw are correctly adjusted at the factory and should not be removed.
2. If the fixed SAS should happen to have been removed, carry out fixed SAS adjustment.
3. If the speed adjusting screw should happen to have been removed, carry out speed adjusting screw adjustment.

TSB Revision

DISASSEMBLY SERVICE POINTS

◀A▶ THROTTLE POSITION SENSOR REMOVAL

(1) Do not disassemble the sensor and motor.
(2) Do not clean the sensor and motor by dipping them into cleaning solvent. Clean them with shop towel.

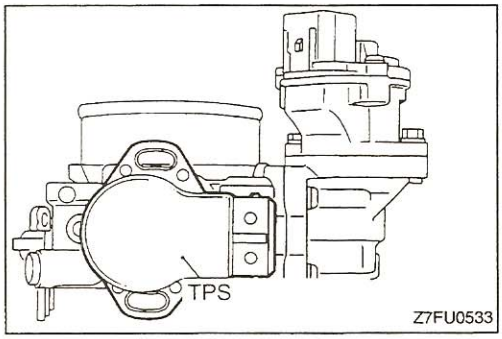
◀B▶ THROTTLE BODY REMOVAL

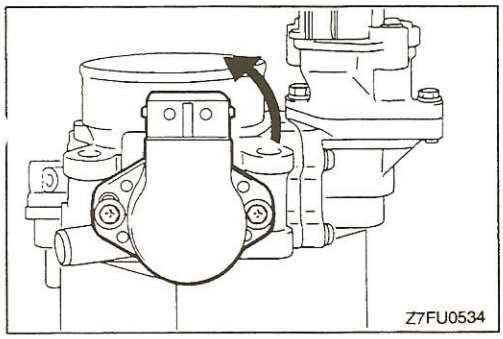
(1) Do not remove the throttle body.
(2) Check if the vacuum port or passage is clogged. Use compressed air to clean the vacuum passage.

REASSEMBLY SERVICE POINTS

▶A◀ THROTTLE POSITION SENSOR (TPS) INSTALLATION

(1) Install the throttle position sensor to the throttle body as shown in the illustration.

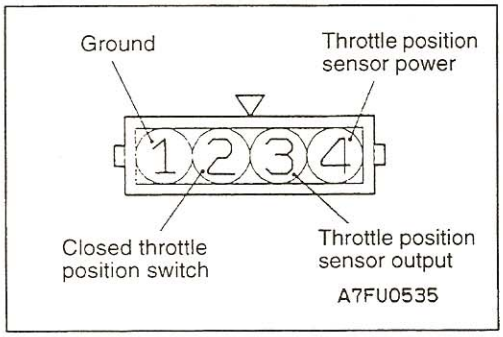




(2) Turn the throttle position sensor 90° counterclockwise to set it, and tighten the screws.
(3) Connect a circuit tester between terminals 1 (ground) and 3 (output), or between terminals 3 (output) and 4 (power). Then, make sure that the resistance changes smoothly when the throttle valve is slowly moved to the fully open position.
(4) Check for continuity between terminals 2 (closed throttle position switch) and 1 (ground) with the throttle valve both fully closed and fully open.

Throttle valve position	Continuity
Fully closed	Conductive
Fully open	Non-conductive

If there is no continuity with throttle valve fully closed, turn the throttle position sensor clockwise, and then check again.
(5) If the above specifications are not met, replace TPS.



INSPECTION

13100980023

DASH POT

(1) Push the dash pot rod in lightly and confirm the resistance.

NOTE
1. Resistance increases as the rod is pushed harder.
2. If the rod can be pushed in with no resistance, either the diaphragm or check valve is faulty.

(2) Release finger and confirm that the rod returns to its original position quickly.

NOTE
If the rod returns slowly, the check valve is faulty.

TSB Revision

NOTES

FUEL SUPPLY

CONTENTS

13509000241

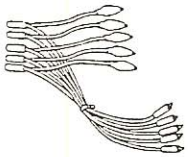
GENERAL SPECIFICATIONS

13500020017

Items		Specifications
Fuel	Tank capacity dm^3 (U.S. gal., Imp. gal.)	92 (24.3, 20.2)
Fuel pump	Type	Electrical, in-tank type
	Driven by	Electric motor

SPECIAL TOOL

13500060057

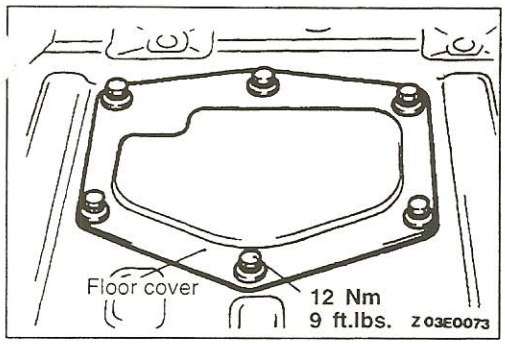
Tool	Tool Number and name	Supersession	Application
	MB991348 Test harness set	Tool not available	• Fuel tank differential pressure sensor check

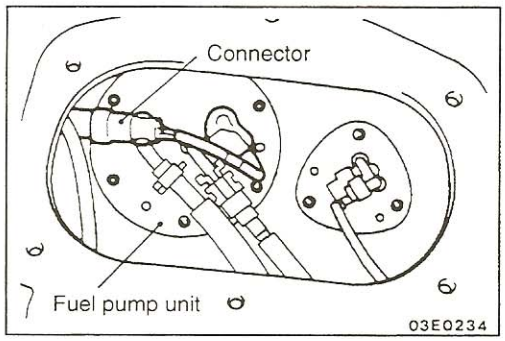
TROUBLESHOOTING

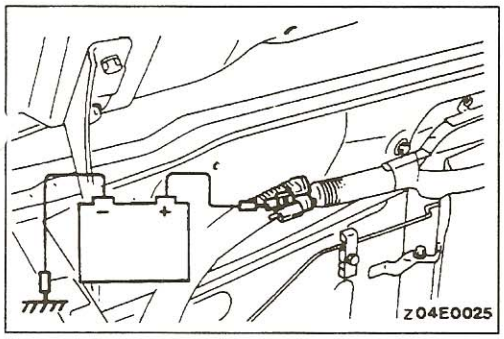
13500070036

Trouble Symptom	Probable Cause	Remedy
Malfunction of engine due to insufficient fuel supply	Bent or kinked fuel pipe or hose	Repair or replace
	Clogged fuel pipe or hose	Clean or replace
	Dirty or rusted fuel tank interior	
	Clogged fuel filter or in-tank fuel filter	Replace
	Malfunction of fuel pump (clogged pump filter)	
	Water in fuel filter	Replace the fuel filter or clean the fuel tank and fuel line.
Malfunction of evaporative emission control system (when tank cap is removed, pressure releasing noise is heard)	Missing vapor line	Correct
	Disconnected vapor line piping joint	
	Folded, bent, cracked or clogged vapor line	Replace
	Malfunction of filler tube	
	Malfunction of fuel tank pressure control valve	

TSB Revision







ON-VEHICLE SERVICE

13100090078

FUEL PRESSURE

HOW TO REDUCE THE FUEL LINE INTERNAL PRESSURE

When removing the fuel pipe and hose, etc., fuel under high pressure will be inside the fuel line, so carry out the following procedure to release the pressure to prevent the fuel from spraying out.

(1) Take out the carpet in the cargo compartment and remove the floor cover.

(2) Disconnect the fuel pump unit connector.
(3) After starting the engine and letting it run until it stops, turn the ignition switch to OFF.
(4) Connect the fuel pump unit connector.
(5) Install the floor cover packing and the floor cover.

FUEL PUMP OPERATION CHECK

13500100032

(1) Use the scan tool to force-drive the fuel pump, and check the operation of the fuel pump.
(For inspection using the scan tool, refer to GROUP 13A – On-vehicle Inspection of MFI Components.)
(2) If the fuel pump does not operate, check by the following procedure. If the results are normal, check the drive circuit.
1) Turn the ignition switch to OFF.
2) When the fuel pump drive connector is connected directly to the battery, check that the sound of the fuel pump operation can be heard.

NOTE
It is hard to hear the sound of an in-tank type fuel pump. So remove the fuel tank filler tube cap to hear it from the tank inlet.

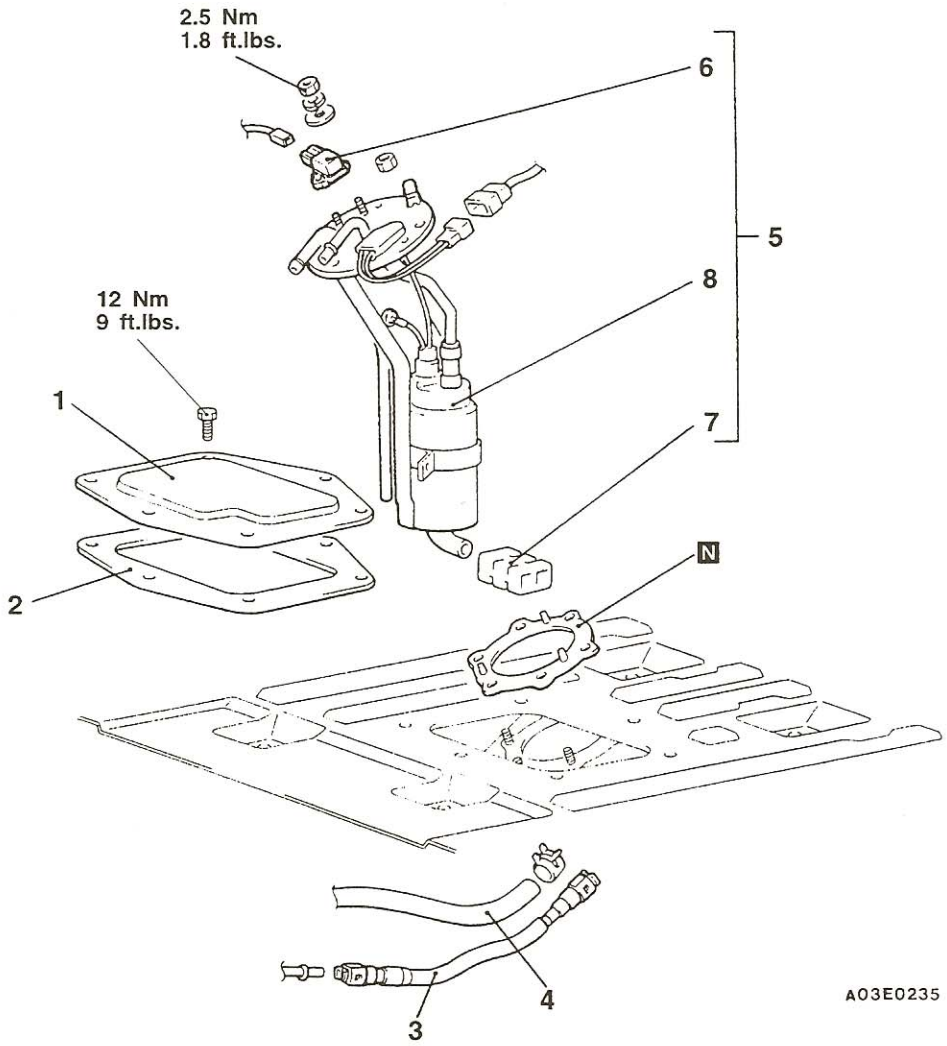
3) Check if the fuel pressure can be felt by pinching the high pressure fuel hose with fingertips.

FUEL PUMP

13500220035

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Fuel Drain and Filling
- Floor Carpet Removal and Installation



Removal steps

1. Floor cover
2. Packing

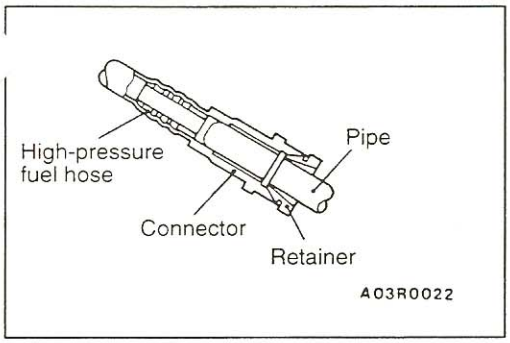
◀A▶ ▶B◀ 3. High-pressure fuel hose

4. Fuel return hose connection
5. Fuel pump and filter assembly

▶A◀ 6. Fuel tank differential pressure sensor

7. Filter
8. Fuel pump assembly

TSB Revision



REMOVAL SERVICE POINT

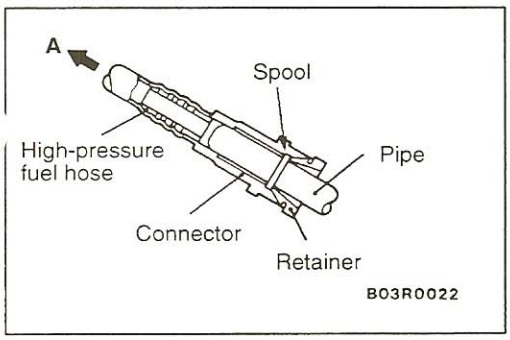
◀A▶ HIGH-PRESSURE FUEL HOSE REMOVAL

Press the high-pressure fuel hose retainer to disengage the connector, and then remove the high-pressure fuel hose.

INSTALLATION SERVICE POINTS

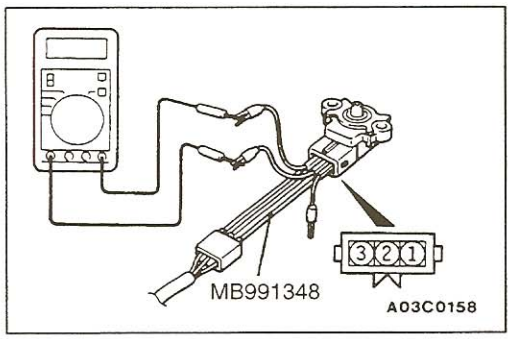
▶A◀ FUEL TANK DIFFERENTIAL PRESSURE SENSOR INSTALLATION

Caution
When removing and installing the sensor, be careful not to damage the packing or let foreign materials stick to the packing, as this will decrease sealing performance.



▶B◀ HIGH-PRESSURE FUEL HOSE INSTALLATION

(1) Insert the high-pressure fuel hose connector securely into the pipe until the retainer goes past the spool of the pipe.
(2) After inserting, gently pull the connector in the direction of A in the illustration and check that the connector does not pull out.



INSPECTION 13500320018

FUEL TANK DIFFERENTIAL PRESSURE SENSOR CHECK

(1) Disconnect the fuel tank differential pressure sensor connector and connect the special tool between the terminals of the disconnected connector.
(2) Turn the ignition switch to ON and take a reading of the following output voltage.
Between terminals (2) and (3).
Standard value: 2.0 – 3.0 V

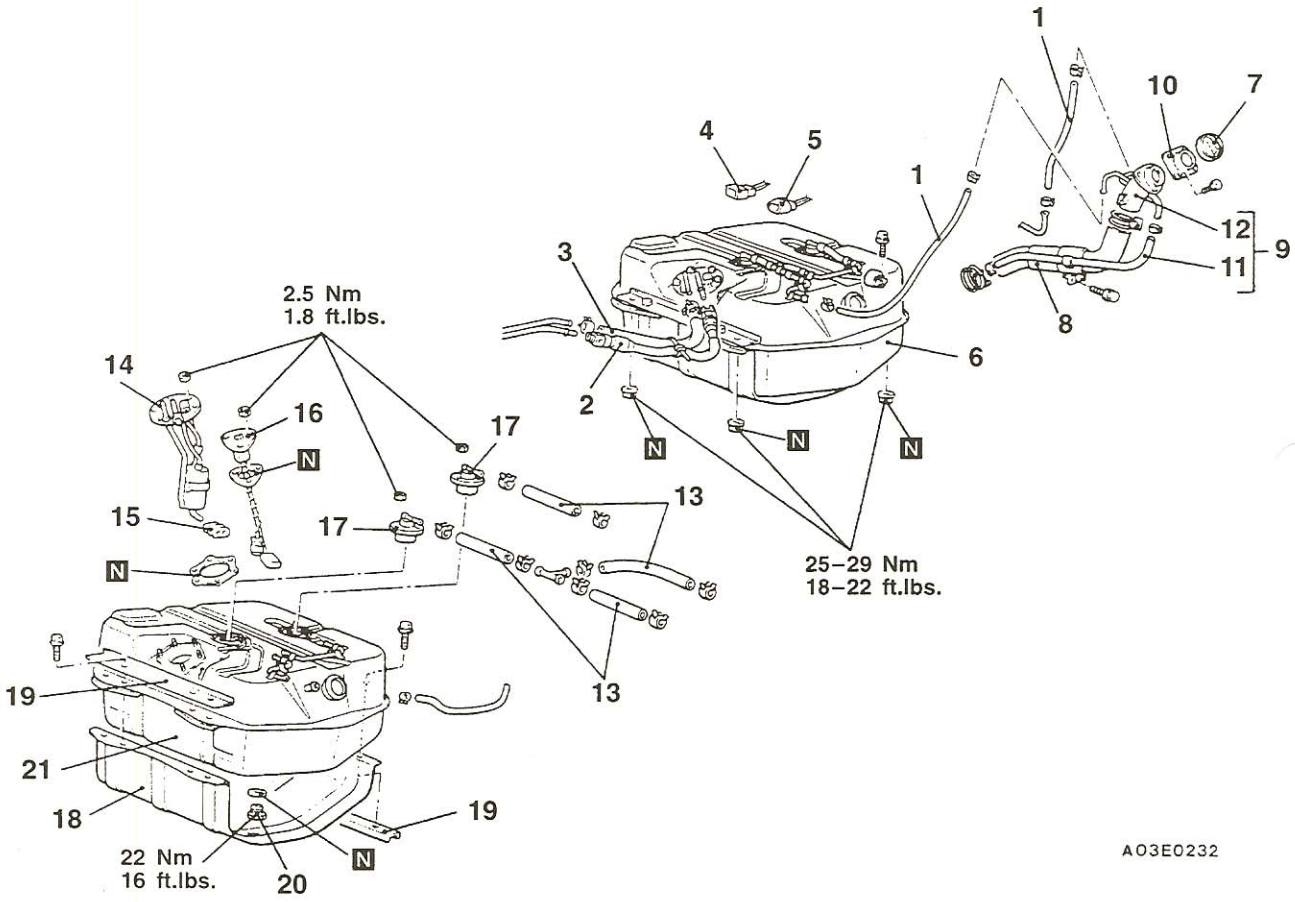
TSB Revision

FUEL TANK

13500190236

REMOVAL AND INSTALLATION

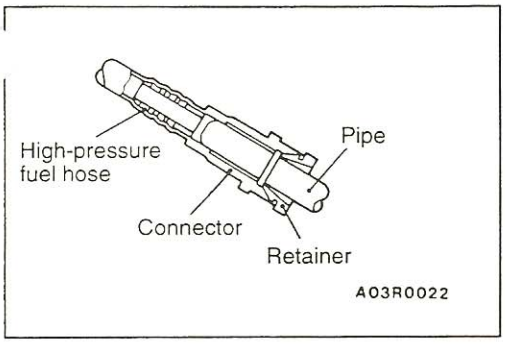
Pre-removal and Post-installation Operation
- Fuel Draining and Filling
- Fuel Tank Filler Tube Protector Removal and Installation
- Floor Carpet Removal and Installation
- Floor Cover Removal and Installation



Removal steps

◀A▶ ▶A◀
1. Vapor hoses
2. High-pressure fuel hose
3. Fuel return hose
4. Fuel pump connector
5. Fuel gage unit connector
6. Fuel tank assembly
7. Fuel tank filler cap
8. Fuel tank filler hose
9. Fuel tank filler tube and vapor hose assembly
10. Packing
11. Vapor hose
12. Fuel tank filler tube
13. Vapor hoses
14. Fuel pump assembly
15. Filter
16. Fuel gage unit
17. Fuel tank rollover valve
18. Fuel tank protector
19. Plate
20. Drain plug
21. Fuel tank

TSB Revision

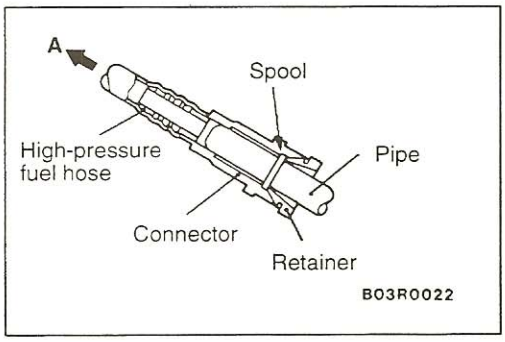


REMOVAL SERVICE POINT

◀A▶ HIGH-PRESSURE FUEL HOSE REMOVAL

Refer to P.13F-5.

Caution
The fuel line has some residual pressure, so cover it with a shop towel.



INSTALLATION SERVICE POINTS

▶A◀ HIGH-PRESSURE FUEL HOSE INSTALLATION

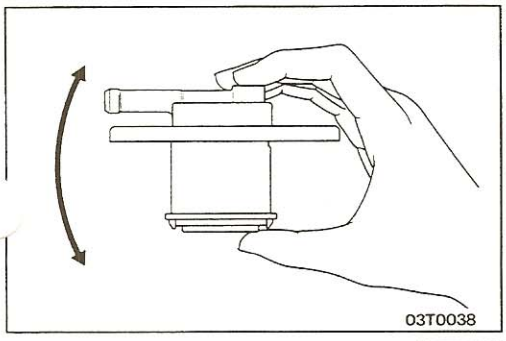
Refer to P.13F-5.

INSPECTION

13500200046

- Check the hoses and the pipes for cracks or damage.
- Check the fuel tank filler tube cap for malfunction.
- Check the fuel tank for deformation, corrosion or cracks.
- Check the fuel tank for dust or foreign material.

  NOTE
  If the inside of the fuel tank is to be cleaned, use any one of the following:
  (1) Kerosene
  (2) Trichloroethylene
  (3) A neutral emulsion type detergent
- Check the in-tank fuel filter for damage or clogging.
- Check the check valve for malfunction.



FUEL TANK ROLLOVER VALVE CHECK

13500300081

If the sound of the float valve moving (knocking sound) can be heard when the valve assembly is gently shaken up and down, then the valve is okay.

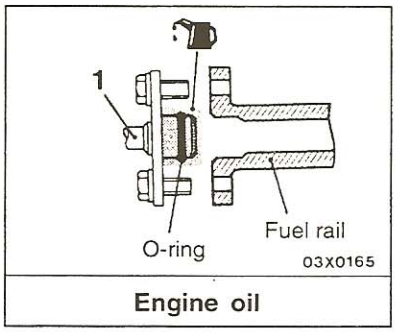
TSB Revision

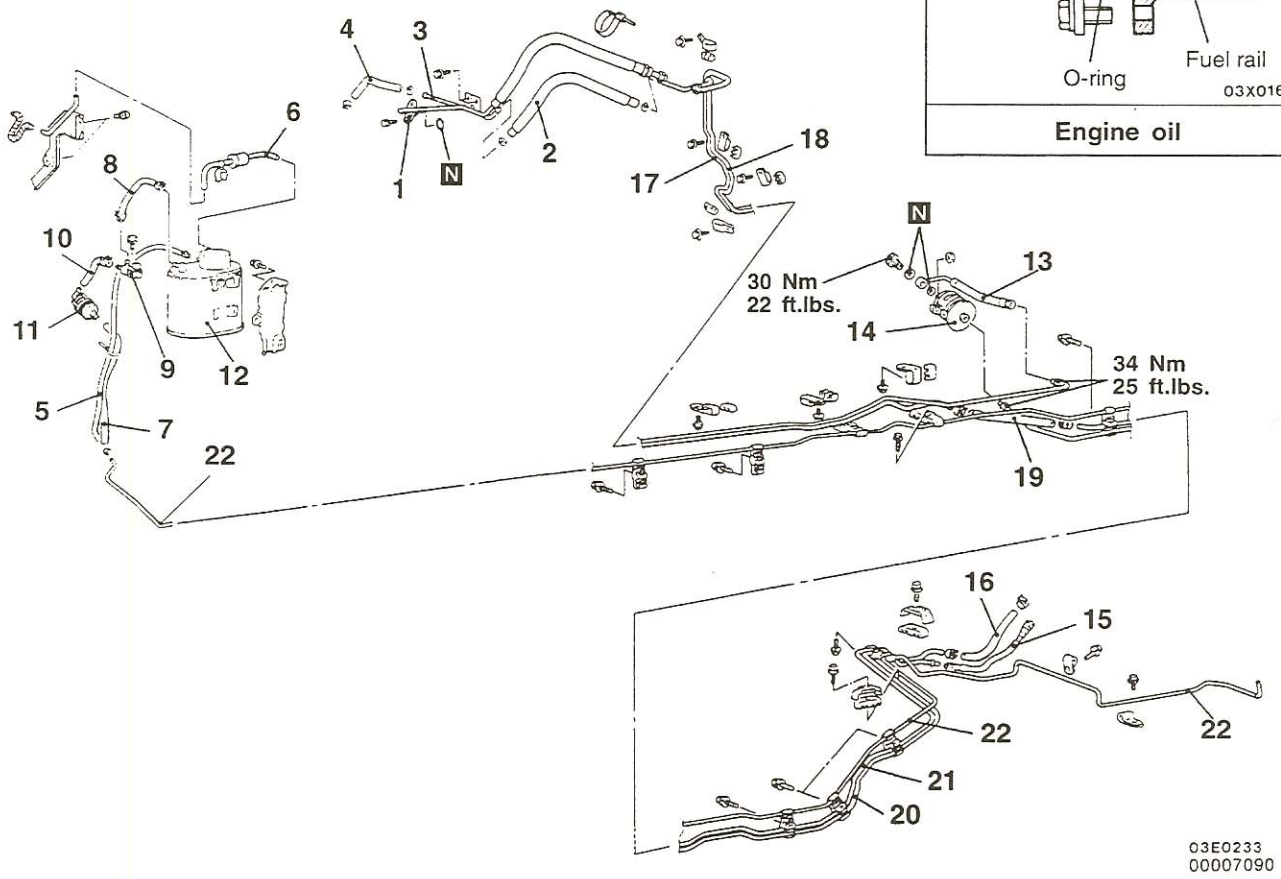
FUEL LINE AND VAPOR LINE

13500340052

REMOVAL AND INSTALLATION

Pre-removal Operation
- Residual Pressure Release from High-pressure Fuel Hose (Refer to P.13F-3.)





Removal steps

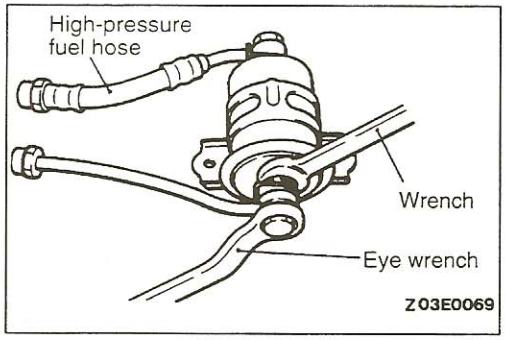
◀A▶ ▶C◀ 1. High-pressure fuel hose
▶A◀ 2. Fuel return hose
3. Fuel return pipe
▶A◀ 4. Fuel return hose
▶A◀ 5. Fuel vapor hose
▶A◀ 6. Fuel vapor hose
▶A◀ 7. Fuel vapor hose
▶A◀ 8. Fuel vapor hose
9. Evaporative emission ventilation solenoid
▶A◀ 10. Fuel vapor hose
11. Air filter
12. Canister
◀B▶ 13. High-pressure fuel hose
14. Fuel filter
◀C▶ ▶B◀ 15. High-pressure fuel hose
▶A◀ 16. Fuel return hose
17. Fuel main pipe (front)
18. Fuel return pipe (front)
▶A◀ 19. Fuel return hose
20. Fuel main pipe (rear)
21. Fuel return pipe (rear)
22. Fuel vapor pipe

TSB Revision

REMOVAL SERVICE POINTS

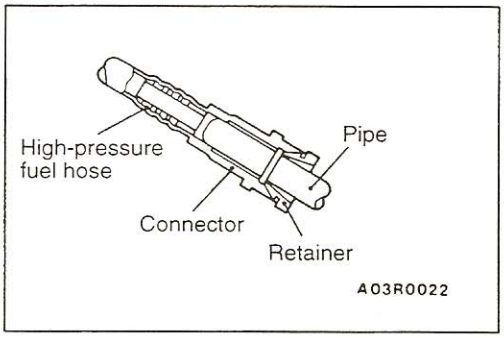
◀A▶ HIGH-PRESSURE FUEL HOSE REMOVAL

Caution
Cover the high-pressure hose connection with shop towels to prevent splashing of fuel that could be caused by some residual pressure in the fuel pipe line.



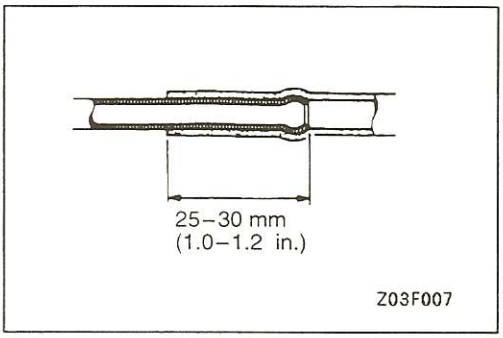
◀B▶ HIGH-PRESSURE FUEL HOSE REMOVAL

Hold the fuel filter with a wrench and use an eye wrench to remove the eye bolt which is securing the high-pressure fuel hose.



◀C▶ HIGH-PRESSURE FUEL HOSE REMOVAL

Refer to P.13F-5.



INSTALLATION SERVICE POINTS

▶A◀ FUEL RETURN HOSE/FUEL VAPOR HOSE INSTALLATION

Insert each hose approximately 25–30 mm (1.0–1.2 in.) into the corresponding pipe.

▶B◀ HIGH-PRESSURE FUEL HOSE INSTALLATION

Refer to P.13F-5.

▶C◀ HIGH-PRESSURE FUEL HOSE (FUEL RAIL SIDE) INSTALLATION

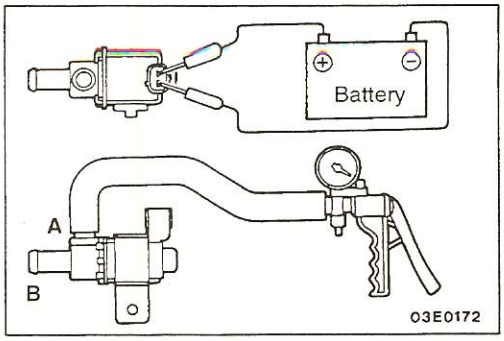
Insert the hose, being careful not to damage the O-ring, and tighten securely.

INSPECTION

13500350017

- Check the fuel hoses and pipes for cracks, bends, deformation, deterioration or clogging.
- Check the fuel filter for clogging or damage.
- Check the canister for clogging or damage.

TSB Revision

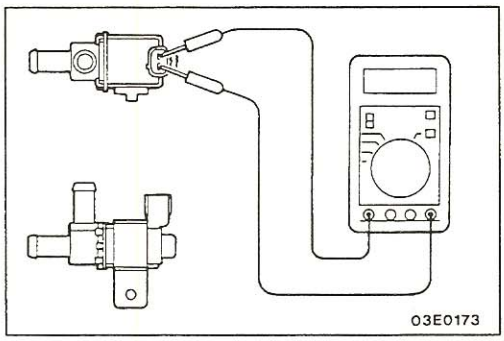


EVAPORATIVE EMISSION VENTILATION SOLENOID

135003

1. Connect a hand vacuum pump to nipple (A) of the solenoid (refer to the illustration at left).
2. Check airtightness by applying a vacuum with voltage applied directly from the battery to the evaporative emission ventilation solenoid.

Battery voltage	Normal condition
Applied	Vacuum maintained
Not applied	Vacuum leaks



3. Measure the resistance between the terminals of the solenoid valve.

   Standard value: 17 – 21 Ω [at 20°C (68°F)]

TSB Revision

ENGINE COOLING

CONTENTS

14109000154

WARNINGS REGARDING SERVICING OF SUPPLEMENTAL RESTRAINT SYSTEM (SRS) EQUIPPED VEHICLES

WARNING!

(1) Improper service or maintenance of any component of the SRS, or any SRS-related component, can lead to personal injury or death to service personnel (from inadvertent firing of the air bag) or to the driver (from rendering the SRS inoperative).

(2) Service or maintenance of any SRS component or SRS-related component must be performed only at an authorized MITSUBISHI dealer.

(3) MITSUBISHI dealer personnel must thoroughly review this manual, and especially its GROUP 52B – Supplemental Restraint System (SRS) and GROUP 00 – Maintenance Service before beginning any service or maintenance of any component of the SRS or any SRS-related component.

NOTE

The SRS includes the following components: SRS diagnosis unit, SRS warning light, air bag module, clock spring, and interconnecting wiring. Other SRS-related components (that may have to be removed/installed in connection with SRS service or maintenance) are indicated in the table of contents by an asterisk (*).

GENERAL SPECIFICATIONS

14100[illegible]7

Items	Specifications
Cooling method	Water-cooled pressurized, forced circulation
Radiator type	Pressurized corrugated fin type
Radiator Performance kJ/h (kcal/h, BTU/h)	200,900 (48,000, 190,476)
Automatic transmission oil cooler performance kJ/h (kcal/h, BTU/h)	6,200 (1,480, 5,873)
Thermostat type	Wax type with jiggle valve
Thermostat identification mark	82 (Stamped on flange)
Fan clutch type	Thermo type with spiral type bimetal
Water pump type	Centrifugal-type impeller

SERVICE SPECIFICATIONS

14100030251

Items		Standard value	Limit
Radiator cap	High pressure valve opening pressure kPa (psi)	75–105 (11–15)	65 (9.2)
	Vacuum valve opening pressure kPa (psi)	–5 or less (–.7 or less)	–
Range of coolant antifreeze concentration %		30–60	–
Thermostat	Valve opening temperature of thermostat °C (°F)	88 (190)	–
	Full-opening temperature of thermostat °C (°F)	100 (212)	–
Engine coolant temperature gage unit resistance At 70°C (158°F) Ω		104±13.5	–
Engine coolant temperature sensor resistance	At 20°C (68°F) kΩ	2.37±0.24	–
	At 80°C (176°F) Ω	290±32	–
Thermo switch <A/T> (always opened type) OFF→ON operating temperature °C (°F)		More than 50 (112)	–

LUBRICANTS

14100040056

Items	Recommended antifreeze	Quantity
Engine coolant	DIA QUEEN LONG-LIFE COOLANT (Part No. 0103044) or HIGH QUALITY ETHYLENE GLYCOL ANTIFREEZE COOLANT	9.5 dm^3 (10.0 qts.)*

NOTE
* includes 0.65 dm^3 (.69 qts.) in reserve tank.

TSB Revision

SEALANTS AND ADHESIVES

14100050059

Items	Specified sealants and adhesives
Cylinder block drain plug	3M Nut Locking Part No. 4171 or equivalent
Engine coolant temperature sensor	
Engine coolant temperature gage unit	3M ATD Part No. 8660 or equivalent
Thermo switch <A/T>	

SPECIAL TOOL

14100060014

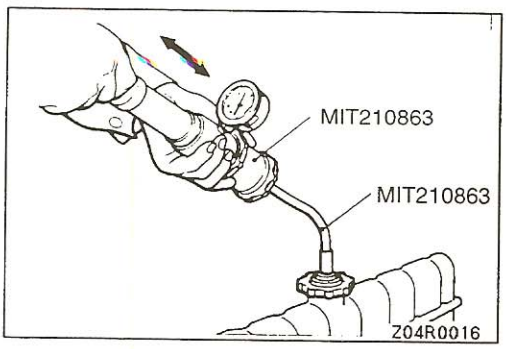
Tool	Tool number and name	Supersession	Application
 00004293	MIT210863 Radiator cap test adapter	–	Radiator cap pressure test

TROUBLESHOOTING

14100070031

Trouble Symptom	Probable Cause		Remedy
Overheat	Insufficient engine coolant		Refill
	Antifreeze concentration too great		Correct
	Loose or broken drive belt		Replace
	Fan clutch does not operate		Replace
	Damaged or blocked (insufficiently ventilated) radiator fins		Correct
	Water leaks	Damaged radiator core joint	Replace
		Corroded or cracked hoses (radiator hose, heater hose, etc.)	Replace
		Loose bolt or malfunction of gasket in water outlet fitting (thermostat)	Correct or replace
		Loose water pump mounting bolt or faulty gasket	Correct or replace
		Faulty radiator cap valve or incorrect setting of spring	Replace
	Faulty thermostat operation		Replace
	Faulty water pump operation		Replace
	Water passage is clogged with slime, rust deposit or other foreign substance		Clean
No rise in temperature	Faulty thermostat	Faulty thermostat	Replace

TSB Revision



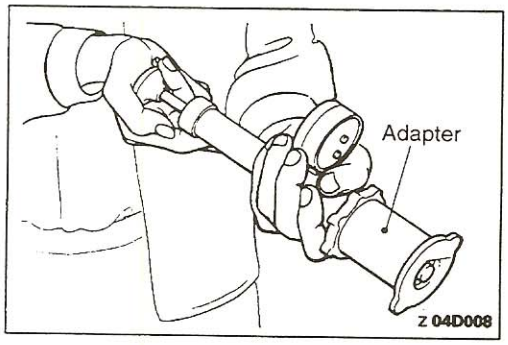
ON-VEHICLE SERVICE

14100[illegible]4

ENGINE COOLANT LEAK CHECK

1. Loosen radiator cap.
2. Check that the coolant level is up to the filler neck.
3. Install a radiator cap tester to the radiator filler neck and apply 160 kPa (23 psi) pressure. Hold for two minutes in that condition, while checking for leakage from the radiator, hose or connections.

   Caution
   Be sure to completely clean away moisture from the places checked.
   When the tester is removed, be careful not to spill any coolant from it.
   Be careful, when installing and removing the tester and when testing, not to deform the filler neck of the radiator.
4. If there is leakage, repair or replace the appropriate part.



RADIATOR CAP PRESSURE CHECK

14100130050

1. Use the adapter to attach the cap to the tester.
2. Increase the pressure until the indicator of the gage stops moving.

   Standard value: 75–105 kPa (11–15 psi)

   Limit: 65 kPa (9.2 psi)
3. Replace the radiator cap if the reading does not remain at or above the limit.

   NOTE
   Check that the cap is clean before testing, since rust or other foreign material on the cap seal will cause an incorrect indication.

ENGINE COOLANT REPLACEMENT

14100120293

Refer to GROUP 00 – Maintenance Service.

ENGINE COOLANT CONCENTRATION TEST

14100110252

Refer to GROUP 00 – Recommended Lubricants and Lubricant Capacities Table.

DRIVE BELT TENSION CHECK AND ADJUSTMENT

14100450033

Refer to GROUP 11A – On-vehicle Service.

RADIATOR

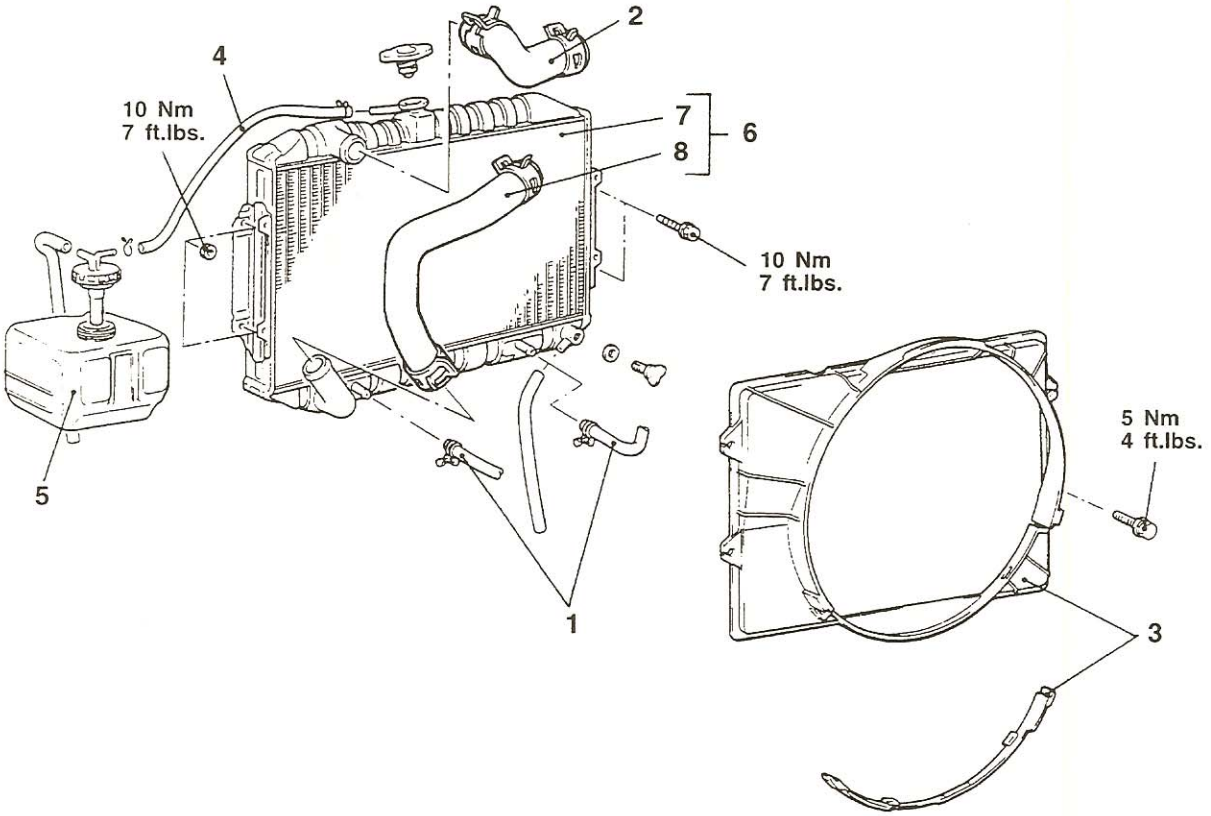
14100150353

REMOVAL AND INSTALLATION

Caution: SRS
Be careful not to subject the front impact sensor to any shocks during removal and installation of the radiator.

Pre-removal Operation
- Engine Coolant Draining
- Under Cover Removal
- Air Cleaner Case Removal

Post-installation Operation
- Under Cover Installation
- Air Cleaner Case Installation
- Engine Coolant Supplying
- Automatic Transmission Fluid Supplying (Refer to GROUP 00 – Maintenance Service.)



A04E0095

Removal steps
1. Automatic transmission oil cooler hose
2. Radiator upper hose
3. Radiator shroud
4. Overflow hose
5. Reserve tank
6. Radiator and radiator lower hose
7. Radiator
8. Radiator lower hose

TSB Revision

INSPECTION

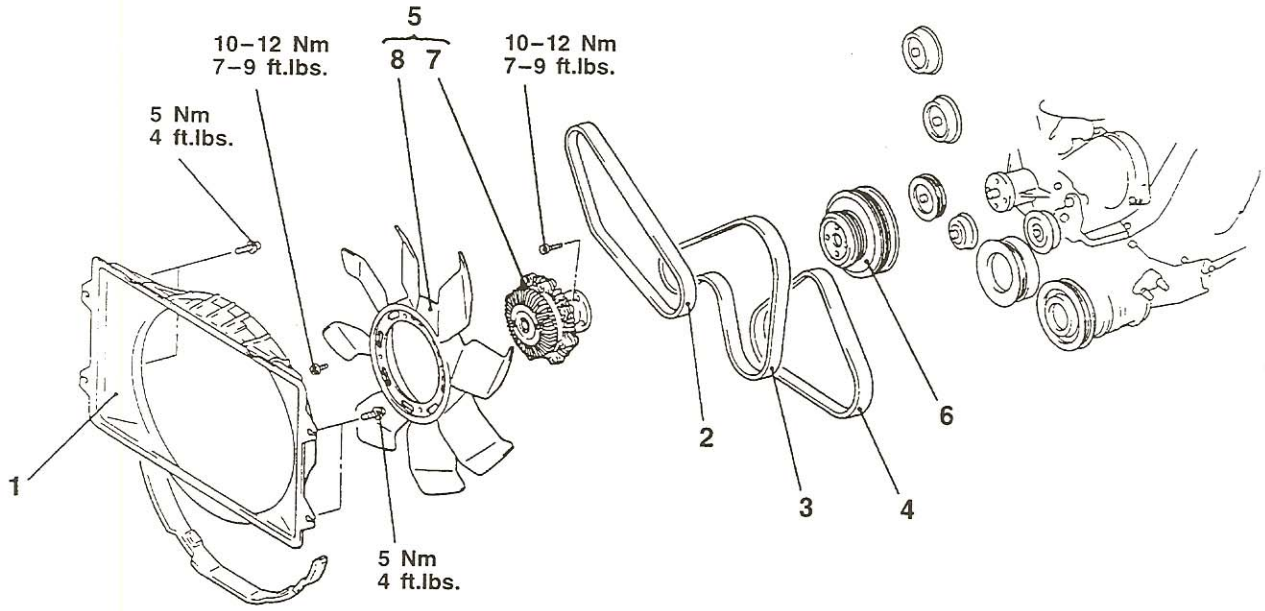
14100160011

- Check for foreign material between radiator fins.
- Check the radiator fins for bend or damage.
- Check the radiator for corrosion, damage, rust or scaling.
- Check the radiator hoses for cracks, damage or deterioration.
- Check the reserve tank for damage.
- Check the spring of radiator cap for deterioration.
- Check the packing of radiator cap for damage or cracks.

COOLING FAN

14100210044

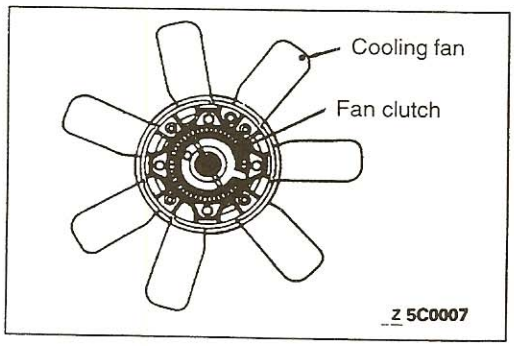
REMOVAL AND INSTALLATION



A04E0084

Removal steps

1. Shroud
2. Drive belt (Power steering)
3. Drive belt (Generator)
4. Drive belt (Air conditioning)
5. Cooling fan and fan clutch assembly
6. Pulley
7. Fan clutch
8. Cooling fan



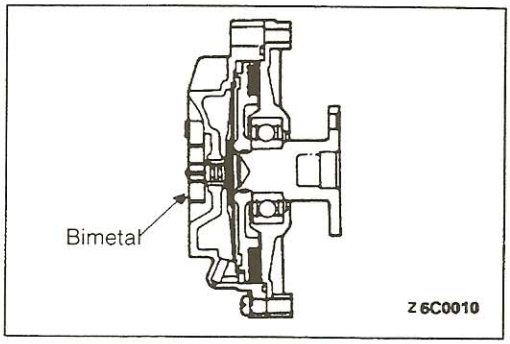
INSPECTION

14100220016

COOLING FAN

- Check the blades for damage and cracks.
- Check for cracks or damage around the bolt holes in the fan hub.
- If any portion of fan is damaged or cracked, replace cor fan.

TSB Revision



FAN CLUTCH

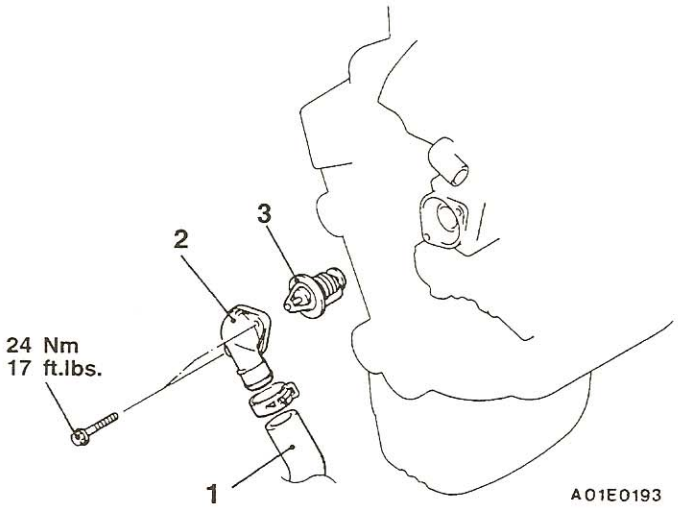
- Check that the fluid in the fan clutch is not leaking at the case joints and seals. If the fluid quantity decreases due to leakage, the fan speed will decrease and engine overheating might result.
- When the fan attached to the engine is turned by hand, it should have some resistance. If the fan turns lightly or freely with no resistance, it is faulty.
- Check bimetal strip for damage.

THERMOSTAT

14100240326

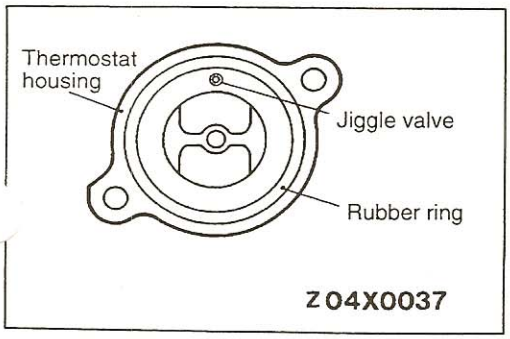
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Engine Coolant Draining and Supplying



Removal steps

1. Radiator lower hose connection
2. Water inlet fitting
▶A◀ 3. Thermostat



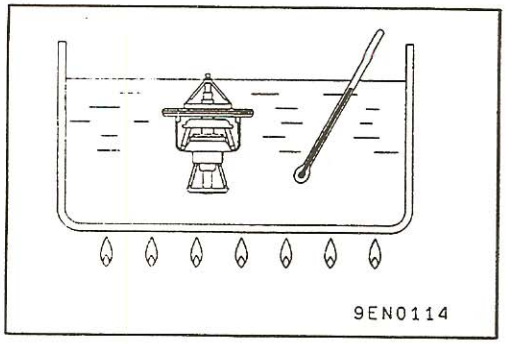
INSTALLATION SERVICE POINT

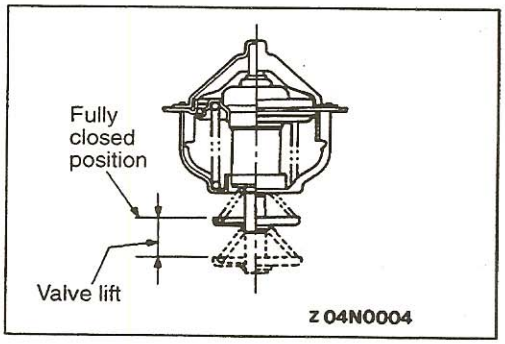
▶A◀ THERMOSTAT INSTALLATION

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

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

TSB Revision





INSPECTION

14100250229

- Check that valve closes tightly at room temperatu
- Check for defects or damage.
- Check for rust or encrustation on the valve, and remove if necessary.
- Immerse thermostat in container of water. Stir to raise water temperature and check that thermostat valve opening temperature and the temperature with valve fully open [valve lift-over 9 mm (.35 in.)] are at the standard value.

Standard value:
Valve opening temperature 88°C (190°F)
Fully open 100°C (212°F)

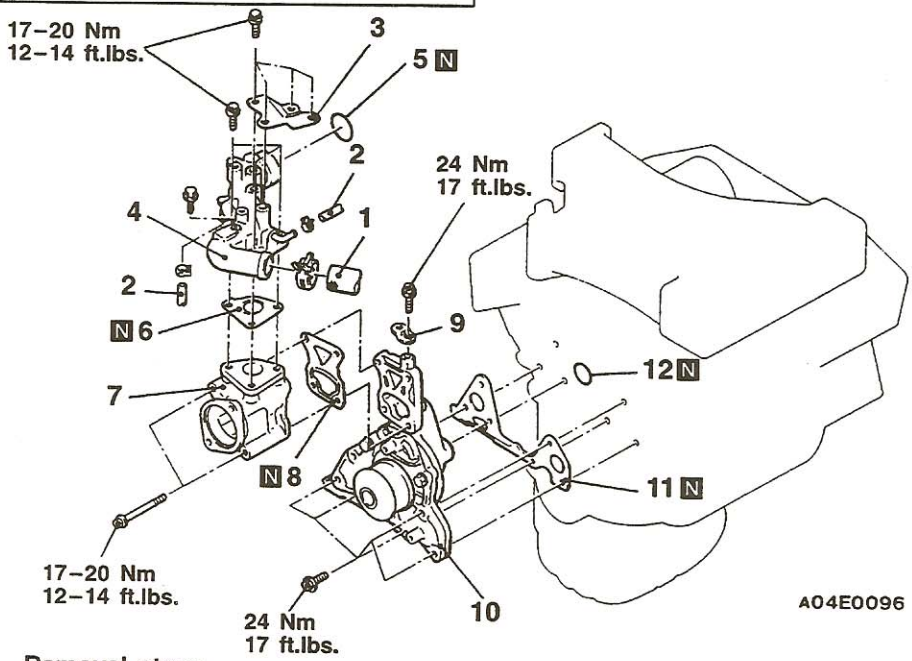
NOTE
Measure valve height when fully closed. Calculate lift by measuring the height when fully open.

WATER PUMP

REMOVAL AND INSTALLATION

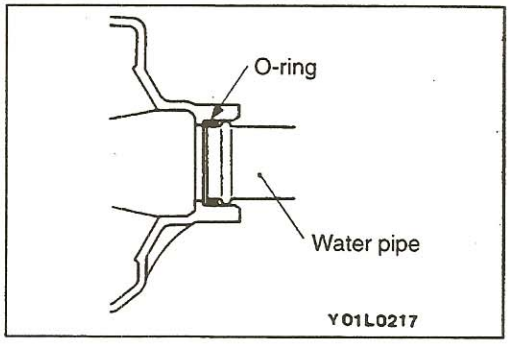
14100270479

Pre-removal and Post-installation Operation
- Engine Coolant Draining and Supplying
- Timing Belt Removal and Installation (Refer to GROUP 11A – Timing Belt.)



Removal steps
- Thermostat (Refer to P.14-7.)
1. Radiator hose
2. Water hose
3. Water outlet fitting bracket
4. Water outlet fitting
▶A◀ 5. O-ring
6. Gasket
7. Thermostat case
8. Gasket
9. Water pump bracket
10. Water pump
11. Water pump gasket
▶A◀ 12. O-ring

TSB Revision



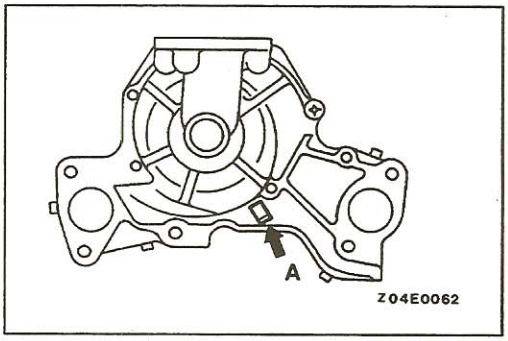
INSTALLATION SERVICE POINT

▶A◀ O-RING INSTALLATION

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

Caution

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



INSPECTION

14100280021

WATER PUMP

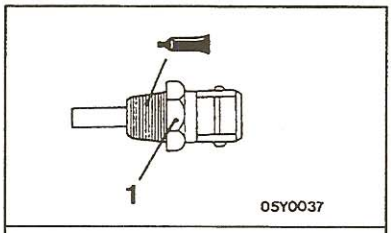
- Check each part for cracks, damage or wear, and replace the water pump assembly if necessary.
- Check the bearing for damage, abnormal noise and sluggish rotation, and replace the water pump assembly if necessary.
- Check the seal unit for leaks, and replace the water pump assembly if necessary.
- Check for water leakage if water leaks from hole "A" seal unit is faulty. Replace as an assembly.

ENGINE COOLANT TEMPERATURE GAGE UNIT AND ENGINE COOLANT TEMPERATURE SENSOR

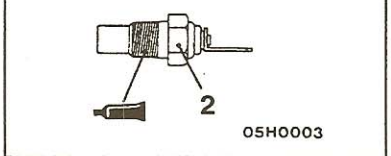
14100470039

REMOVAL AND INSTALLATION

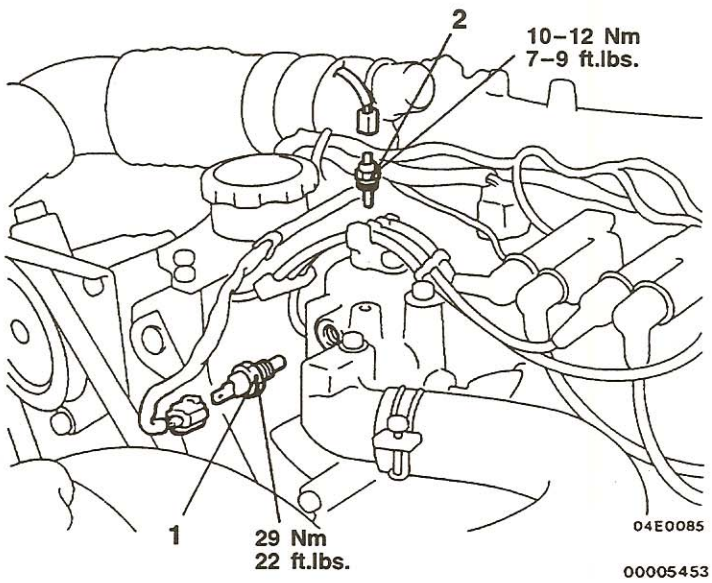
Pre-removal and Post-installation Operation
- Engine Coolant Draining and Supplying



Sealant:
3M Nut Locking Part No. 4171 or equivalent

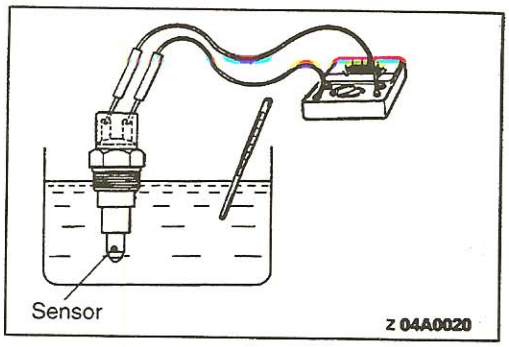


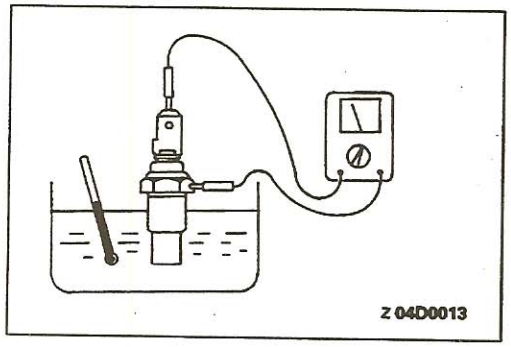
Sealant:
3M ATD Part No. 8660 or equivalent



1. Engine coolant temperature sensor
2. Engine coolant temperature gauge unit

TSB Revision





INSPECTION

1410048032

ENGINE COOLANT TEMPERATURE SENSOR

Raise the water temperature and measure the resistance if within the standard value.

Standard value:

2.37±0.24 kΩ [at 20°C (68°F)]
290±32 Ω [at 80°C (176°F)]

ENGINE COOLANT TEMPERATURE GAGE UNIT

Immerse the gage unit in hot water at 70°C (158°F) and measure the resistance value with an ohmmeter.

Standard value:

104±13.5 Ω [at 70°C (158°F)]

TSB Revision

INTAKE AND EXHAUST

CONTENTS

15109000182

GENERAL SPECIFICATIONS

15100020019

Items		Specifications
Air filter	Type	Dry type
	Element	Unwoven cloth type
Exhaust system	Front exhaust pipe	Dual type
	Muffler	Expansion resonance type
	Coupling	Spherical coupling and flat coupling
	Suspension system	Rubber hangers and rubber suspenders

SERVICE SPECIFICATIONS

15100030050

Items		Standard value	Limit
Intake and exhaust manifolds	Distortion of cylinder head contacting surface mm (in.)	Less than 0.15 (.0059)	0.3 (.012)

TROUBLESHOOTING

15100070038

Trouble Symptom	Probable Cause	Remedy
Exhaust gas leakage	Loose joints	Re-tighten
	Broken pipe or muffler	Repair or replace
Abnormal noise	Broken separator in muffler	Replace
	Broken rubber hangers or suspender	Replace
	Interference of pipe or muffler with vehicle body	Correct
	Broken pipe or muffler	Repair or replace

ON-VEHICLE SERVICE

15100180205

INTAKE MANIFOLD VACUUM CHECK

Refer to GROUP 11A – On-vehicle Service.

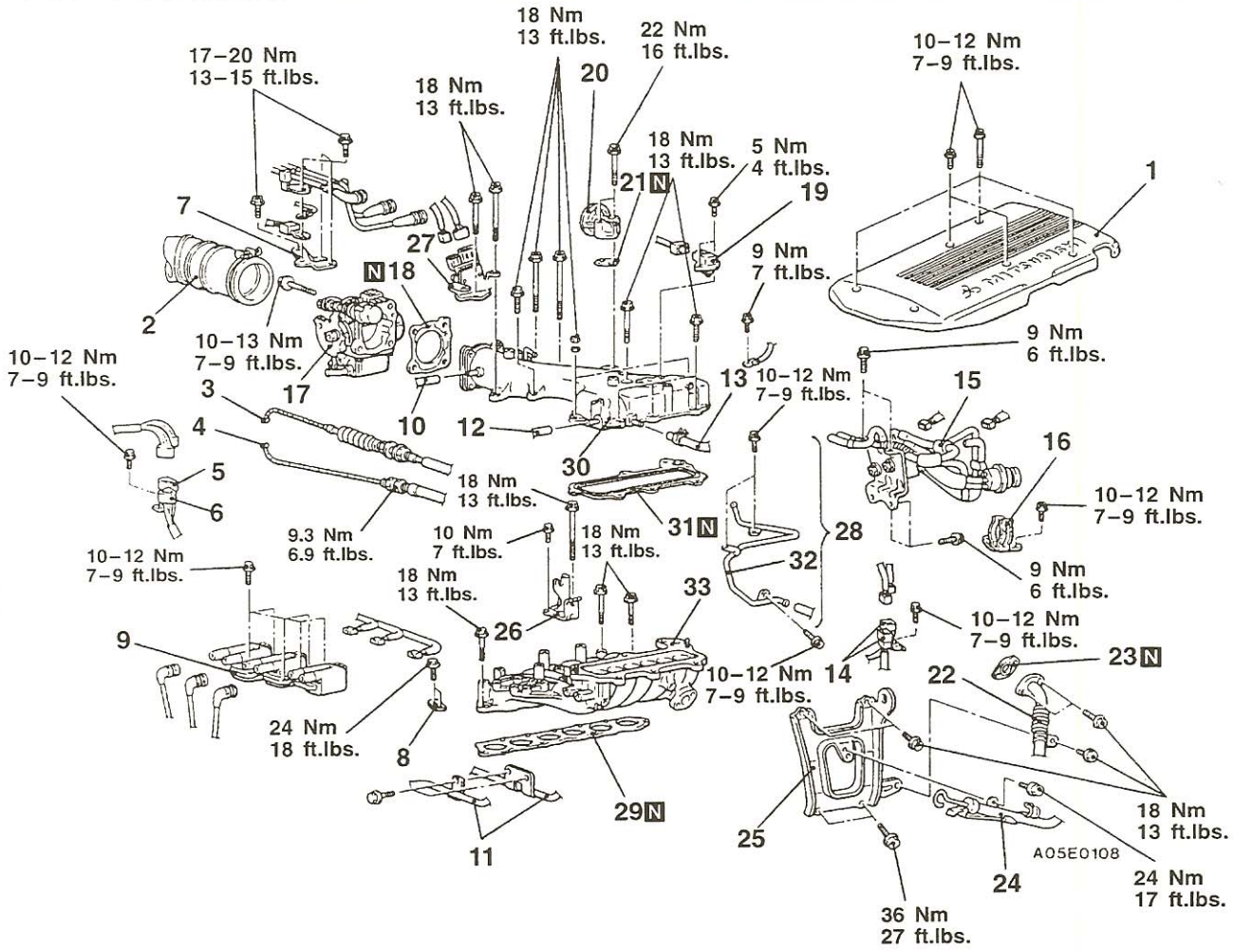
TSB Revision

INTAKE MANIFOLD PLENUM

15100270186

REMOVAL AND INSTALLATION

Post-installation Operation
- Accelerator Cable Adjustment (Refer to GROUP 17 – On-vehicle Service.)
- Throttle Cable Adjustment (Refer to GROUP 23A – On-vehicle Service.)



Removal steps

1. Intake manifold plenum cover
2. Air intake hose connection
3. Throttle cable connection
4. Accelerator cable connection
5. Crank angle sensor connector
6. Camshaft position sensor connector
7. Water outlet fitting bracket
8. Water pump stay
9. Ignition coils
10. Vacuum hose connection
11. Fuel pipe connection
12. PCV hose connection
13. Brake booster vacuum hose connection
14. Heated oxygen sensor connector (Vehicles for California)
15. Solenoid valve assembly and vacuum hose assembly
16. VCV bracket

◀A▶

17. Throttle body assembly
18. Throttle body gasket
19. Manifold differential pressure sensor
20. EGR valve
21. EGR valve gasket
22. EGR pipe connection
23. EGR pipe gasket
24. Fluid filler pipe connection
25. Intake manifold plenum stay
26. Throttle cable bracket
27. Power transistor
28. Intake manifold plenum assembly

▶A◀

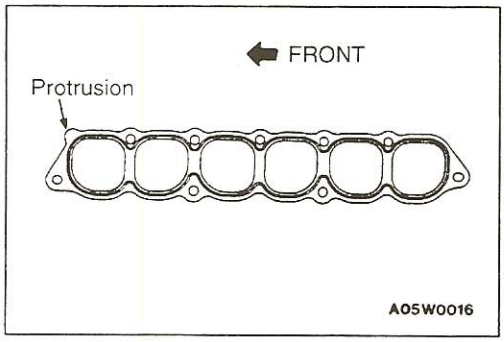
29. Intake manifold plenum gasket
30. Air intake fitting
31. Air intake fitting gasket
32. Vacuum pipe
33. Upper intake manifold

TSB Revision

REMOVAL SERVICE POINT

◀A▶ THROTTLE BODY ASSEMBLY REMOVAL

Leave the water hoses attached to the throttle body assembly.



INSTALLATION SERVICE POINT

▶A◀ INTAKE MANIFOLD PLENUM GASKET INSTALLATION

Install the gasket with the protrusion in the position illustrated.

INSPECTION

15100280011

Check the intake manifold plenum for damage and cracks and replace it if any defects are found.

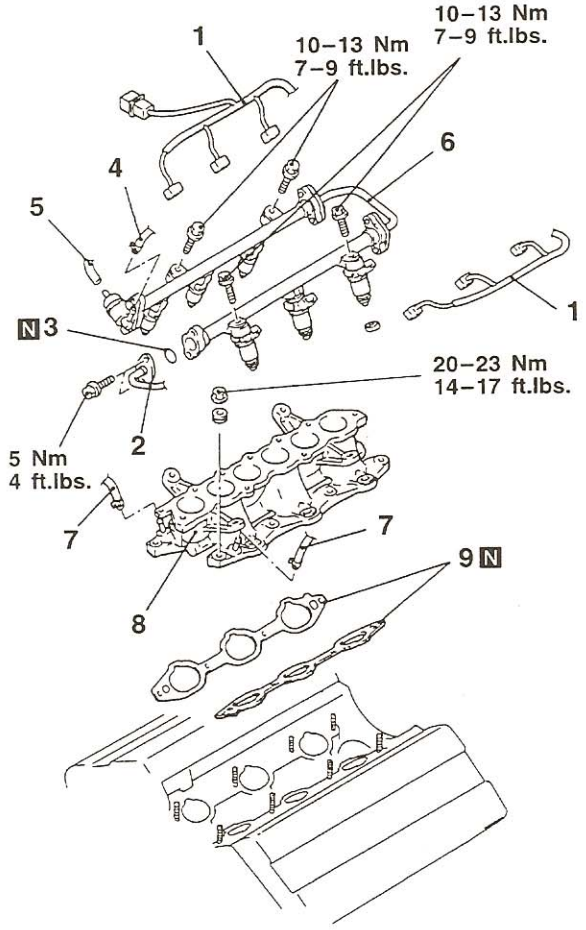
INTAKE MANIFOLD

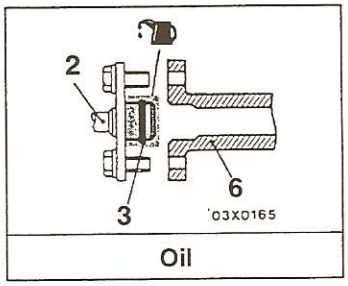
15100300519

REMOVAL AND INSTALLATION

Pre-removal Operation
- Residual Pressure Release from High Pressure Hose (Refer to GROUP 13F – On-vehicle Service.)
- Engine Coolant Draining (Refer to GROUP 00 – Coolant Replacement.)
- Intake Manifold Plenum Removal (Refer to P.15-3.)

Post-installation Operation
- Intake Manifold Plenum Installation (Refer to P.15-3.)
- Engine Coolant Filling (Refer to GROUP 00 – Coolant Replacement.)
- Accelerator Cable Adjustment (Refer to GROUP 17 – On-vehicle Service.)
- Throttle Cable Adjustment (Refer to GROUP 23A – On-vehicle Service.)
- Fuel Leakage Checking



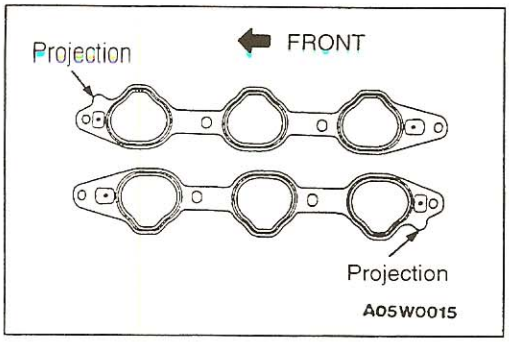


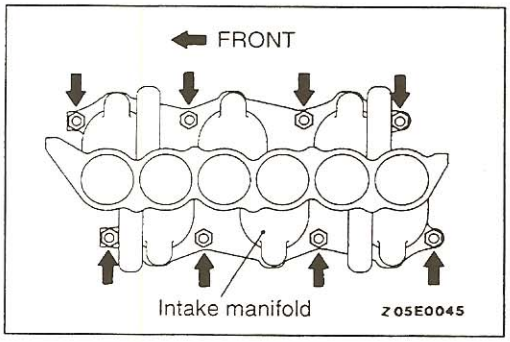
05E0094

00005437

Removal steps
1. Injector harness connection
2. High-pressure fuel hose connection
3. O-ring
4. Fuel return hose connection
5. Vacuum hose connection
6. Fuel rail (with injectors)
7. Water hose connection
▶B◀ 8. Intake manifold
▶A◀ 9. Intake manifold gasket

TSB Revision





INSTALLATION SERVICE POINTS

▶A◀ INTAKE MANIFOLD GASKET INSTALLATION

Install the gaskets so that the projections face in the directions shown in the illustration.

▶B◀ INTAKE MANIFOLD INSTALLATION

Tighten the intake manifold mounting nuts one bank after the other by the following procedure.

(1) Tighten the nuts in the right bank to 7 Nm (5 ft.lbs.).
(2) Tighten the nuts in the left bank to 20 to 23 Nm (14 to 17 ft.lbs.).
(3) Tighten the nuts in the right bank to 20 to 23 Nm (14 to 17 ft.lbs.).
(4) Repeat steps (2) and (3) again in the same order.

INSPECTION

15100310116

Check the following points; replace the part if a problem is found.

(1) Damage or cracking of any part.
(2) Clogging of the negative pressure (vacuum) outlet port, or clogging of the water or gas passages.

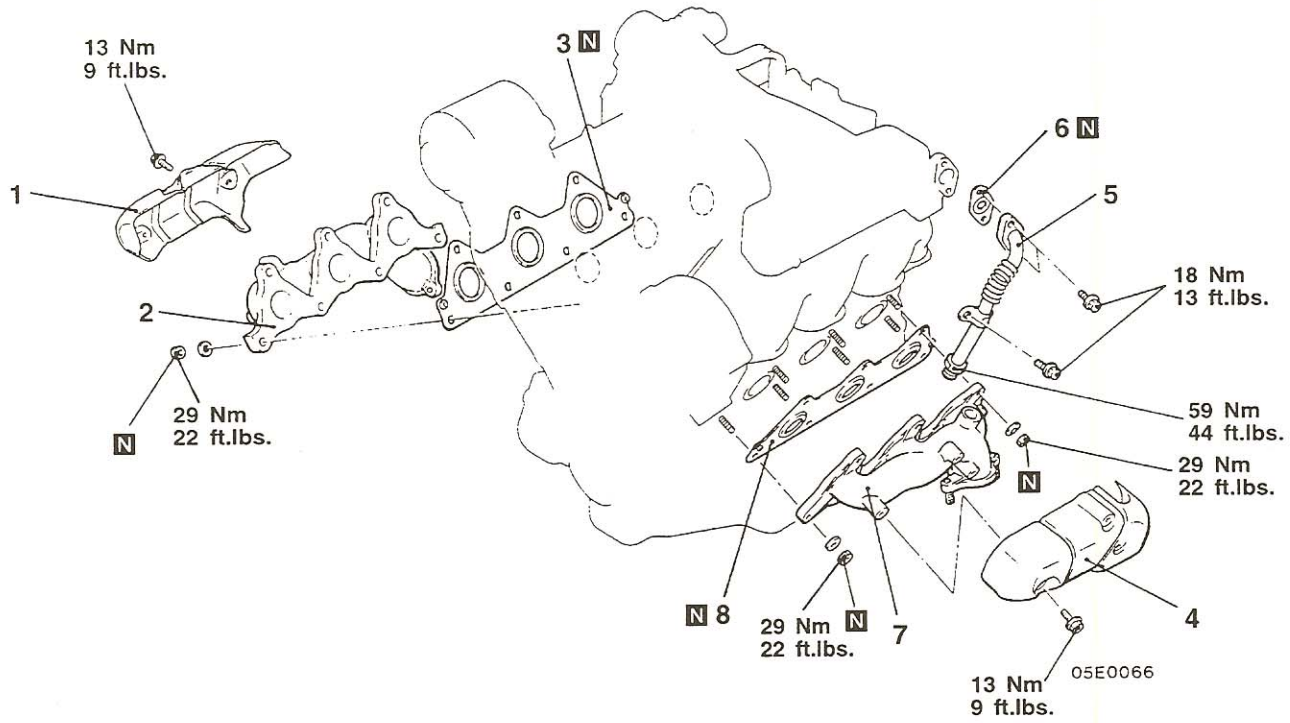
TSB Revision

EXHAUST MANIFOLD

15100330501

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Front Exhaust Pipe Removal and Installation. <Vehicles for Federal> (Refer to P.15-8.)
- Warm up Three-way Catalytic Converter. <Vehicles for California> (Refer to P.15-9.)



Exhaust manifold removal steps (Right)
- Air duct and air cleaner cover
1. Heat protector (R.H.)
2. Exhaust manifold (R.H.)
3. Gasket

Exhaust manifold removal steps (Left)
- Battery and battery tray
4. Heat protector (L.H.)
5. EGR pipe
6. Gasket
7. Exhaust manifold (L.H.)
8. Gasket

INSPECTION

15100340030

EXHAUST MANIFOLD

- Damage or cracking of any part.

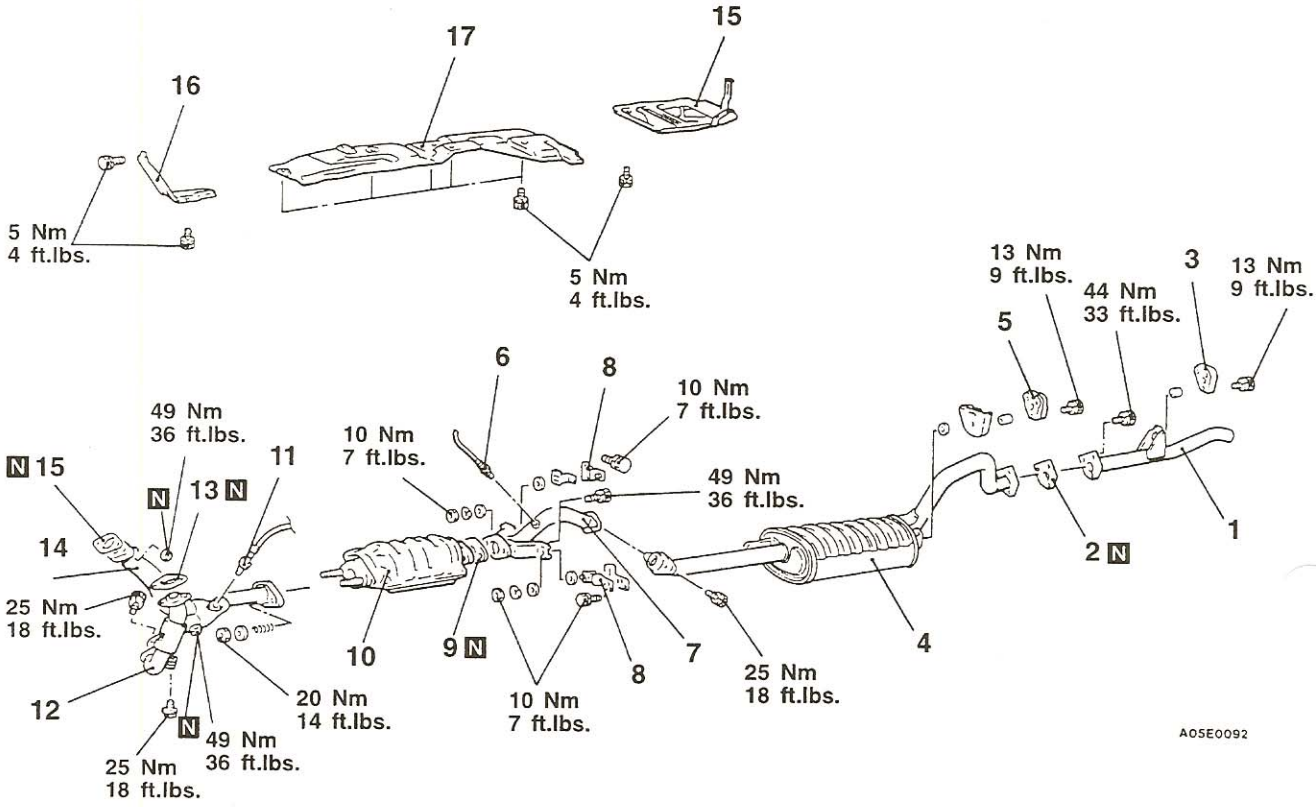
TSB Revision

EXHAUST PIPE, MUFFLER AND CATALYTIC CONVERTER <For Federal>

151005

REMOVAL AND INSTALLATION

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



Removal steps

1. Tail pipe
2. Gasket
3. Hanger
4. Main muffler
5. Hanger
6. Heated oxygen sensor
7. Center exhaust pipe
8. Suspender
9. Gasket
10. Catalytic converter
11. Heated oxygen sensor
12. Front exhaust pipe (L.H.)
13. Gasket
14. Front exhaust pipe (R.H.)
15. Gasket
16. Heat protector
17. Front panel heat protector
18. Heat protector <Vehicle with amplifire>

INSPECTION

15100550013

- Check the mufflers and pipes for corrosion or damage.
- Check the rubber hangers and rubber suspenders for deterioration or damage.
- Check for gas leakage from the mufflers and pipes.

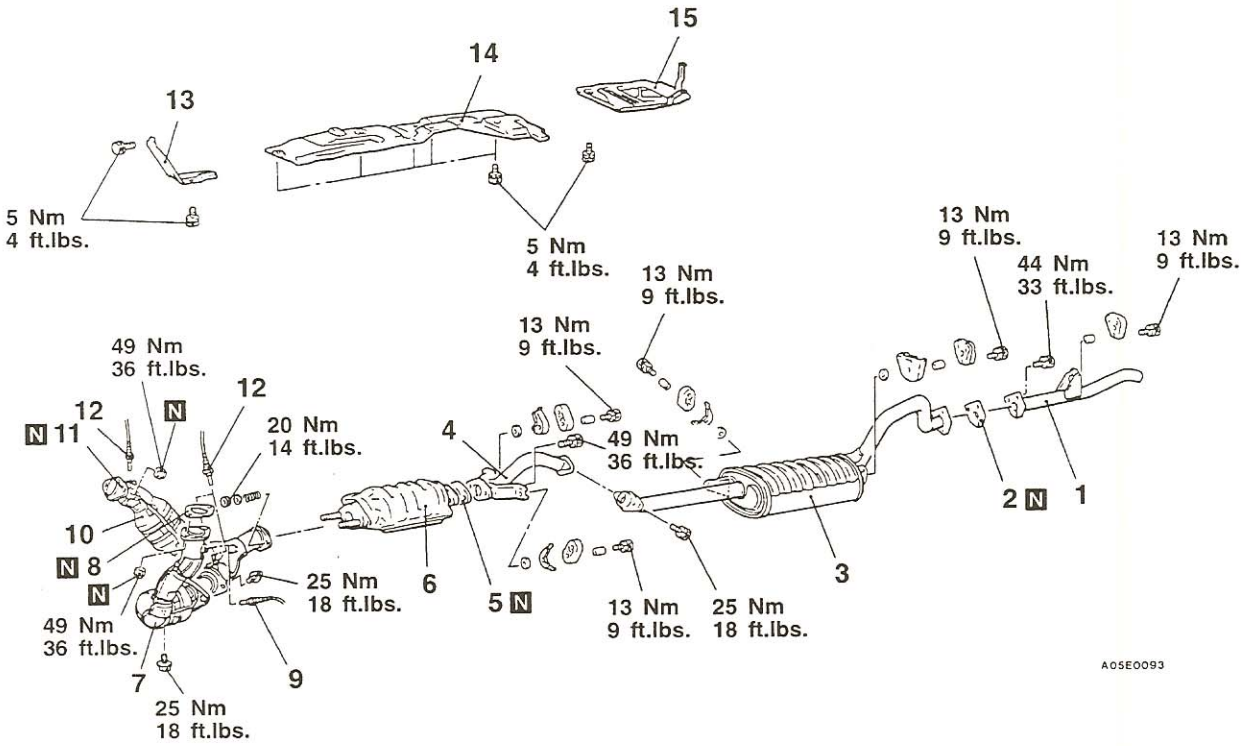
TSB Revision

EXHAUST PIPE, MUFFLER AND CATALYTIC CONVERTER <For California>

15100540270

REMOVAL AND INSTALLATION

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



Removal steps

1. Tail pipe
2. Gasket
3. Main muffler
4. Center exhaust pipe
5. Gasket
6. Catalytic converter
7. Left bank warm up three-way catalytic converter
8. Gasket
9. Heated oxygen sensor
10. Right bank warm up three-way catalytic converter
11. Gasket
12. Heated oxygen sensor
13. Heat protector
14. Front panel heat protector
15. Heat protector <Vehicle with amplifire>

INSPECTION

15100550020

- Check the mufflers and pipes for corrosion or damage.
- Check the rubber hangers and rubber suspenders for deterioration or damage.
- Check for gas leakage from mufflers and pipes.

TSB Revision

NOTES

ENGINE ELECTRICAL

CONTENTS

16109000165

CHARGING SYSTEM

161000

GENERAL INFORMATION

OPERATION

When engine is stopped

When the ignition switch is switched to the ON position, electricity flows from the generator "L" terminal to the field coil, and at the same time the charging warning light illuminates.

When engine is being started or has started

When the engine is started, charging voltage is applied to the generator "L" terminal, with the result that the charging warning light is extinguished. In addition, because battery positive voltage is applied to the generator "S" terminal, this battery positive voltage is monitored at the IC voltage regulator, thus switching the current to the field coil on and off and thereby controlling the output voltage of the generator. Power is supplied to each load from the generator "B" terminal.

NOTE
The generator relay functions as a back-up for the flow of electricity to the field coil if there is a disconnection or damaged wiring of the charging warning light.

<Charging warning light>

- This warning light illuminates when the ignition key is in the ON position, and switches off after the engine has started. This warning light illuminates when the drive belt breaks or the trouble occurs in the charging system.

GENERAL SPECIFICATIONS

16100020085

GENERATOR

Items	Standard value
Type	Battery positive voltage sensing
Rated output V/A	12/100
Voltage regulator	Electronic built-in type

SERVICE SPECIFICATIONS

16100030088

Items		Standard value	Limit
Regulated voltage Ambient temp. at voltage regulator	–20°C (–4°F)	14.2 – 15.4	–
	20°C (68°F)	13.9 – 14.9	–
	60°C (140°F)	13.4 – 14.6	–
	80°C (176°F)	13.1 – 14.5	–
Field coil resistance Ω		Approximately 3 – 5	–
Generator output line voltage drop (at 30 A) V		–	max. 0.3
Output current		–	70% of normal output current

TROUBLESHOOTING

16100070011

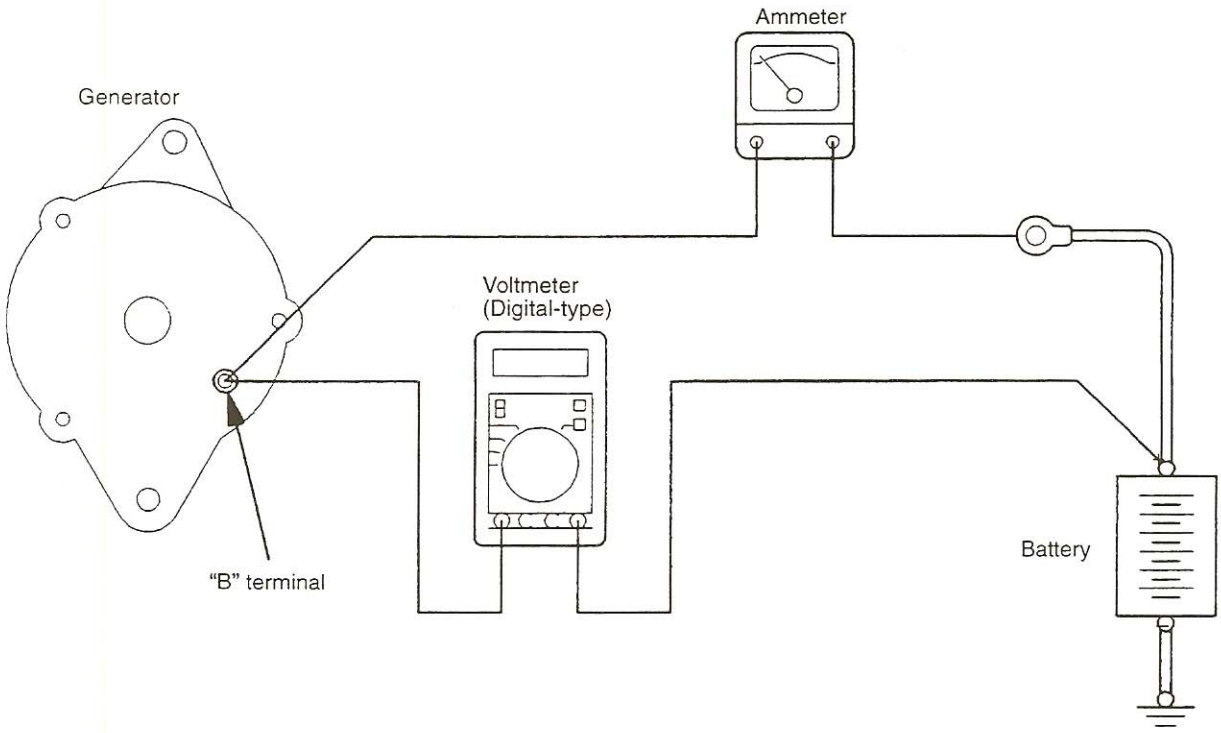
TROUBLESHOOTING HINTS

1. Charging warning light does not illuminate when the ignition switch is turned to ON, before the engine starts.
   - Check the bulb.
2. Charging warning light does not switch off once the engine starts.
   - Check the IC voltage regulator inside the generator.
3. Discharged or overcharged battery
   - Check the IC voltage regulator inside the generator.
4. The charging warning light illuminates dimly.
   - Check the diode (inside the combination meter) for a short-circuit.

ON-VEHICLE SERVICE

16100090229

GENERATOR OUTPUT LINE VOLTAGE DROP TEST



9EN0468

This test determines whether the wiring from the generator "B" terminal to the battery (+) terminal (including the fusible link) is in a good condition or not.

(1) Always be sure to check the following before the test.
- Generator installation
- Generator drive belt tension (Refer to GROUP 00 – Maintenance Service.)
- Fusible link
- Abnormal noise from the generator while the engine is running

(2) Turn the ignition switch to the OFF position.
(3) Disconnect the negative battery cable.
(4) Disconnect the generator output wire from the generator "B" terminal and connect a DC test ammeter with a range of 0 – 100 A in series between the "B" terminal and the disconnected output wire. (Connect the (+) lead of the ammeter to the "B" terminal, and then connect the (–) lead of the ammeter to the disconnected output wire.)

NOTE
A clamp-type ammeter which enables measurements to be taken without disconnecting the generator output wire is recommended. The reason for this is if a vehicle in which the voltage may have dropped due to an imperfect connection at the generator "B" terminal is being inspected, and the generator "B" terminal is loosened when the test ammeter is connected, the connection will be completd at this time and the possibility of finding problems will be reduced.

(5) Connect a digital-type voltmeter between the generator "B" terminal and the battery (+) terminal. (Connect the (+) lead of the voltmeter to the "B" terminal, and then connect the (–) lead of the voltmeter to the battery (+) cable.)
(6) Reconnect the negative battery cable.
(7) Connect a tachometer or scan tool.
(8) Leave the hood open.
(9) Start the engine.

(10) With the engine running at 2500 r/min, turn the headlights and other lights on and off to adjust the generator load so that the value displayed on the ammeter is slightly above 30 A.

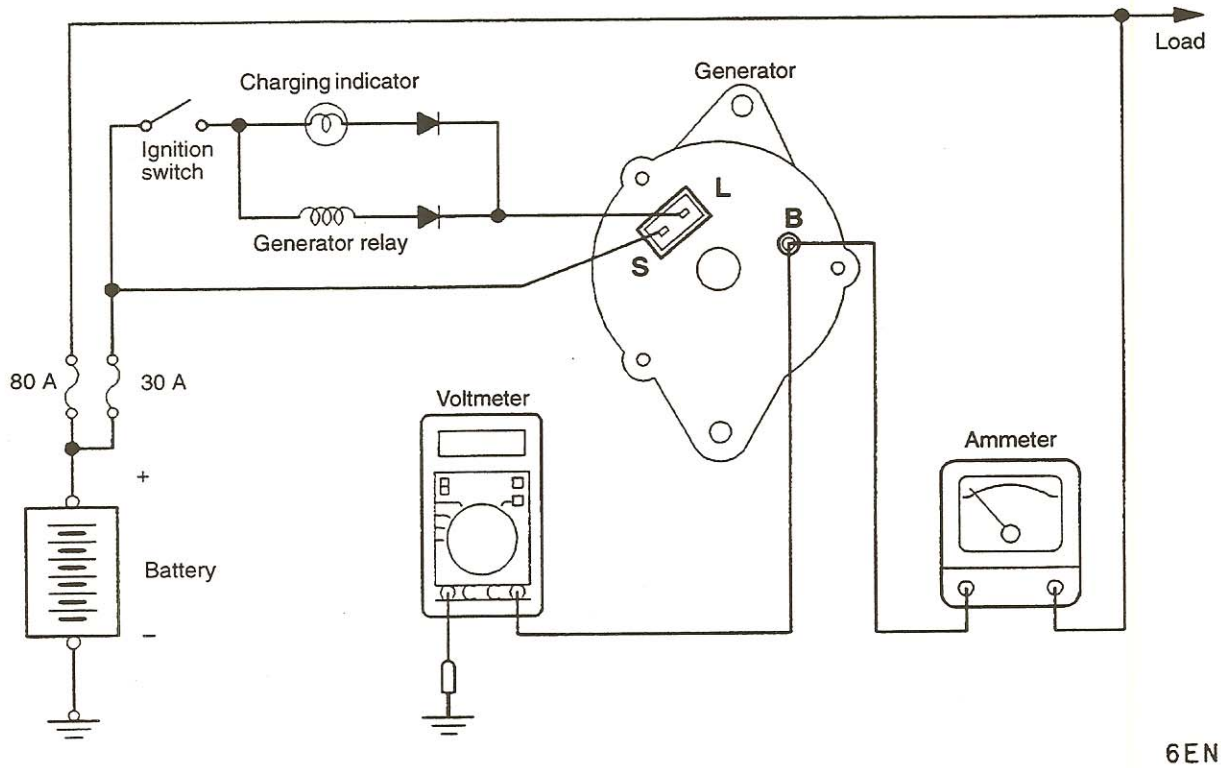
Limit value: max. 0.3 V

NOTE
When the generator output is high and the value displayed on the ammeter does not decrease to 30A, set the value to 40A. Read the value displayed on the voltmeter at this time.
In this case the limit value becomes max. 0.4V. Adjust the engine speed by gradually decreasing it until the value displayed on the ammeter is 30 A. Take a reading of the value displayed on the voltmeter at this time.

(11) If the value displayed on the voltmeter is above the limit value, there is probably a malfunction in the generator output wire, so check the wiring between the generator "B" terminal and the battery (+) terminal (including fusible link).
If a terminal is not sufficiently tight or if the harness has become discolored due to overheating, repair and then test again.
(12) After the test, run the engine at idle.
(13) Turn off all lights and turn the ignition switch to the OFF position.
(14) Disconnect the tachometer or scan tool.
(15) Disconnect the negative battery cable.
(16) Disconnect the ammeter and voltmeter.
(17) Connect the generator output wire to the generator "B" terminal.
(18) Connect the negative battery cable.

OUTPUT CURRENT TEST

16100100239



6EN1140

This test determines whether the generator outputs normal current.

(1) Before the test, always be sure to check the following.
- Generator installation
- Battery (Refer to GROUP 54 – Battery.)

NOTE
The battery to be used should be slightly discharged. The load in a fully-charged battery will be insufficient and the test may not be able to be carried out correctly.
- Generator drive belt tension (Refer to GROUP 00 – Maintenance Service.)
- Fusible link
- Abnormal noise from the generator while the engine is running

(2) Turn the ignition switch to the OFF position.
(3) Disconnect the negative battery cable.
(4) Disconnect the generator output wire from the generator "B" terminal and connect a DC test ammeter with a range of 0–100 A in series between the "B" terminal and the disconnected output wire. (Connect the (+) lead of the ammeter to the "B" terminal, and then connect the (–) lead of the ammeter to the disconnected output wire.)

WARNING
Never use clips to connect the line. Loose connections (e.g. using clips) will lead to a serious accident because of high current.

NOTE
A clamp-type ammeter which enables measurements to be taken without disconnecting the generator output wire is recommended.

(5) Connect a voltmeter with a range of 0–20 V between the generator "B" terminal and the ground. (Connect the (+) lead of the voltmeter to the "B" terminal, and then connect the (–) lead of the voltmeter to the ground.)
(6) Connect the negative battery cable.
(7) Connect a tachometer or scan tool.
(8) Leave the hood open.
(9) Check to be sure that the reading on the voltmeter is equal to the battery voltage.

NOTE
If the voltage is 0 V, the cause is proba' an open circuit in the wire or fusible link betwe the generator "B" terminal and the battery (+) terminal.

(10) After turning the light switch on and turning on the headlights, start the engine.
(11) Immediately after setting the headlights to high beam and turning the heater blower switch to the high revolution position, increase the engine speed to 2,500 r/min and read the maximum current output value displayed on the ammeter.

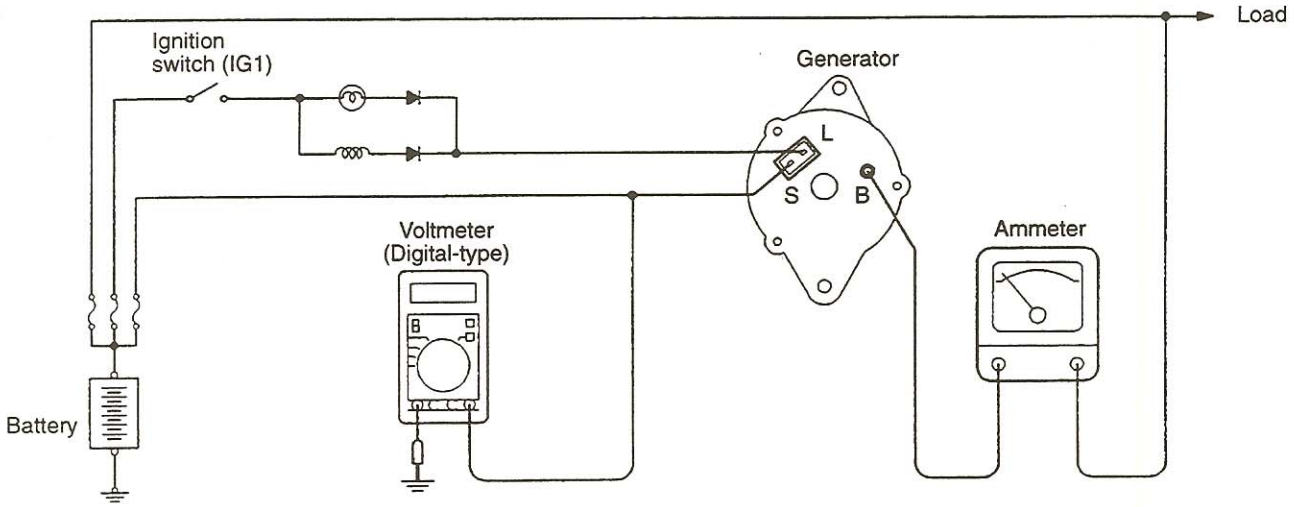
Limit value: 70% of nominal current output

NOTE
- For the nominal current output, refer to the Generator Specifications.
- Because the current from the battery will soon drop after the engine is started, the above step should be carried out as quickly as possible in order to obtain the maximum current output value.
- The current output value will depend on the electrical load and the temperature of the generator body.
- If the electrical load is small while testing, the specified level of current may not be output even though the generator is normal In such cases, increase the electrical lc by leaving the headlights turned on fc. some time to discharge the battery or by using the lighting system in another vehicle, and then test again.
- The specified level of current also may not be output if the temperature of the generator body or the ambient temperature is too high. In such cases, cool the generator and then test again.

(12) The reading on the ammeter should be above the limit value. If the reading is below the limit value and the generator output wire is normal, remove the generator from the engine and check the generator.
(13) Run the engine at idle speed after the test.
(14) Turn the ignition switch to the OFF position.
(15) Disconnect the tachometer or scan tool.
(16) Disconnect the negative battery cable.
(17) Disconnect the ammeter and voltmeter.
(18) Connect the generator output wire to the generator "B" terminal.
(19) Connect the negative battery cable.

REGULATED VOLTAGE TEST

16100110232



6EN1149

This test determines whether the voltage regulator is correctly controlling the generator output voltage.

(1) Always be sure to check the following before the test.
- Generator installation
- Check to be sure that the battery installed in the vehicle is fully charged. (Refer to GROUP 54 – Battery.)
- Generator drive belt tension (Refer to GROUP 00 – Maintenance Service.)
- Fusible link
- Abnormal noise from the generator while the engine is running

(2) Turn the ignition switch to the OFF position.
(3) Disconnect the negative battery cable.
(4) Connect a digital-type voltmeter between the generator "S" terminal and the ground. (Connect the (+) lead of the voltmeter to the "S" terminal, and then connect the (–) lead of the voltmeter to a secure ground or to the battery (–) terminal.)
(5) Disconnect the generator output wire from the generator "B" terminal.
(6) Connect a DC test ammeter with a range of 0–100 A in series between the "B" terminal and the disconnected output wire. (Connect the (+) lead of the ammeter to the "B" terminal, and then connect the (–) lead of the ammeter to the disconnected output wire.)
(7) Reconnect the negative battery cable.
(8) Connect a tachometer or scan tool.
(9) Turn the ignition switch to the ON position and check that the reading on the voltmeter is equal to the battery voltage.

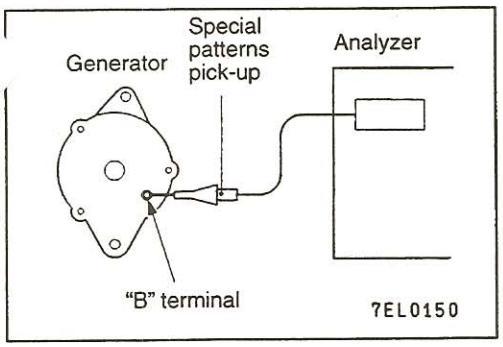
NOTE
If the voltage is 0 V, the cause is probably an open circuit in the wire or fusible link between the generator "S" terminal and the battery (+) terminal.

(10) Check to be sure that all lights and accessories are off.
(11) Start the engine.
(12) Increase the engine speed to 2,500 rpm.
(13) Read the value displayed on the voltmeter when the current output by the generator becomes 10 A or less.
(14) If the voltage reading conforms to the value in the voltage regulation table, then the voltage regulator is operating normally.
If the voltage is outside the standard value, there is a malfunction of the voltage regulator or of the generator.

VOLTAGE REGULATION TABLE

Inspection terminal	Voltage regulator ambient temperature (°C [°F])	Standard value (V)
Terminal "S"	–20 (–4)	14.2 – 15.4
	20 (68)	13.9 – 14.9
	60 (140)	13.4 – 14.5
	80 (176)	13.1 – 14.5

(15) After the test, lower the engine speed to the idle speed.
(16) Turn the ignition switch to the "OFF" position.
(17) Disconnect the negative battery cable.
(18) Disconnect the ammeter, voltmeter and tachometer.
(19) Connect the generator output wire to the generator "B" terminal.
(20) Connect the negative battery cable.



WAVE PATTERN CHECK USING AN ANALYZER

16100120105

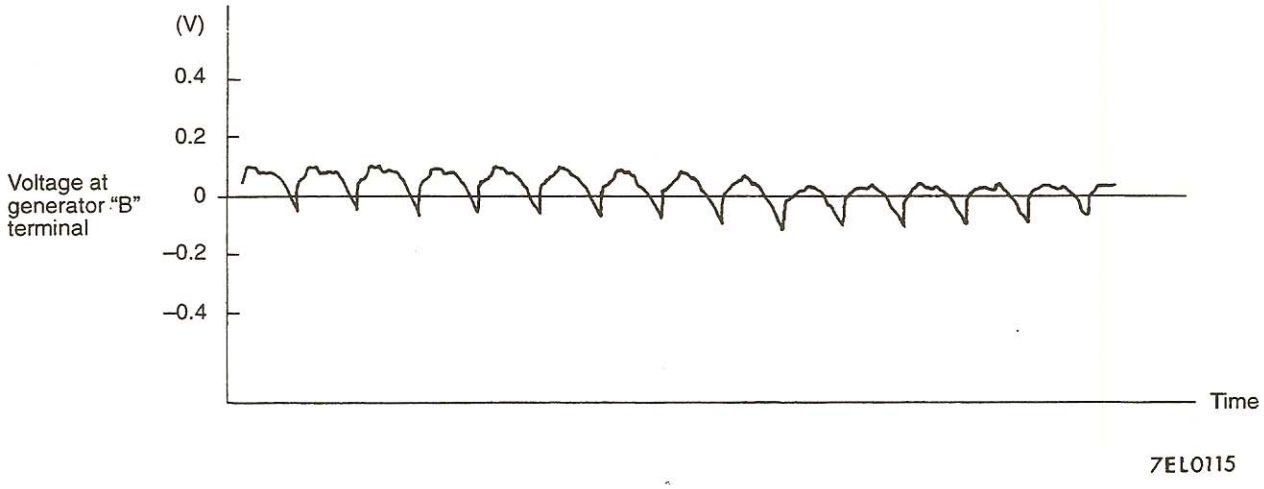
MEASUREMENT METHOD

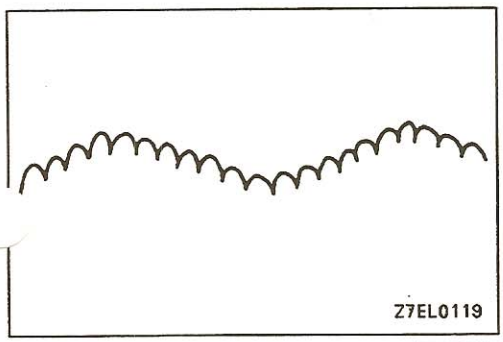
Connect the analyzer special patterns pick-up to the generator "B" terminal.

STANDARD WAVEFORM

Observation Conditions

FUNCTION	SPECIAL PATTERNS
PATTERN HEIGHT	VARIABLE
VARIABLE knob	Adjust while viewing the wave pattern
PATTERN SELECTOR	RASTER
Engine revolutions	Curb idle speed



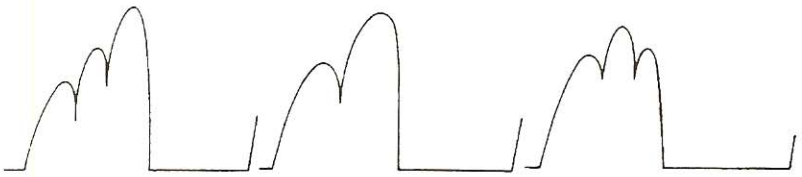
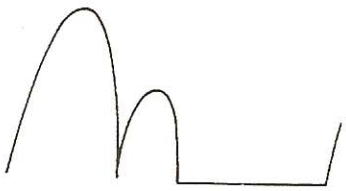
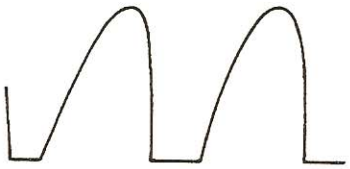


NOTE
Furthermore, the voltage waveform of the generator "B" terminal can undulate as shown at left. This waveform is produced when the regulator operates according to fluctuations in the generator load (current), and is normal for the generator.
If the ripple height is extremely high (approx. 2 V or higher during idling), there is a open circuit between the generator B terminal and the battery due to a blown fuse, etc., and often the generator itself is normal.

TSB Revision

ABNORMAL WAVEFORMS EXAMPLES

NOTE
1. The size of the waveform patterns differs largely depending on the adjustment of the variable knob on the analyzer.
2. Identification of abnormal waveforms is easier when there is a large output current (regulator is not operating). (Waveforms can be observed when the headlights are illuminated.)
3. Check the condition of the charging warning light (illuminated/not illuminated). Also, check the condition of all charging system components.

Abnormal waveforms	Probable cause
Example 1  Z7EL0120	• Open circuit in diode
Example 2  Z7EL0121	• Short-circuit in diode
Example 3  Z7EL0122	• Open circuit in stator coil
Example 4  Z7EL0123	• Short-circuit in stator coil
Example 5  At this time, the charge light is illuminated. Z7EL0124	• Open circuit in supplementary diode

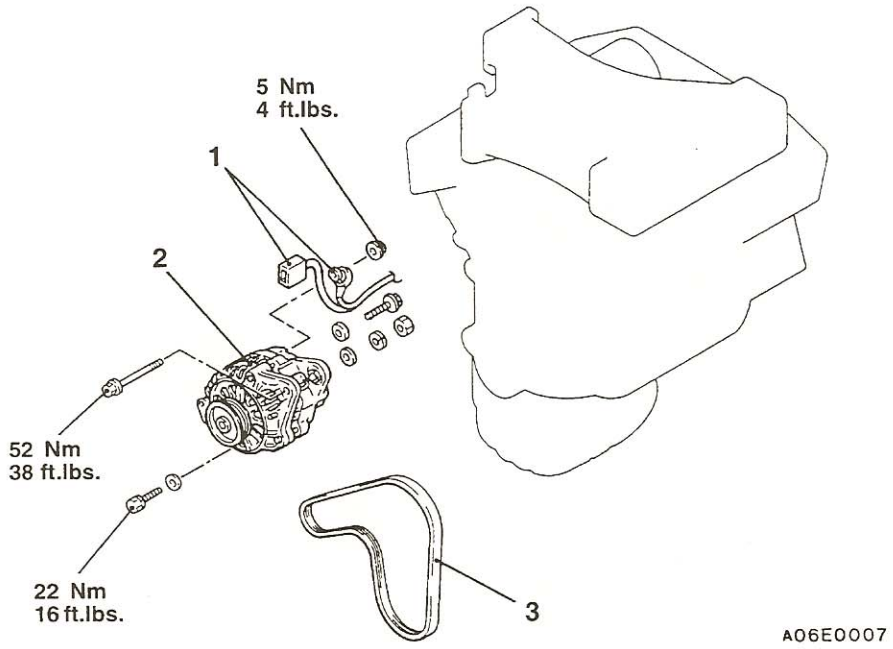
TSB Revision

GENERATOR

16100140217

REMOVAL AND INSTALLATION

Post-installation Operation
- Drive Belt Tension Adjustment
  (Refer to GROUP 11A – On-vehicle Service.)

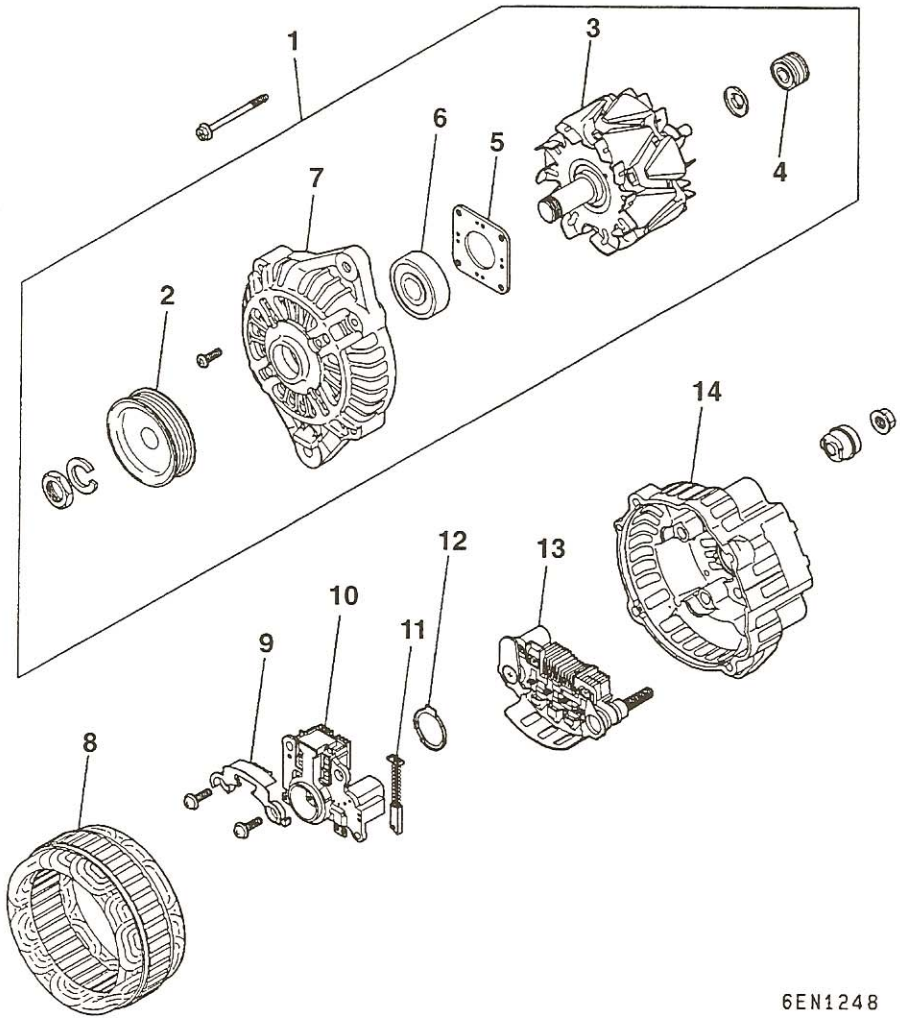


Removal steps
1. Connection for generator connector
2. Generator
3. Belt

TSB Revision

DISASSEMBLY AND REASSEMBLY

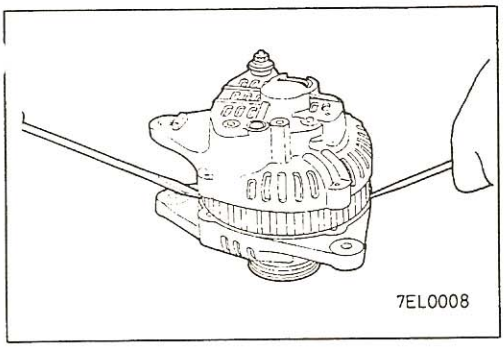
16100160268



Disassembly steps

◀A▶ ◀B▶ 1. Front bracket assembly
2. Generator pulley
▶B◀ 3. Rotor
4. Rear bearing
5. Bearing retainer
6. Front bearing
7. Front bracket
◀C▶ 8. Stator
9. Plate
◀C▶ ▶A◀ 10. Regulator assembly
11. Brush
12. Slinger
13. Rectifier
14. Rear bracket

TSB Revision

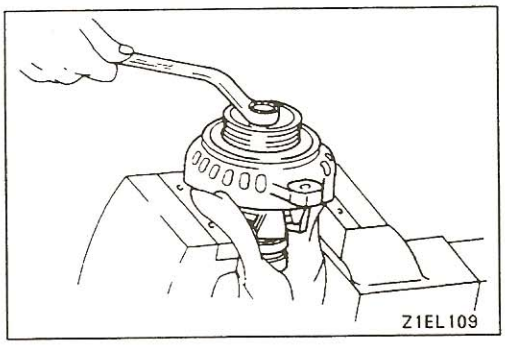


DISASSEMBLY SERVICE POINTS

◀A▶ FRONT BRACKET ASSEMBLY REMOVAL

Insert a flat tip screwdriver, etc., in the clearance between the front bracket assembly and stator core, to pry open and separate the stator and front bracket.

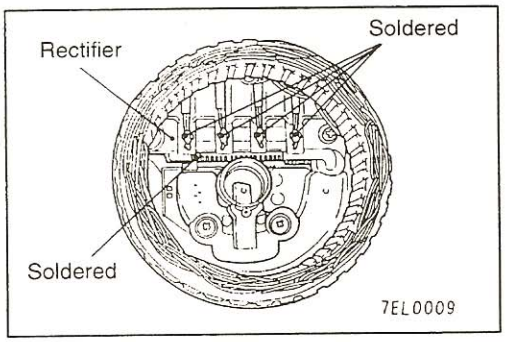
Caution
The stator coil could be damaged so do not insert the screwdriver too far.



◀B▶ PULLEY REMOVAL

Face the pulley side upward, fix the rotor with a work bench and remove the pulley.

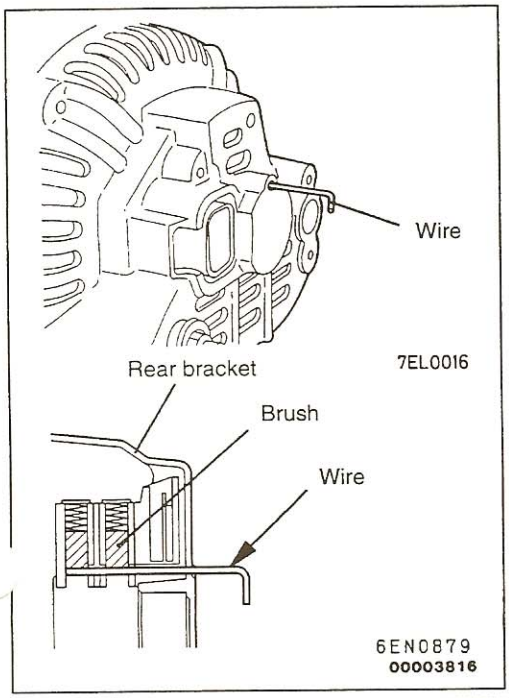
Caution
Use care so that the rotor is not damaged.



◀C▶ STATOR/REGULATOR ASSEMBLY REMOVAL

(1) Use a soldering iron (180 to 250 W) to unsolder the stator. This work should complete within approximately four seconds to prevent heat from transferring to the diode.
(2) When removing the rectifier from the regulator assembly, remove the soldered sections of the rectifier.

Caution
1. **Use care to make sure that the heat of the soldering iron is not transmitted to the diodes for a long period.**
2. **Use care that no undue force is exerted to the lead wires of the diode.**



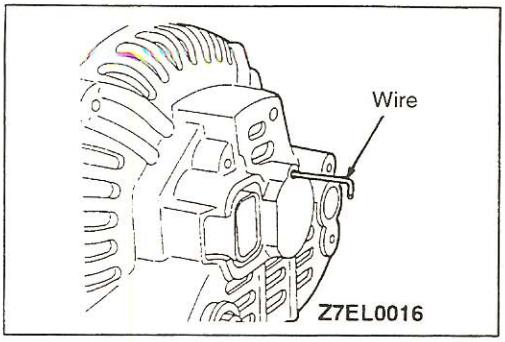
REASSEMBLY SERVICE POINTS

▶A◀ REGULATOR ASSEMBLY INSTALLATION

After installing the regulator assembly, insert a wire into the hole provided on the rear bracket while pressing in the brush to fix the brush.

NOTE
The brush is fixed when a wire is inserted, making rotor installation easier.

TSB Revision



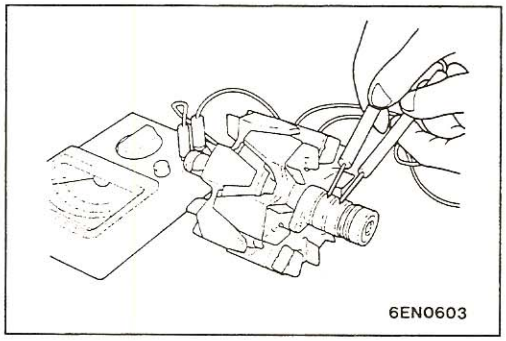
▶B◀ ROTOR INSTALLATION

After installing the rotor, remove the wire used to fix the br

INSPECTION

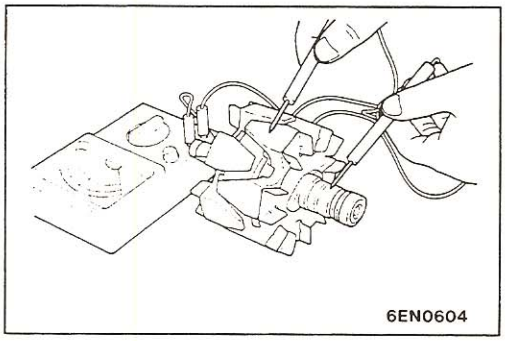
16100170186

ROTOR CHECK



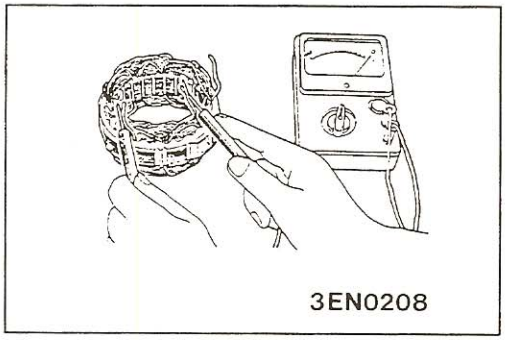
(1) Check the continuity between the rotor coil slip rings, and replace the rotor if the resistance value is not at the standard value.

Standard value: 3 – 5 Ω

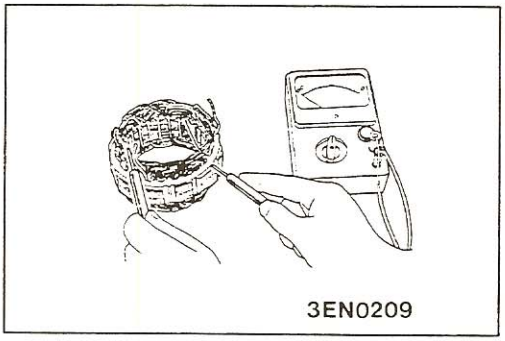


(2) Check the continuity between the slip ring and core, and if there is continuity, replace the rotor.

STATOR CHECK

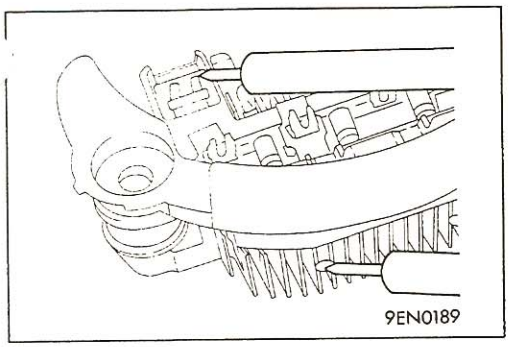


(1) Check the continuity between the coil leads, and if there is continuity, replace the stator.



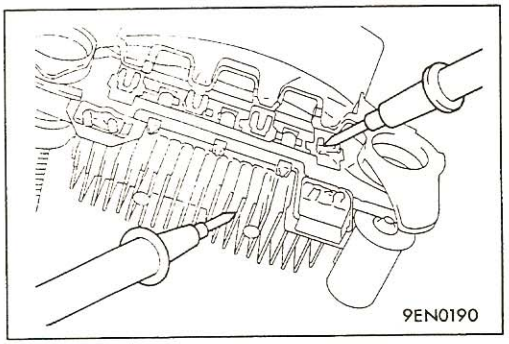
(2) Check the continuity between the coil and core, and if there is continuity, replace the stator.

TSB Revision

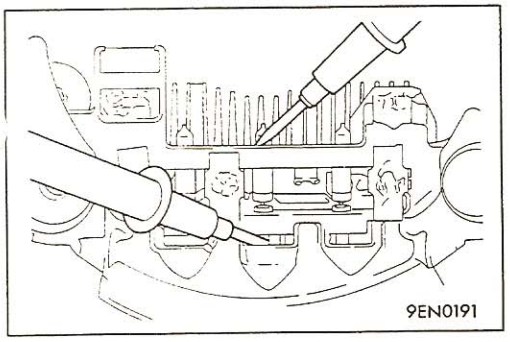


RECTIFIER CHECK

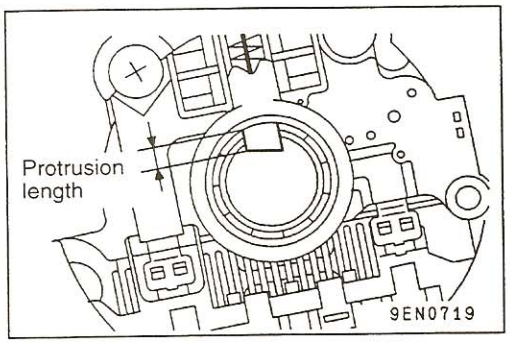
(1) Inspect the (+) heat sink by checking the continuity between the (+) heat sink and stator coil lead wire connection terminal using a tester probe.
If there is a continuity at both, the diode is short circuited, so replace the rectifier.



(2) Inspect the (–) heat sink by checking the continuity between the (–) heat sink and stator coil lead wire connection terminal using a tester probe.
If there is a continuity at both, the diode is short circuited, so replace the rectifier.



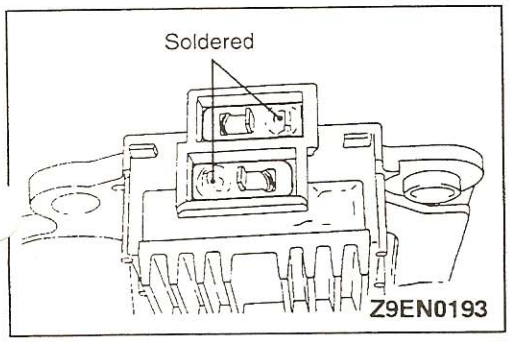
(3) Check the diode trio by connecting an ohmmeter to both ends of each diode and check the continuity of the three diodes.
If there is a continuity at both ends, or if there is no continuity, the diode is damaged so replace the rectifier.



BRUSH CHECK

(1) Measure the length of the brush protrusion shown in the illustration, and replace the brush if the measured value is below the limit value.

Limit: 2 mm (.8 in.) or less



(2) The brush can be removed if the solder of the brush lead wire is removed.
(3) When installing a new brush, insert the brush into the holder as shown in the illustration, and then solder the lead wires.

TSB Revision

STARTING SYSTEM

16200[illegible]5

GENERAL INFORMATION

OPERATION

- For vehicles equipped with M/T, the clutch pedal position switch contact is switched off when the clutch pedal is depressed; when the ignition switch is then turned to the "ST" position, electricity flows to the starter relay and the starter motor, the contact (magnetic switch) of the starter is switched on and the starter motor is activated.

  NOTE
  If the ignition switch is turned to the "ST" position without the clutch pedal being depressed, electricity flows to the starter relay (coil), the clutch pedal position switch (contacts) and to the ground, with the result that the contacts of the starter relay are switched off, and, because the power to the starter motor is thereby interrupted, the starter motor is not activated.
- For vehicles equipped with A/T, when the ignition switch is switched to the "ST" position while the selector lever is at the "P" or "N" position, the contact (magnetic switch) of the starter is switched on and the starter motor is activated.

GENERAL SPECIFICATIONS

16200020019

STARTER MOTOR

Items	Specifications
Type	Reduction drive
Rated output kW/V	1.2/12
No. of pinion teeth	8

SERVICE SPECIFICATIONS

16200030067

Items		Specifications	Limit
Free running characteristics	Terminal voltage V	11	–
	Current A	90 or less	–
	Speed r/min	3,000 or more	–
Pinion gap mm (in.)		0.5–2.0 (.020–.079)	–
Commutator runout mm (in.)		0.05 (.0020)	0.1 (.004)
Commutator diameter mm (in.)		29.4 (1.157)	28.8 (1.134)
Under-cut depth mm (in.)		0.5 (.020)	–

TROUBLESHOOTING

16200070014

TROUBLESHOOTING HINTS

The starter motor does not operate at all.

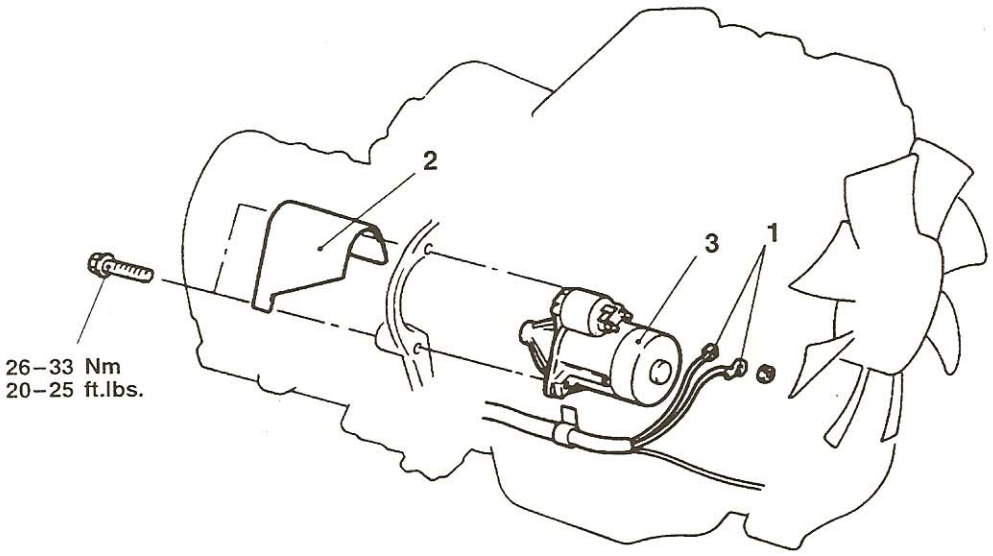
- Check the starter (coil).
- Check for poor contact at the battery terminals and starter.
- Check the park/neutral position switch.
- Check the clutch pedal position switch.
- Check the starter relay.
- Check the key reminder switch.

STARTER MOTOR

16200100164

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operations
- Draining and Refilling of Automatic Transmission Fluid (Refer to GROUP 00 – Maintenance service.)
- Removal and Installation of Oil Cooler Tube (Refer to GROUP 23A – Transmission Fluid Cooler, Hoses and Pipes.)



Z16W1694

Removal steps

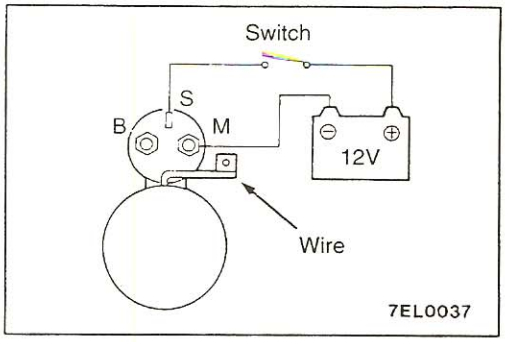
1. Connection for starter motor connector
2. Starter cover
◀A▶ 3. Starter motor

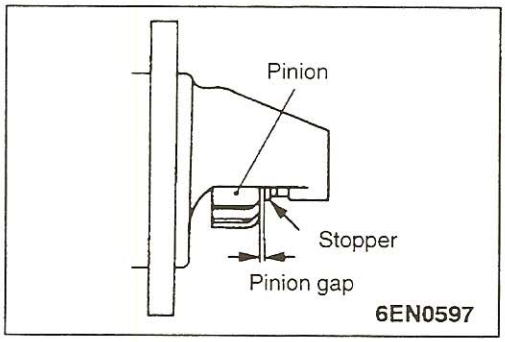
REMOVAL SERVICE POINTS

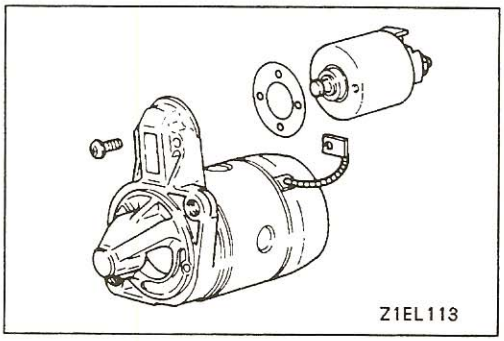
◀A▶ STARTER MOTOR REMOVAL

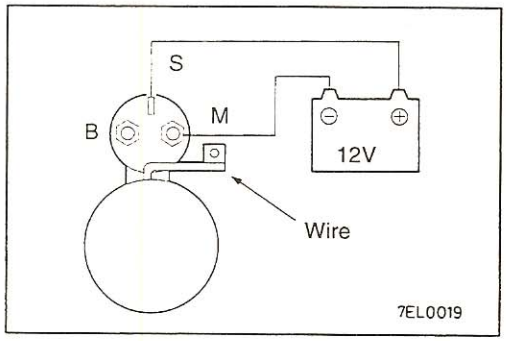
Vehicles with manual transmission: Jack up the vehicle, remove the starter motor mounting bolts from below the body, and then separate the starter motor from the transmission assembly.

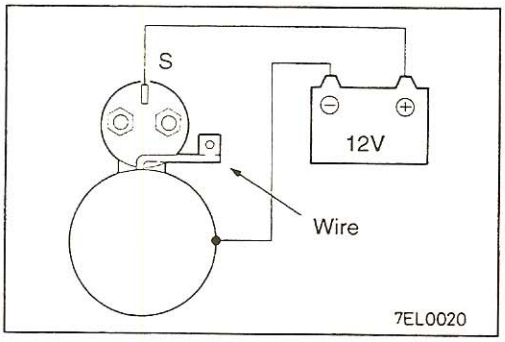
TSB Revision











INSPECTION

16200110099

PINION GAP ADJUSTMENT

(1) Disconnect the wire from the M-terminal of the magnetic switch.
(2) Connect a 12 V battery between the S-terminal and the M-terminal.
(3) Turn on the switch, and the pinion will move out.

Caution
This test must be performed quickly (within 10 seconds) to prevent the coil from burning.

(4) Use a feeler gage to check the clearance between the pinion and the stopper (pinion gap).

Standard value: 0.5 – 2.0 mm (.020 – .079 in.)

(5) If the pinion gap is outside the standard value, adjust by adding or removing gaskets between the magnetic switch and the front bracket.

MAGNETIC SWITCH PULL-IN TEST

(1) Disconnect the wire from the M-terminal of the magnetic switch.
(2) Connect a 12 V battery between the S-terminal and the M-terminal.
(3) Manually pull out the pinion as far as the pinion stopper position.

Caution
This test must be performed quickly (within 10 seconds) to prevent the coil from burning.

(4) If the pinion moves out, the pull-in coil is good. If it doesn't, replace the magnetic switch.

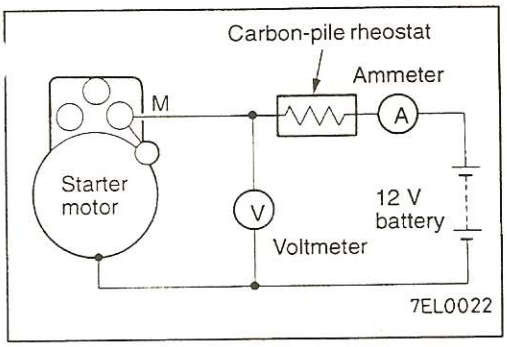
MAGNETIC SWITCH HOLD-IN TEST

(1) Disconnect the wire from the M-terminal of the magnetic switch.
(2) Connect a 12 V battery between the S-terminal and the body.

Caution
This test must be performed quickly (within 10 seconds) to prevent the coil from burning.

(3) If the pinion remains out, everything is operating properly. If the pinion moves in, there is an open circuit in the hold-in circuit. Replace the magnetic switch.

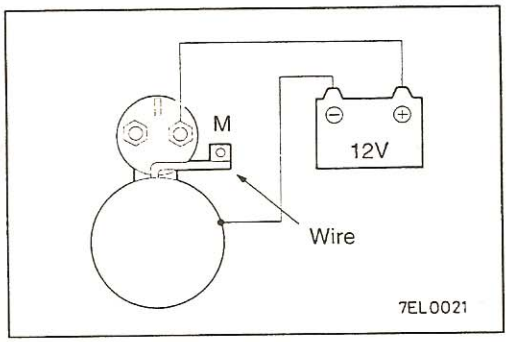
TSB Revision



FREE RUNNING TEST

(1) Place the starter motor in a vise equipped with soft jaws and connect a fully-charged 12-volt battery to starter motor as follows:
(2) Connect a test ammeter (100-ampere scale) and carbon pile rheostat in series to the positive battery terminal and starter motor terminal.
(3) Connect a voltmeter (15-volt scale) to the starter motor.
(4) Rotate the carbon pile to the full-resistance position.
(5) Connect the battery cable to the negative battery terminal and the starter motor body.
(6) Adjust the rheostat until the battery positive voltage shown by the voltmeter is 11V.
(7) Confirm that the maximum amperage is within the specifications and that the starter motor turns smoothly and freely.

Standard value: 90 A or less



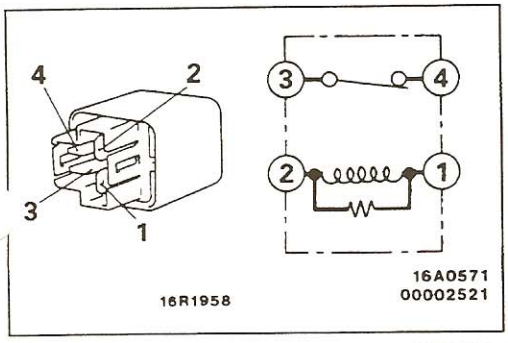
MAGNETIC SWITCH RETURN TEST

(1) Disconnect the wire from the M-terminal of the magnetic switch.
(2) Connect a 12 V battery between the M-terminal and the body.

Caution
This test must be performed quickly (within 10 seconds) to prevent the coil from burning.

(3) Pull the pinion out and then release it. If the pinion quickly returns to its original position, everything is operating properly. If it doesn't, replace the magnetic switch.

Caution
Be careful not to get your fingers caught when pulling out the pinion.



STARTER RELAY

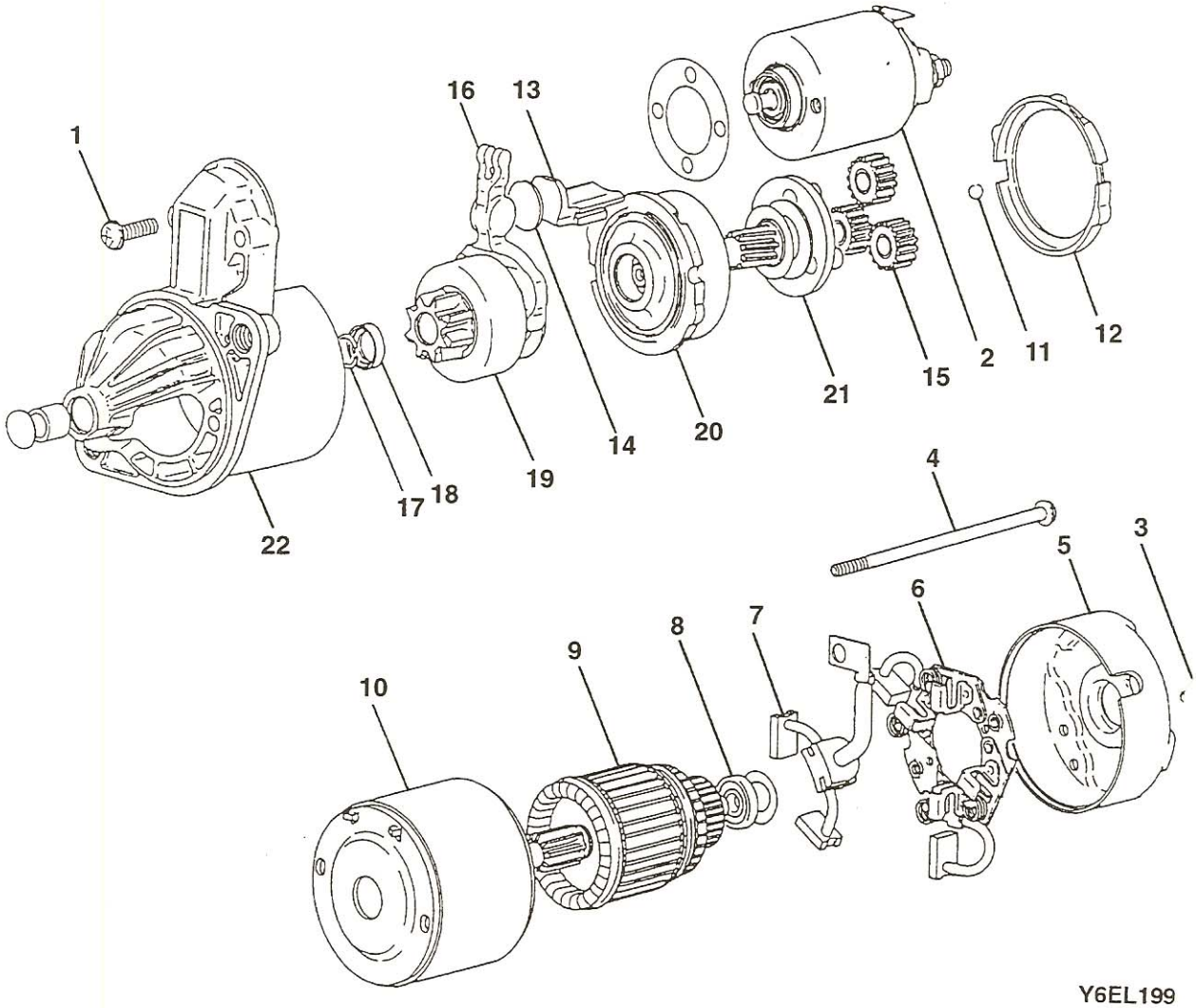
(1) Remove the starter relay.
(2) Connect the battery to terminal (1) and check the continuity between the terminals with terminal (2) grounded.

Power is supplied	Terminals (3) – (4)	No continuity
Power is not supplied	Terminals (3) – (4)	Continuity
	Terminals (1) – (2)	Continuity

TSB Revision

DISASSEMBLY AND REASSEMBLY

16200120139



Y6EL199

Disassembly steps

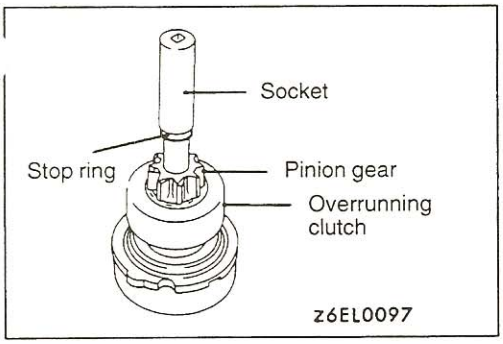
1. Screw
2. Magnetic switch
3. Screw
4. Screw
5. Rear bracket
6. Brush holder
7. Brush
8. Rear bearing
◀A▶ 9. Armature
10. Yoke assembly
◀A▶ 11. Ball
12. Packing A
13. Packing B
14. Plate
15. Planetary gear
16. Lever
◀B▶ ▶A◀ 17. Snap ring
◀B▶ ▶A◀ 18. Stop ring
19. Overrunning clutch
20. Internal gear
21. Planetary gear holder
22. Front bracket

DISASSEMBLY SERVICE POINTS

◀A▶ ARMATURE/BALL REMOVAL

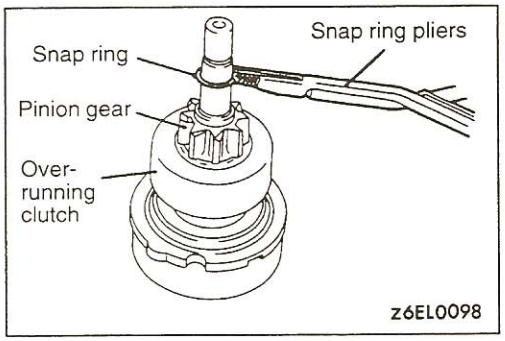
Caution
When removing the armature, take care not to lose the ball which is used as a bearing in the armature end.

TSB Revision



◀B▶ SNAP RING/STOP RING REMOVAL

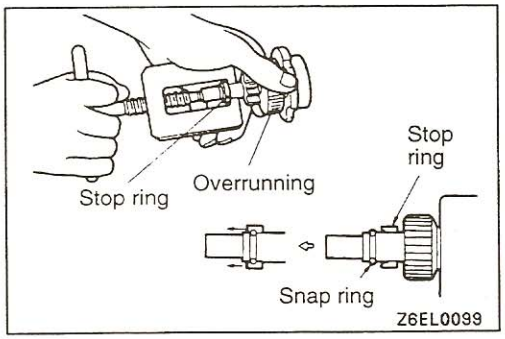
(1) Place a socket wrench of an appropriate size against the stop ring, and then tap the socket wrench to move the stop ring down toward the pinion gear.



(2) After removing the snap ring using snap-ring pliers, remove the stop ring and the overrunning clutch.

CLEANING STARTER MOTOR PARTS

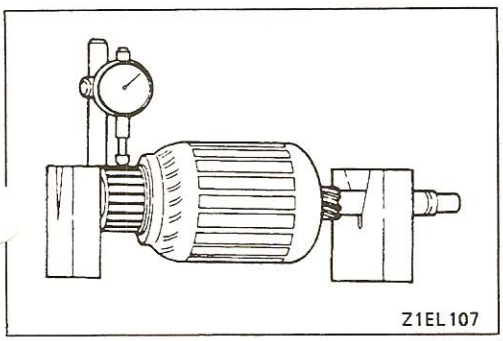
1. Do not immerse parts in cleaning solvent. Immersing the yoke and field coil assembly and/or armature will damage the insulation. Wipe these parts with a cloth only.
2. Do not immerse the drive unit in cleaning solvent. The overrunning clutch is pre-lubricated at the factory and solvent will wash lubrication from the clutch.
3. The drive unit may be cleaned with a brush moistened with cleaning solvent and wiped dry with a cloth.



REASSEMBLY SERVICE POINTS

▶A◀ STOP RING/SNAP RING INSTALLATION

Use a suitable pulling tool to pull the overrunning clutch stop ring over the snap ring.



INSPECTION

16200130224

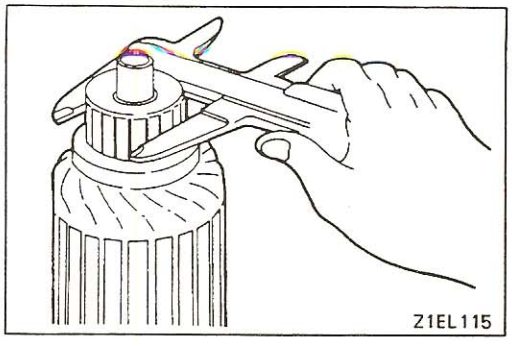
COMMUTATOR CHECK

(1) Place the armature on a pair of V-blocks, and then use a dial gage to check the deflection.

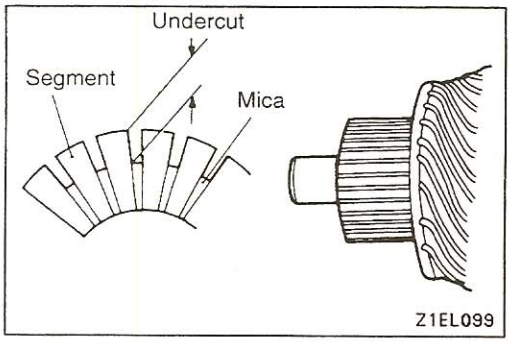
Standard value: 0.05 mm (.0020 in.)

Limit: 0.1 mm (.0040 in.)

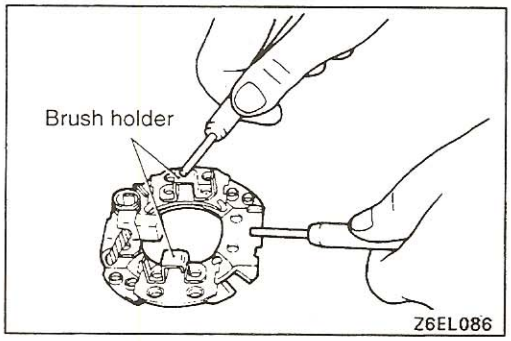
TSB Revision



(2) Check the outer diameter of the commutator.
Standard value: 29.4 mm (1.158 in.)
Limit: 28.8 mm (1.134 in.)

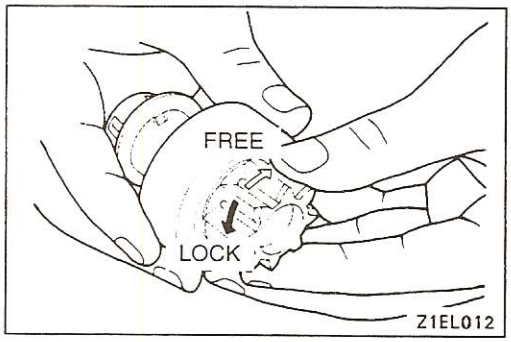


(3) Check the depth of the undercut between the segments.
Standard value: 0.5 mm (.020 in.)



BRUSH HOLDER CHECK

Check for continuity between the brush holder plate and the brush holder.
The normal condition is no continuity.

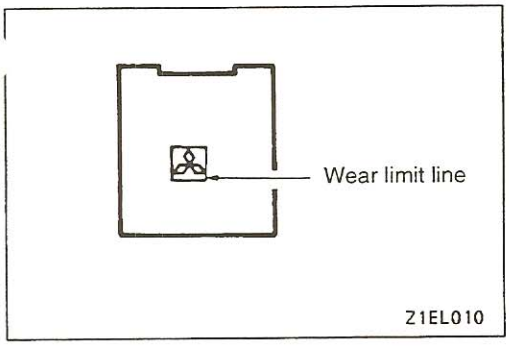


OVERRUNNING CLUTCH CHECK

1. While holding the clutch housing, rotate the drive pinion. The drive pinion should rotate smoothly in one direction, but should not rotate in the opposite direction. If the clutch does not function properly, replace the overrunning clutch assembly.
2. Check the pinion for wear or burrs. If the pinion is worn or burred, replace the overrunning clutch assembly. If the pinion is damaged, inspect the ring gear for wear or burrs also.

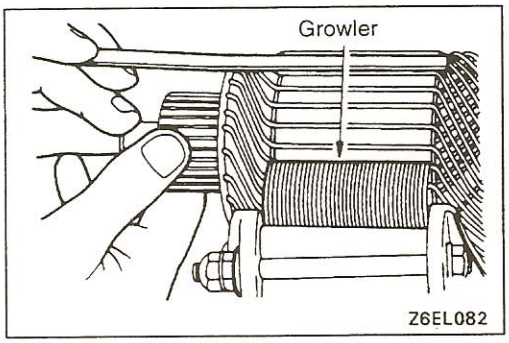
FRONT AND REAR BRACKET BUSHING CHECK

Check the bushing for wear or burrs. If the bushing is worn or burred, replace the front bracket assembly or the rear bracket assembly.



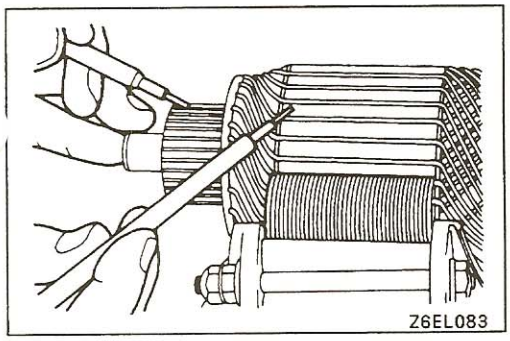
BRUSH CHECK

1. Brushes that are worn beyond the wear limit line, or oil-soaked should be replaced.
2. When replacing the ground brush, slide the brush out from the brush holder by prying back the retaining spring.

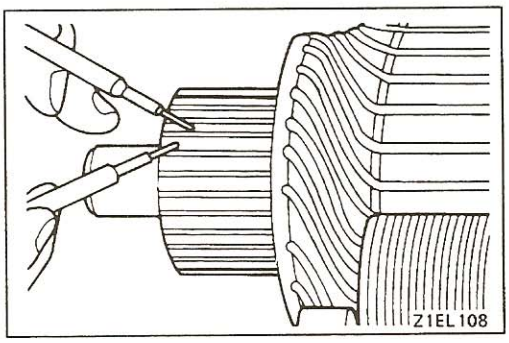


ARMATURE CHECK

(1) Check the armature coil for short circuit.
(2) Place the armature in a growler.
(3) If a thin steel blade is held parallel and just above the armature while it is rotated slowly in the growler, a shorted armature will cause the blade to vibrate and be attracted to the core. In this case, replace the shorted armature.



(4) Check the insulation between the armature coil cores and the commutator segments. They are normal if there is no continuity.



(5) Check for continuity between the segments. The condition is normal if there is continuity.

IGNITION SYSTEM

163000[illegible]

GENERAL INFORMATION

OPERATION

- This action induces a high voltage in the secondary winding of the ignition coil. The secondary winding current produced flows from the ignition coil through the distributor and spark plug to ground, thus causing ignition in each cylinder.
- When the ignition switch is turned to ON, battery positive voltage is applied to the ignition coil primary winding.
- As the distributor shaft rotates, ignition signals are transmitted from the engine control module to the ignition power transistor.
- These signals activate the ignition power transistor to cause ignition coil primary winding current to repeatedly flow through the ignition coil negative terminal through the ignition power transistor to ground or to be interrupted.

GENERAL SPECIFICATIONS

16300020036

IGNITION COIL

Items	Specifications
Type	Mold 3-coil
Identification No.	FC0020, FC0021
Part No.	MD314582, MD314583

SPARK PLUGS

Items	Specifications
NGK	PFR5J-11
NIPPON DENSO	PK16PR-P11
CHAMPION	–

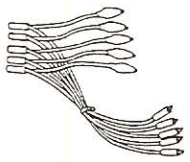
SERVICE SPECIFICATIONS

16300030213

Items		Specifications
Ignition coil	Primary coil resistance at 20°C (68°F) Ω	0.74 – 0.90
	Secondary coil resistance at 20°C (68°F) kΩ	20.1 – 27.3
Spark plug gap mm (in.)		1.0 – 1.1 (.039 – .043)

SPECIAL TOOL

16300060083

Tool	Tool number and name	Supersession	Application
	MB991348 Test harness set	Tool not available	Inspection of ignition primary voltage (ignition power transistor connection)

TSB Revision

TROUBLESHOOTING

16300070017

TROUBLESHOOTING HINTS

1. Engine cranks but does not start.
   1) Spark is insufficient or does not occurs at all (on spark plug)
      - Check the ignition coil.
      - Check the distributor.
      - Check the ignition power transistor.
      - Check the spark plugs.
      - Check the spark plug cable.
   2) Spark is good.
      - Check the ignition timing.
2. Engine idles roughly or stalls.
   - Check the spark plugs.
   - Check the ignition timing.
   - Check the ignition coil.
   - Check the spark plug cable.
3. Poor acceleration
   - Check the ignition timing.
4. Engine overheats or consumes excessive fuel.
   - Check the ignition timing.

ON-VEHICLE SERVICE

16300170298

IGNITION SECONDARY VOLTAGE WAVE PATTERN CHECK

MEASUREMENT METHOD

(1) Clamp the spark plug cable (No. 1, No. 3 or No. 5) with the secondary pick-up.

NOTE
1. Because of the two-cylinder simultaneous ignition system, the waves for two cylinders in each group appear during wave observation. However, wave observation is carried out for the cylinder (No. 1, No. 3 or No. 5) with the spark plug cable which has been clamped by the secondary pick-up.
2. Identification of which cylinder waveform is displayed can be difficult, but the waveform of the cylinder which is clamped by the secondary pick-up will be stable, so this can be used as a reference for identification.

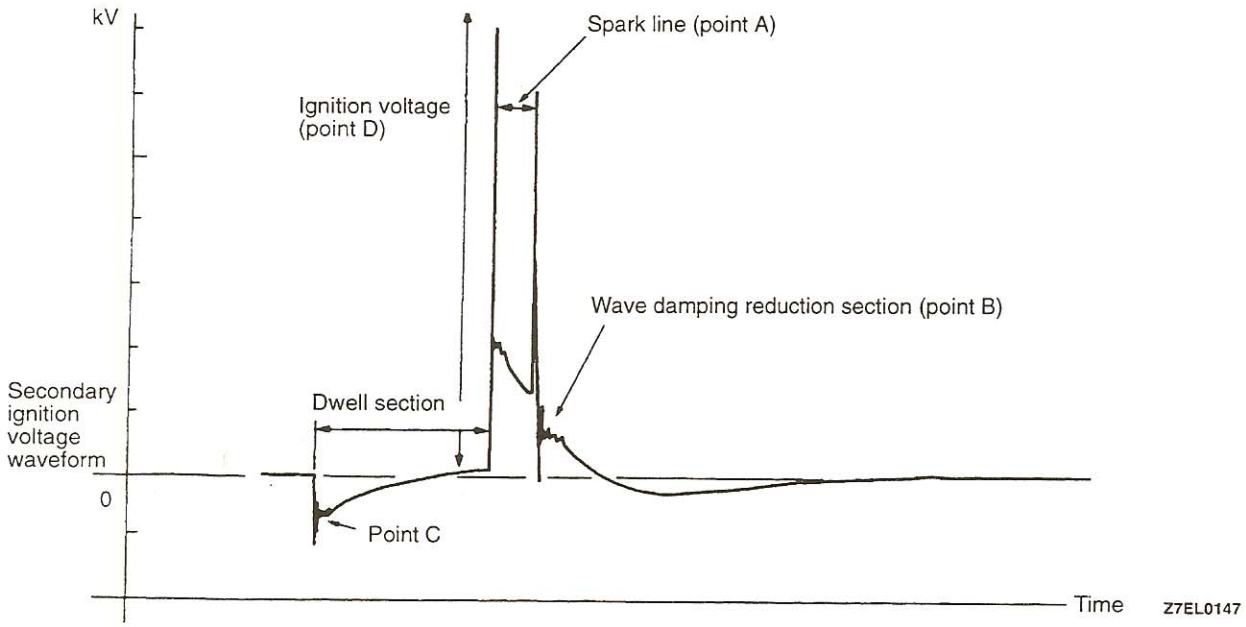
(2) Clamp the spark plug cable (No. 1, No. 3 or No. 5) with the trigger pick-up.

NOTE
Clamp the same spark plug cable as the one which has been clamped by the secondary pick-up.

STANDARD WAVEFORM

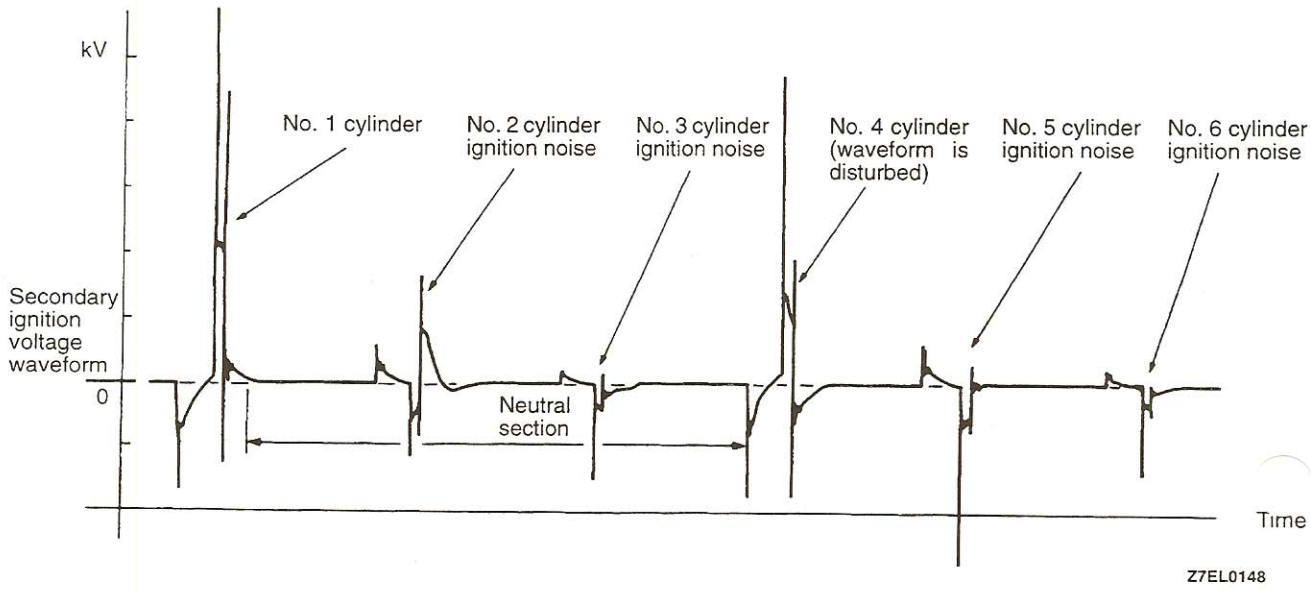
Observation conditions

FUNCTION	SECONDARY
PATTERN HEIGHT	HIGH (or LOW)
PATTERN SELECTOR	RASTER
Engine revolutions	Curb idle speed



Observation conditions (Only PATTERN SELECTOR below changes from the above conditions.)

PATTERN SELECTOR	DISPLAY



TSB Revision

WAVEFORM OBSERVATION POINTS

(Point A):

The height, length and slope of the spark line (refer to Abnormal Waveform Examples 1, 2, 3 and 4) show the following trends.

Spark line		Plug gap	Condition of electrode	Compression pressure	Concentration of air mixture	Ignition timing	Spark plug cable
Length	Long	Small	Normal	Low	Rich	Advanced	Leak
	Short	Large	Large wear	High	Lean	Retarded	High resistance
Height	High	Large	Large wear	High	Lean	Retarded	High resistance
	Low	Small	Normal	Low	Rich	Advanced	Leak
Slope		Large	Plug is fouled	–	–	–	–

(Point B): Number of vibrations in reduction vibration section (Refer to Abnormal Waveform Example 5.)

Number of vibrations	Coil and condenser
Three or more	Normal
Except above	Abnormal

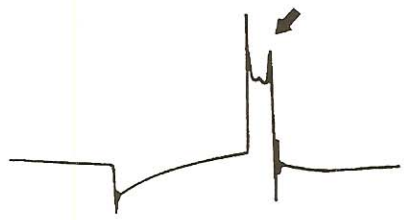
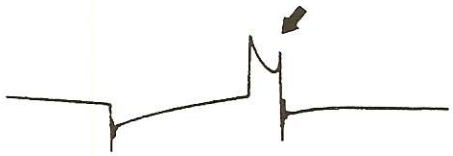
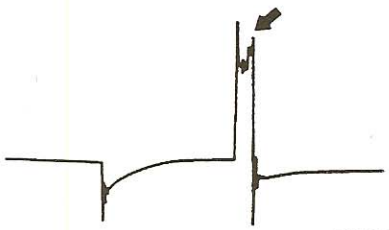
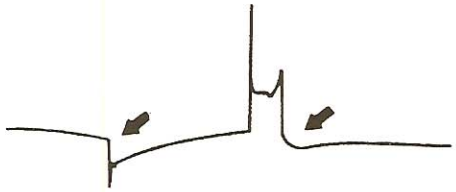
(Point C): Number of vibrations at beginning of dwell section (Refer to Abnormal Waveform Example 5.)

Number of vibrations	Coil
5–6 or higher	Normal
Except above	Abnormal

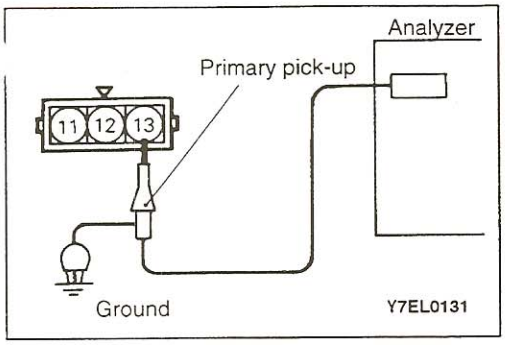
(Point D): Ignition voltage height (deviation per each cylinder) shows the following trends.

Ignition voltage	Plug gap	Condition of electrode	Compression pressure	Concentration of air mixture	Ignition timing	Spark plug cable
High	Large	Large wear	High	Lean	Retarded	High resistance
Low	Small	Normal	Low	Rich	Advanced	Leak

ABNORMAL WAVEFORMS EXAMPLES

Abnormal waveforms	Wave characteristics	Cause of problem
Example 1  Z01P0215	Spark line is high and short.	Spark plug gap is too large.
Example 2  Z01P0216	Spark line is low and long, and is sloping. Also, the second half of the spark line is distorted. This could be a result of misfiring.	Spark plug gap is too small.
Example 3  Z01P0217	Spark line is low and long, and is sloping. However, there is almost no spark line distortion.	Spark plug gap is fouled.
Example 4  Z01P0218	Spark line is high and short. Difficult to distinguish between this and abnormal wave pattern example 1.	Spark plug cable is nearly falling off, causing a dual ignition.
Example 5  Z01P0219	No waves in wave damping section	Layer short-circuit in ignition coil.

TSB Revision



IGNITION PRIMARY VOLTAGE WAVE PATTERN CHECK

16300170304

MEASUREMENT METHOD

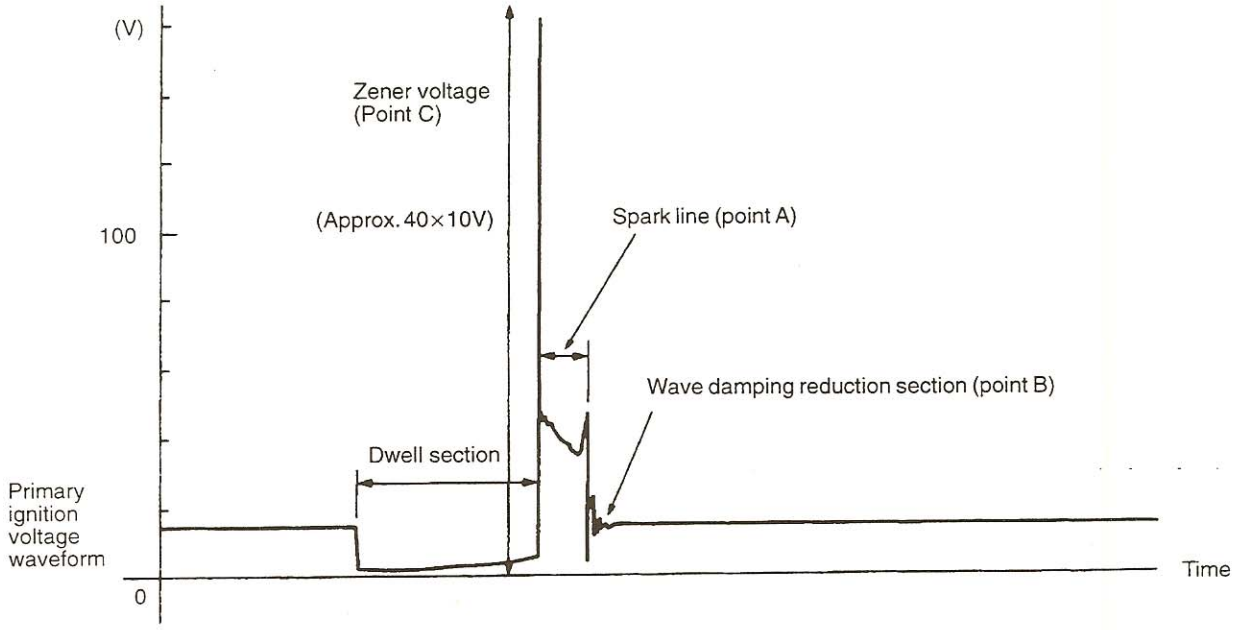
(1) Disconnect the ignition power transistor connector and connect the special tool (Harness connector: MB991348) in between. All terminals should be connected.
(2) When observing the No. 1 – No. 4 cylinder group, connect the primary pick-up of the analyzer probe to power transistor side connector terminal (13).
For the No. 2 – No. 5 cylinder group, connect to terminal (12) and for the No. 3 – No. 6 cylinder group, connect to terminal (11).
(3) Ground the primary pick-up ground terminal.
(4) Clamp the spark plug cable with the trigger pick-up.

NOTE
(1) Clamp the spark plug cable of cylinder No. 1, No. 3 or No. 5 which belongs to the same group as the cylinder to which the primary pick-up is connected.
(2) The waveform of any cylinder in the same group appears from the left side of the screen.

STANDARD WAVEFORM

Observation conditions

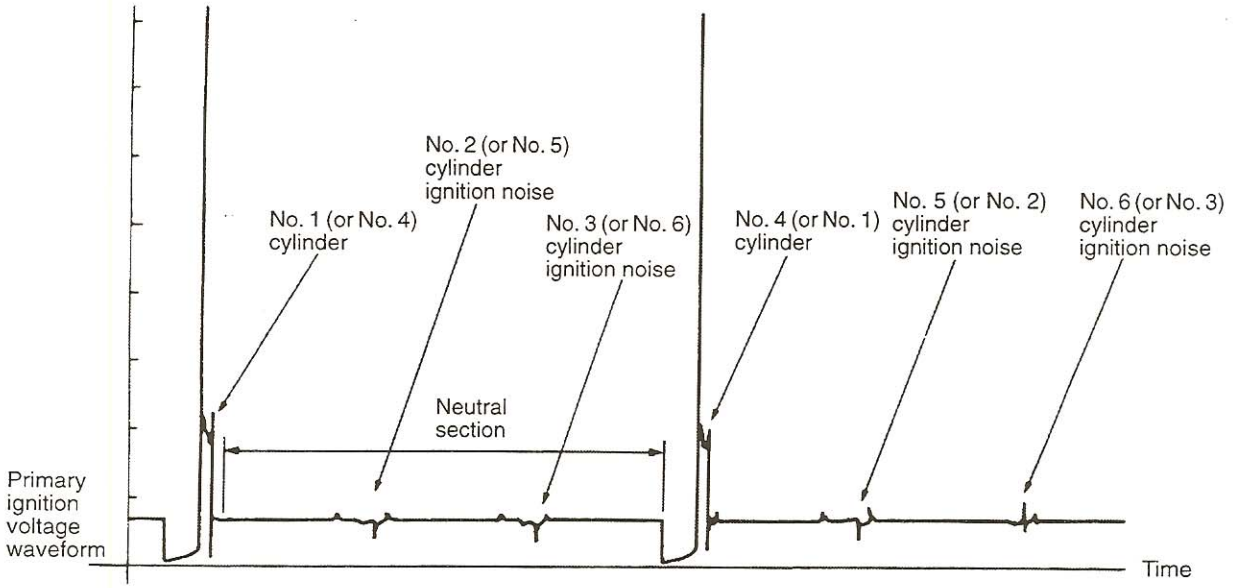
FUNCTION	SECONDARY
PATTERN HEIGHT	HIGH (or LOW)
PATTERN SELECTOR	RASTER
Engine revolutions	Curb idle speed



TSB Revision

Observation conditions (Only PATTERN SELECTOR below changes from the above conditions.)

PATTERN SELECTOR	DISPLAY



TSB Revision

WAVEFORM OBSERVATION POINTS

(Point A):

The height, length and slope of the spark line (refer to Abnormal Waveform Examples 1, 2, 3 and 4) show the following trends.

Spark line		Plug gap	Condition of electrode	Compression pressure	Concentration of air mixture	Ignition timing	Spark plug cable
Length	Long	Small	Normal	Low	Rich	Advanced	Leak
	Short	Large	Large wear	High	Lean	Retarded	High resistance
Height	High	Large	Large wear	High	Lean	Retarded	High resistance
	Low	Small	Normal	Low	Rich	Advanced	Leak
Slope		Large	Plug is fouled	–	–	–	–

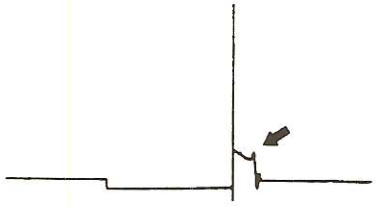
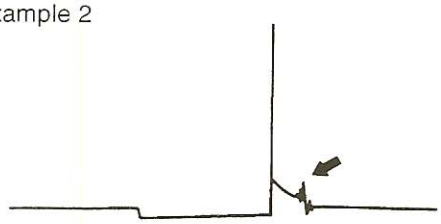
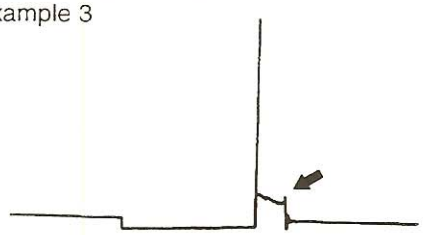
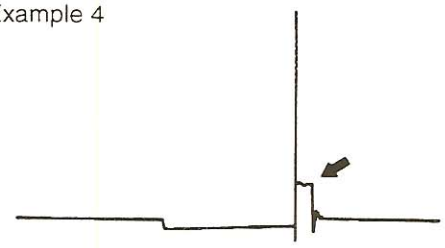
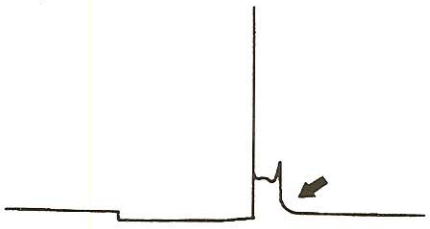
(Point B): Number of vibrations in reduction vibration section (Refer to Abnormal Waveform Example 5.)

Number of vibrations	Coil and condenser
5 – 6 or higher	Normal
Except above	Abnormal

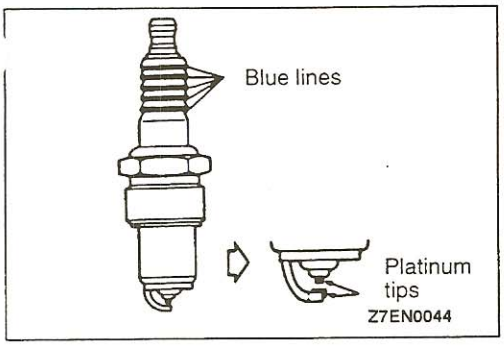
(Point C): Height of Zener voltage

Height of Zener voltage	Coil and condenser
Higher	Problem in Zener diode
Low	Abnormal resistance in primary coil circuit

ABNORMAL WAVEFORMS EXAMPLES

Abnormal waveforms	Wave characteristics	Cause of problem
Example 1  Z01P0210	Spark line is high and short.	Spark plug gap is too large.
Example 2  Z01P0211	Spark line is low and long, and is sloping. Also, the second half of the spark line is distorted. This could be a result of misfiring.	Spark plug gap is too small.
Example 3  Z01P0212	Spark line is low and long, and is sloping. However, there is almost no spark line distortion.	Spark plug gap is fouled.
Example 4  Z01P0213	Spark line is high and short.	Spark plug cable is nearly falling off, causing a dual ignition.
Example 5  Z01P0214	No waves in wave damping section	Layer short-circuit in ignition coil.

TSB Revision



IGNITION SYSTEM

16300330054

INSPECTION

SPARK PLUGS

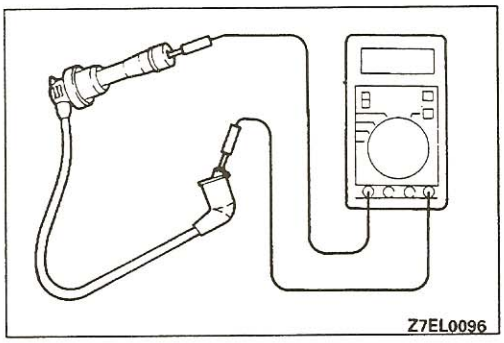
Check the plug gap and replace if the limit is exceeded.

Standard value: 1.0 – 1.1 mm (.039 – .043 in.)

Limit: 1.3 mm (.051 in.)

Caution

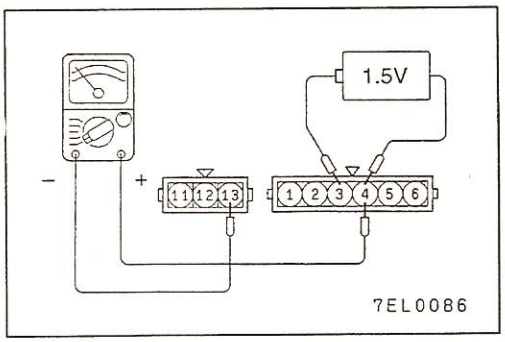
1. **Do not attempt to adjust the gap of the platinum plug.**
2. **Cleaning of the platinum plug may result in damage to the platinum tips. Therefore, if carbon deposits must be removed, use a plug cleaner and complete cleaning within 20 seconds to protect the electrode. Do not use a wire brush.**



SPARK PLUG CABLE

(1) Check the cap and coating for cracks.
(2) Measure resistance.

Limit: max. 22 kΩ



IGNITION POWER TRANSISTOR

NOTE
An analog-type circuit tester should be used.

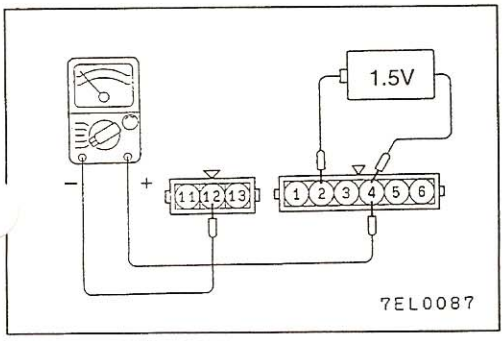
No. 1 – No. 4 coil side

(1) Connect the negative (–) terminal of the 1.5 V power supply to terminal (4) of the ignition power transistor, and then check whether there is continuity between terminal (13) and terminal (4) when terminal (3) and the positive (+) terminal are connected and disconnected.

NOTE
Connect the (–) probe of the circuit tester to terminal (13).

Terminal (3) and (+) terminal	Terminal (13) and terminal (4)
Connected	Continuity
Unconnected	No continuity

(2) Replace the ignition power transistor if there is a malfunction.



No. 2 – No. 5 coil side

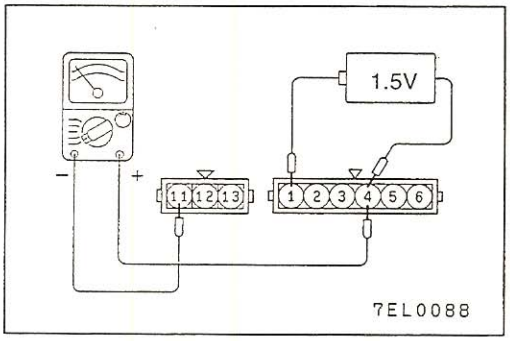
(1) Connect the negative (–) terminal of the 1.5 V power supply to terminal (4) of the ignition power transistor, and then check whether there is continuity between terminal (12) and terminal (4) when terminal (2) and the positive (+) terminal are connected and disconnected.

NOTE
Connect the (–) probe of the circuit tester to terminal (12).

TSB Revision

Terminal (2) and (+) terminal	Terminal (12) and terminal (4)
Connected	Continuity
Unconnected	No continuity

(2) Replace the ignition power transistor if there is a malfunction.



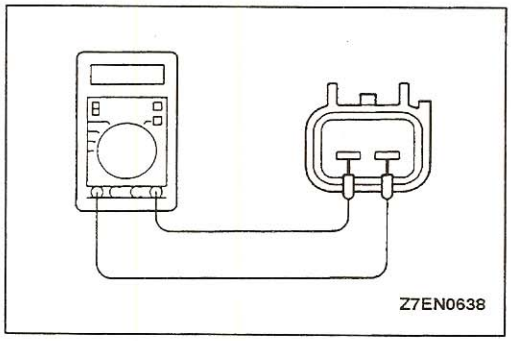
No. 3 – No. 6 coil side

(1) Connect the negative (–) terminal of the 1.5 V power supply to terminal (4) of the ignition power transistor, and then check whether there is continuity between terminal (11) and terminal (4) when terminal (1) and the positive (+) terminal are connected and disconnected.

NOTE
Connect the (–) probe of the circuit tester to terminal (11).

Terminal (1) and (+) terminal	Terminal (11) and terminal (4)
Connected	Continuity
Unconnected	No continuity

(2) Replace the ignition power transistor if there is a malfunction.

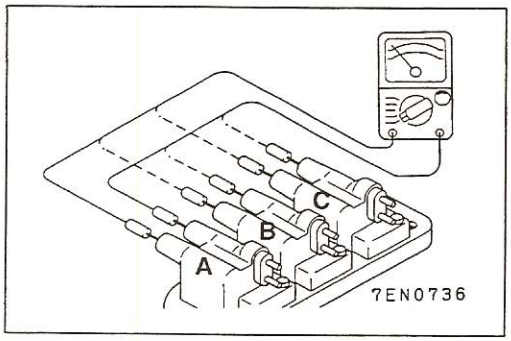


IGNITION COIL

Primary Coil Resistance

(1) Measure the resistance between the terminals for each ignition coil.

Standard value: 0.74 – 0.90 Ω



Secondary Coil Resistance

(2) Measure the resistance between the high-tension terminals for each ignition coil.

Measurement points

No.3 – No.6 cylinder side coil ..... A coil
No.1 – No.4 cylinder side coil ..... B coil
No.2 – No.5 cylinder side coil ..... C coil

Standard value: 20.1 – 27.3 kΩ

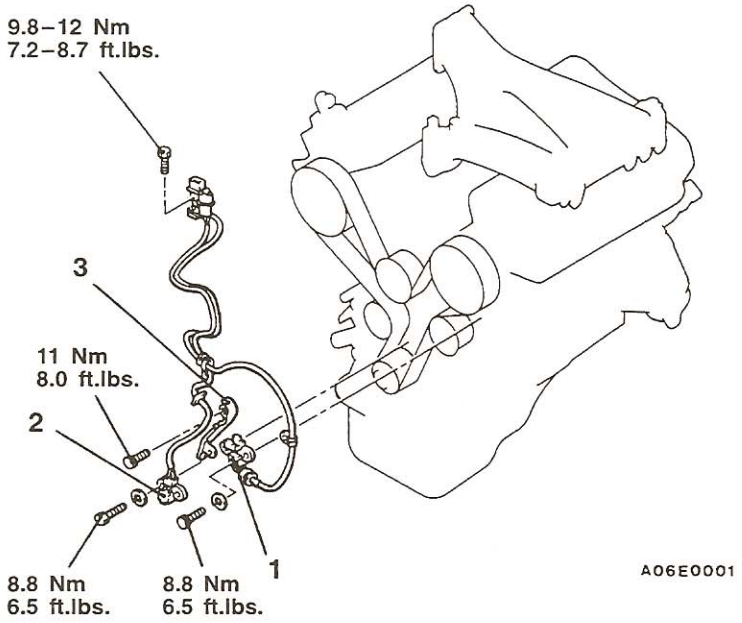
TSB Revision

CRANKSHAFT POSITION SENSOR AND CAMSHAFT POSITION SENSOR

16300250299

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operations
- Timing Belt Cover Removal and Installation (Refer to GROUP 11A – Timing belt)



1. Camshaft position sensor
2. Crankshaft position sensor
3. Harness protector

INSPECTION

16300260544

CAMSHAFT POSITION SENSOR CHECK

Refer to GROUP 13A – On-vehicle Inspection of MFI Components.

TSB Revision

NOTES

ENGINE AND EMISSION CONTROL

CONTENTS

17209000080

WARNINGS REGARDING SERVICING OF SUPPLEMENTAL RESTRAINT SYSTEM (SRS) EQUIPPED VEHICLES

WARNING!

(1) Improper service or maintenance of any component of the SRS, or any SRS-related component, can lead to personal injury or death to service personnel (from inadvertent firing of the air bag) or to the driver (from rendering the SRS inoperative).

(2) Service or maintenance of any SRS component or SRS-related component must be performed only at an authorized MITSUBISHI dealer.

(3) MITSUBISHI dealer personnel must thoroughly review this manual, and especially its GROUP 52B – Supplemental Restraint System (SRS) and GROUP 00 – Maintenance Service before beginning any service or maintenance of any component of the SRS or any SRS-related component.

NOTE

The SRS includes the following components: SRS diagnosis unit, SRS warning light, air bag module, clock spring and interconnecting wiring. Other SRS-related components (that may have to be removed/installed in connection with SRS service or maintenance) are indicated in the table of contents by an asterisk (*).

ENGINE CONTROL

1710007[illegible]

TROUBLESHOOTING

Trouble Symptom	Probable Cause	Remedy
Throttle valve will not fully open or close	Incorrectly adjusted accelerator cable	Adjust
	Broken return spring	Replace
	Malfunction of throttle lever	
Accelerator pedal operation not smooth (over acceleration)	Accelerator pedal incorrectly tightened	Repair
	Incorrectly installed accelerator cable	
	Accelerator cable requires lubrication	Lubricate or replace

SPECIAL TOOLS

17100060015

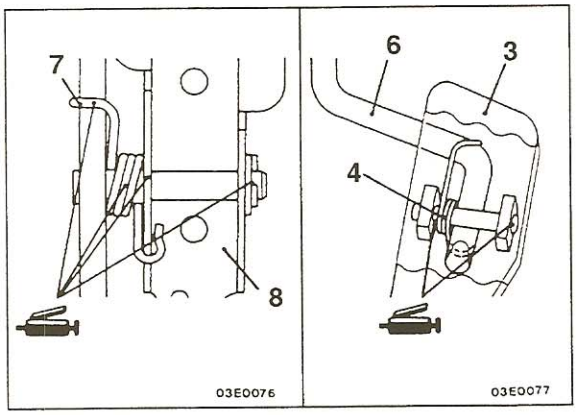
Tool	Tool number and name	Supersession	Application
	MB991502 Scan tool (MUT-II)	MB991496-0D	Fuel pump operation check
	ROM pack	–	

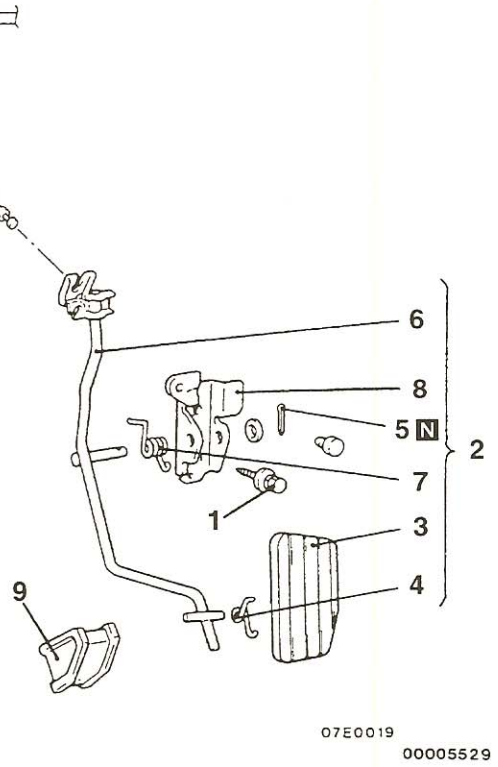
TSB Revision

ACCELERATOR CABLE AND ACCELERATOR PEDAL

17100120195

REMOVAL AND INSTALLATION





Accelerator cable removal steps

1. Accelerator arm bracket mounting bolts
2. Accelerator pedal assembly
3. Pedal
4. Spring
5. Cotter pin
6. Accelerator arm
7. Return spring
8. Accelerator arm bracket
9. Stopper

INSPECTION

17100130020

- Check the cable for damage.
- Check the cable outer casing for damage.
- Check the cable for uneven movement.
- Check the accelerator arm for bends.
- Check the return spring for deterioration.
- Check the connection of the accelerator cable and end fitting.

TSB Revision

AUTO-CRUISE CONTROL SYSTEM

17200[illegible]

GENERAL SPECIFICATIONS

Items		Specifications
Main switch	Rated load A	1
	Voltage drop V	0.15 or less
Control switch	Rated load A	SET: 0.1 RESUME: 0.1 CANCEL: 1.2
	Voltage drop V	0.2 or less
Cruise control unit	Set error km/h (mph)	–1.0 – 0 (–.6 – 0)
	Range of speed control km/h (mph)	40 (25) or more
Actuator	Drive system	Vacuum type
	Stroke mm (in.)	38 – 42 (1.5 – 1.7)
Motor-driven vacuum pump	Rated load A	0.4 or less

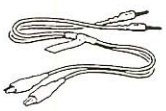
SERVICE SPECIFICATIONS

17200030064

Items	Standard value
Accelerator cable play mm (in.)	0 – 1 (0 – .04)
Throttle cable play mm (in.)	1 – 2 (.04 – .08)
Cruise control cable play mm (in.)	1 – 2 (.04 – .08)
Control valve, release valve resistance Ω	50 – 60

SPECIAL TOOLS

17200060063

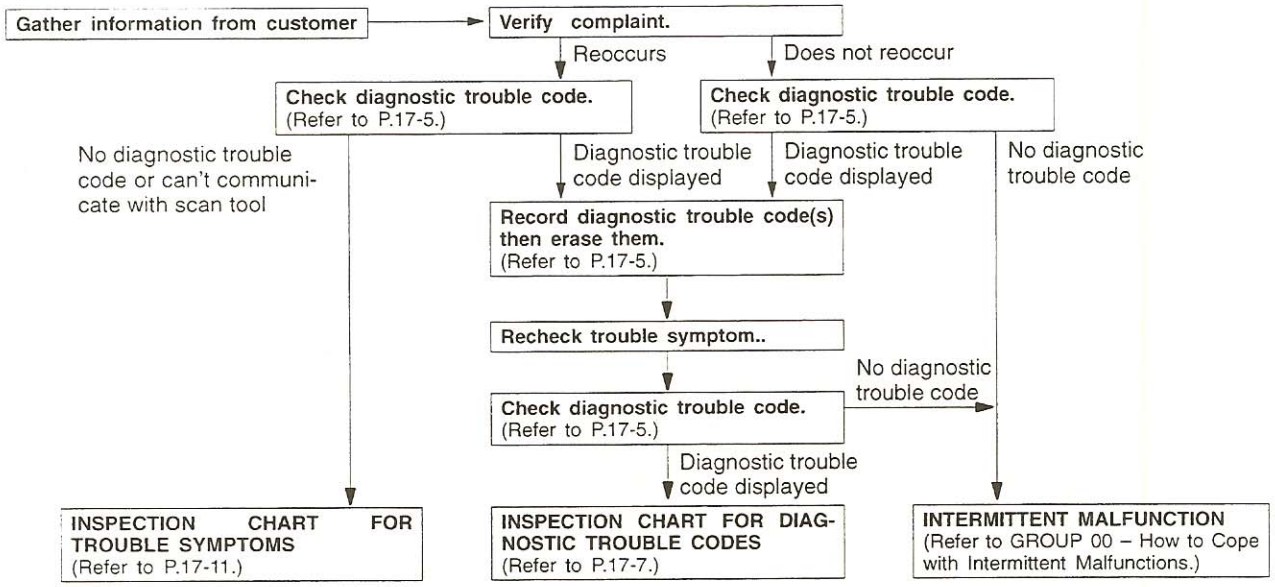
Tool	Tool number and name	Supersession	Application
	MB991502 Scan tool (MUT-II)	MB991496-0D	Checking of the diagnostic trouble code
	ROM pack	–	
	MB991529 Diagnostic trouble code check harness	Tool not necessary if scan tool (MUT-II) is available	Checking of diagnostic output when using a voltmeter

TSB Revision

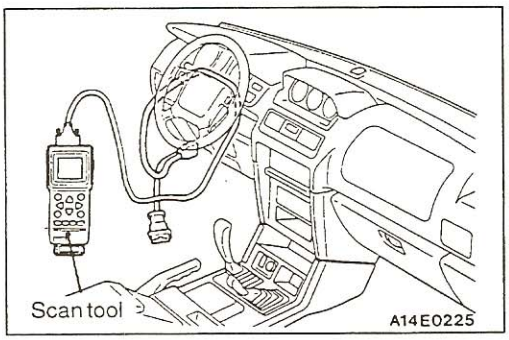
TROUBLESHOOTING

17200200281

DIAGNOSTIC TROUBLESHOOTING FLOW



NOTE
Before carrying out trouble diagnosis, check to be sure that all of the following items are normal.
1. Is the vacuum hose correctly installed and undamaged?
2. Are the auto-cruise, accelerator, and throttle cables routed correctly?
3. Do the link assembly and cables move smoothly?
4. Is the each cable play at the within its standard value?



DIAGNOSTIC FUNCTION

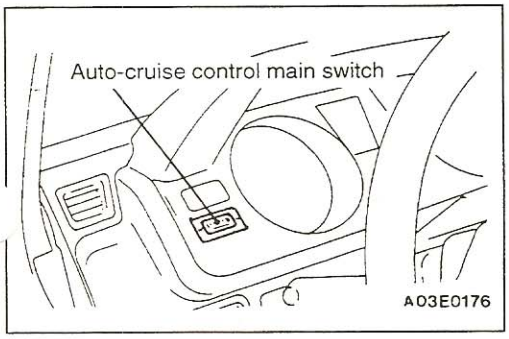
17200210215

HOW TO READ DIAGNOSTIC TROUBLE CODES

When using the scan tool

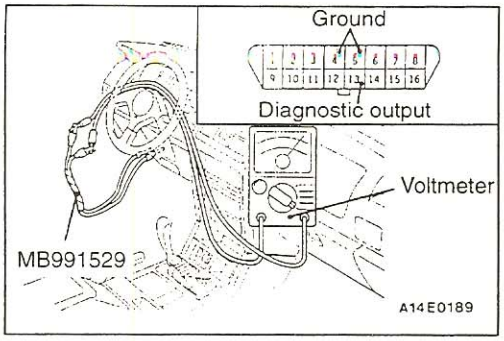
1. Connect the scan tool to the data link connector.

   Caution
   Turn the ignition switch off before disconnecting or connecting the scan tool.



2. With the ignition switch in the ON position, turn the auto-cruise control main switch to ON and take a reading of the diagnostic trouble codes.

TSB Revision

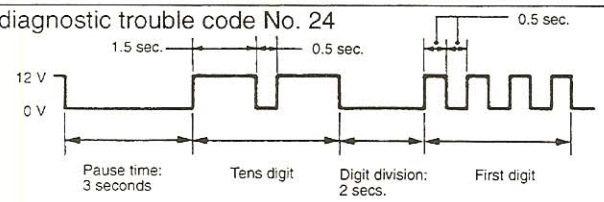


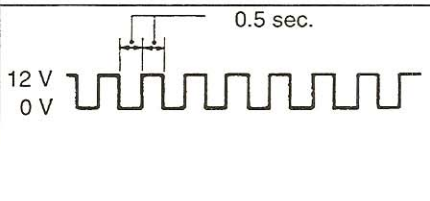
When using a voltmeter

1. Use the special tool to connect a voltmeter between ground terminal and the diagnostic output terminal of data link connector.
2. In the same way as when using the scan tool, turn the ignition switch to ON and turn on the auto-cruise control main switch. Then take a reading of the diagnostic trouble codes from the movement of the needle on the voltmeter.

HOW TO READ DIAGNOSTIC TROUBLE CODES FROM A VOLTMETER

Example of diagnostic trouble code voltage waveform	Normal voltage waveform
For diagnostic trouble code No. 24	



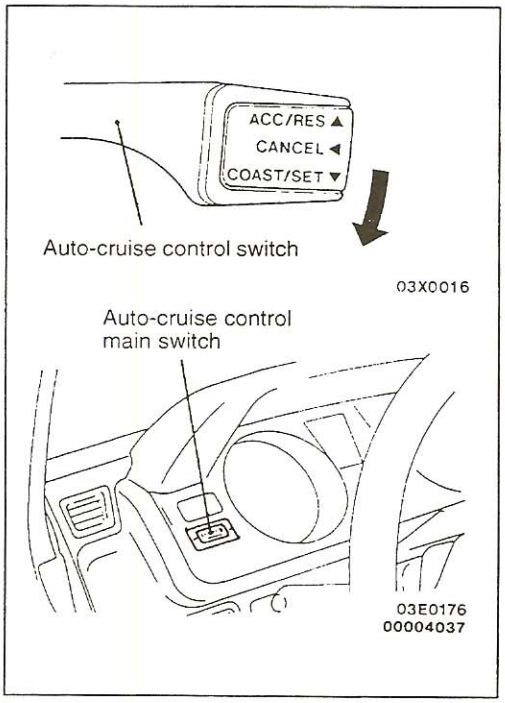


NOTE
Other on-board diagnostic items are also output as voltage waveforms corresponding to diagnostic trouble code numbers.

HOW TO ERASE DIAGNOSTIC TROUBLE CODES

The diagnostic trouble codes can be erased by disconnecting the (–) cable from the battery for 10 seconds or more and then re-connecting it, or by the following procedure.

1. Turn the ignition switch to ON.
2. With the SET switch at the ON position, turn the main switch to ON, and within 1 second after this, turn the RESUME switch to ON.
3. With the SET switch once more at the ON position, turn the stop light switch ON for a continuous period of 5 seconds or more.



HOW TO READ INPUT SWITCH CODES

1. Connect the scan tool or a voltmeter to the data link connector. (Refer to P.17-5.)
2. With the ignition switch in the ON position, turn the SET switch to the ON position.
3. Within 1 second after turning the auto-cruise control main switch to ON, turn the RESUME switch to ON.
4. Operate each switch listed in the input inspection table and take a reading of the input switch codes with the scan tool or the fluctuation of a voltmeter.

   NOTE
   These codes are output as voltage waveforms in the same way as above.

TSB Revision

Input Inspection Table

Code No.	Input operation	Operation judgement
21	SET switch ON	Auto-cruise control-ECU judges that SET switch is ON
22	RESUME switch ON	Auto-cruise control-ECU judges that RESUME switch is ON
23	Stop light switch (ON when brake pedal depressed)	Auto-cruise control-ECU judges that stop light switch is ON
24	Vehicle speed signal	Auto-cruise control-ECU judges that vehicle speed is 40 km/h (25 mph) or higher
25		Auto-cruise control-ECU judges that vehicle speed is lower than 40 km/h (25 mph)
26	• Park/neutral position switch (ON when selector lever in N range)	Auto-cruise control-ECU judges that park/neutral position switch is ON
27	CANCEL switch ON	Auto-cruise control-ECU judges that CANCEL switch is ON
28	Throttle position sensor signal	Auto-cruise control-ECU judges that throttle position sensor voltage is 1.5 V or more
29	Closed throttle position switch	Auto-cruise control-ECU judges that closed throttle position switch is OFF

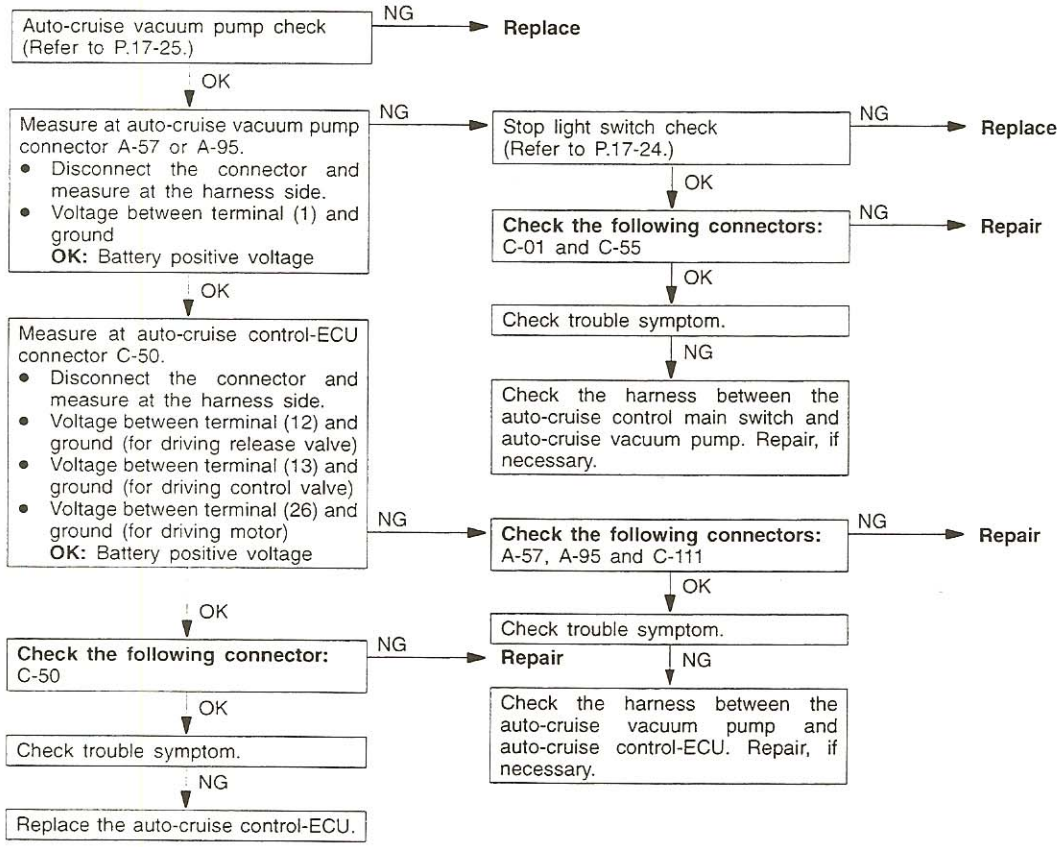
INSPECTION CHART FOR DIAGNOSTIC TROUBLE CODES

17200220294

Code No.	On-board diagnostic items	Reference page
11	Auto-cruise vacuum pump drive system	17-8
12	Vehicle speed signal system	17-9
14	Auto-cruise vacuum pump power supply system	17-9
15	Auto-cruise control switch	17-10
16	Auto-cruise control-ECU	17-10
17	Throttle position sensor system	17-10

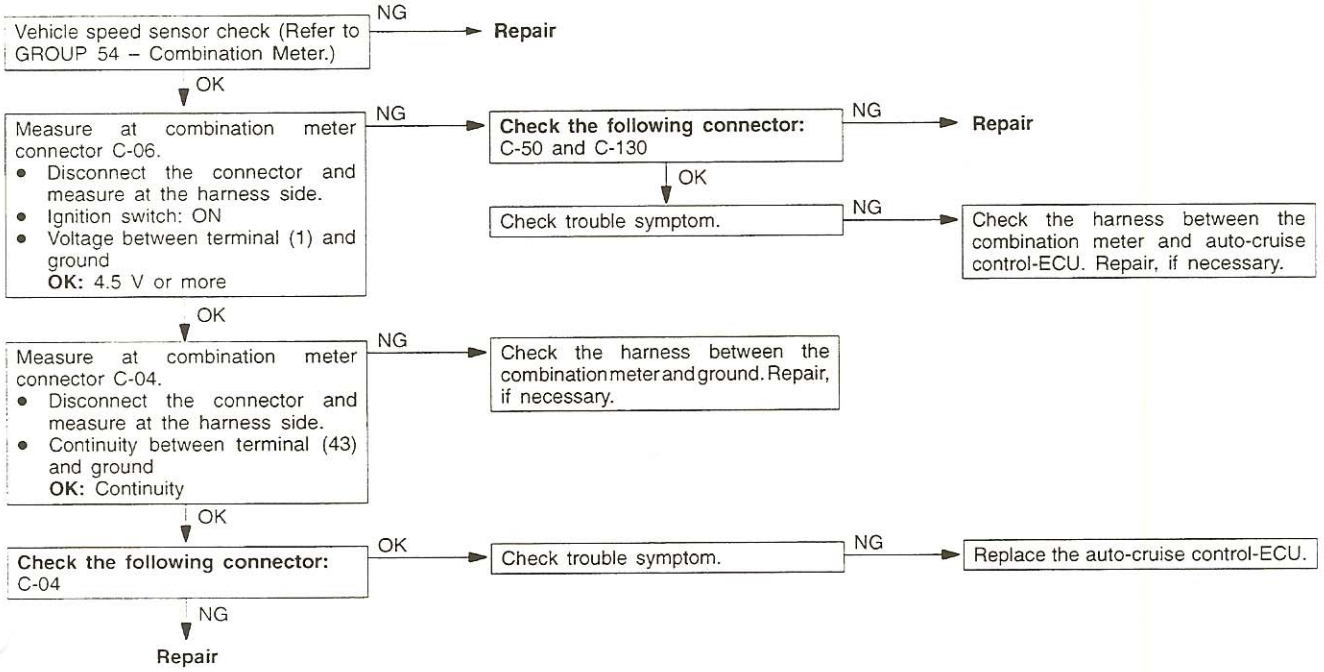
INSPECTION PROCEDURE FOR DIAGNOSTIC TROUBLE CODES

Code No.11 Auto-cruise vacuum pump drive system	Probable cause
[Comment] This diagnostic trouble code is output if the release valve, control valve and motor drive signals from the auto-cruise vacuum pump are not input to the auto-cruise control-ECU.	• Malfunction of the auto-cruise vacuum pump • Malfunction of the stop light switch • Malfunction of the connector • Malfunction of the harness • Malfunction of the auto-cruise control-ECU

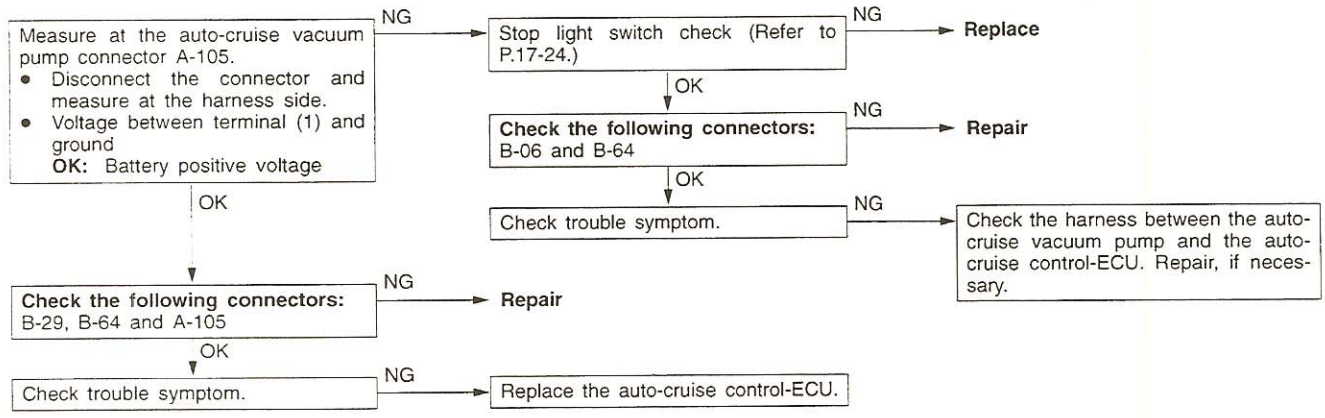


TSB Revision

Code No.12 Vehicle speed signal system	Probable cause
[Comment] This diagnostic trouble 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 (25 mph) or more.	• Malfunction of the vehicle speed sensor • Malfunction of the connector • Malfunction of the harness • Malfunction of the auto-cruise control-ECU



Code No.14 Autocruise vacuum pump power supply system	Probable cause
[Comment] This code will be output when the drive signals for the auto-cruise vacuum pump release valve, control valve and motor are not input to the auto-cruise control-ECU.	• Malfunction of the stop light switch • Malfunction of the connector • Malfunction of the harness • Malfunction of the auto-cruise control-ECU



TSB Revision

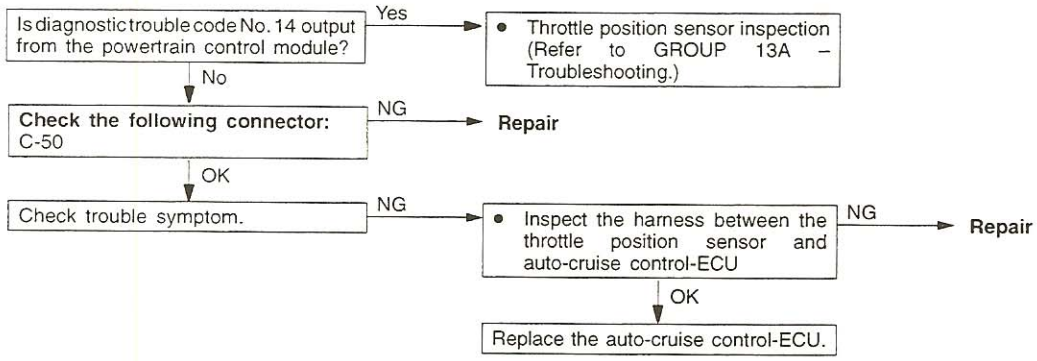
Code No.15 Auto-cruise control-ECU	Probable cause
[Comment] This diagnostic trouble code is output if the RESUME switch or SET switch remains ON.	• Malfunction of the auto-cruise control switch

Replace the auto-cruise control switch.

Code No.16 Auto-cruise control-ECU	Probable cause
[Comment] This diagnostic trouble code is output if there is an abnormality in the CANCEL hold circuit or the microprocessor monitor circuit in the auto-cruise control-ECU.	• Malfunction of the auto-cruise control-ECU

Replace the auto-cruise control-ECU.

Code No.17 Throttle position sensor system	Probable cause
[Comment] This diagnostic trouble code is output if a voltage of 1.5 V or more (when the closed throttle position switch is ON) or 0.2 V or less (when the closed throttle position switch is OFF) is output for a continuous period of 4 seconds or more.	• Malfunction of the throttle position sensor • Malfunction of the connector • Malfunction of the harness • Malfunction of the auto-cruise control-ECU



TSB Revision

INSPECTION CHART FOR TROUBLE SYMPTOMS

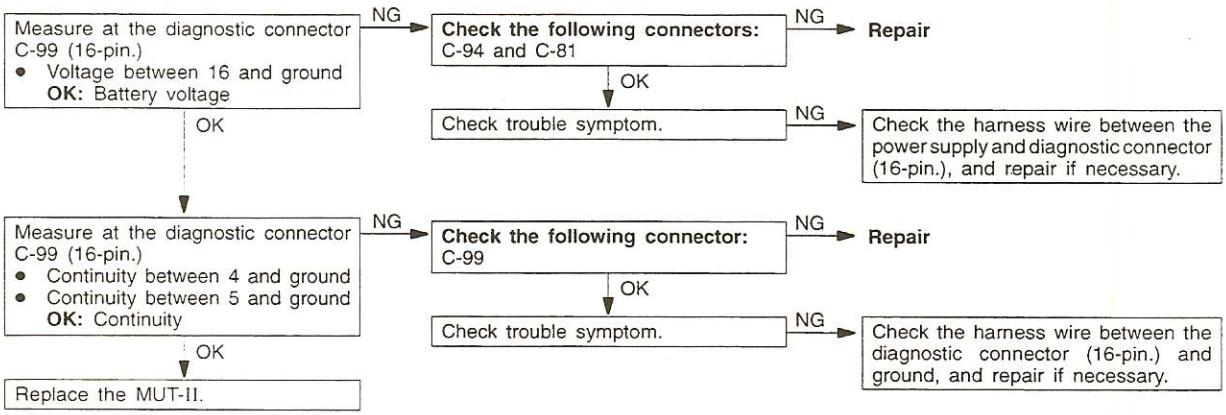
17200230273

Trouble symptom		Inspection procedure No.	Reference page
Communication with scan tool is not possible.	Communication with all systems is not possible.	1	17-11
	Communication with auto-cruise control-ECU only is not possible.	2	17-12
Input switch inspection using the scan tool is not possible. (However, diagnostic inspection is possible.)		3	17-13
Auto-cruise control does not cancel.	When brake pedal is depressed	4	17-13
	When select lever is set to N range	5	17-14
	When CANCEL switch is set to ON	6	17-14
The diagnosis result displayed on the scan tool is normal even though auto-cruise control cannot be set.		7	17-15
Auto-cruise control cannot be set.		8	17-15
Hunting (repeated acceleration and deceleration) occurs at the set vehicle speed.		9	17-16
When the auto-cruise control main switch is ON, the switch indicator on the instrument panel does not illuminate. (However, auto-cruise control is normal.)		10	17-16
Auto-cruise control main switch illumination light does not illuminate.		11	17-16
Auto-cruise control indicator light inside combination meter does not illuminate. (However, auto-cruise control is normal.)		12	17-17

INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

INSPECTION PROCEDURE 1

Communication with scan tool is not possible. (Communication with all systems is not possible.)	**Probable cause**
[Comment] A defect in the power supply system (including ground) for the diagnostic line may be present.	• Malfunction of the connector. • Malfunction of the harness.

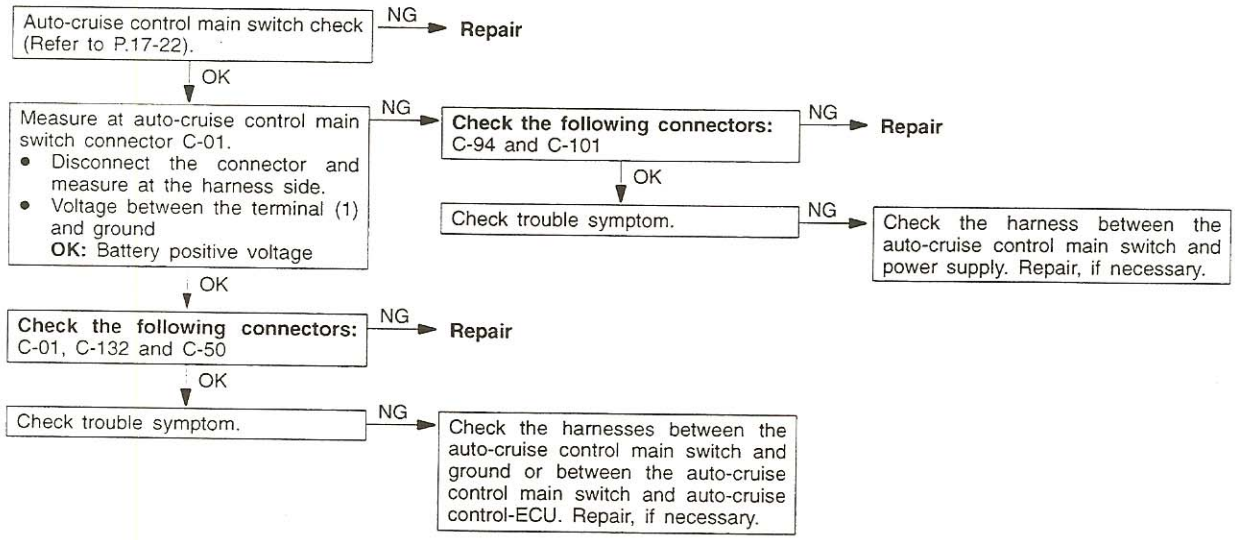


TSB Revision

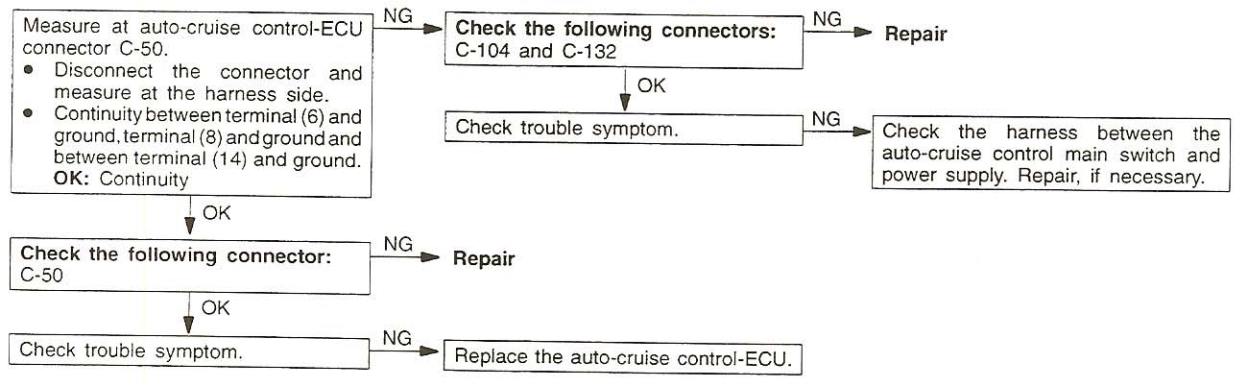
INSPECTION PROCEDURE 2

Communication with scan tool is not possible. (Communication with auto-cruise control-ECU only is not possible.)	Probable cause
[Comment] A malfunction of the auto-cruise control main switch circuit or a malfunction of the auto-cruise control-ECU ground circuit may be present.	• Malfunction of the auto-cruise control main switch. • Malfunction of the connector. • Malfunction of the harness. • Malfunction of the auto-cruise control-ECU.

1. Auto-cruise control main switch circuit malfunction



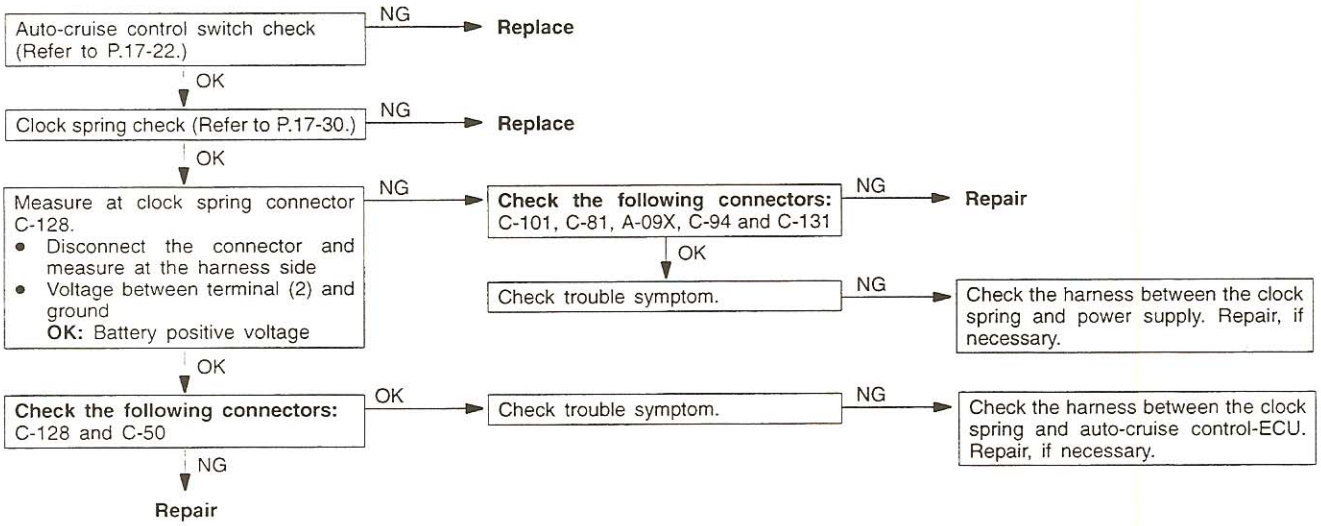
2. Auto-cruise control-ECU ground circuit malfunction



TSB Revision

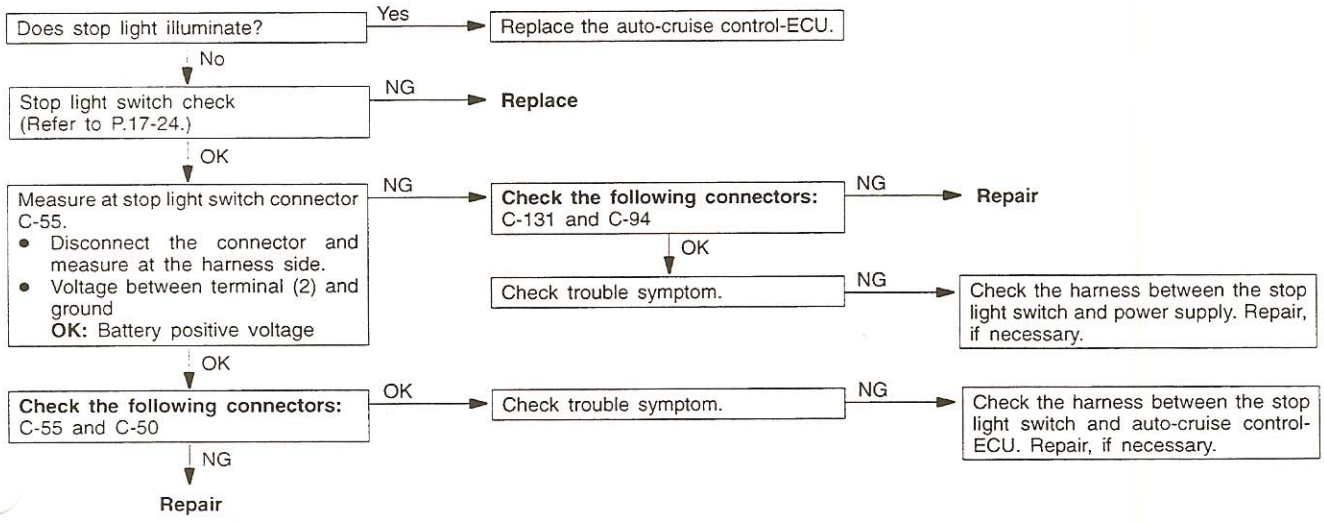
INSPECTION PROCEDURE 3

Input switch inspection using the scan tool is not possible. (However, diagnostic inspection is possible.)	Probable cause
[Comment] A malfunction of auto-cruise control switch circuit system may be present.	• Malfunction of the auto-cruise control switch. • Malfunction of the clock spring . • Malfunction of the connector. • Malfunction of the harness.



INSPECTION PROCEDURE 4

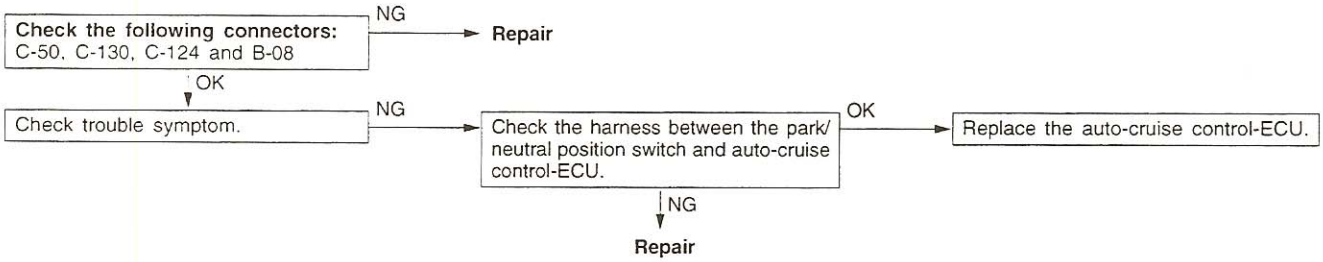
When brake pedal is depressed, auto-cruise control does not cancel.	Probable cause
[Comment] A malfunction of stop light switch or a malfunction of stop light circuit may be present.	• Malfunction of the stop light switch. • Malfunction of the connector. • Malfunction of the harness. • Malfunction of the auto-cruise control-ECU.



TSB Revision

INSPECTION PROCEDURE 5

When select lever is set to N range, auto-cruise control does not cancel.	Probable cause
[Comment] The cause is probably an open-circuit in the output signal circuit in N range.	• Malfunction of the park/neutral position switch • Malfunction of the connector. • Malfunction of the harness. • Malfunction of the auto-cruise control-ECU.



INSPECTION PROCEDURE 6

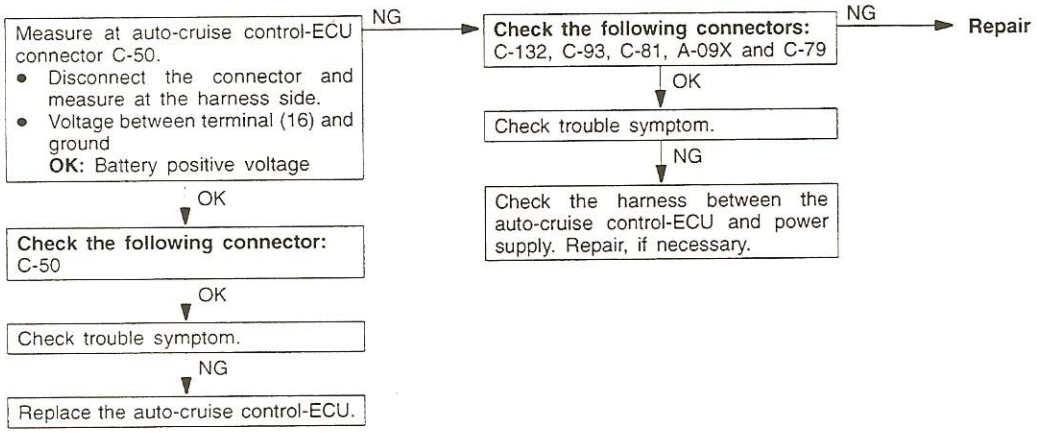
When auto-cruise control CANCEL switch is set to ON, auto-cruise control does not cancel.	Probable cause
[Comment] An open-circuit in the circuit inside the CANCEL switch may be present.	• Malfunction of the auto-cruise control switch.

Replace the auto-cruise control switch.

TSB Revision

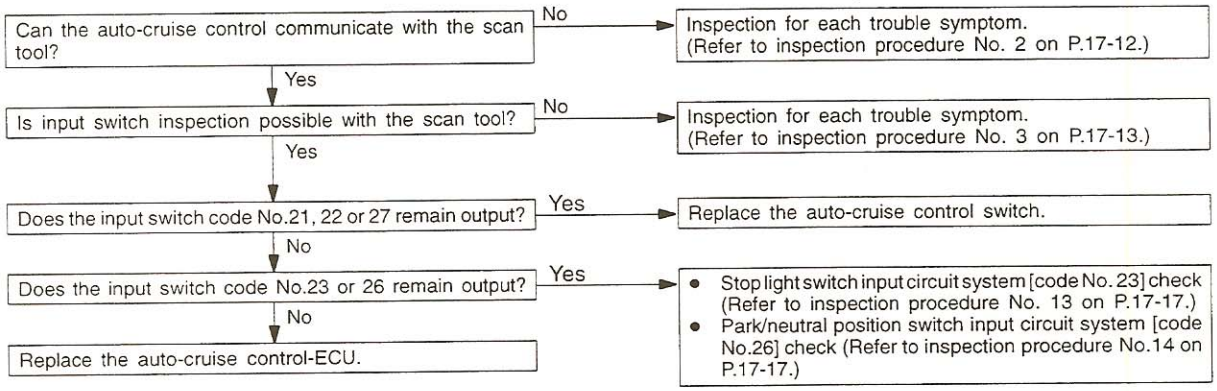
INSPECTION PROCEDURE 7

The diagnostic result displayed on the scan tool is normal even though auto-cruise control cannot be set.	Probable cause
[Comment] Because of an open-circuit in the battery backup circuit system, the fail-safe function prevents diagnostic trouble codes from being memorized and displayed even though auto-cruise control is canceled.	• Malfunction of the connector. • Malfunction of the harness. • Malfunction of the auto-cruise control-ECU.



INSPECTION PROCEDURE 8

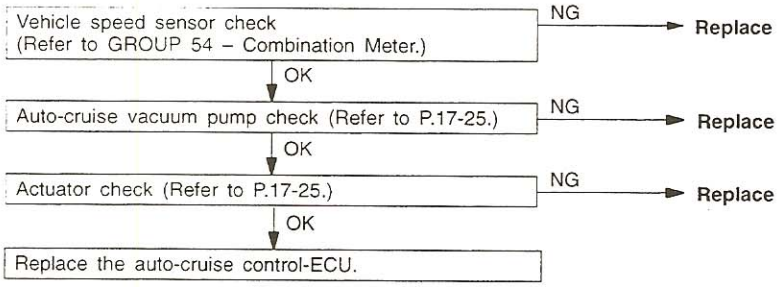
Auto-cruise control cannot be set.	Probable cause
[Comment] A malfunction of switches or that the fail-safe function cancelling auto-cruise control may be present.	• Malfunction of the auto-cruise control main switch. • Malfunction of the auto-cruise control switch. • Malfunction of the clock spring. • Malfunction of the harnesses or connectors. • Malfunction of the park/neutral position switch. • Malfunction of the auto-cruise control-ECU.



TSB Revision

INSPECTION PROCEDURE 9

Hunting (repeated acceleration and deceleration) occurs at the set vehicle speed.	Probable cause
[Comment] A malfunction of vehicle speed sensor or incorrect vacuum in the auto-cruise vacuum pump or actuator may be present.	• Malfunction of the vehicle speed sensor. • Malfunction of the auto-cruise vacuum pump. • Malfunction of the actuator. • Malfunction of the auto-cruise control-ECU.



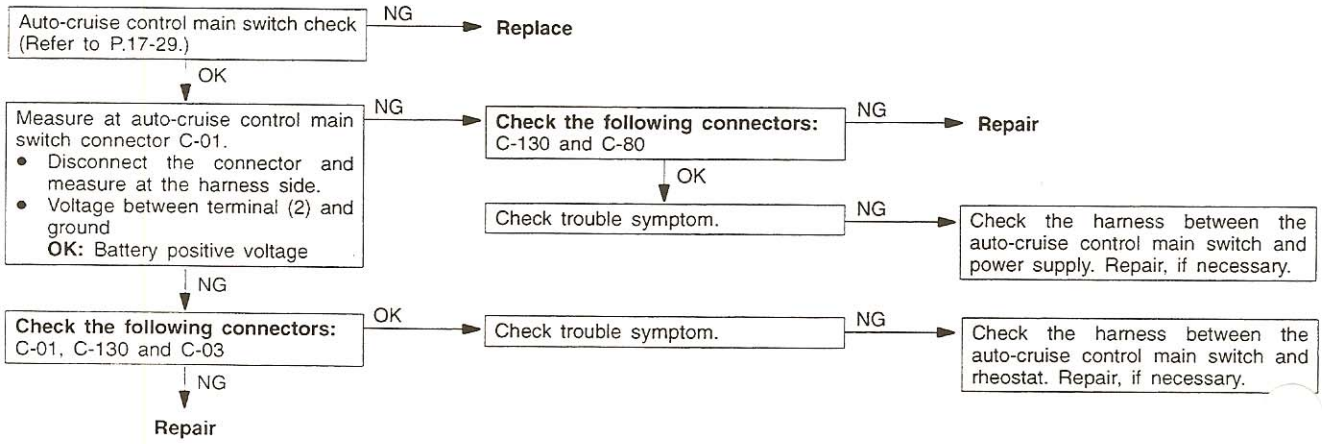
INSPECTION PROCEDURE 10

When the auto-cruise control main switch is ON, the switch indicator on the instrument panel does not illuminate. (However, auto-cruise control is normal.)	Probable cause
[Comment] Blown bulb in auto-cruise control main switch.	• Malfunction of the auto-cruise control main switch.

Replace the auto-cruise control main switch.

INSPECTION PROCEDURE 11

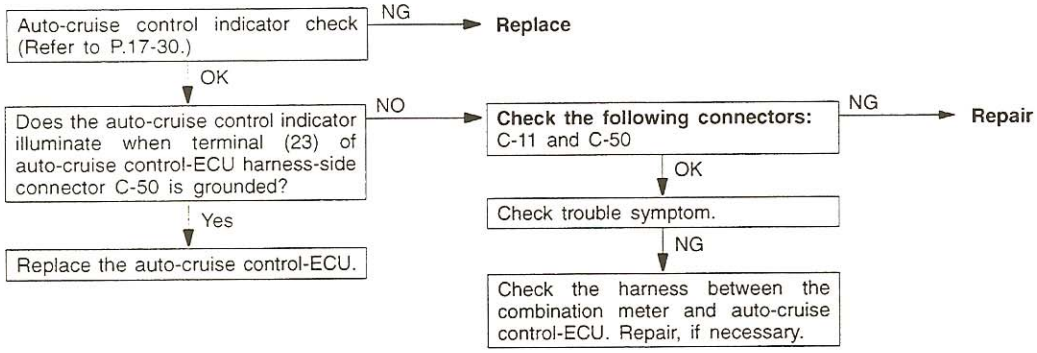
Auto-cruise control main switch illumination light does not illuminate.	Probable cause
[Comment] A malfunction of auto-cruise control main switch, harness, or connector may exist.	• Malfunction of the auto-cruise control main switch. • Malfunction of the connector. • Malfunction of the harness.



TSB Revision

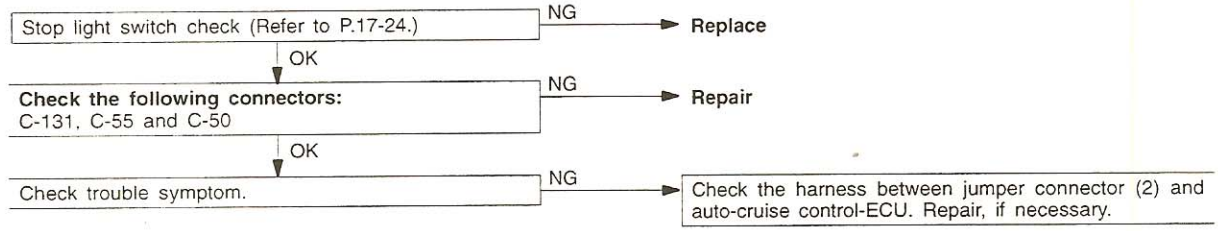
INSPECTION PROCEDURE 12

Auto-cruise control indicator inside combination meter does not illuminate. (However, auto-cruise control is normal.)	Probable cause
[Comment] A malfunction of the bulb, the connector or harness may be present.	• Malfunction of the bulb. • Malfunction of the harness. • Malfunction of the connector. • Malfunction of the auto-cruise control-ECU.



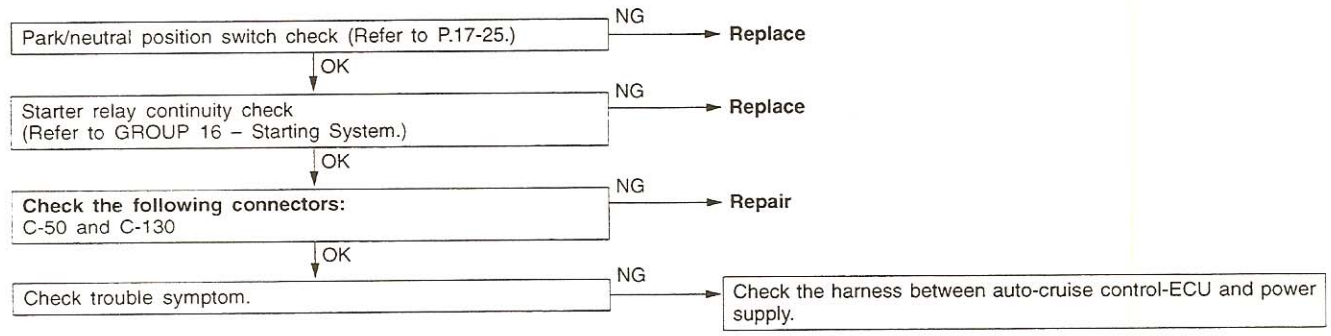
INSPECTION PROCEDURE 13

Stop light switch input circuit system check (Code No. 23)



INSPECTION PROCEDURE 14

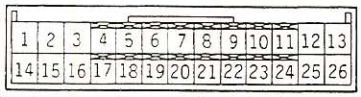
Park/neutral position switch input circuit system check (Code No. 26)



TSB Revision

CHECK AT THE ECU TERMINALS

17200270152



03X0097

Terminal No.	Check item	Check conditions		Normal condition
1	Park/neutral position switch input	When selector lever is in a position other than N range	When park/neutral position switch is OFF	Battery positive voltage
		When selector lever is in N range	When park/neutral position switch is ON	0 V
2	ECU power supply	When ignition switch is ON		Battery positive voltage
3	Power supply for OD signal control	When ignition switch is ON		Battery positive voltage
4	Closed throttle position switch output	When accelerator pedal is depressed	When closed throttle position switch is OFF	4.5 – 5.5 V
		When accelerator pedal is not depressed	When closed throttle position switch is ON	0 V
5	Throttle position sensor input	When accelerator pedal is fully depressed		4.0 – 5.5 V
		When accelerator pedal is released		0.5 – 0.7 V
6	Ground	At all times		Continuity
8	Ground	At all times		Continuity
10	OD control signal	OD-OFF request		4 V or more
		No OD-OFF request		0 – 1 V
12	Auto-cruise vacuum pump release valve and control valve input	When driving at constant speed using the SET switch	Release valve closed	0 V
13			Control valve closed	0 V
12		When accelerating with the RESUME switch while driving at constant speed	Release valve closed	0 V
13			Release valve closed	0 V
12		When decelerating with the SET switch while driving at constant speed	Release valve closed	0 V
13			Control valve open	Battery positive voltage
12		When canceling constant speed driving with the CANCEL switch	Release valve open	Battery positive voltage
13			Control valve open	Battery positive voltage
14	Ground	At all times		Continuity
15	Stop light switch input	When brake pedal is depressed	When stop light switch is ON	Battery positive voltage
		When brake pedal is not depressed	When stop light switch is OFF	0 V
16	ECU backup power supply	At all times		Battery posit. voltage

TSB Revision

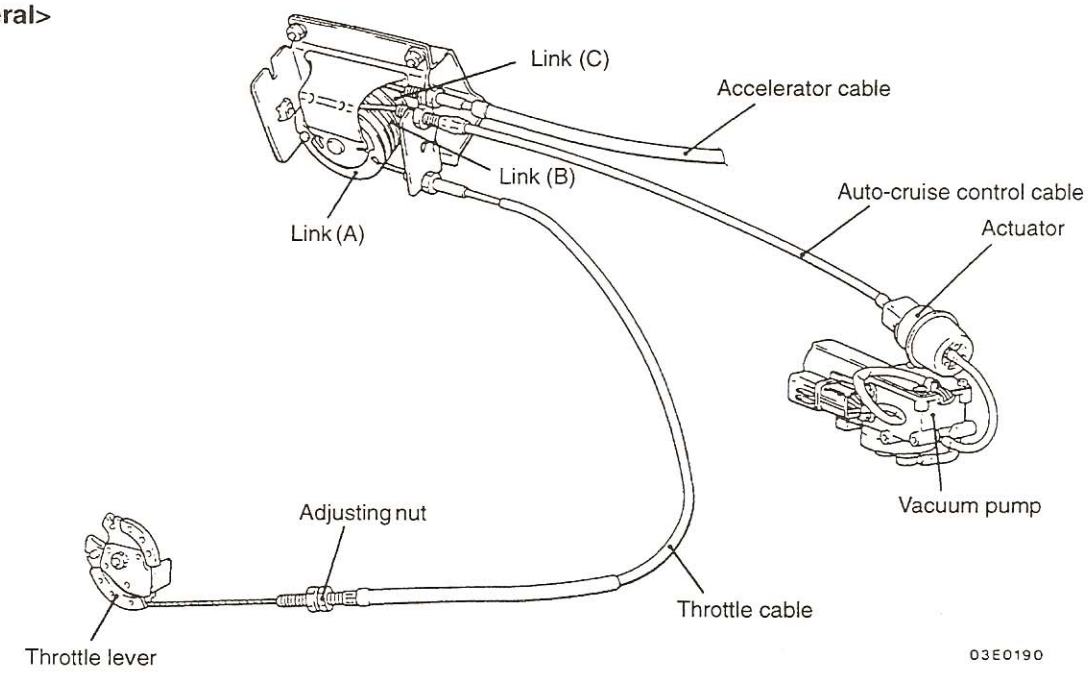
Terminal No.	Check item	Check conditions		Normal condition
18	Auto-cruise control switch input	When SET switch is pressed	When SET switch is ON	3 V
		When SET switch is not pressed	When SET switch is OFF	0 V
		When RESUME switch is pressed	When RESUME switch is ON	6 V
		When RESUME switch is not pressed	When RESUME switch is OFF	0 V
		When CANCEL switch is pressed	When CANCEL switch is ON	Battery positive voltage
		When CANCEL switch is not pressed	When CANCEL switch is OFF	0 V
19	Vehicle speed sensor input	When vehicle is moved forwards and backwards, sensor turns ON and OFF repeatedly.	When sensor is ON	0 V
			When sensor is OFF	4.5 V or more
20	ACC power supply	When ignition switch is in ACC position		Battery positive voltage
23	Indicator input (inside combination meter)	When driving at constant speed	When indicator is illuminated	0 V
		When constant speed driving is cancelled	When indicator is switched off	Battery positive voltage
24	Diagnosis control input	When ignition switch is ON		4 V or more
25	Surge absorption circuit terminal	When auto-cruise main switch is ON		Battery positive voltage
26	Auto-cruise vacuum pump motor input	When driving at constant speed using the SET switch	Motor stopped	Battery positive voltage
		When accelerating with the RESUME switch while driving at constant speed	Motor running	0 V
		When decelerating with the SET switch while driving at constant speed	Motor stopped	Battery positive voltage
		When cancelling constant speed driving with the CANCEL switch	Motor stopped	Battery positive voltage

ON-VEHICLE SERVICE

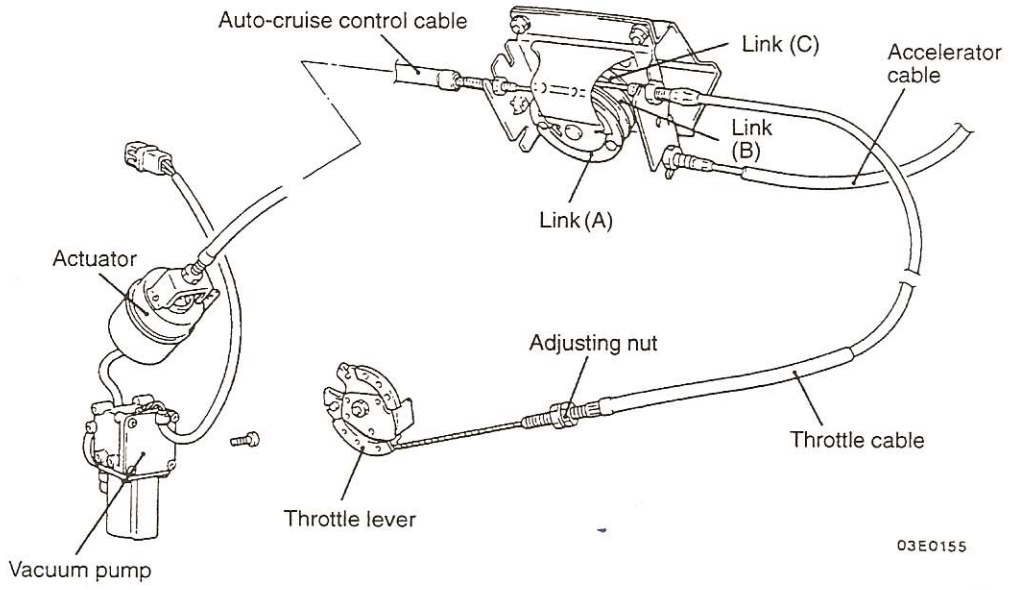
17200090253

AUTO-CRUISE CONTROL CABLE CHECK AND ADJUSTMENT

<For Federal>

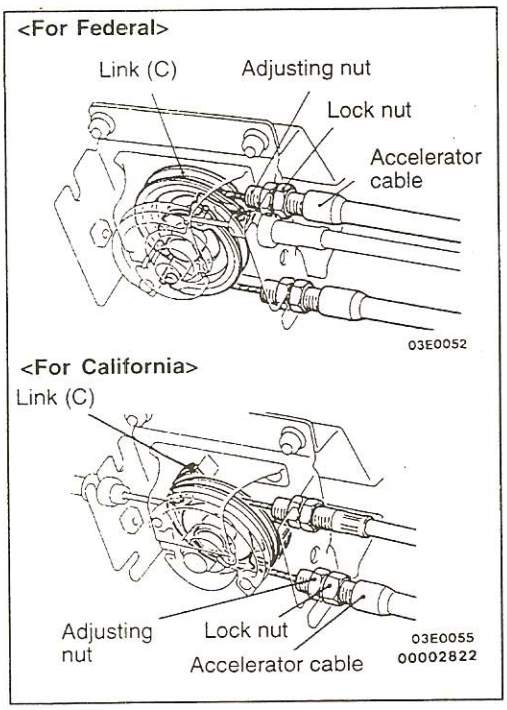


<For California>



(1) Remove the link protector. (Refer to P.17-26.)
(2) Check if there is any deflection in the inner cables of the accelerator cable, cruise control cable and throttle cable.
If there is excessive deflection or no play in an i cable, loosen the adjusting bolts and nuts to release e link from the throttle lever.
(Do not remove the adjusting bolts or nuts.)

TSB Revision

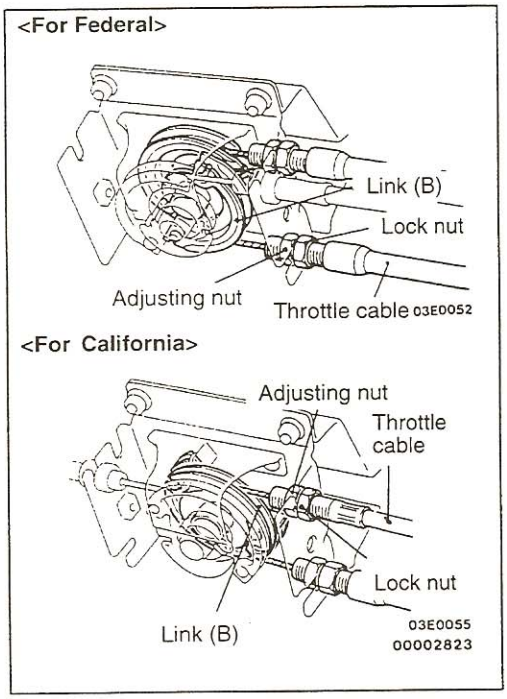


Accelerator Cable

(1) While holding link (C) so that it is touching the stopper, adjust the play of the accelerator cable with the adjusting nut so that the cable play is at the standard value.

Standard value
ELC-4A/T 2 – 3 mm (.08 – .12 in.)

(2) After adjusting, secure the cable with the lock nut.

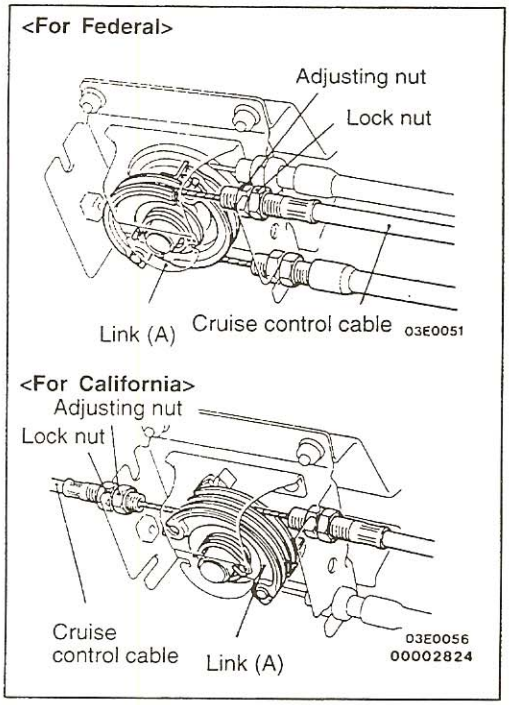


Throttle Cable

(1) While holding link (B) so that it is touching link (C), adjust the play of the throttle cable with the adjusting nut and adjusting bolts <throttle lever side> so that the cable play is at the standard value.

Standard value: 1 – 2 mm (.04 – .08 in.)

(2) After adjusting, secure the cable with the lock nut.

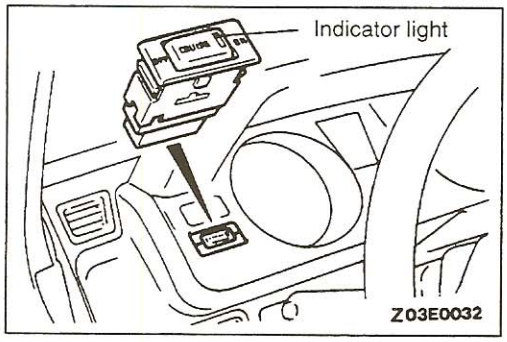


Auto-cruise Control Cable

(1) While holding link (A) so that it is touching link (B), ac the play of the cruise control cable with the adjusting nut so that the cable play is at the standard value.

Standard value: 1 – 2 mm (.04 – .08 in.)

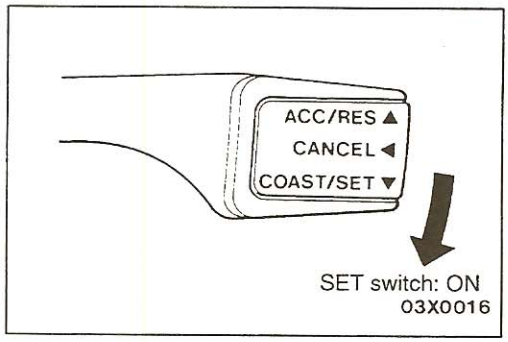
(2) After adjusting, secure the cable with the lock nut.



AUTO-CRUISE CONTROL MAIN SWITCH CHECK

17200110065

(1) Turn the ignition switch to ON.
(2) Check that the indicator light within the switch illumina when the main switch is turned to ON.



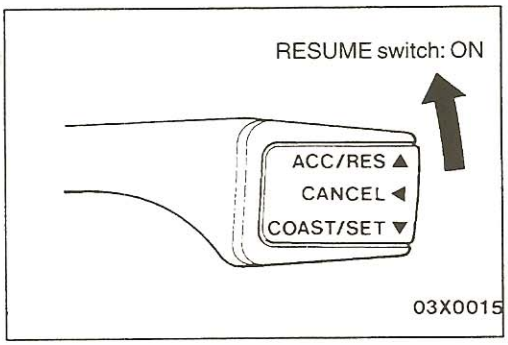
AUTO-CRUISE CONTROL SWITCH CHECK

17200120181

Cruise Control Setting Check

(1) Switch ON the main switch.
(2) Drive at the desired speed above approximately 40 km/h (25 mph).
(3) Turn the control switch to the SET position.
(4) Check that when the switch is released the speed is the desired constant speed.

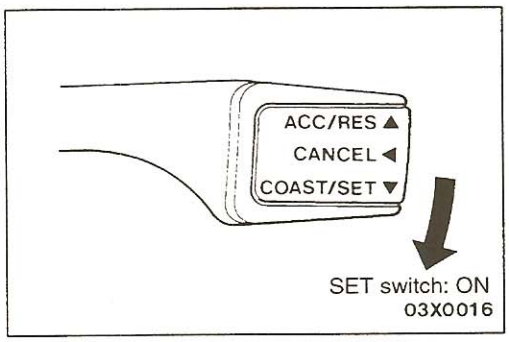
NOTE
If the vehicle speed decreases to approximately 15 km/h (9 mph) below the set speed, because of climbing a hill for example, the cruise control will be canceled.



Speed Increase Setting Check

(1) Set to the desired speed.
(2) Turn the control switch to RESUME.
(3) Check that acceleration continues while the switch is pressed, and that after it is released the constant speed at the time when it was released becomes the driving speed.

NOTE
Even if, during acceleration, the vehicle speed reaches or exceeds the high limit [approximately 200 km/h (124 mph)], acceleration will continue, however, when the switch is released, the set speed ("memorized speed") will become the high limit of the vehicle speed.



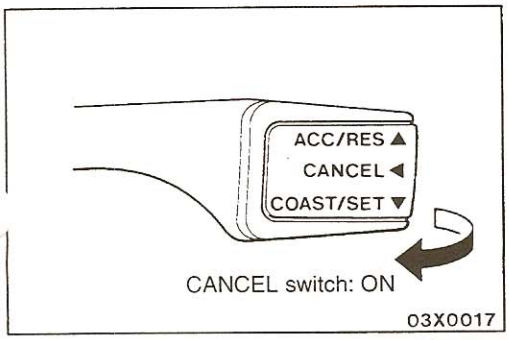
Speed Reduction Setting Check

(1) Set to the desired speed.
(2) Turn the control switch to SET.
(3) Check that deceleration continues while the switch is pressed, and that after it is released the constant speed at the time when it was released becomes the driving speed.

NOTE
When the vehicle speed reaches the low limit [approximately 40 km/h (25 mph)] during deceleration, the automatic speed control will be canceled.

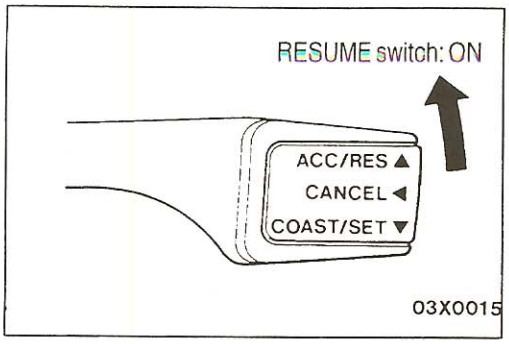
Auto-cruise Control Cancellation Check and Check of Return to the Set Speed Before Cancellation

(1) Set the cruise speed control.
(2) Check that there is a return to ordinary driving when either of the operations below is performed.

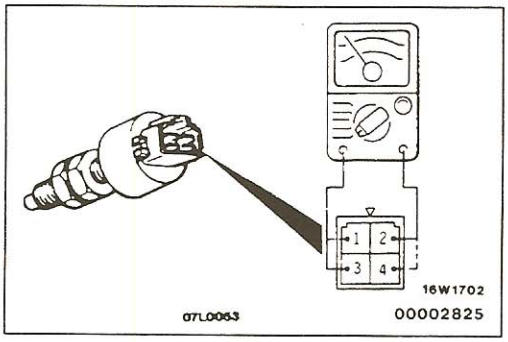


1) The cruise control switch is turned to CANCEL.
2) The brake pedal is depressed.
3) The selector lever is at "N".

TSB Revision



(3) Turn the control switch to RESUME while driving at a vehicle speed of approximately 40 km/h (25 mph) or hi[and check that there is a return to the cruise co[speed before the function is canceled and the vehicle travels at a constant speed.
(4) When driving at constant speed, check that the vehicle returns to the normal driving condition when the main switch is turned to OFF.



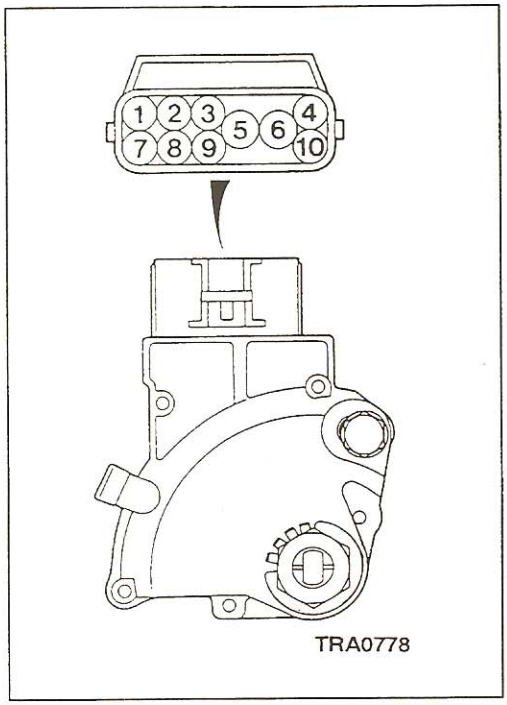
AUTO-CRUISE CONTROL COMPONENT CHECK

17200170285

Stop Light Switch/Brake Switch Check

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

Measurement conditions	Brake switch terminal		Stop light switch terminal	
Measurement conditions	1	4	2	3
When brake pedal is depressed			○—○	
When brake pedal is not depressed	○—○			



Park/Neutral Position Switch ("N" position) Check

(1) Disconnect the connector.
(2) Check to be sure that there is continuity between connector terminals (5) and (6) when the selector lever is moved to the "N" range.

Throttle Position Sensor Check

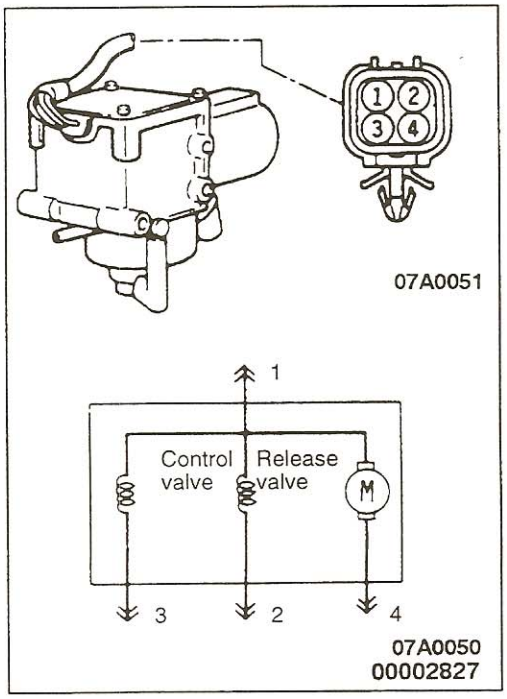
Refer to GROUP 13 – On-vehicle service.

Closed Throttle Position Switch Check

Refer to GROUP 13 – On-vehicle service.

Vehicle Speed Sensor Check

Refer to GROUP 54 – Meters and Gages.



Auto-cruise Vacuum Pump Check

<Solenoid valve (Control valve, Release valve)>

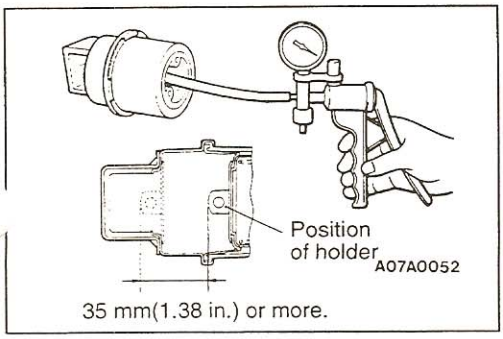
(1) Disconnect the cruise vacuum pump connector.
(2) Measure the resistance between terminals (1) – (2) and between (1) – (3).

Standard value: 50 – 60 Ω

(3) Check that the solenoid valve makes an operating noise when battery positive voltage is applied between terminals (1) – (2) and between (1) – (3).
(4) If there is a malfunction of the solenoid valve, replace the cruise vacuum pump assembly.

<Motor>

(1) Disconnect the cruise vacuum pump connector.
(2) Check that the motor operates when battery positive voltage is applied between terminals (1) – (4).



Actuator Check

(1) Remove the actuator.
(2) Apply negative pressure to the actuator with the vacuum pump and check that the holder moves more than 35 mm (1.38 in.). In addition, check that there is no change in the position of the holder when negative pressure is maintained in that condition.
(3) First install the actuator, and then inspect and adjust the cruise control cable. (Refer to P. 17-20.)

TSB Revision

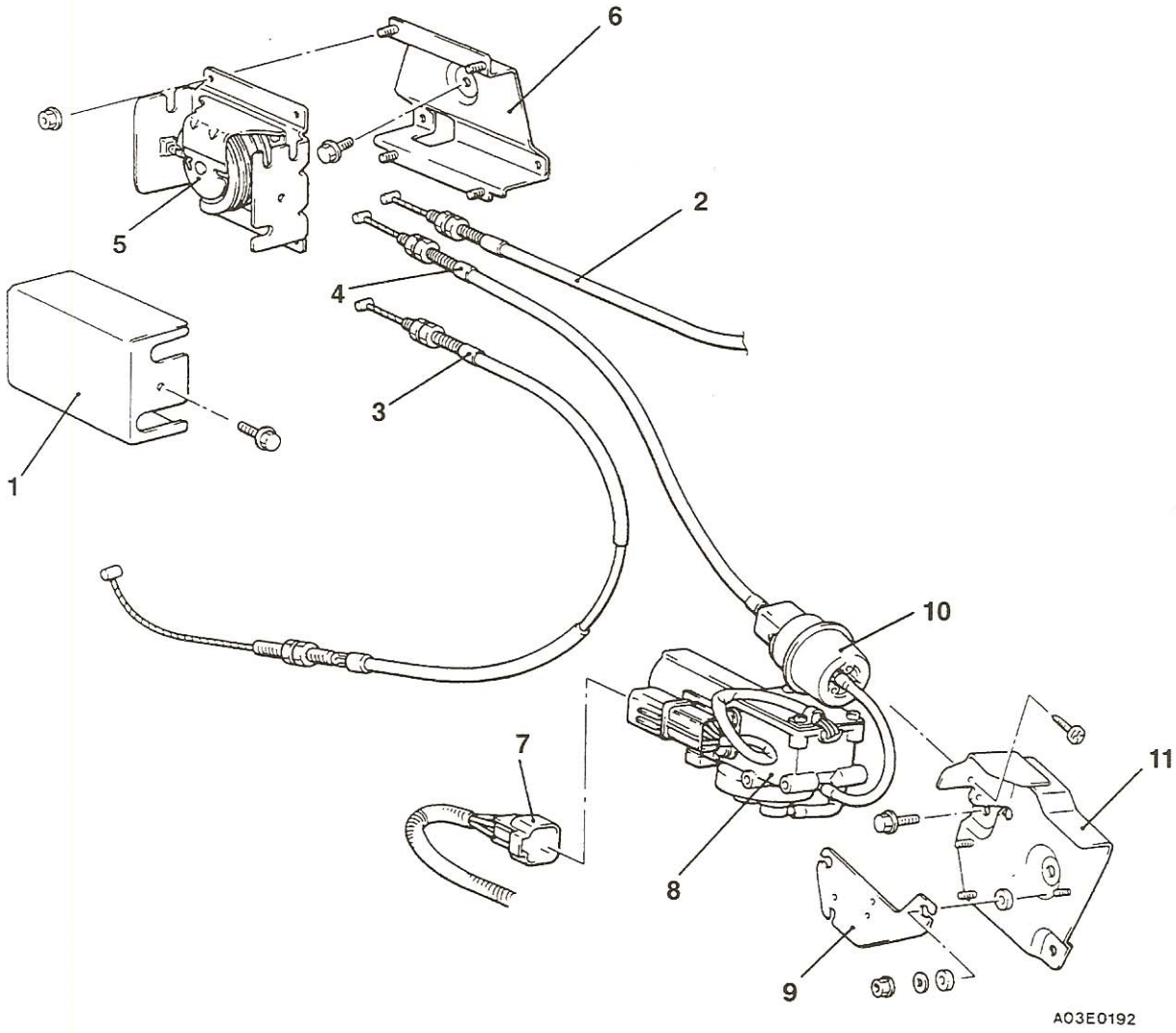
AUTO-CRUISE CONTROL

17200140000

REMOVAL AND INSTALLATION <LINK AND ACTUATOR>

Post-installation Operation
- Control Cables Adjustment (Refer to P.17-20.)

<For Federal>

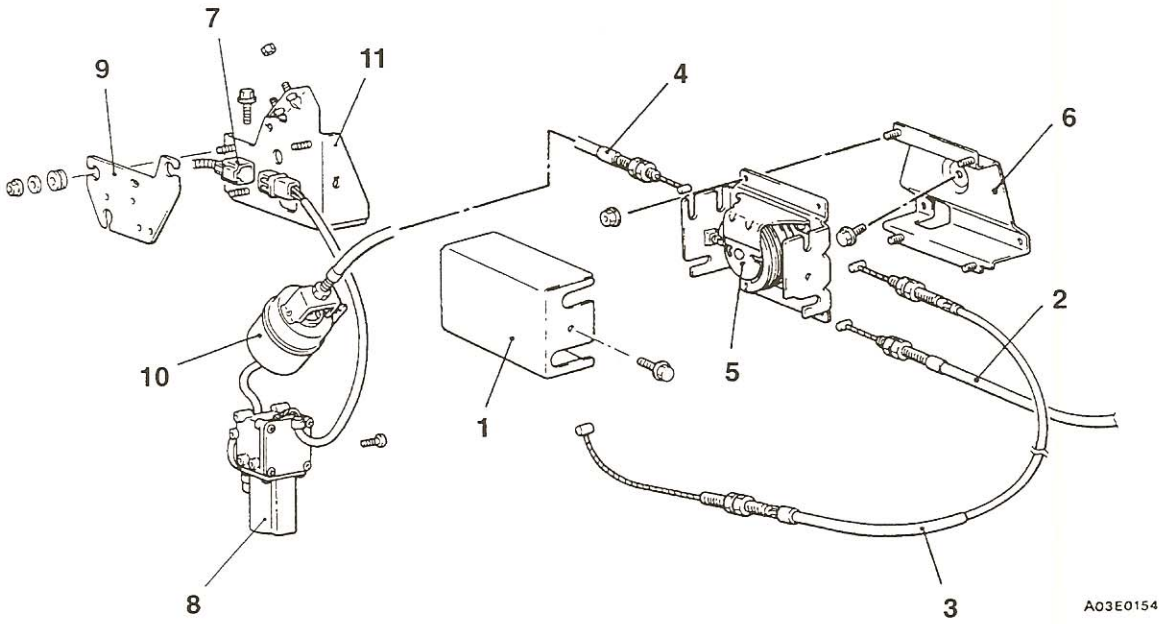


Intermediate link removal steps
1. Link protector
2. Accelerator cable and link connection
3. Throttle cable and link connection
4. Cruise control cable and link connection
5. Intermediate link
6. Link bracket

Actuator removal steps
4. Cruise control cable and link connection
7. Wiring connector
8. Vacuum pump
9. Pump bracket
10. Actuator
11. Actuator bracket

TSB Revision

<For California>



Intermediate link removal steps

1. Link protector
2. Accelerator cable and link connection
3. Throttle cable and link connection
4. Cruise control cable and link connection
5. Intermediate link
6. Link bracket

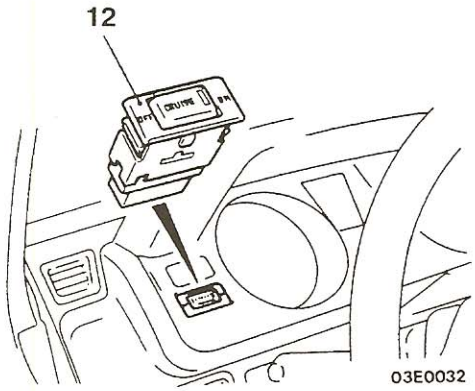
Actuator removal steps

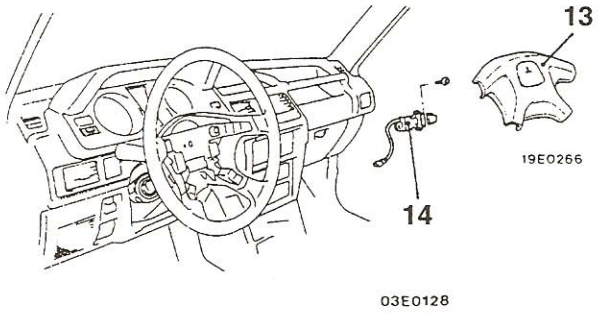
4. Cruise cable and link connection
7. Wiring connector
8. Vacuum pump
9. Pump bracket
10. Actuator
11. Actuator bracket

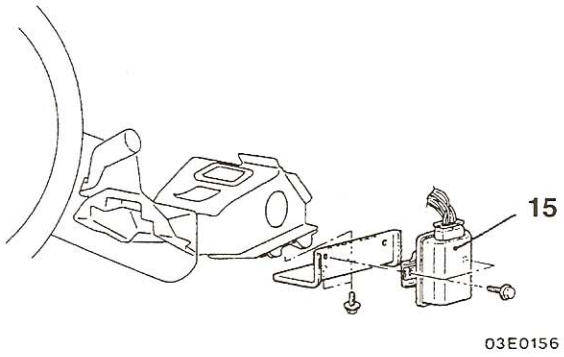
TSB Revision

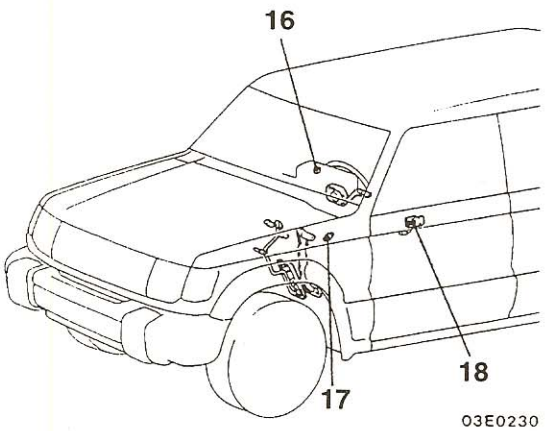
REMOVAL AND INSTALLATION <SWITCHES, CONTROL UNIT AND SENSORS>

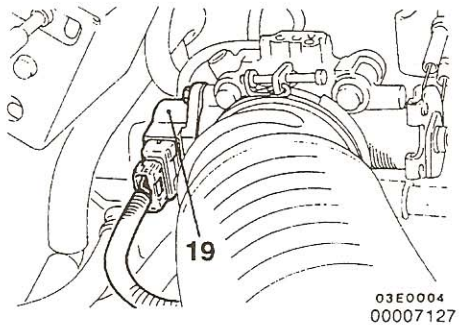
CAUTION: SRS
Before removal of air bag module, refer to GROUP 52B – SRS Service Precautions and GROUP 52B – Air Bag Module and Clock Spring.











Removal steps of switches

12. Main switch
13. Air bag module (Refer to GROUP 52B – Air Bag Module and Clock Spring.)
14. Control switch

Removal steps of control unit

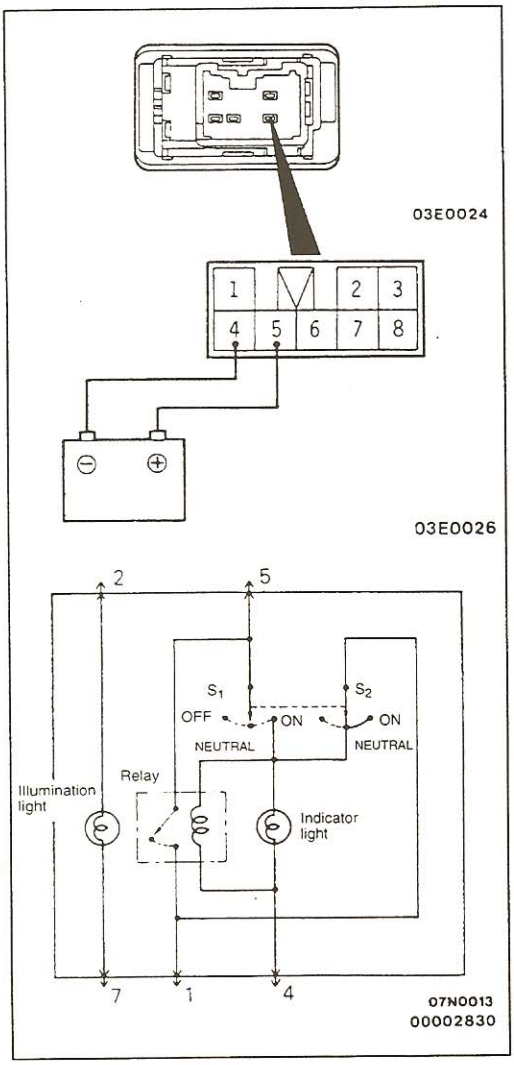
- Instrument panel (Refer to GROUP 52 – Instrument Panel.)

15. Control unit

Removal steps of sensors

16. Vehicle speed sensor (reed switch) (Refer to GROUP 54 – Meters and Gages.)
17. Stop light switch
18. Park/Neutral position switch
19. TPS (Throttle position sensor)

TSB Revision



INSPECTION

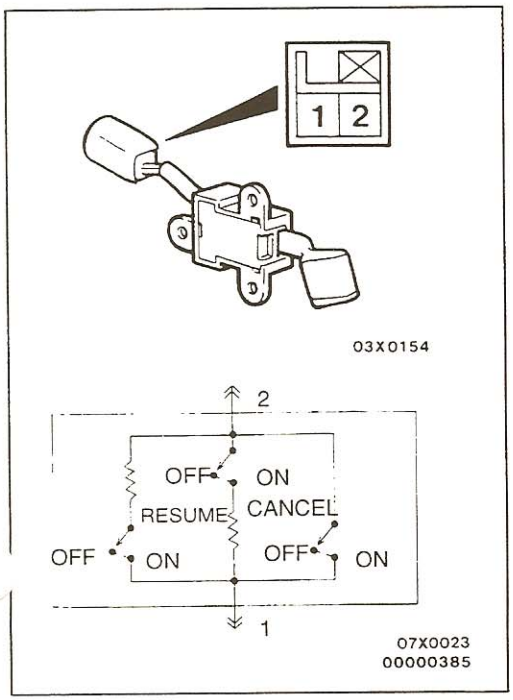
17200110072

AUTO-CRUISE CONTROL MAIN SWITCH CHECK

(1) Operate the main switch and check the continuity between the terminals.

Switch state	Terminal					
Switch state	2	Illumination	7	5	1	4
Pressed to OFF	○	⌀	○			
Neutral position	○	⌀	○		○	○
Pressed to ON	○	⌀	○	○		○

(2) Connect the positive battery terminal to terminal (5) and the negative battery terminal to terminal (4), and then check that there is battery positive voltage between terminal (1) and the ground when the main switch is turned to ON and during the period before it is turned to OFF. Check that the battery positive voltage between terminal (1) and the ground is reduced to 0 V when the main switch is turned to OFF.



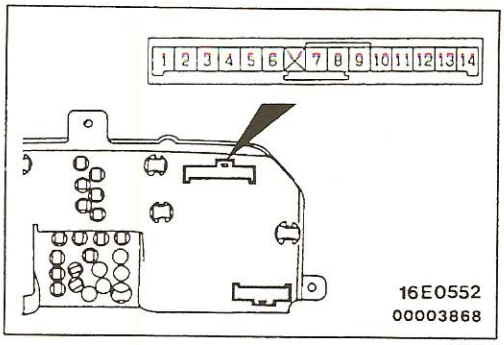
AUTO-CRUISE CONTROL SWITCH CHECK

17200120075

Disconnect the connector of the control switch and operate the control switch to measure the resistance between the individual terminals.
If the readings are as shown below, the control switch may be considered good.

Switch operation	Resistance between terminals
When the switch is not operated	No continuity
When the switch is turned to CANCEL	Approx. 0 Ω
When the switch is turned to RESUME	Approx. 820 Ω
When the switch is turned to SET	Approx. 2,700 Ω

TSB Revision



AUTO-CRUISE CONTROL INDICATOR LIGHT CHECK

17200

(1) Remove the combination meter.
(Refer to GROUP 54 – Combination meter.)
(2) Check the continuity between terminals (4) and (5).
If there is no continuity, replace the auto-cruise control indicator bulb.

CLOCK SPRING CHECK

17200180073

Refer to GROUP 52B – Air Bag Module and Clock Spring.

ENGINE EMISSION CONTROL

17300020064

GENERAL SPECIFICATIONS

Positive crankcase ventilation system		Closed type with positive crankcase ventilation valve
Evaporative emission control system (Canister storage type)	Canister	Charcoal type
	Evaporative emission purge solenoid	Duty cycle solenoid valve
Exhaust gas recirculation system <Federal>	EGR valve	Vacuum-activated diaphragm type
	EGR solenoid	Duty cycle solenoid valve
Three-way catalytic converter		Monolith type

SERVICE SPECIFICATIONS

17300030203

Items	Specifications
Evaporative emission purge solenoid coil resistance Ω	36 – 44 [at 20°C (68°F)]
EGR solenoid coil resistance Ω	36 – 44 [at 20°C (68°F)]

SPECIAL TOOL

17300060141

Tool	Tool number and name	Supersession	Application
	MB995061 Purge flow indicator	–	Inspection of purge control system

TROUBLESHOOTING

17300070069

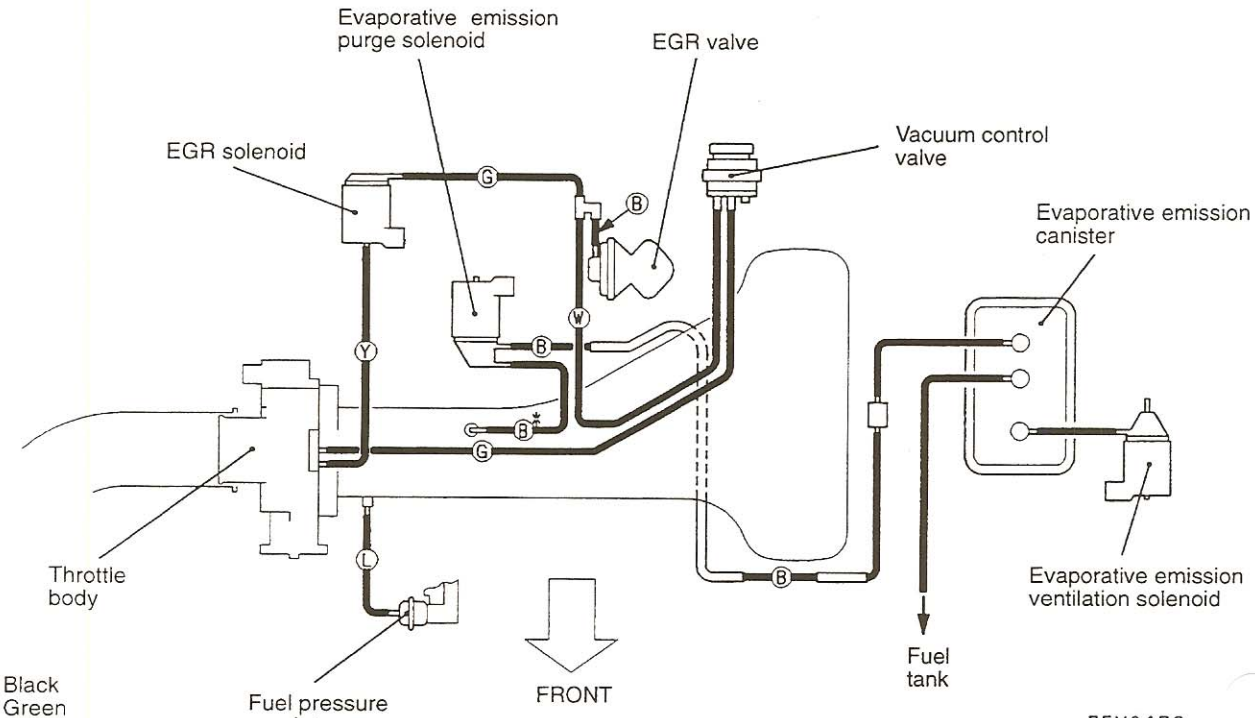
Trouble Symptom	Probable Cause	Remedy
Engine will not start or is hard to start	Disconnected or damaged vacuum hoses	Repair or replace
	The EGR valve is not closed.	Repair or replace
	Malfunction of evaporative emission purge solenoid	Repair or replace
Rough idle or engine stalls	Disconnected or damaged vacuum hoses	Repair or replace
	The EGR valve is not closed.	Repair or replace
	Malfunction of positive crankcase ventilation system	Replace
	Malfunction of purge control system	Check the system. If there is a problem, check its component parts.
Excessive oil consumption	Clogged positive crankcase ventilation line	Check the positive crankcase ventilation system
Engine hesitates or poor acceleration	Malfunction of the exhaust gas recirculation system	Check the system; if there is a problem, check its component parts.
Poor fuel mileage	Malfunction of the exhaust gas recirculation system	Check the system; if there is a problem, check its component parts.

TSB Revision

VACUUM HOSES

17300090423

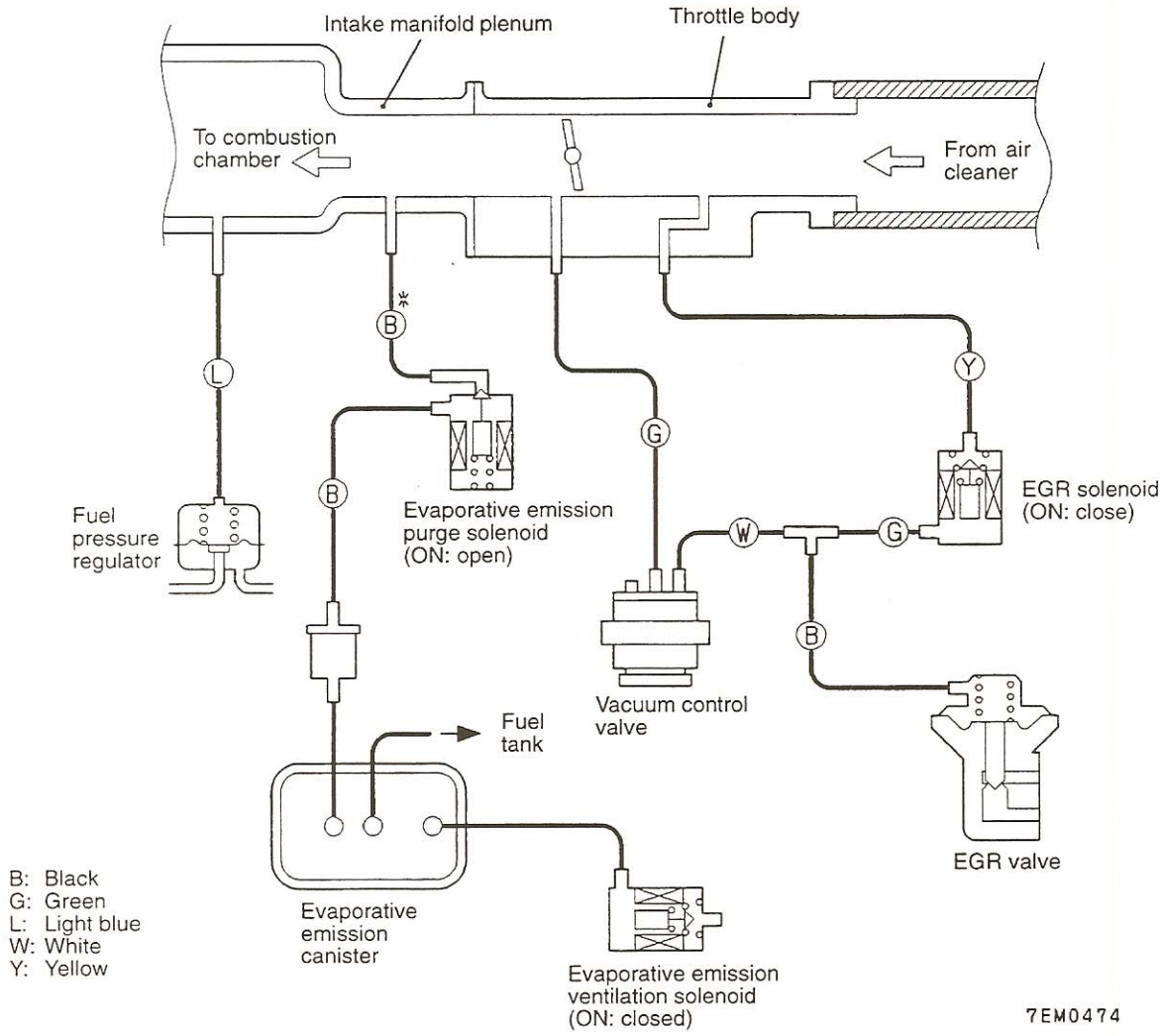
VACUUM HOSE ROUTING



B: Black
G: Green
L: Light blue
W: White
Y: Yellow
*: With red-paint mark

TSB Revision

VACUUM CIRCUIT DIAGRAM



VACUUM HOSE CHECK

(1) Referring to the VACUUM HOSES ROUTING, confirm that the vacuum hoses are properly connected.
(2) Check the hoses for irregularities (disconnection, looseness, etc.) and confirm that there is no breakage or damage.

VACUUM HOSE INSTALLATION

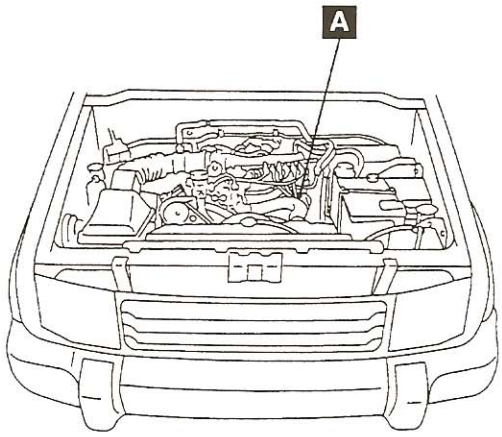
(1) When connecting a hose, firmly press it onto the nipple.
(2) Referring to the VACUUM HOSES ROUTING, connect the hoses correctly.

TSB Revision

POSITIVE CRANKCASE VENTILATION SYSTEM

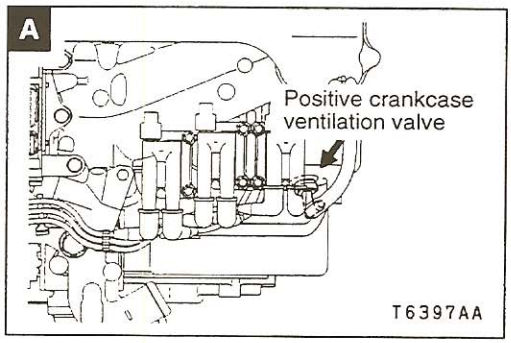
17300500123

COMPONENT LOCATION



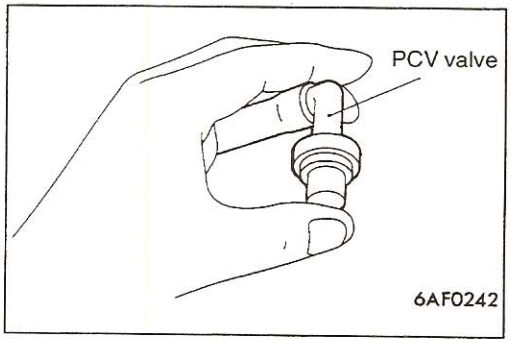
7EM0445

Name	Symbol
Positive crankcase ventilation valve	A



CRANKCASE VENTILATION SYSTEM CHECK

17300110181



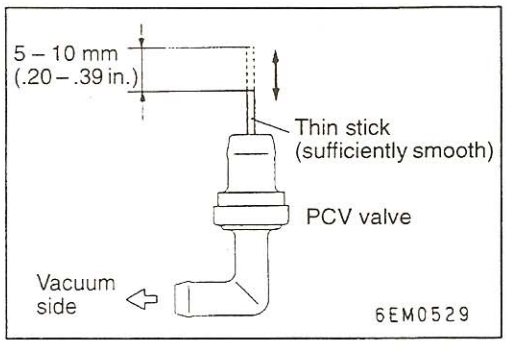
(1) Remove the positive crankcase ventilation (PCV) valve from the rocker cover, then reconnect the PCV valve to the vacuum supply hose.

(2) With the engine idling, put finger on the open end of the PCV valve, and check for negative pressure (vacuum) with finger.

NOTE
At this time, the plunger in the PCV valve should m back and forth as the open end is covered and uncove

(3) If negative pressure is not felt, clean or replace the PCV valve. Inspect the vacuum supply hose and its port for restriction or plugged condition.

TSB Revision



POSITIVE CRANKCASE VENTILATION (PCV) VALVE CHECK

17300120160

(1) Hold the PCV valve with the vacuum side down. Using light pressure, depress the PCV valve spring with the thin stick 5 – 10 mm (.20 – .39 in.). Release pressure on the stick to see if the PCV valve spring will lift the stick to its original position.
(2) If the stick returns quickly to its original position, the PCV valve is OK. If the stick does not return quickly, clean or replace the PCV valve.

EVAPORATIVE EMISSION CONTROL SYSTEM

17300510479

GENERAL INFORMATION

The evaporative emission control system prevents fuel vapors generated in the fuel tank from escaping into the atmosphere.

Fuel vapors from the fuel tank flow through the fuel tank pressure control valve and vapor pipe/hose to be stored temporarily in the EVAP canister.

When the vehicle is in operation, fuel vapors stored in the EVAP canister flow through the EVAP purge solenoid and purge port and go into the intake manifold plenum to be sent to the combustion chamber.

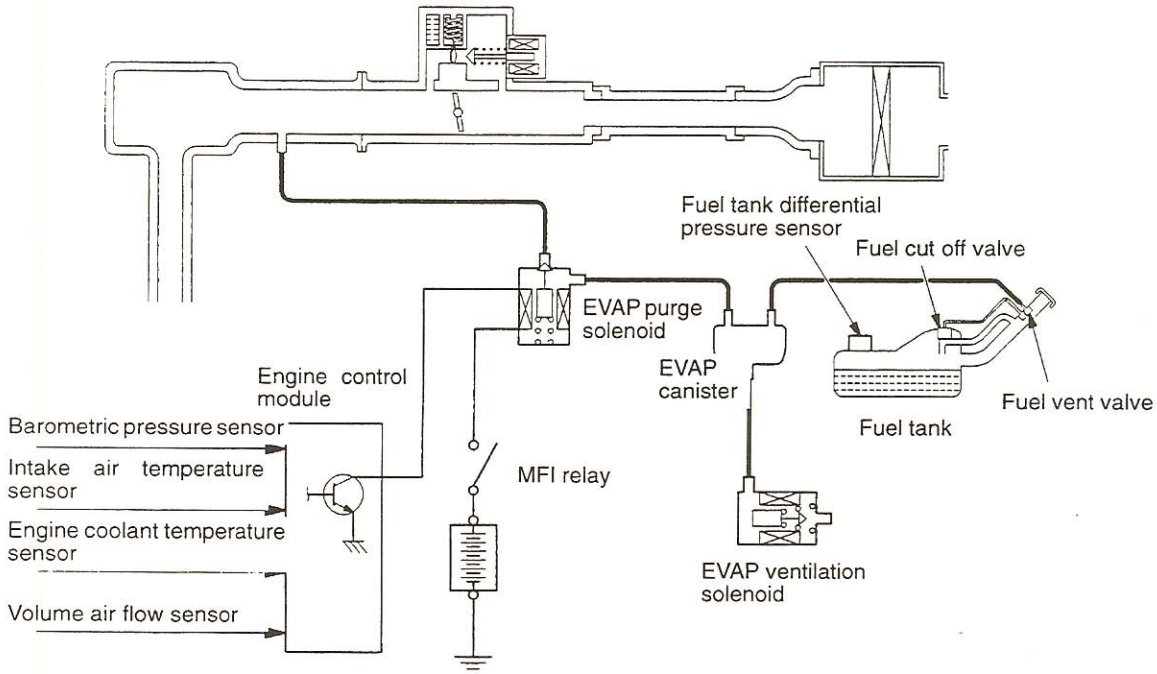
When the engine coolant temperature is low or when the intake air quantity is small (when the engine is at idle, for example), the engine control module brings the EVAP purge solenoid into the OFF state to shut off the fuel vapor flow to the intake manifold plenum. This does not only insure the driveability when the engine is cold or running under low load but also stabilize the emission level.

Furthermore, an EVAP ventilation solenoid is located between the EVAP canister and the atmosphere in order to carry out OBD-II EVAP leak monitoring.

This solenoid is normally off, but turns on during OBD-II EVAP leak monitoring to shut off the flow of air into the EVAP canister from the atmosphere.

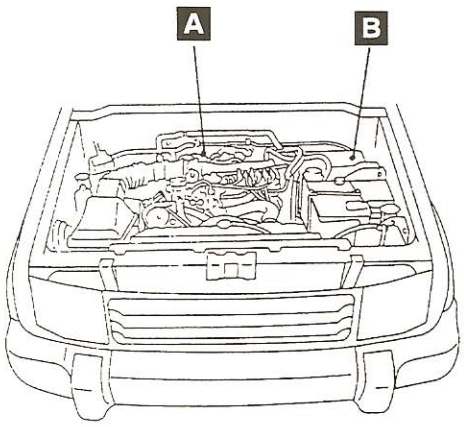
In addition, the fuel filler tube is provided with a fuel vent valve to prevent the fuel from overflowing when filling the fuel tank.

SYSTEM DIAGRAM

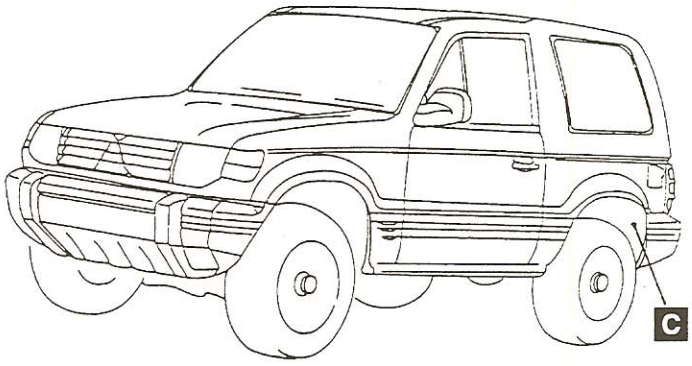


TSB Revision

COMPONENT LOCATION



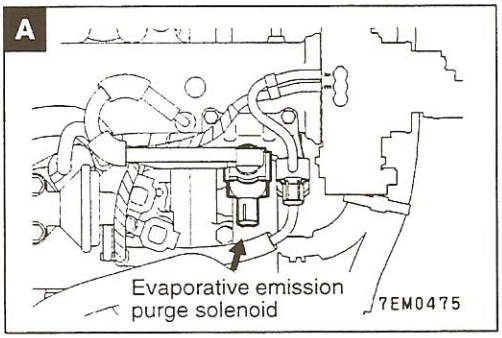
16E1432

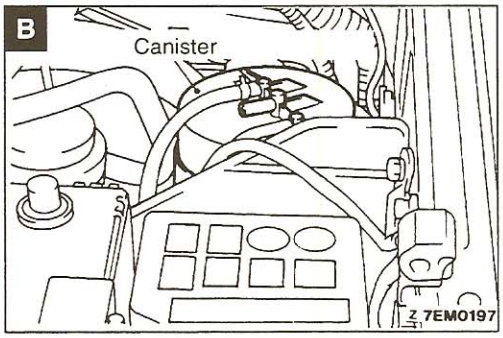


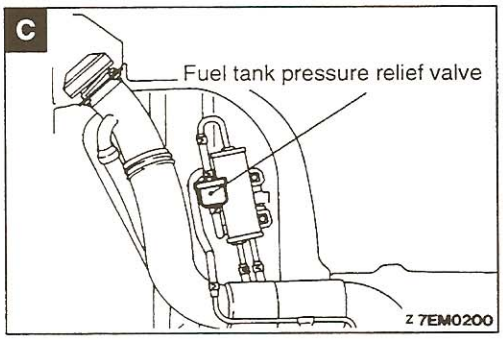
7EM0196

7EM0446

Name	Symbol	Name	Symbol
Canister	B	Fuel tank pressure relief valve	C
Evaporative emission purge solenoid	A		



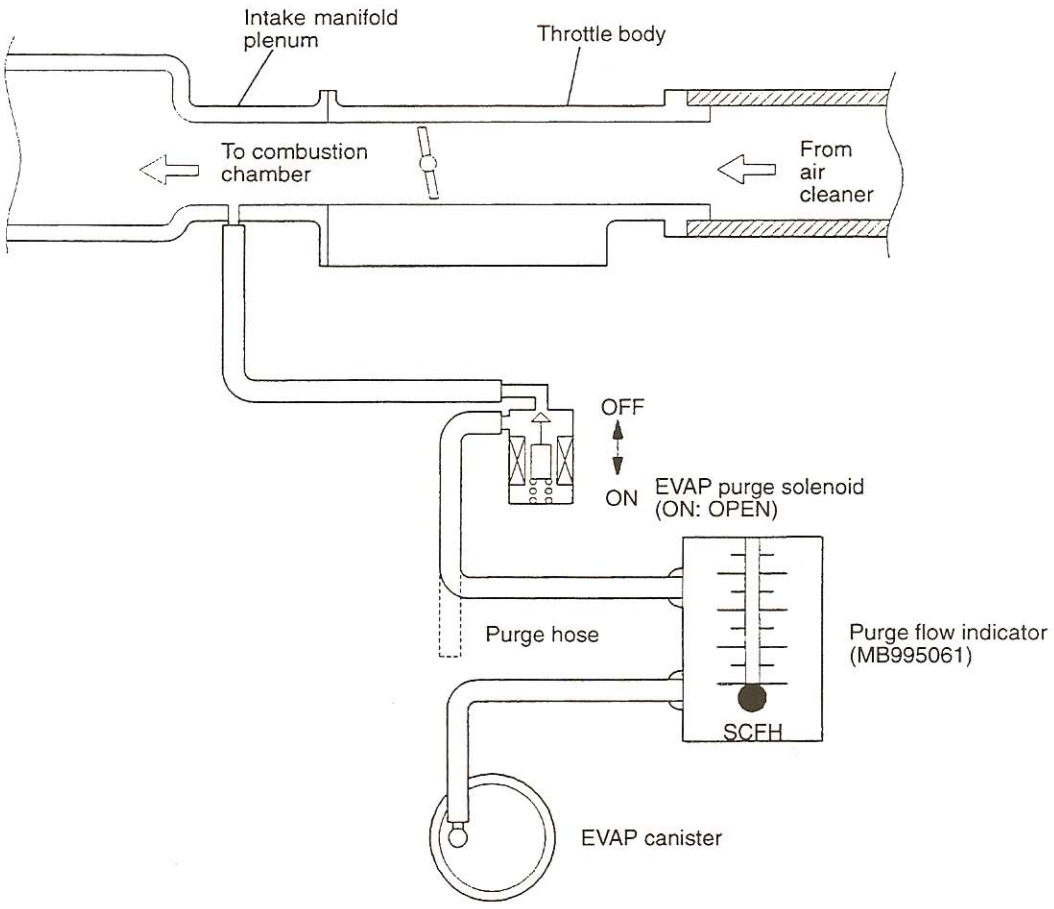




TSB Revision

PURGE CONTROL SYSTEM CHECK (PURGE FLOW CHECK)

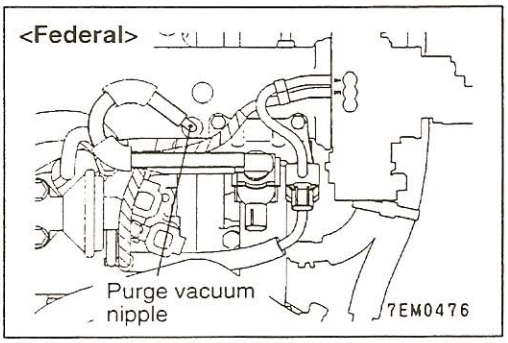
17300140470



1. Disconnect the purge hose from the evaporative emission (EVAP) canister, and connect the the special tool (purge flow indicator) between the EVAP canister and the purge hose.
2. Before inspection and adjustment, set the vehicle in the following conditions:
   - Engine coolant temperature: 80 – 95°C (176 – 203°F)
   - Lights, cooling fan and accessories: OFF
   - Transmission: P range
3. Run the engine at idle for more than four minutes.
4. Race the engine suddenly several times, and check the purge flow amount.

   Standard value: 20 cm^3/sec (2.5 SCFH) or more
5. If the purge flow amount is less than the standard value, disconnect the vacuum hose from the EVAP canister and carry out the check again.
   If the purge flow amount is less than the standard value, check the evaporative emission purge solenoid, vacuum port and vacuum hose for clogging.
   If the purge flow amount meets the standard value, the EVAP canister should be replaced.

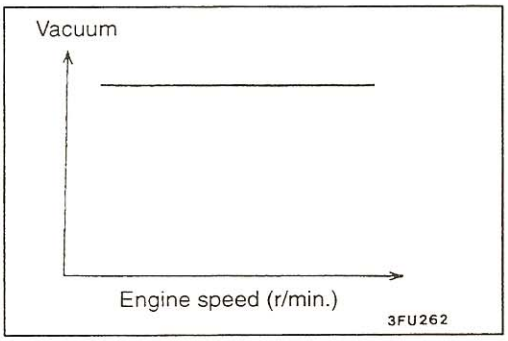
TSB Revision



PURGE PORT VACUUM CHECK

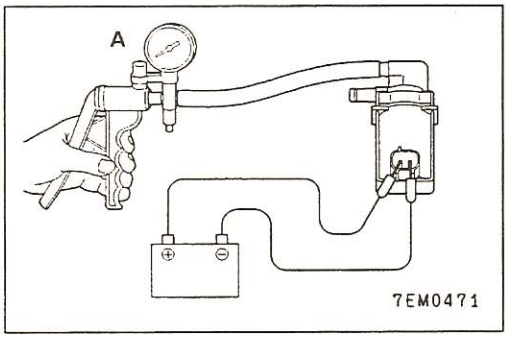
17300150367

(1) Disconnect the vacuum hose (black) from the air intake fitting vacuum nipple and connect a hand vacuum pump to the nipple.



(2) Start the engine and check to see that, after raising the engine speed by racing the engine, purge vacuum is kept constant regardless of the increased engine speed.

NOTE
If there is no vacuum created, it is possible that the throttle body purge port or intake air plenum port may be clogged and require cleaning.



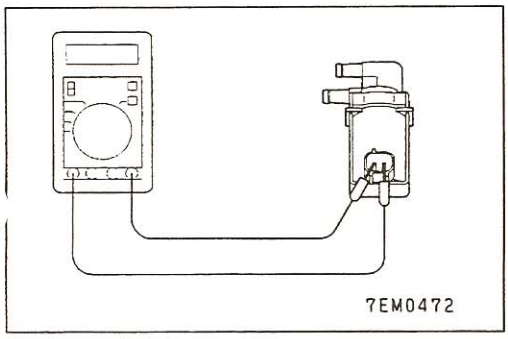
EVAPORATIVE EMISSION PURGE SOLENOID CHECK

17300170349

NOTE
When disconnecting the vacuum hose, make an identification mark on it so that it can be reconnected to the original position.

(1) Disconnect the vacuum hose from the solenoid valve.
(2) Disconnect the harness connectors.
(3) Connect a hand vacuum pump to nipple (A) of the solenoid valve (refer to the illustration at left).
(4) Apply a vacuum and check for air-tightness when voltage applied directly to the evaporative emission purge solenoid and when the voltage is discontinued.

Battery positive voltage	Normal condition
When applied	Negative pressure leaks.
When discontinued	Negative pressure is maintained.



(5) Measure the resistance between the terminals of the solenoid valve.

Standard value: 36 – 44 Ω [at 20 °C (68 °F)]

TSB Revision

VOLUME AIR FLOW SENSOR, ENGINE COOLANT TEMPERATURE SENSOR CHECK 17300

Refer to GROUP 13A – On-vehicle Inspection of MFI Components.

CANISTER 17300420093

REMOVAL AND INSTALLATION

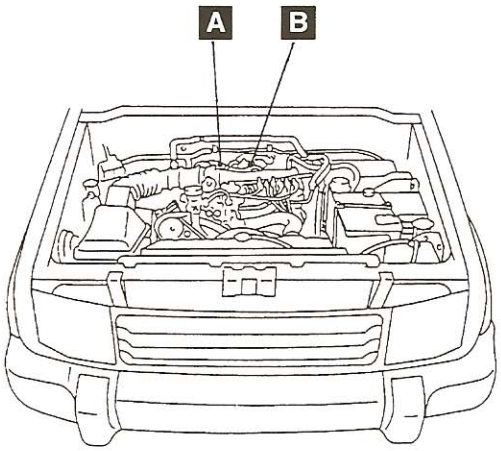
Refer to GROUP 13F – Fuel Line and Vapor Line

INSPECTION 17300430052

Check for damage, cracks for fusion and replace if faulty.

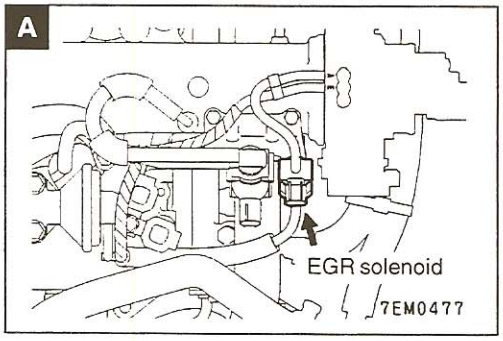
EXHAUST GAS RECIRCULATION (EGR) SYSTEM 17300520366

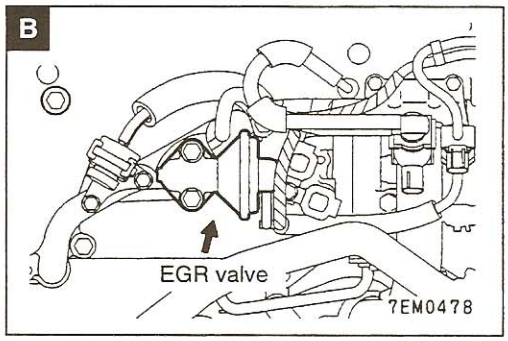
COMPONENT LOCATION



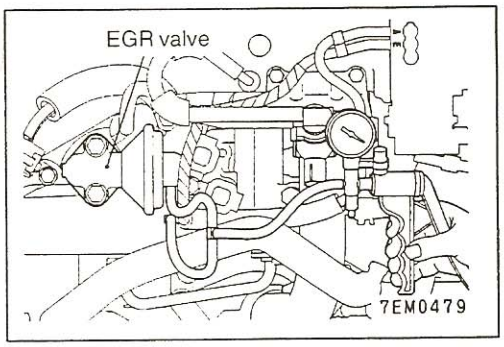
7EM0457

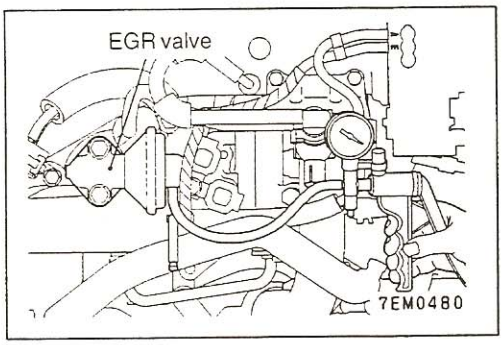
Name	Symbol	Name	Symbol
EGR solenoid	A	EGR valve	B





TSB Revision





EGR SYSTEM CHECK

17300260343

(1) Disconnect the green striped vacuum hose from the EGR valve, and using a three-way terminal, connect a hand vacuum pump as shown.

(2) Regarding cold condition [coolant temperature: 20°C (68°F) or less] and warm condition [coolant temperature: 70°C (158°F) or more] of the engine, check the following two points.

<Cold condition of engine>

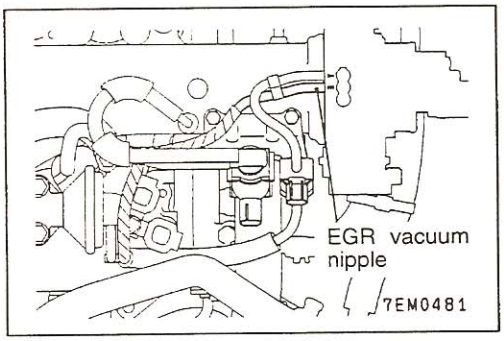
Engine operation	Normal state
Race the engine by rapidly press in the accelerator pedal.	The negative pressure does not vary. (Atmospheric pressure)

<Warm condition of engine>

Engine operation	Normal state
Race the engine by rapidly press in the accelerator pedal.	The negative pressure rises to 13 kPa (3.9 in. Hg) or more.

(3) Disconnect the three-way terminal, and connect the hand vacuum pump to the EGR valve.

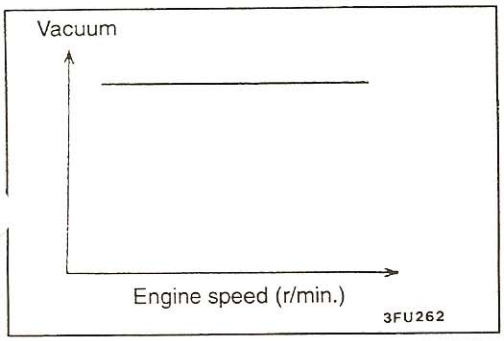
(4) When a negative pressure of 31 kPa (9.1 in.Hg) is applied during idling, check that the engine stops or idles unstably.



EGR VALVE CONTROL VACUUM CHECK

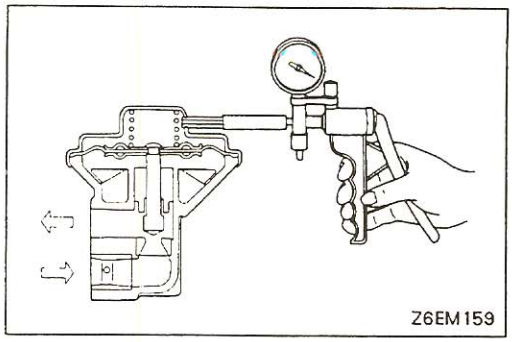
17300300076

(1) Disconnect the vacuum hose (green stripe) from the throttle body EGR vacuum nipple and connect a hand vacuum pump to the nipple.



(2) Start the engine and check to see that, after rapidly increasing engine rpm, vacuum remains fairly constant.

TSB Revision



EGR VALVE CHECK

17300280097

(1) Remove the EGR valve and check it for sticking, dep of carbon, etc.
If such condition exists, clean with adequate solvent to ensure tight valve seat contact.
(2) Connect a hand vacuum pump to EGR valve.
(3) Apply a vacuum of 67 kPa (19.7 in.Hg.) and check airtightness.
(4) Blow in air from one passage of the EGR to check condition as follows.

Applying vacuum	Applying vacuum
4.0 kPa (1.2 in.Hg.) or less	Air does not blow through
31 kPa (9.1 in.Hg.) or more	Air blows through

(5) Install a new gasket and EGR valve, tighten bolts to specified torque.

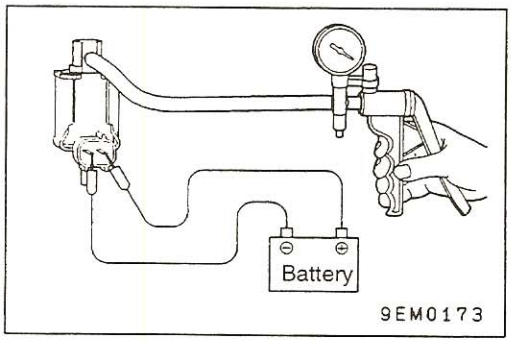
Specified tightening torque: 22 Nm (16 ft.lbs.)

EGR SOLENOID CHECK

17300310185

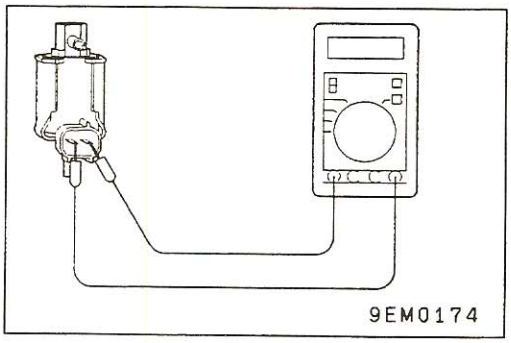
NOTE
When disconnecting the vacuum hose, make an identification mark on it so that it can be reconnected to the original posit

(1) Disconnect the vacuum hose from the solenoid valve.
(2) Disconnect the harness connector.
(3) Connect a hand vacuum pump to the nipple to which the green-striped vacuum hose was connected.



(4) Apply a vacuum and check for air-tightness when voltage applied directly to the EGR solenoid and when the voltage is discontinued.

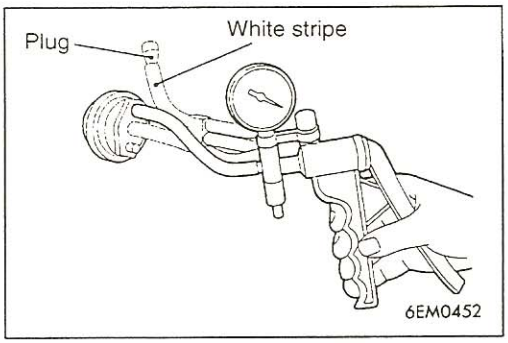
Battery voltage	Result
When applied	Vacuum is maintained
When discontinued	Vacuum leaks



(5) Measure the resistance between the terminals of the solenoid valve.

Standard value: 36 – 44 Ω [at 20°C (68°F)]

TSB Revision



VACUUM CONTROL VALVE CHECK 17300270070

1. Disconnect the vacuum hose (white stripe) from the vacuum control valve and connect the hand vacuum pump to the vacuum control valve.
2. Plug the end of the removed vacuum hose.
3. Start the engine and run at idle.
4. Check the vacuum condition.

Engine condition	Normal vacuum condition
Idling	Approx. 23 kPa (6.7 in.Hg)

MIXTURE CONTROL SYSTEM 17300340023

- To inspect the mixture control system, refer to GROUP 13A.
- For detailed information concerning the illumination pattern of the check engine/malfunction indicator lamp and other aspects of the on-board diagnostic, refer to GROUP 13A.

CATALYTIC CONVERTER 17300390189

REMOVAL AND INSTALLATION

For Federeal: Refer to GROUP 15 – Exhaust Pipe, Muffler and Catalytic Converter.
For California: Refer to GROUP 15 – Exhaust Pipe, Muffler and Catalytic Converter.

INSPECTION 17300400035

Check for damage, cracks or fusion and replace if faulty.

Caution

1. **Stop the engine immediately if engine misfiring occurs, otherwise an abnormally hot exhaust system will damage the catalytic converter or other underbody parts.**
2. **Correct and repair the ignition or fuel system if there are malfunctions, otherwise engine misfiring may occur which will damage the catalytic converter.**
3. **Observe manufacturer's specifications when doing service work.**

NOTES

AUTOMATIC TRANSMISSION

CONTENTS

23109000255

NOTES

AUTOMATIC TRANSMISSION

CONTENTS

23109000262

GENERAL INFORMATION

2310001[illegible]65

The automatic transmissions come in one model, namely, V4AW3.

Items		Specifications
Model		V4AW3
Torque converter type		With torque converter clutch
Transmission type		Electronically controlled 4-speed full automatic
Control elements	Clutch	Multiple disc type 3 sets
	Brake	Multiple disc type 3 sets
	One-way clutch	Sprag type 3 sets
Gear ratio	1st gear	2.804
	2nd gear	1.531
	3rd gear	1.000
	4th gear	0.754
	Reverse	2.393
Oil pump type		Gear type
Oil-cooling system		Air-cooled type and water-cooled type
Transfer type		Active Trac AWD
Shift ratios	LOW	1.900
	HIGH	1.000
Speedometer gear ratio		26/9

SERVICE SPECIFICATIONS

23100030161

Items		Specifications
Stall speed r/min		2,100–2,600
Line pressure kPa (psi)	D range When idling	430–490 (61–70)
	D range During stall	1,140–1,390 (162–198)
	R range When idling	520–620 (74–88)
	R range During stall	1,400–1,750 (199–249)
Transmission and transfer assembly	Distance between inner cable stopper and edge of dust cover mm (in.)	34–35 (1.34–1.38)

LUBRICANTS

23100040157

Items	Specified lubricants	Quantity
Automatic transmission fluid	ATF DEXRON II or equivalent	Approx. 9.8 dm^3 (10.4 qts.)
Transfer oil	Hypoid gear oil SAE 75W-85W conforming to API classification GL-4 or higher	Approx. 2.5 dm^3 (2.6 qts.)
Transfer control lever assembly O-ring	Hypoid gear oil SAE 75W-85W conforming to API classification GL-4 or higher	Small quantity
Transfer oil seal lip	Hypoid gear oil SAE 75W-90 or 75W-85W conforming to API classification GL-4 or higher	As required
Oil filler pipe O-ring	ATF DEXRON II or equivalent	As required

SEALANTS AND ADHESIVES

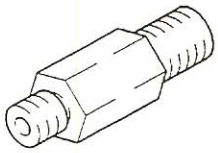
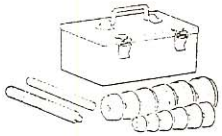
23100050013

Items		Specified sealants and adhesives
Transmission control	Transfer control lever assembly gasket	3M ATD Part No. 8663 or equivalent
	Stopper plate gasket	3M ATD Part No. 8663 or equivalent
	Transfer control lever assembly mounting bolt	3M Stud Locking No. 4170 or equivalent
Transmission and transfer assembly	Control housing gasket	3M ATD Part No. 8663 or equivalent
	Control housing mounting bolt	3M Stud Locking No. 4170 or equivalent

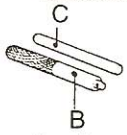
TSB Revision

SPECIAL TOOLS

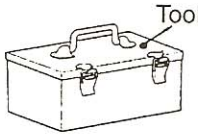
2310006[illegible]

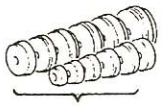
Tool	Tool number and name	Supersession	Application
	MD998330 (includes MD998331) Oil pressure gage (3,000 kPa, 427 psi)	MD998330-01	Measurement of oil pressure
	MD998920 Adapter	MD998206A-01	Connection for oil pressure gage
	MB990925 Bearing and oil seal installer set	MB990925-01	Installation of oil seal MB990938, MB990928

MB990925



Bar (snap-in type)

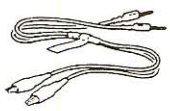
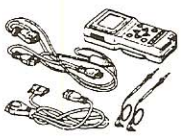




Installer adaptor

A09E012[illegible]

	Contents of new tool (MB990925)	Current tools	O.D. mm (in.)		Contents of new tool (MB990925)	Current tools	O.D. mm (in.)
A	MB990926	MB990272 MB990658 MB990659	39 (1.54)	A	MB990933	MB990307 MB990724	63.5 (2.50)
	MB990927	MB990264 MB990680	45 (1.77)		MB990934	MB990766 MB990807	67.5 (2.66)
	MB990928	MB990271 MB990808	49.5 (1.95)		MB990935	MB990133 MB990308 MB990762	71.5 (2.81)
	MB990929	MB990306	51.0 (2.01)		MB990936	MB990718	75.5 (2.97)
	MB990930	MB990283	54.0 (2.13)		MB990937	MB990309	79.0 (3.11)
	MB990931	MB990681 MB990764	57.0 (2.24)	B	MB990938	MB990124	–
	MB990932	MB990263	61.0 (2.40)	C	MB990939	–	–

	MB991529 Diagnostic trouble code check terminal	MB991529	Reading the diagnostic trouble codes
	MB991502 Scan tool (MUT-II)	MB991496-0D	Checking of the diagnosis code

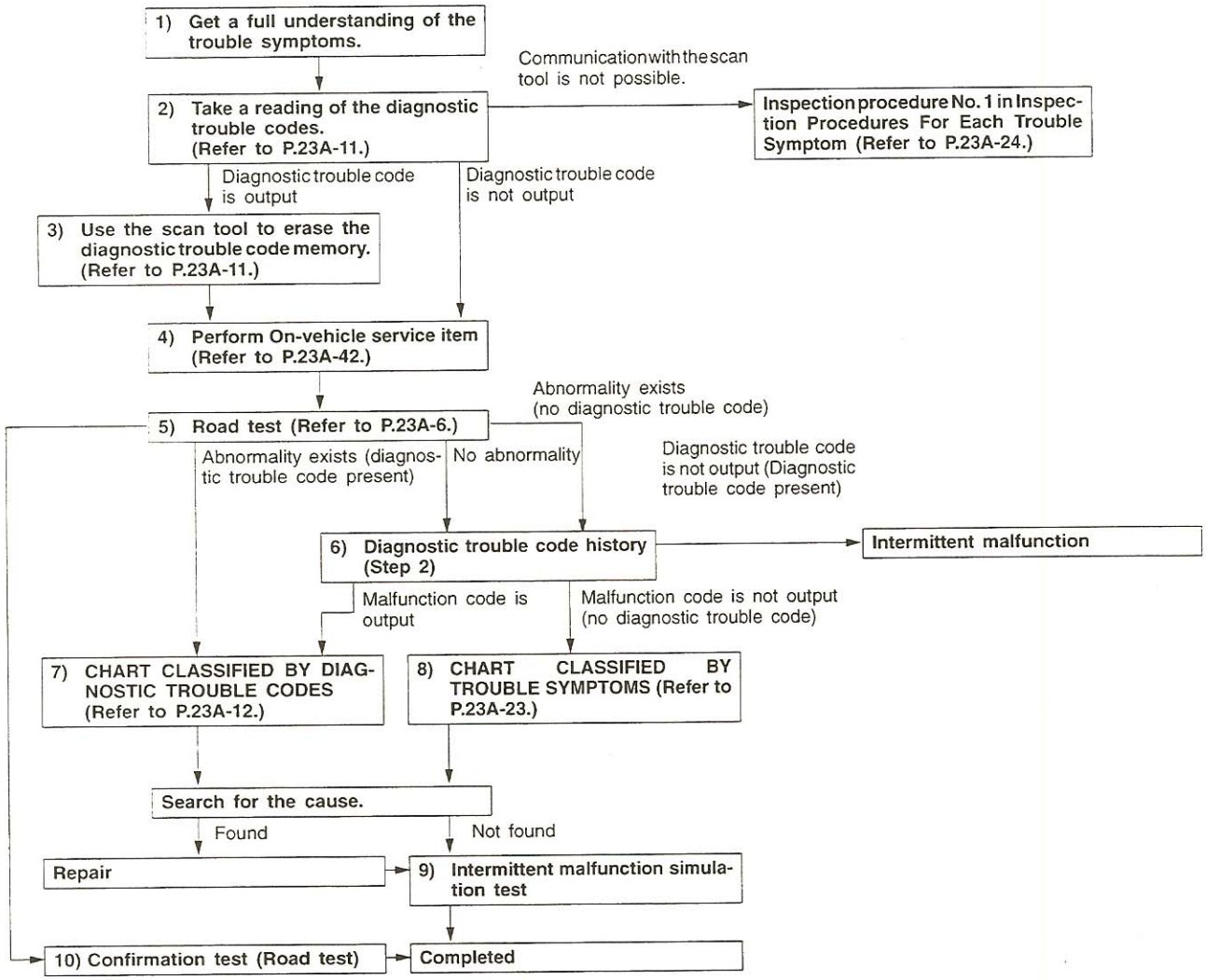
TSB Revision

TROUBLESHOOTING

23100760381

STANDARD FLOW OF DIAGNOSTIC TROUBLESHOOTING

Malfunctions of the 4 A/T system can be caused by malfunctions or incorrect adjustments of the electronic control system, hydraulic control system or A/T system or a combination of these.
Carry out troubleshooting by the following procedure in order to make effective diagnoses.



1) Get a full understanding of the conditions under which the trouble symptoms that the customer is complaining about occur, including frequency of occurrence.
2) Use the scan tool to read and make a note of the diagnostic trouble codes (including fail-safe codes). (Refer to P.23A-11.)
3) Erase the diagnostic trouble codes in order to carry out a road test. (Refer to P.23A-11.)
4) Carry out adjustment of the basic inspection items (ATF, TPS, park/neutral position switch, throttle cable, etc.). (Refer to P.23A-42.)
5) Carry out a road test. (Refer to P.23A-6.) Be sure to check that the basic inspection items and all diagnostic trouble codes and conditions of reoccurrence are covered during this test.
6) Check that the diagnostic trouble codes which were read before the road test (in step (2) above) are present.
7) Determine the probable cause from the Chart Classified by Diagnostic Trouble Codes. (Refer to P.23A-12.)
8) Determine the probable cause from the Chart Classified by Trouble Symptoms. (Refer to P.23A-23.)
9) Carry out a intermittent malfunction simulation test. (Refer to GROUP 00 – How To Use Troubleshooting/Inspection Service Points.)
10) After repairs are completed, carry out a road test to check that the malfunction has been repaired.

TSB Revision

ROAD TEST (Transfer Lever Position: 4H Range)

23100780387

Procedure	Conditions	Operation	Judgement value	Inspection item	Inspection procedure page
1	Ignition switch: ON Engine: Stopped	Overdrive switch (1) ON (2) OFF	★ Data List No. 35 (1) O.D. (2) O.D.-OFF	Overdrive switch	Overdrive switch system (P.23A-33)
		Pattern select switch (1) Normal (2) Hold	★ Data List No. 36 (1) 4WD (2) Hold	Pattern select switch	Pattern select switch system (P.23A-33)
1	Ignition switch: ON Engine: Stopped	Selector lever position (1) P (2) R (3) N (4) D (5) 2 (6) L	★ Data List No. 51 (1) ON Other than (1) OFF ★ Data List No. 52 (2) ON Other than (2) OFF ★ Data List No. 53 (3) ON Other than (3) OFF ★ Data List No. 54 (4) ON Other than (4) OFF ★ Data List No. 55 (5) ON Other than (5) OFF ★ Data List No. 56 (6) ON Other than (6) OFF	Park/neutral position switch	Code Nos. 29, 30 – Park/neutral position switch system (P.23A-15)
1	Ignition switch: ON Engine: Stopped	Brake pedal (1) Depressed (2) Released	★ Data List No. 28 (1) ON (2) OFF	Stop light switch	Stop light switch system (P.23A-34)
		Transfer lever position (1) 4H (2) 4L	Data list No.49 (1) T/F High (2) T/F Low	Low range operation detection switch	Low range operation detection switch system (P.23A-35)
2	Ignition switch: ST Engine: Stopped	Engine starting test in P and N positions	Starting should be possible	Starting	Does not move forward or reverse (P.23A-25)
					Does not move forward only (P.23A-25)
					Does not move reverse only (P.23A-26)
					Malfunction of lock-up (P.23A-32)

TSB Revision

Procedure	Conditions	Operation	Judgement value	Inspection item	Inspection procedure page
3	Warming up	(1) When engine is cold (2) When engine is hot	★ Data list No.57 (1) LOW TEMP. (2) HIGH TEMP.	Engine coolant temperature signal	Code Nos.23, 24 – Signal line from ECM to TCM (P.23A-14)
		Drive for 15 minutes or more so that the ATF temperature becomes 70 – 90°C (158 – 194°F).	★ Data List No. 15 70–90°C (158–194°F)	Oil temperature sensor	Code Nos. 15, 16 – Oil temperature sensor system (P.23A-13)
4	Engine: Idling Selector lever position: N	Accelerator pedal (1) Fully closed (2) Depressed (3) Fully open (up to 2 seconds)	★ Data List No. 11 (1) 0 – 5% (2) Gradually rises (1) (3) 85 – 100%	Throttle position sensor	Code No. 11 – Throttle position sensor system (P.23A-13)
		Selector lever operation (1) N to D shift (2) N to R shift	Should be no abnormal shifting shocks Time lag should be within 2 seconds	Does not move	Does not move forward or reverse (P.23A-25)
					Does not move forward only. (P.23A-25)
					Does not reverse only (P.23A-26)
				Shock	Large shocks (P.23A-30)
5	Engine: Idling (Vehicle stopped) Selector lever position: D Mode selection: Normal	Accelerator pedal (1) Fully closed	★ Data List No. 27 (1) 1st	Shift solenoid No. 1	Code Nos. 41, 42 – Shift solenoid No. 1 system (P.23A-17)
				Shift solenoid No. 2	Code Nos. 43, 44 – Shift solenoid No. 2 system (P.23A-18)
6	Selector lever position: D Mode selection: Normal Overdrive: OFF	Engine (1) Idling (Vehicle stopped) (2) Driving at 10 km/h (6 mph) (3) Driving at a constant speed of 50 km/h (31 mph) (20 seconds or more) (4) Driving at a constant speed of 40 km/h (24 mph) with the selector lever in 2 range	★ Data List No. 27 (1) 1st (2) 1st (3) 3rd (4) 2nd	Shift solenoid No. 1	Code Nos. 41, 42 – Shift solenoid No. 1 system (P.23A-17)
				Shift solenoid No. 2	Code Nos. 43, 44 – Shift solenoid No. 2 system (P.23A-18)
			★ Data List No. 32 (1) 0 rpm (2) 200 – 400 rpm (3) 1300 – 1900 rpm (4) 1000 – 1500 rpm	Output shaft speed sensor	Code No. 32 – Output shaft speed sensor system (P.23A-17)
			★ Data list No.31 (3) 1300 – 1900	Input shaft speed sensor	Code No.31 – Input shaft speed sensor system (P.23-16)

TSB Revision

Procedure	Conditions	Operation	Judgement value	Inspection item	Inspection procedure page
6	Selector lever position: D Mode selection: Normal Overdrive: OFF	Engine (1) Idling (Vehicle stopped) (2) Driving at 10 km/h (6 mph) (3) Driving at a constant speed of 50 km/h (31 mph) (20 seconds or more) (4) Driving at a constant speed of 40 km/h (24 mph) with the selector lever in 2 range	★ Data List No. 41 (2) ON (3) OFF (4) ON	Shift solenoid No. 1	Code Nos. 41, 42 – Shift solenoid No. 1 system (P.23A-17)
			★ Data List No. 43 (2) OFF (3) ON (4) ON	Shift solenoid No. 2	Code Nos. 43, 44 – Shift solenoid No. 2 system (P.23A-18)
			★ Data List No. 47 (2) OFF (3) ON (3) Acceleration should be smooth with no abnormal vibration.	Malfunction of lock-up solenoid when shifting	Code Nos. 47, 48 – Lock-up solenoid system (P.23A-18)
					Shifting point abnormality (P.23A-28)
					Slippage (vibration) (P.23A-31)
7	Selector lever position: D Mode selection: Normal Overdrive: ON	Engine (1) Driving at a constant speed of 50 km/h (31 mph) (20 seconds or more)	★ Data List No. 27 (1) 4th	Shift solenoid No. 1	Code Nos. 41, 42 – Shift solenoid No. 1 system (P.23A-17)
				Shift solenoid No. 2	Code Nos. 43, 44 – Shift solenoid No. 2 system (P.23A-18)
			★ Data List No. 41 (1) OFF	Shift solenoid No. 1	Code Nos. 41, 42 – Shift solenoid No. 1 system (P.23A-17)
			★ Data List No. 43 (1) OFF	Shift solenoid No. 2	Code Nos. 43, 44 – Shift solenoid No. 2 system (P.23A-18)

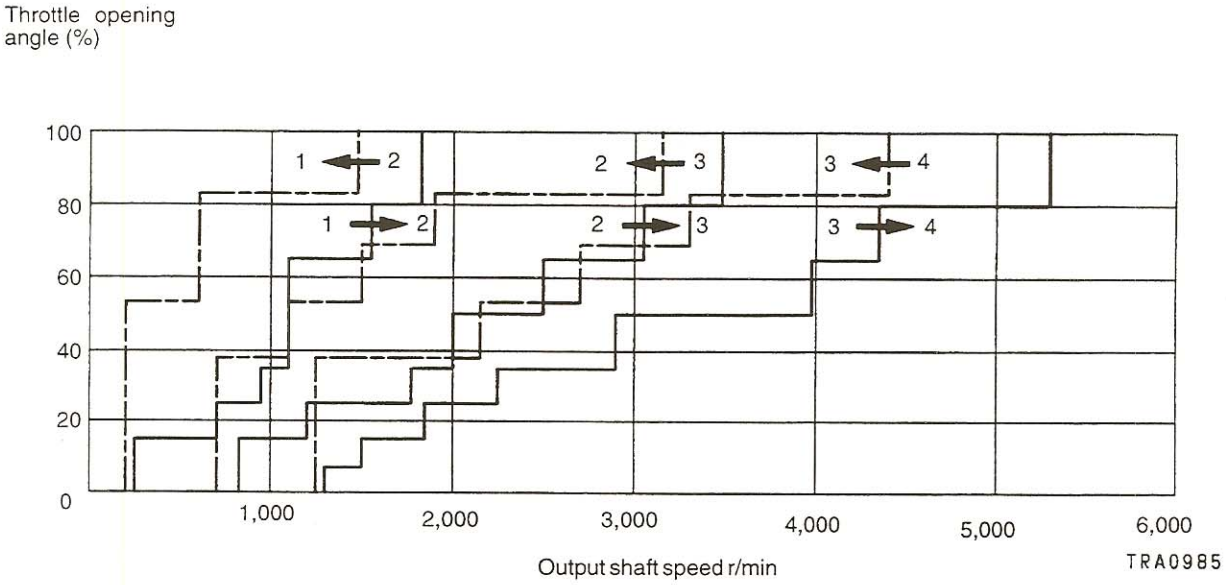
TSB Revision

Procedure	Conditions	Operation	Judgement value	Inspection item	Inspection procedure page
8	Selector lever position: D Mode selection: Normal Overdrive: ON • Carry out the same test with the mode selection at HOLD also.	Monitor scan tool data list Nos. 11, 27 and 32. (1) TPS: Accelerate to 4th gear at opening angle of 30%. (2) Slowly decelerate to a standstill. (3) TPS: Accelerate to 4th gear at opening angle of 50%. (4) At 50 km/h (30 mph) in 4th gear, turn the overdrive OFF. (5) At 50 km/h (30 mph) in 3 range, move the selector lever to 2 range. (6) At 20 km/h (12 mph) in 2 range, move the selector lever to L range.	(1), (2) and (3) should match the specified output shaft speed (vehicle speed), and there should be no abnormal shocks. For (4), (5) and (6), downshifting should occur immediately after moving the lever.	Abnormality while shifting	Upshifting does not occur (P.23A-26)
					Downshifting does not occur (P.23A-27)
					Shifting point abnormality (P.23A-28)
					Upshifting occurs spontaneously (P.23A-28)
					Incorrect drive gear position (P.23A-29)
				Malfunction while driving	Large shocks (P.23A-30)
					Slippage (vibration) (P.23A-31)
					Malfunction of lock-up (P.23A-32)
					Abnormal engine braking (P.23A-32)

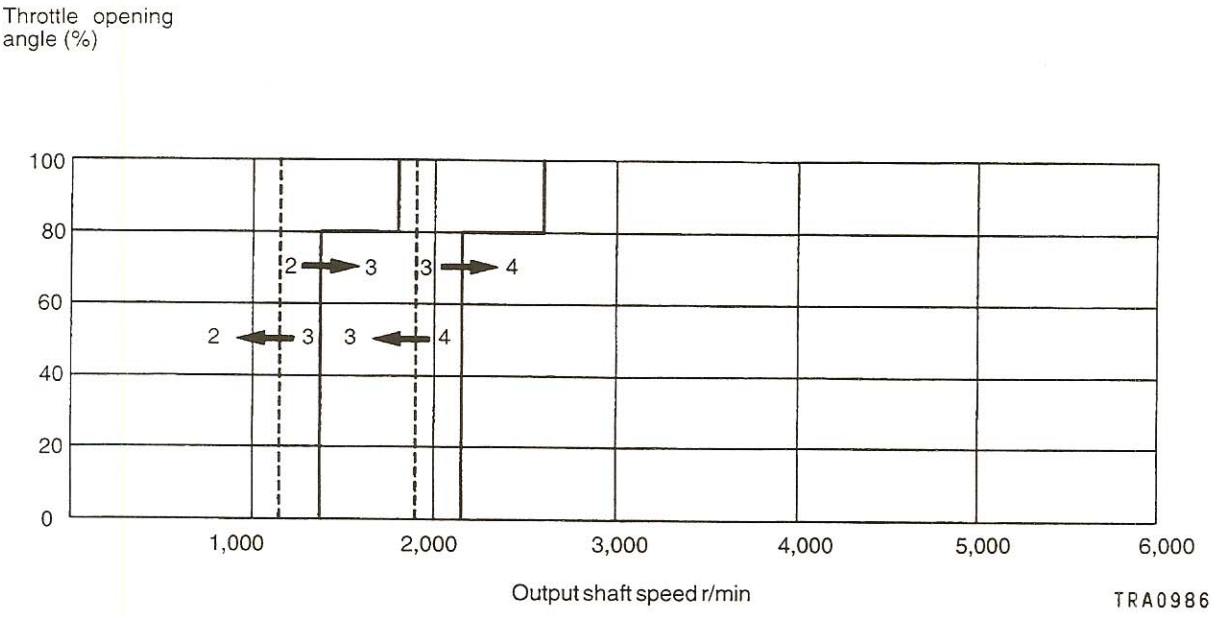
TSB Revision

SHIFT PATTERN

Normal pattern



Hold pattern



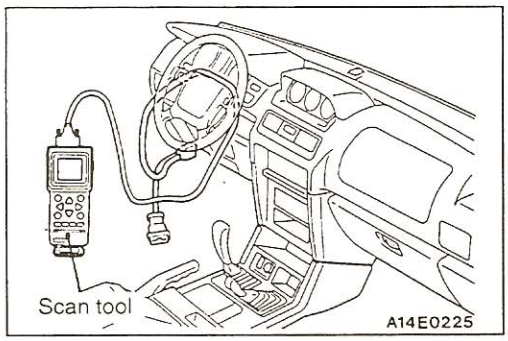
TSB Revision

DIAGNOSTIC FUNCTIONS

23100770117

PRECAUTIONS BEFORE SERVICE

(1) If the battery positive voltage is low, diagnostic trouble codes will not be output. Accordingly, check the battery before carrying out inspection.
(2) If the battery is disconnected or if the engine control module connector is disconnected, the diagnostic trouble code memory will be erased.
Accordingly, the battery should not be disconnected until reading of the diagnostic trouble codes has been completed.

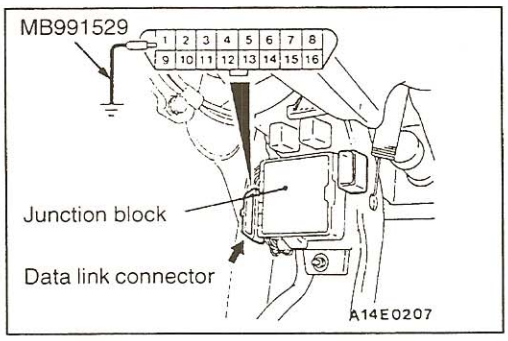


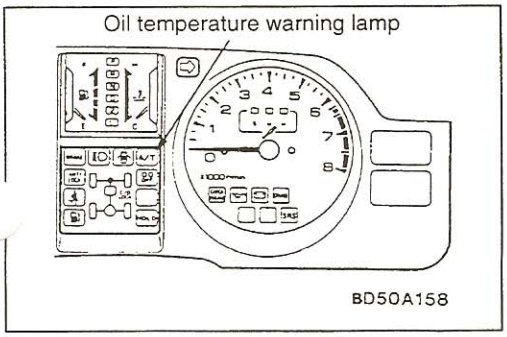
READING THE DIAGNOSTIC TROUBLE CODES

<When using the scan tool>

Caution
Turn the ignition switch OFF before connecting or disconnecting the scan tool.

(1) Connect the scan tool to the data link connector.
(2) Turn the ignition switch to the ON position.
(3) Take a reading of the diagnostic trouble code output.
(4) Repair the malfunction location while referring to the Inspection Procedures For Each Diagnostic Trouble Code.
(5) Turn the ignition switch to OFF and then back to ON again.
(6) Erase the diagnostic trouble codes.
(7) Check that the diagnostic trouble code output is normal.



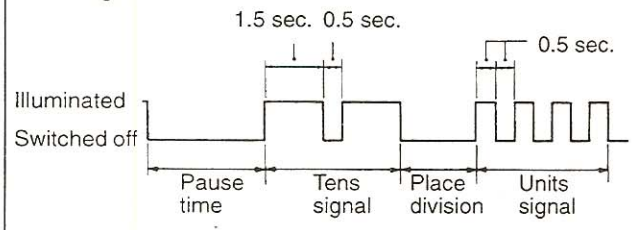
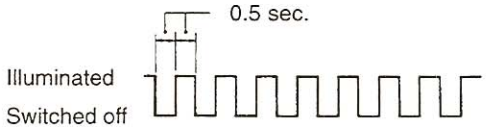


<When using the oil temperature warning lamp>

(1) Use the special tool (diagnostic trouble code check harness) to ground terminal No. 1 of the data link connector.
(2) Take a reading of the diagnostic trouble codes from the flashing of the oil temperature warning lamp.
(3) Repair the malfunction location while referring to the Chart Classified by Diagnostic Trouble Codes.
(4) Erase the diagnostic trouble codes by the following procedure.
    1) Turn the ignition switch to OFF.
    2) After disconnecting the battery cable from the negative battery terminal for 10 seconds or more, re-connect the cable.
    3) Turn the ignition switch to ON, take a reading of the diagnostic trouble code output and check that a normal code is output.
    4) After the engine has warmed up, run it at idle for about 10 minutes.

TSB Revision

UNDERSTANDING DIAGNOSIS RESULT BY THE OIL TEMPERATURE WARNING LAMP FLASHING

Example of flashing when a diagnostic trouble code is output	Flashing when normal
For diagnostic trouble code No. 24  Z6FU2060	 Z6FU2061

NOTE
Other diagnostic trouble codes also are output by the flashing of the check warning lamp corresponding to the same code numbers as when using the scan tool.

CHART CLASSIFIED BY DIAGNOSTIC TROUBLE CODES

23100790359

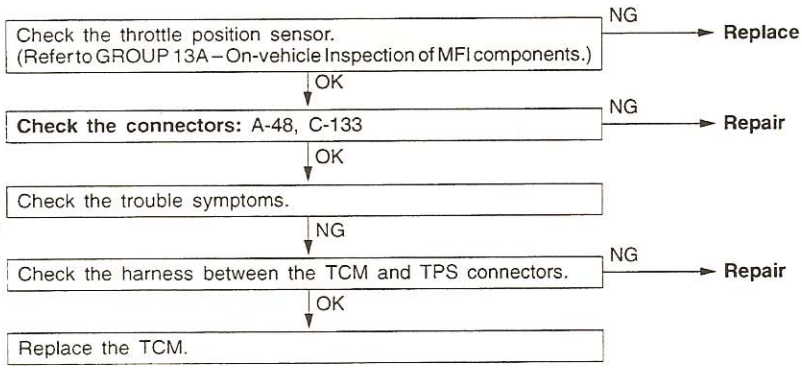
Code	Diagnostic item		Reference page
11	Throttle position sensor system	Malfunction of sensor Open or short circuit	23A-13
15	Oil temperature sensor system	Open circuit	23A-13
16	Oil temperature sensor system	Short circuit	23A-13
21	Ignition signal system	Short circuit	23A-14
22	Ignition signal system	Open circuit	23A-14
23	Signal line from ECM to TCM (Engine coolant temperature signal line)	Open circuit	23A-14
24	Signal line from ECM to TCM (Engine coolant temperature signal line)	Short circuit	23A-14
29	Park/neutral position switch system	Short circuit	23A-15
30	Park/neutral position switch system	Open circuit	23A-15
31	Input shaft speed sensor system	Open circuit	23A-16
32	Output shaft speed sensor system	Open circuit	23A-17
41	Shift solenoid No.1 system	Open circuit	23A-17
42	Shift solenoid No.1 system	Short circuit	23A-17
43	Shift solenoid No.2 system	Open circuit	23A-18
44	Shift solenoid No.2 system	Short circuit	23A-18
47	Lock-up solenoid system	Open circuit	23A-18
48	Lock-up solenoid system	Short circuit	23A-18
49	Torque converter clutch system engagement problem		23A-19
50	Torque converter clutch system disengagement problem		23A-20

TSB Revision

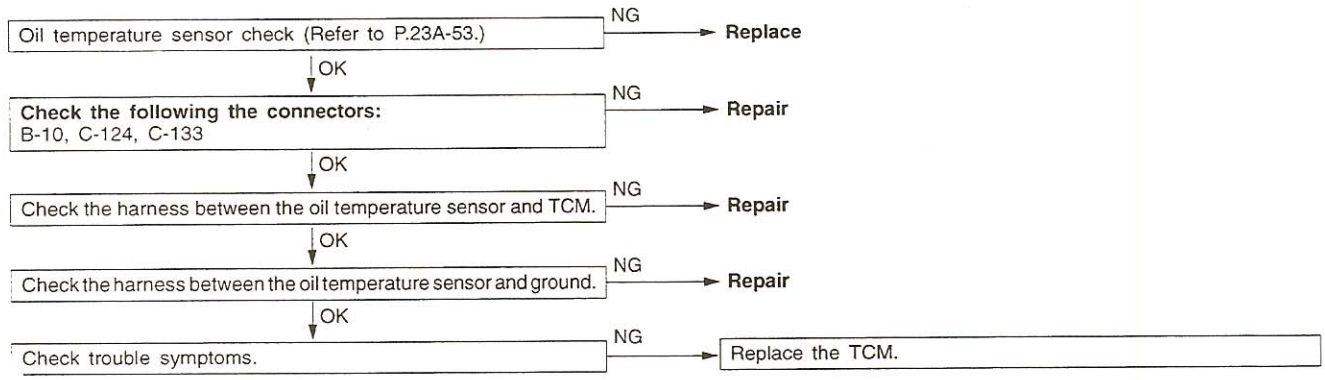
Code	Diagnostic item	Reference page
51	1st gear ratio is not specified	23A-21
52	2nd gear ratio is not specified	23A-21
53	3rd gear ratio is not specified	23A-22
54	4th gear ratio is not specified	23A-22

INSPECTION PROCEDURES FOR EACH DIAGNOSTIC TROUBLE CODE

Code No. 11 Throttle position sensor system	Probable cause
[Comment] If the TPS output becomes 4.95 V or more, TPS output is excessive, and if the TPS output becomes 0.09 V or less, TPS output is insufficient. In both cases, diagnostic trouble code No. 11 is output.	• Malfunction of throttle position sensor • Malfunction of connector • Malfunction of TCM

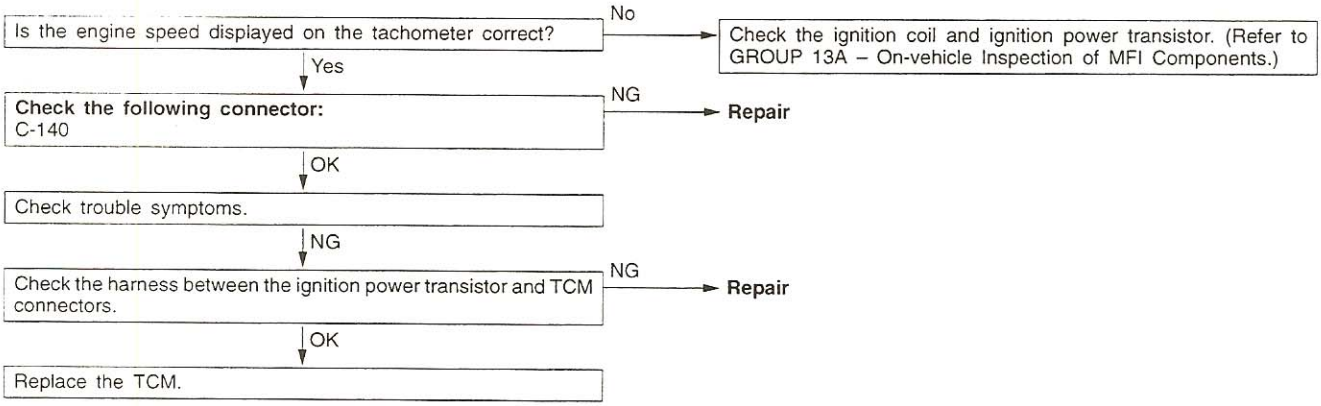


Code Nos.15,16 Oil temperature sensor system	Probable cause
If the oil temperature sensor output is –10°C or less (5.6 kΩ or less) even though 15 minutes have passed since the engine started, there is judged to be an open circuit in the oil temperature sensor circuit and code No.15 is output. Furthermore, if the oil temperature sensor output is 204°C or higher (10 Ω or less), there is judged to be a short circuit in the oil temperature sensor circuit and code No.16 is output.	• Malfunction of oil temperature sensor • Malfunction of connector • Malfunction of TCM

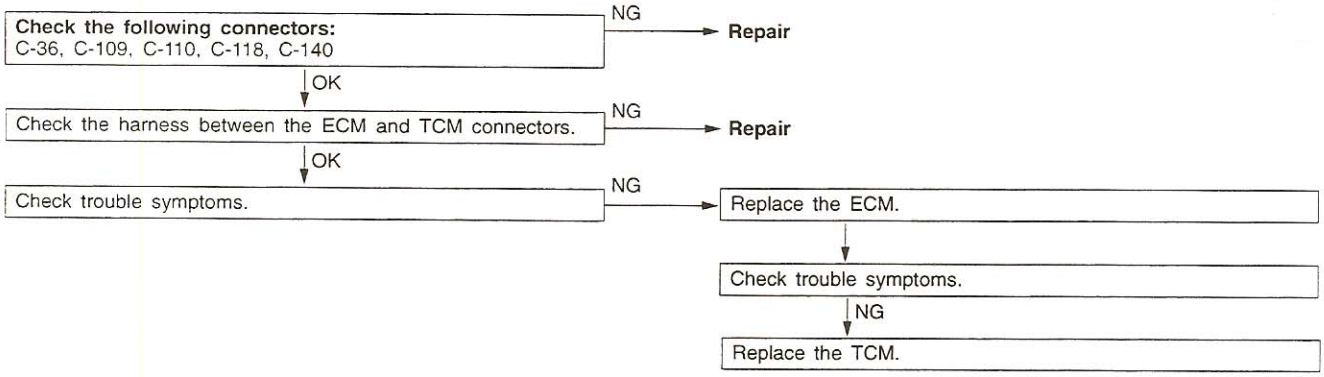


TSB Revision

Code Nos.21, 22 Ignition signal system	Probable cause
If a low signal is input for 5 seconds while the shift lever is in D, 2 or L range and the output shaft speed is 1,500 r/min or more, there is judged to be a short circuit in the ignition signal circuit and code No.21 is output. Furthermore, if a high signal is input for 5 seconds, there is judged to be an open circuit in the ignition signal circuit and code No.22 is output.	• Malfunction of ignition power transistor • Malfunction of connector • Malfunction of TCM

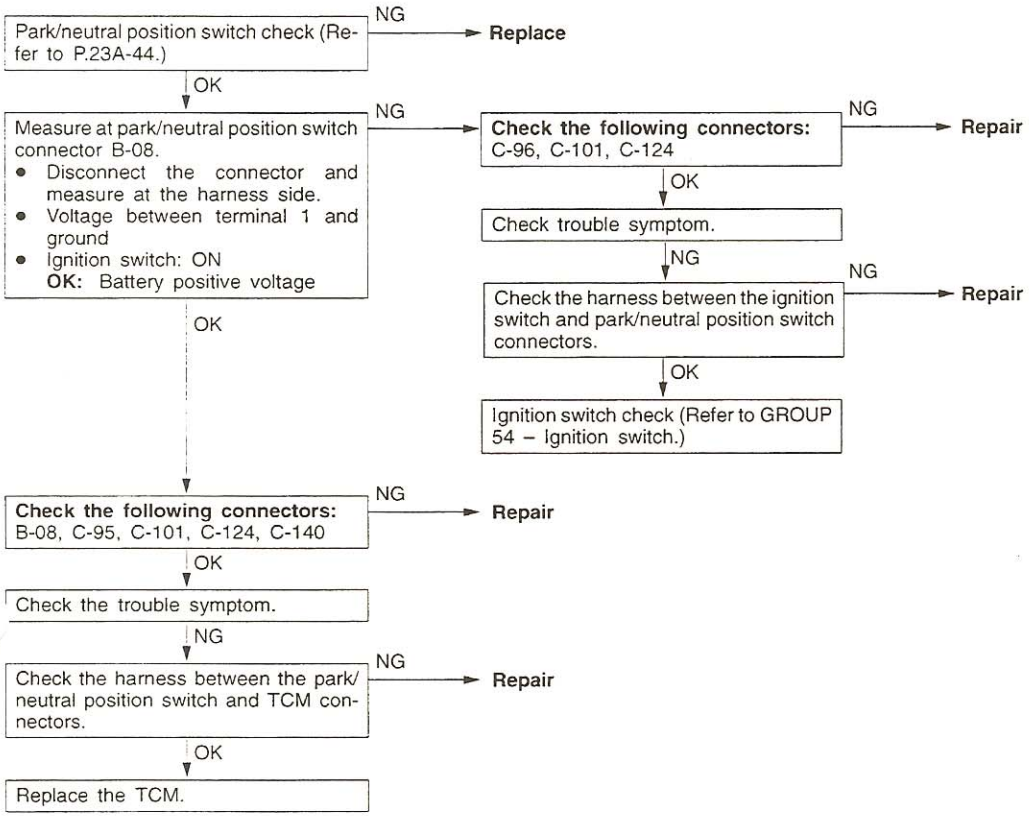


Code Nos.23, 24 Signal line from ECM to TCM (Engine coolant temperature signal line)	Probable cause
If a high signal is input for 5 seconds, there is judged to be an open circuit in the signal line and code No.23 is output. Furthermore, if a low signal is input for 5 seconds, there is judged to be a short circuit in the signal line and code No.24 is output.	• Malfunction of connector • Malfunction of TCM • Malfunction of ECM



TSB Revision

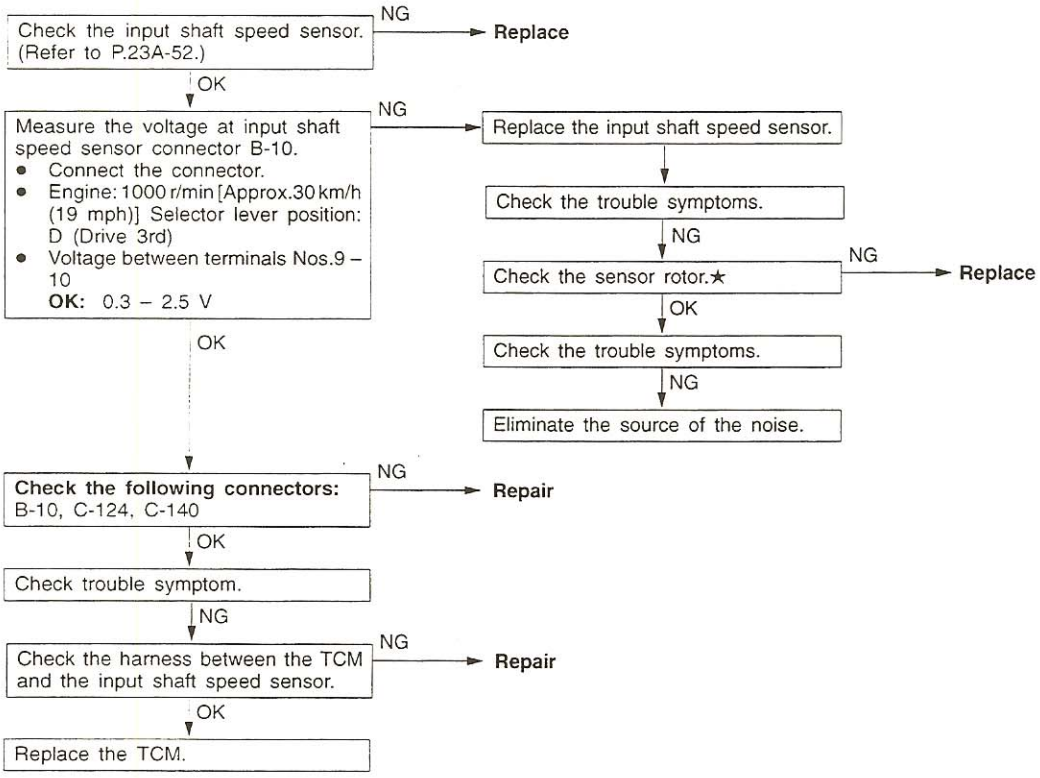
Code Nos.29, 30 Park/neutral position switch system	Probable cause
If no park/neutral position switch signal is input continuously for 30 seconds or more after the ignition switch is turned to ON, there is judged to be an open circuit in the park/neutral position switch circuit and code No.29 is output. Furthermore, if two or more park/neutral position switch signals are input continuously for 30 seconds or more after the ignition switch is turned to ON, there is judged to be a short circuit in the park/neutral position switch circuit and code No.30 is output.	• Malfunction park/neutral position switch • Malfunction of connector • Malfunction of TCM



TSB Revision

Code No.31 Input shaft speed sensor system	Probable cause
If no input shaft speed sensor pulse is output for 58 seconds while the output shaft speed is 775 r/min or more, there is judged to be a problem with the input shaft speed sensor and code No.31 is output.	• Malfunction of input shaft speed sensor • Malfunction of connector • Malfunction of sensor rotor • Malfunction of TCM • Noise generated

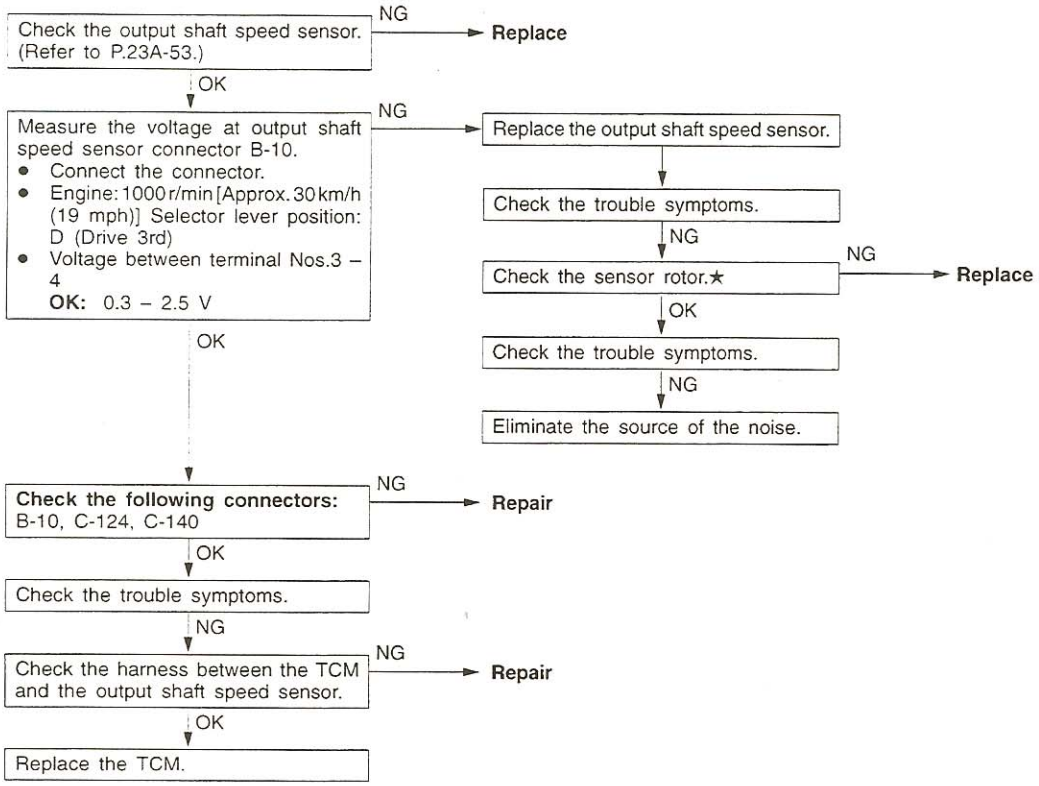
★: Refer to Automatic Transmission Overhaul.



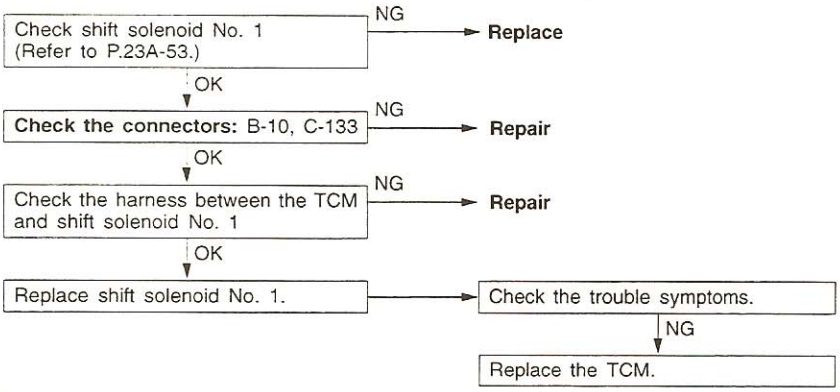
TSB Revision

Code No.32 Output shaft speed sensor system	Probable cause
If no output shaft speed sensor pulse is output for 58 seconds while the input shaft speed is 775 r/min or more, there is judged to be a problem with the output shaft speed sensor and code No.32 is output.	• Malfunction of output shaft speed sensor • Malfunction of connector • Malfunction of sensor rotor • Malfunction of TCM • Noise generated

★: Refer to Automatic Transmission Overhaul.

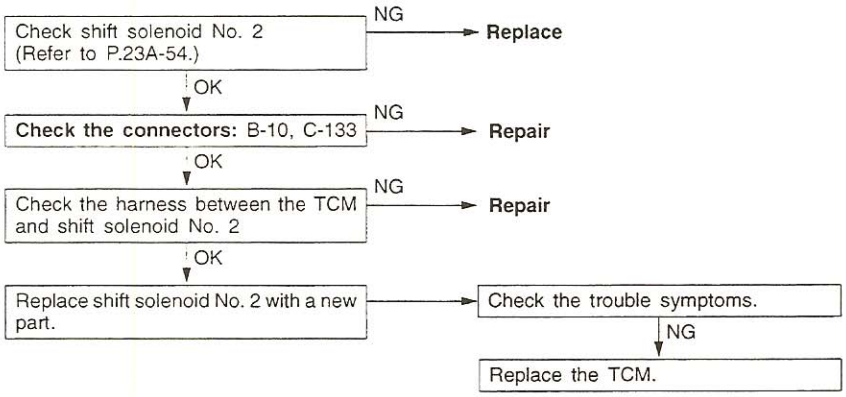


Code Nos. 41, 42 Shift solenoid No. 1 system	Probable cause
[Comment] If the resistance value of shift solenoid No. 1 is large, there is an open circuit in shift solenoid No. 1 and diagnostic trouble code No. 41 is output. If the resistance value is small, there is a short-circuit in shift solenoid No. 1 and diagnostic trouble code No. 42 is output.	• Malfunction of shift solenoid No. 1 • Malfunction of connector • Malfunction of TCM

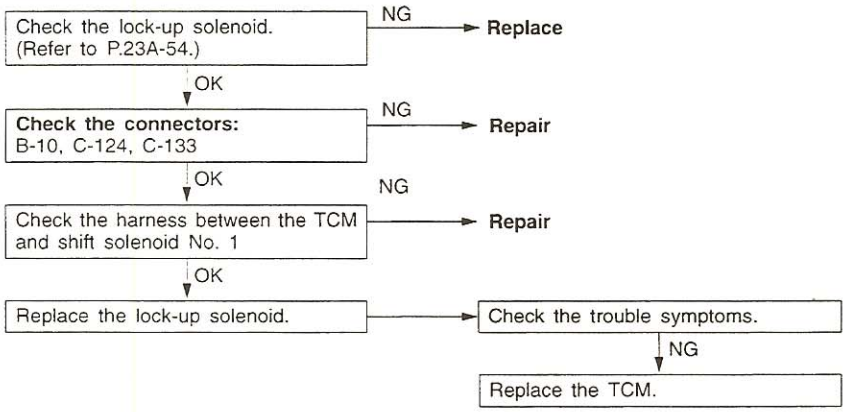


TSB Revision

Code Nos. 43, 44 Shift solenoid No. 2 system	Probable cause
[Comment] If the resistance value of shift solenoid No. 2 is large, there is an open circuit in shift solenoid No. 2 and diagnostic trouble code No. 43 is output. If the resistance value is small, there is a short-circuit in shift solenoid No. 2 and diagnostic trouble code No. 44 is output.	• Malfunction of shift solenoid No. 2 • Malfunction of connector • Malfunction of TCM



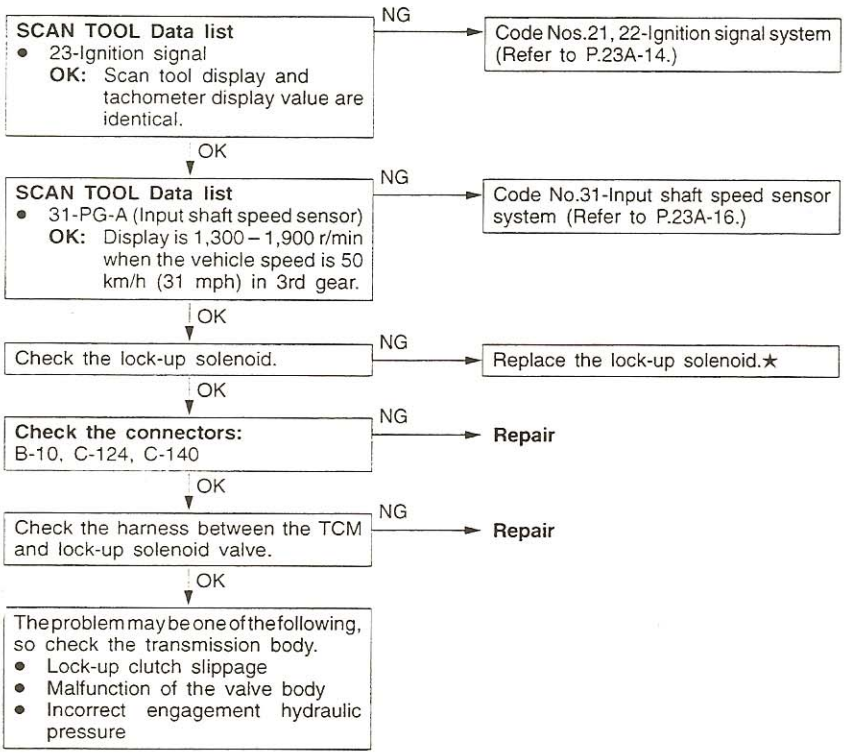
Code Nos. 47, 48 Lock-up solenoid system	Probable cause
[Comment] If the resistance value of the lock-up solenoid is large, there is an open circuit in the lock-up solenoid and diagnostic trouble code No. 47 is output. If the resistance value is small, there is a short-circuit in the lock-up solenoid and diagnostic trouble code No. 48 is output.	• Malfunction of lock-up solenoid • Malfunction of connector • Malfunction of TCM



TSB Revision

Code No.49 Torque converter clutch system engagement problem	Probable cause
If the difference between the input shaft speed and the engine speed is 50 r/min or more for 5 seconds while the shifting lever is in D range and the lock-up solenoid is on, there is judged to be a problem with the torque converter clutch (not engaging) and code No.49 is output.	• Malfunction of torque converter • Malfunction of valve body

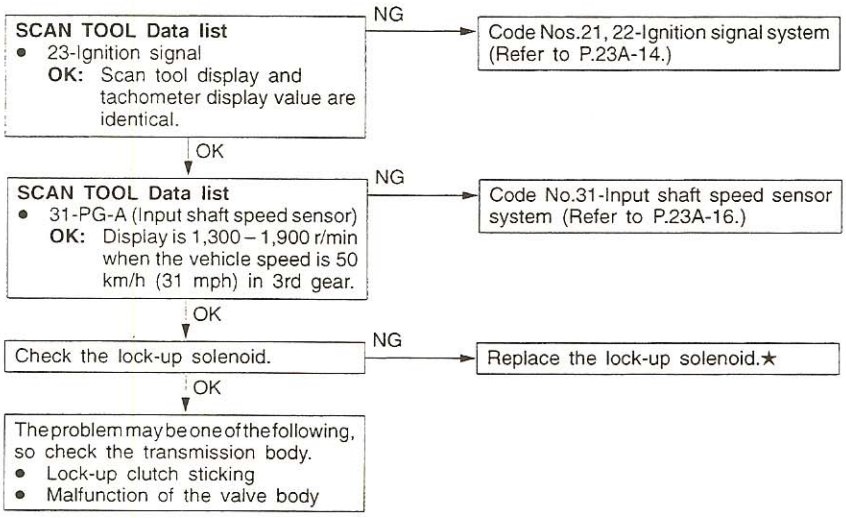
★: Refer to Automatic Transmission Overhaul.



TSB Revision

Code No.50 Torque converter clutch system disengagement problem	Probable cause
If the difference between the input shaft speed and the engine speed is 50 r/min or less for 5 seconds while the shifting lever is in D range and the lock-up solenoid is off, there is judged to be a problem with the torque converter clutch (not disengaging) and code No.50 is output.	• Malfunction of torque converter • Malfunction of valve body

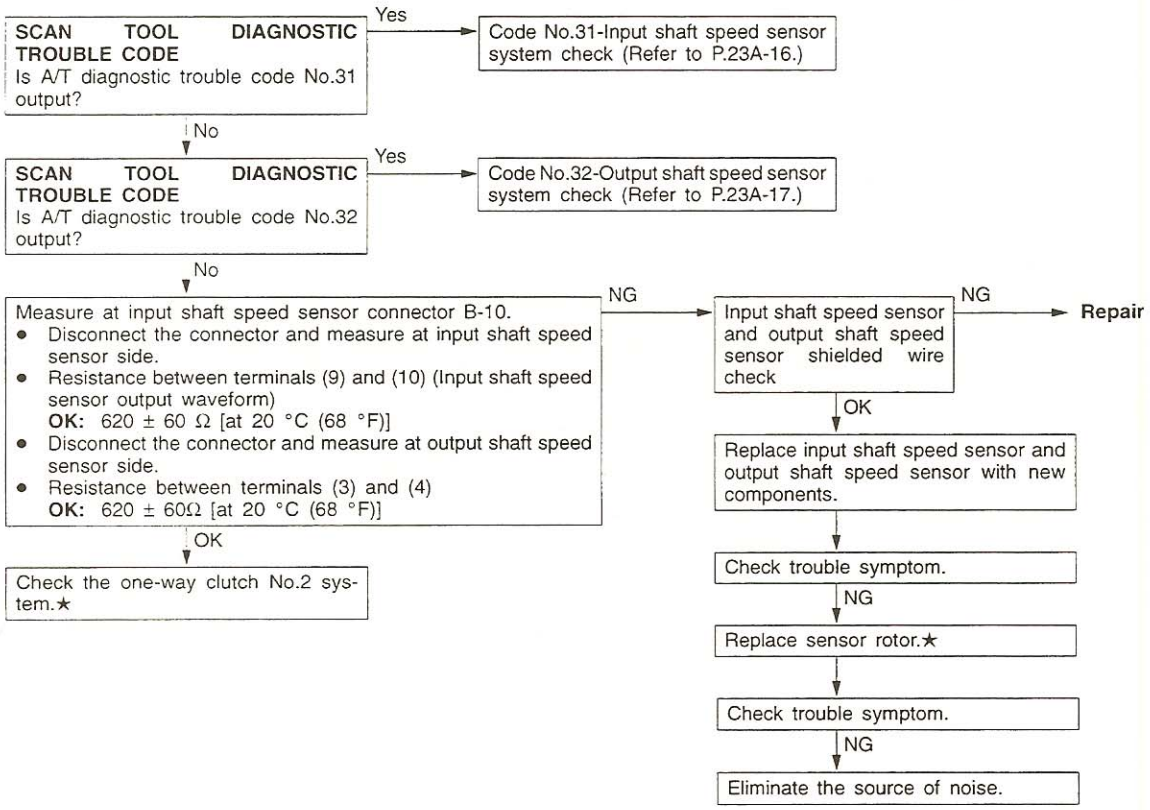
★: Refer to Automatic Transmission Overhaul.



TSB Revision

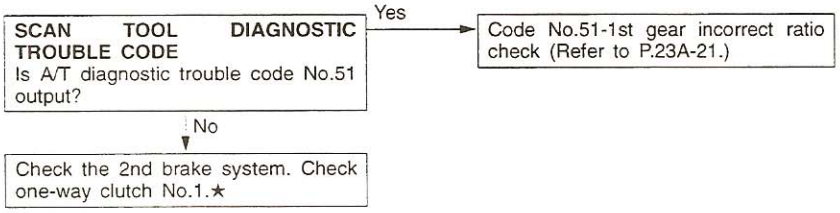
Code No.51 1st gear incorrect ratio	Probable cause
If the difference between the input shaft speed (input shaft speed sensor output) divided by the 1st gear ratio and the output shaft speed (output shaft speed sensor output) is continuously 200 r/min or more for 5 seconds or more after 2 seconds have passed since the transmission has shifted to 1st gear, there is judged to be a phase difference of 1st gear and code No.51 is output.	• Malfunction of input shaft speed sensor • Malfunction of output shaft speed sensor • Malfunction of one-way clutch No.2 system • Noise generated

★: Refer to Automatic Transmission Overhaul



Code No.52 2nd gear incorrect ratio	Probable cause
If the difference between the input shaft speed (input shaft speed sensor output) divided by the 2nd gear ratio and the output shaft speed (output shaft speed sensor output) is continuously 200 r/min or more for 5 seconds or more after 2 seconds have passed since the transmission has shifted to 2nd gear, there is judged to be a phase difference of 2nd gear and code No.52 is output.	• Malfunction of input shaft speed sensor • Malfunction of output shaft speed sensor • Malfunction of 2nd brake system • Malfunction of one-way clutch system • Noise generated

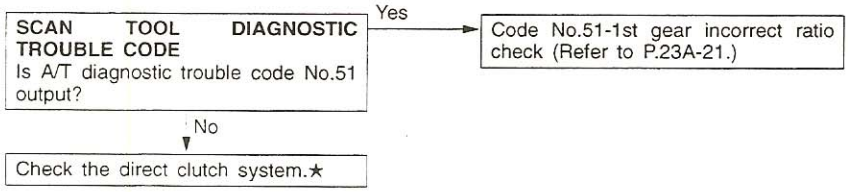
★: Refer to Automatic Transmission Overhaul



TSB Revision

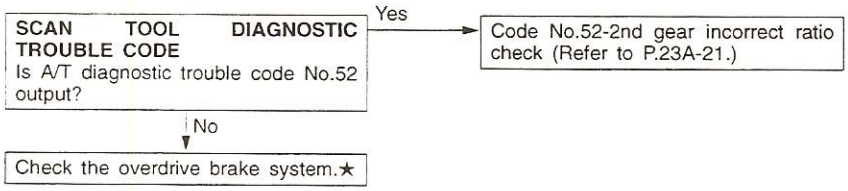
Code No.53 3rd gear incorrect ratio	Probable cause
If the difference between the input shaft speed (input shaft speed sensor output) divided by the 3rd gear ratio and the output shaft speed (output shaft speed sensor output) is continuously 200 r/min or more for 5 seconds or more after 2 seconds have passed since the transmission has shifted to 3rd gear, there is judged to be a phase difference of 3rd gear and code No.53 is output.	• Malfunction of input shaft speed sensor • Malfunction of output shaft speed sensor • Malfunction of direct clutch system • Noise generated

★: Refer to Automatic Transmission Overhaul



Code No.54 4th gear incorrect ratio	Probable cause
If the difference between the input shaft speed (input shaft speed sensor output) divided by the 4th gear ratio and the output shaft speed (output shaft speed sensor output) is continuously 200 r/min or more for 5 seconds or more after 2 seconds have passed since the transmission has shifted to 4th gear and after a lock-up solenoid on command has been given, there is judged to be a phase difference of 4th gear and code No.54 is output.	• Malfunction of input shaft speed sensor • Malfunction of output shaft speed sensor • Malfunction of overdrive brake system • Noise generated

★: Refer to Automatic Transmission Overhaul



TSB Revision

CHART CLASSIFIED BY TROUBLE SYMPTOMS

23100800359

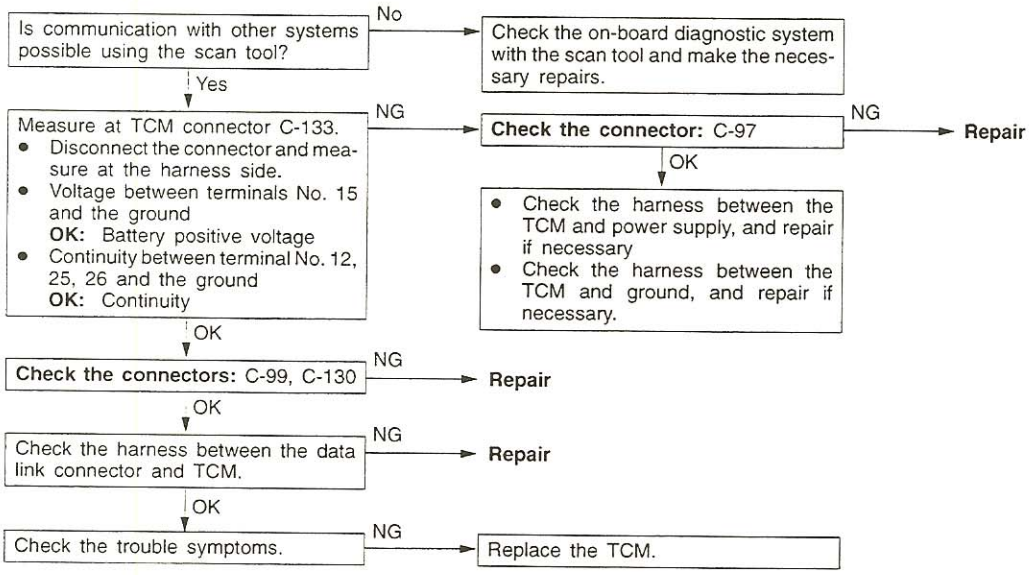
Trouble symptom		Inspection procedure No.	Reference page
Communication with the scan tool is not possible.		1	23A-24
Does not move	Does not move forward or reverse	2	23A-25
	Does not move forward only	3	23A-25
	Does not reverse only	4	23A-26
Malfunction when shifting	Upshifting does not occur	5	23A-26
	Downshifting does not occur	6	23A-27
	Shifting point abnormality	7	23A-28
	Upshifting occurs spontaneously	8	23A-28
	Incorrect drive gear position	9	23A-29
Large shocks		10	23A-30
Slippage (vibration)		11	23A-31
Malfunction of lock-up		12	23A-32
Abnormal engine braking		13	23A-32
Electronic circuit systems	Pattern select switch system	14	23A-33
	Overdrive switch system	15	23A-33
	Stop light switch system	16	23A-34
	Free wheel engage switch system	17	23A-34
	Low range operation detection switch system	18	23A-35

TSB Revision

INSPECTION PROCEDURES FOR EACH TROUBLE SYMPTOM

INSPECTION PROCEDURE 1

• Communication with the scan tool is not possible.	Probable cause
[Comment] If communication with the scan tool is not possible, the cause is probably a malfunction in the on-board diagnostic system or the TCM is not functioning.	• Malfunction of on-board diagnostic system • Malfunction of TCM power circuit • Malfunction of TCM ground circuit • Malfunction of TCM

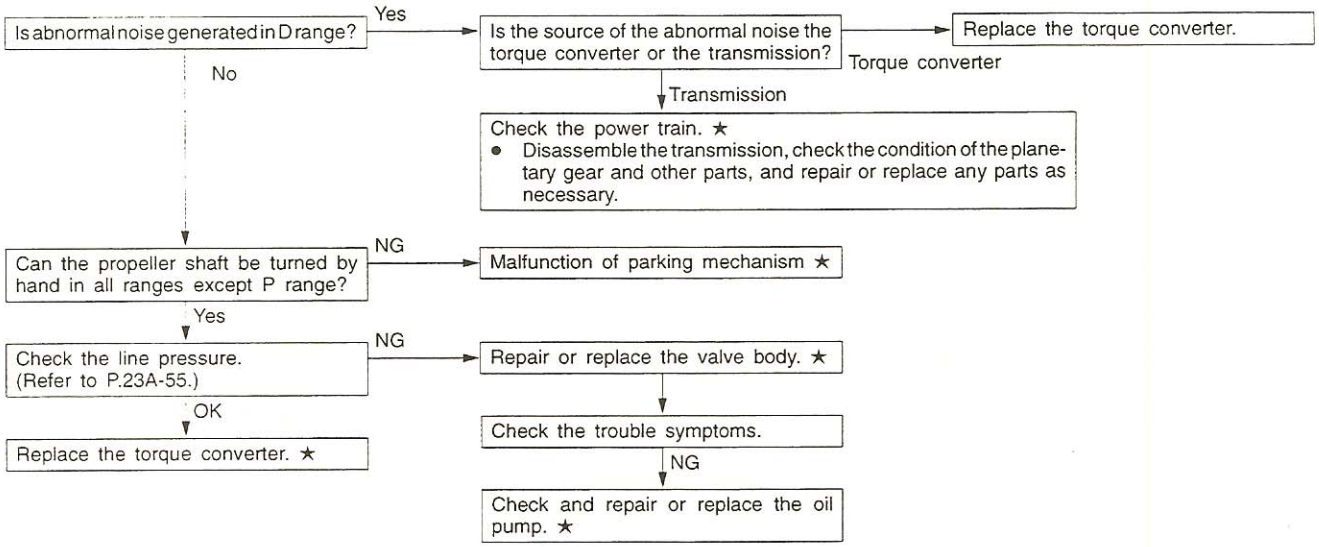


TSB Revision

INSPECTION PROCEDURE 2

• Does not move forward or reverse	Probable cause
[Comment] When the engine is idling, the vehicle does not move forward or back even if the selector lever is shifted from N to D, 2, L or R. In such cases, the cause is probably abnormal line pressure or a malfunction of the torque converter, oil pump, parking mechanism or the power train.	• Abnormal line pressure • Malfunction of power train • Malfunction of oil pump • Malfunction of valve body • Malfunction of parking mechanism • Malfunction of torque converter

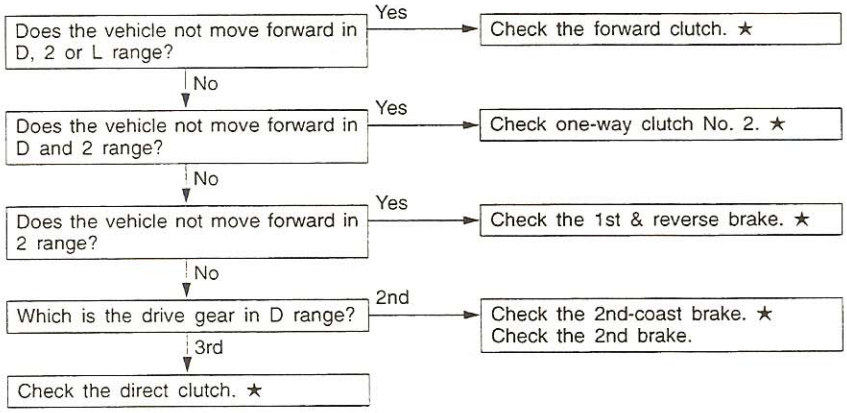
★ : Refer to Automatic Transmission Overhaul.



INSPECTION PROCEDURE 3

• Does not move forward only	Probable cause
[Comment] When the engine is idling, the vehicle does not move forward even if the selector lever is shifted from N to D, 2 or L. In such cases, the cause is probably a malfunction of the clutch or brake.	• Malfunction of forward clutch • Malfunction of direct clutch • Malfunction of one-way clutch No. 2 • Malfunction of 2nd-coast brake • Malfunction of 2nd brake • Malfunction of 1st & reverse brake

★ : Refer to Automatic Transmission Overhaul.

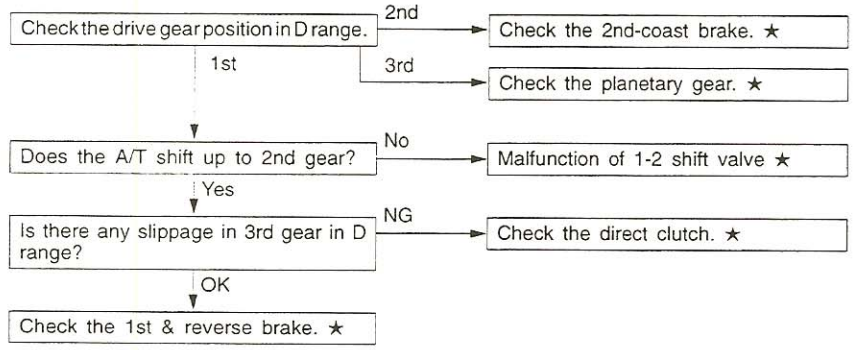


TSB Revision

INSPECTION PROCEDURE 4

• Does not reverse only	Probable cause
[Comment] When the engine is idling, the vehicle does not reverse even if the selector lever is shifted from N to R. In such cases, the cause is probably a malfunction of a clutch, brake or the valve body.	• Malfunction of 2nd-coast brake • Malfunction of direct clutch • Malfunction of 1st & reverse brake • Malfunction of valve body • Malfunction of planetary gear

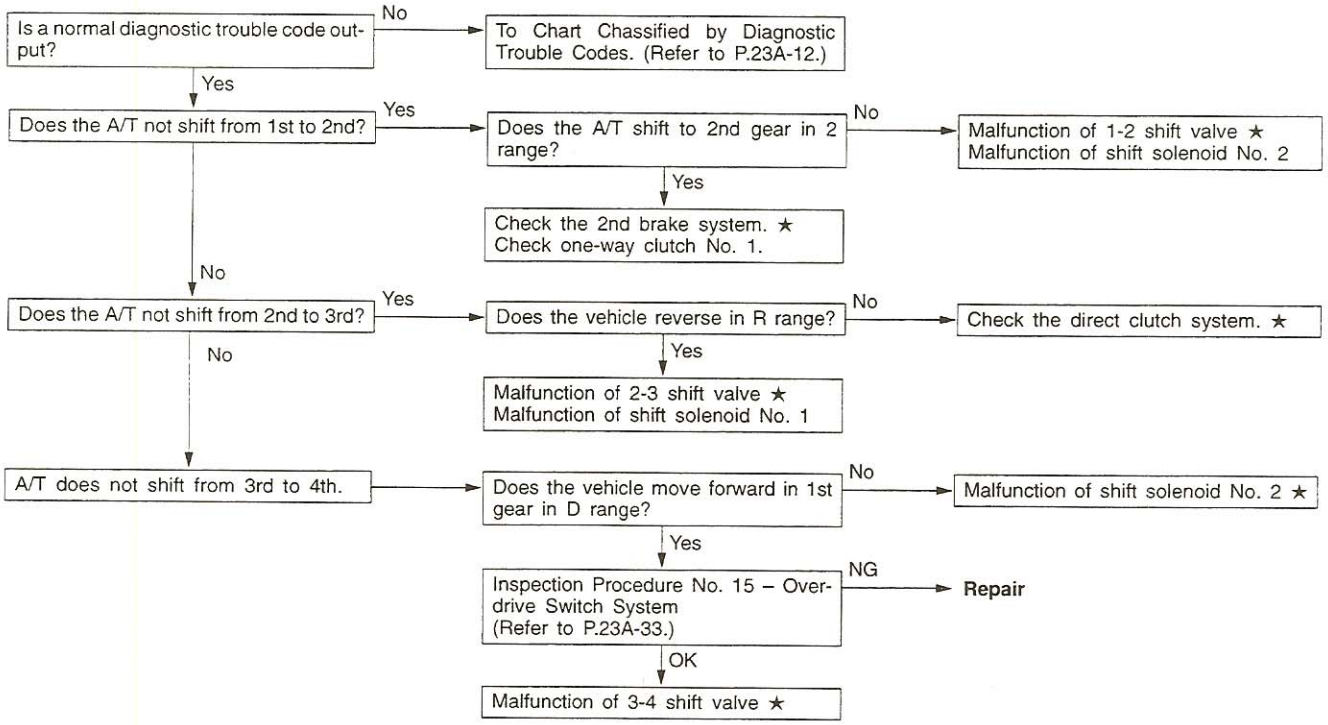
★ : Refer to Automatic Transmission Overhaul.



INSPECTION PROCEDURE 5

• Upshifting does not occur	Probable cause
[Comment] Upshifting does not occur under conditions when upshifting should occur. Check shifting from 1st to 2nd, 2nd to 3rd and 3rd to 4th respectively.	• Shift solenoid • TCM • Power train internal parts

★ : Refer to Automatic Transmission Over.

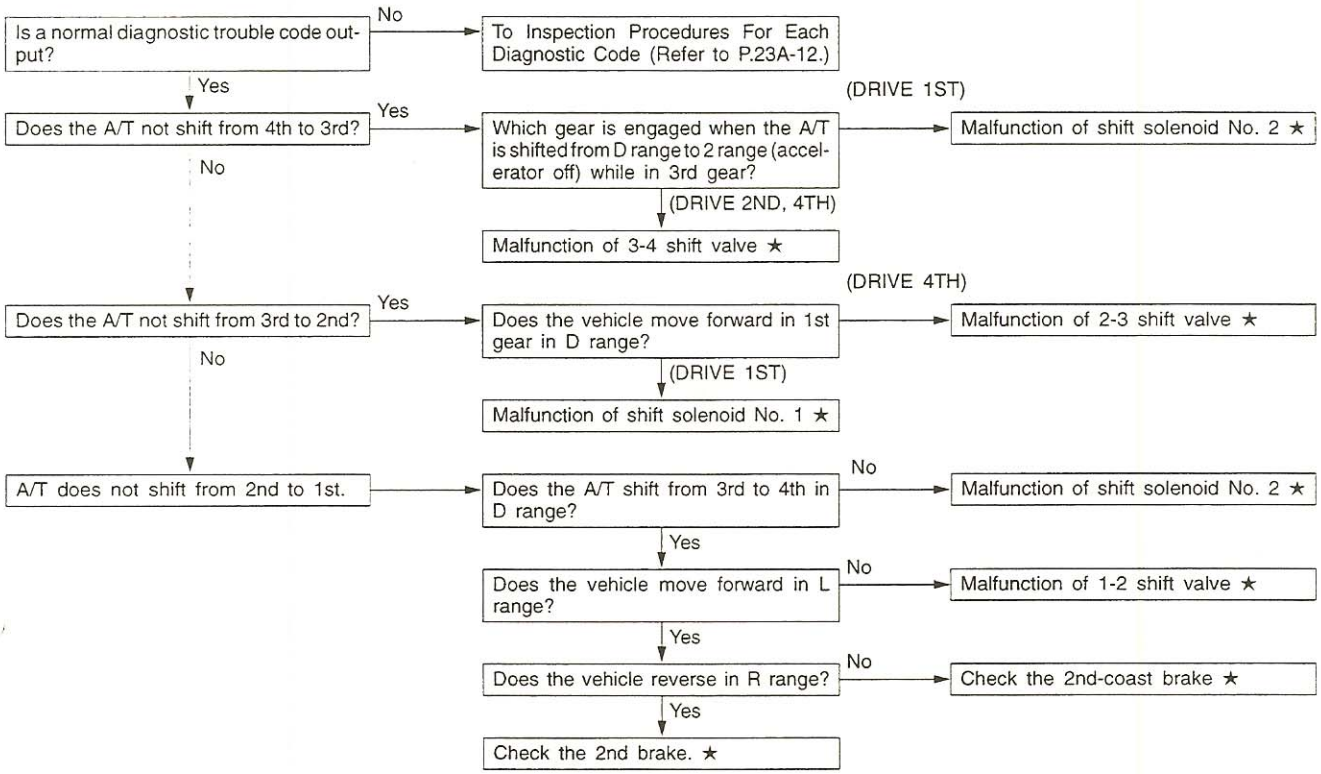


TSB Revision

INSPECTION PROCEDURE 6

• Downshifting does not occur	Probable cause
[Comment] Downshifting does not occur under conditions when downshifting should occur. Check shifting from 2nd to 1st, 3rd to 2nd and 4th to 3rd respectively.	• Shift solenoid • TCM • Power train internal parts

★ : Refer to Automatic Transmission Overhaul.



TSB Revision

INSPECTION PROCEDURE 7

Shifting point abnormality	Probable cause
[Comment] Shifting occurs at points are different from the shift pattern. Note that the shift pattern will vary in different modes and at high oil temperatures.	• Throttle position sensor • Output shaft speed sensor • Oil temperature sensor • Pattern select switch • Free wheel engage switch • Low range operation detection switch • TCM • ECM

Is a normal diagnostic trouble code output?
- No → To Inspection Procedure for Each Diagnostic Trouble Code (Refer to P.23A-12.)
- Yes ↓

SCAN TOOL Data list
- 36-Mode select switch
  OK: HOLD only when in hold mode.

- NG → Inspection Procedure No.14-Pattern select switch system (Refer to P.23A-33.)
- OK ↓

SCAN TOOL Data list
- 36-Mode select switch
  OK: 2WD when in 2WD mode
  4WD when in 4WD mode
  However, pattern select switch should be at the normal position.

- NG → Inspection Procedure No.17-Free wheel engage switch system (Refer to P.23A-34.)
- OK ↓

SCAN TOOL Data list
- 49-Transfer switch
  OK: T/F low when at 4LLc
  T/F high when not at 4LLc

- NG → Inspection Procedure No.18-Low range operation detection switch (Refer to P.23A-35.)
- OK ↓

SCAN TOOL Data list
- 15-Fluid temperature sensor
  OK: 70 – 100 °C after engine has warmed up

- NG → Code Nos.15, 16-Oil temperature system (Refer to P.23A-
- OK ↓

SCAN TOOL Data list
- 57-Engine coolant temperature signal
  OK: LOW TEMP. when engine coolant temperature is 30°C (86°F) or lower
  HIGH TEMP. when engine coolant temperature is 70°C (158°F) or higher

- NG → Code Nos.23, 24-Signal line from ECM to TCM (Refer to 23A-14.)
- OK ↓

Check trouble symptoms.
- NG → Replace the TCM.

INSPECTION PROCEDURE 8

Upshifting occurs spontaneously	Probable cause
[Comment] Upshifting occurs in ranges where upshifting should not occur, such as when in 2nd gear in L range, 3rd gear in 2 range or 4th gear in D range when the O.D. switch is off.	• Park/neutral position switch • Overdrive switch • TCM

SCAN TOOL Data list
- 51-P range switch, 52-R range switch
  53-N range switch, 54-D range switch
  55-2 range switch, 56-L range switch
  OK: ON only when the selector lever is at each position

- NG → Code Nos. 29, 30-Park/neutral position switch system check (Refer to P.23A-15.)
- OK ↓

SCAN TOOL Data list
- 35-Overdrive switch
  OK: Scan tool display and mode selected should match

- NG → Inspection Procedure No.15-Overdrive switch system (Refer to P.23A-33.)
- OK ↓

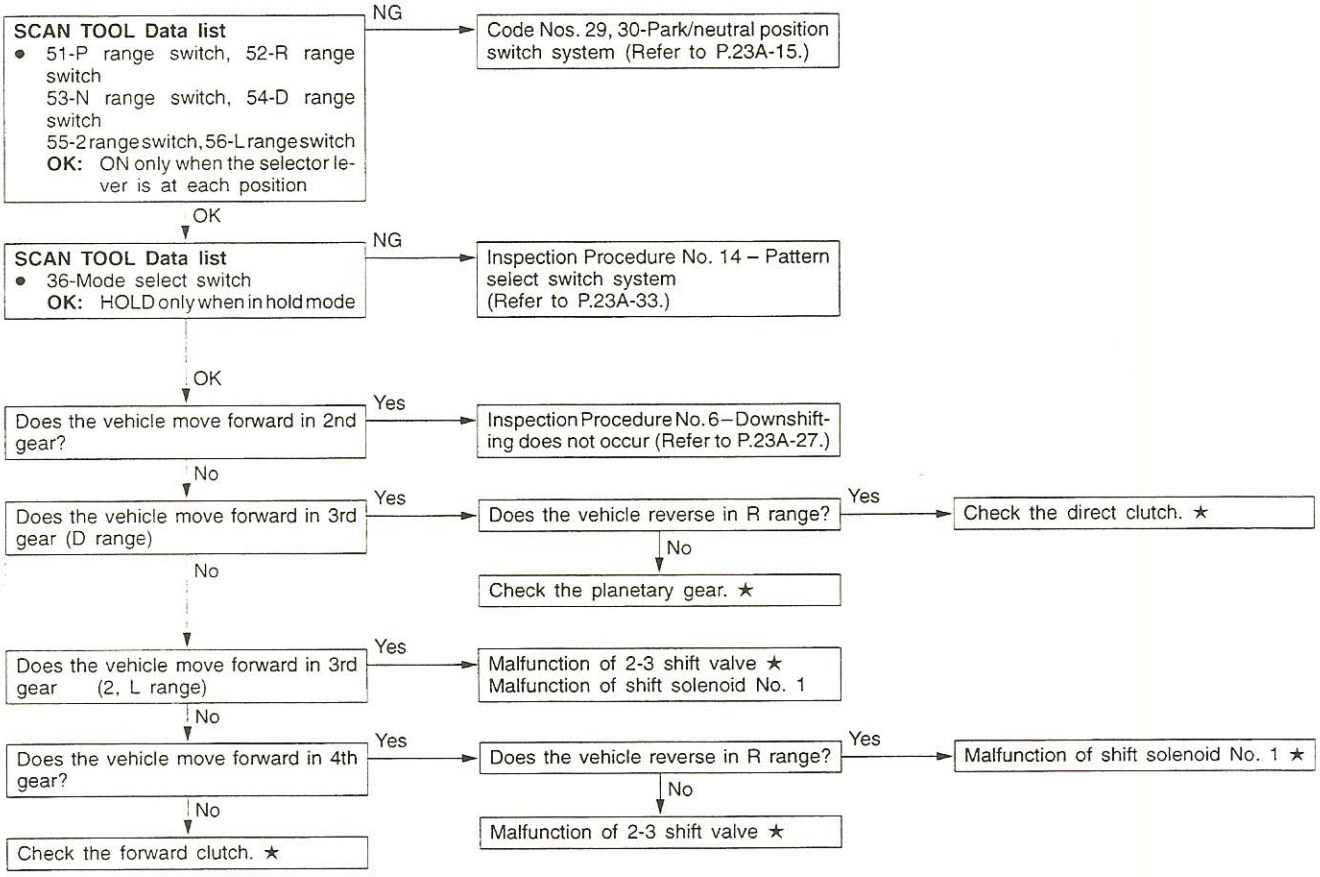
Replace the TCM.

TSB Revision

INSPECTION PROCEDURE 9

• Incorrect drive gear position	Probable cause
[Comment] Vehicle starts off in 2nd, 3rd or 4th gear when in D range. Often occurs when starting off is not smooth.	• Park/neutral position switch • Pattern select switch • Direct clutch • Planetary gear • Valve body

★ : Refer to Automatic Transmission Overhaul.

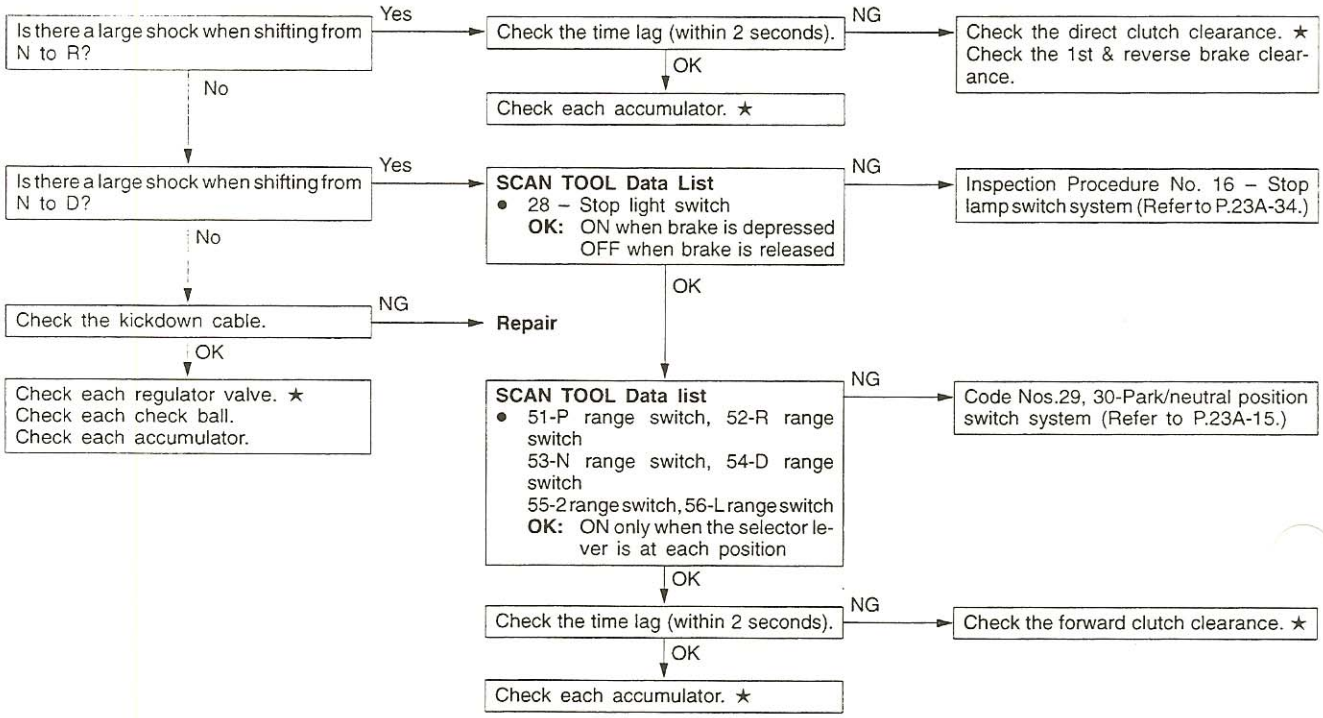


TSB Revision

INSPECTION PROCEDURE 10

• Large shocks	Probable cause
[Comment] Shocks accompany shifting from N to D, N to R and during each upshift and downshift.	• Direct clutch • 1st & reverse brake • Stop light switch • Park/neutral position switch • Forward clutch • Valve body

★ : Refer to Automatic Transmission Overhaul.

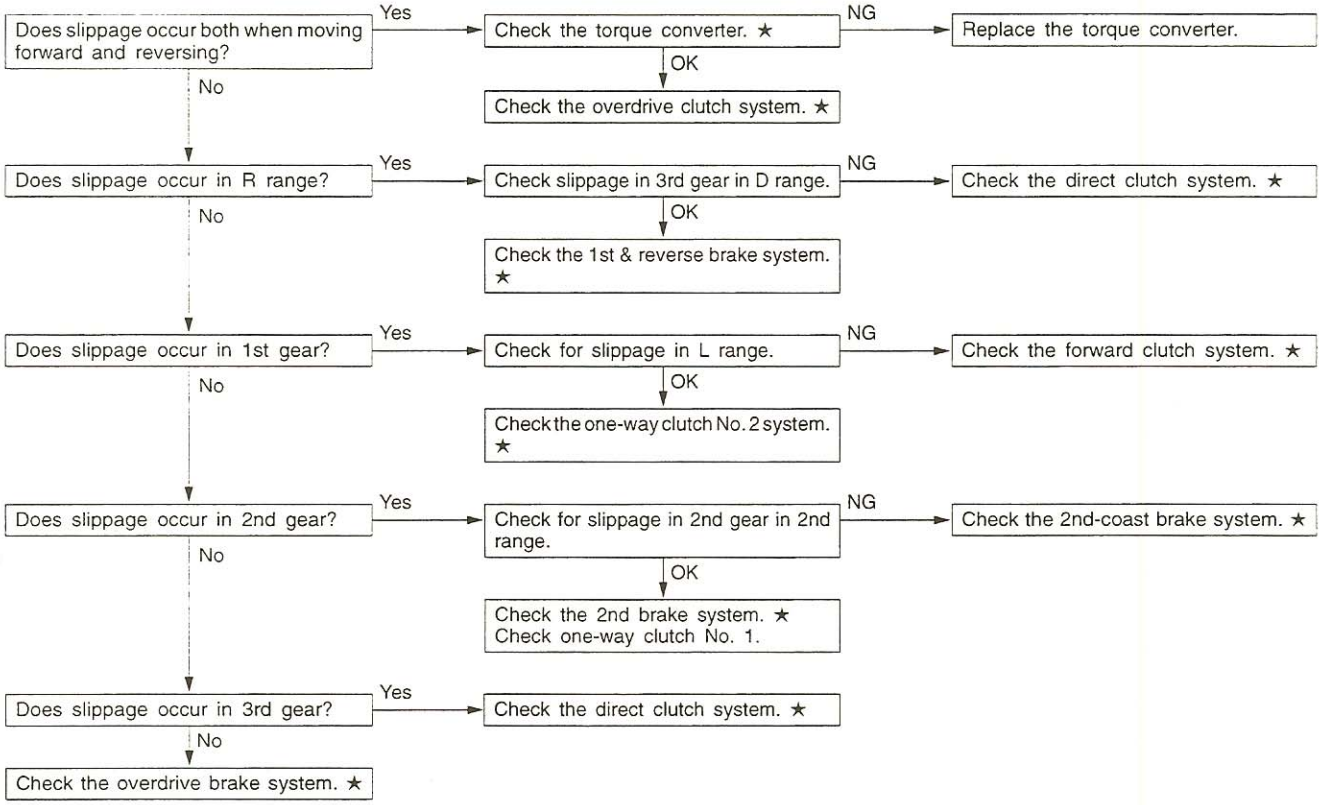


TSB Revision

INSPECTION PROCEDURE 11

● Slippage (vibration)	Probable cause
[Comment] Occurs when a clutch or brake does not fully engage due to low hydraulic pressure or a worn facing. Appears as vibration when the problem is slight.	● Torque converter ● Direct clutch ● Forward clutch ● 2nd-coast brake ● 2nd brake ● Overdrive brake

★ : Refer to Automatic Transmission Overhaul.

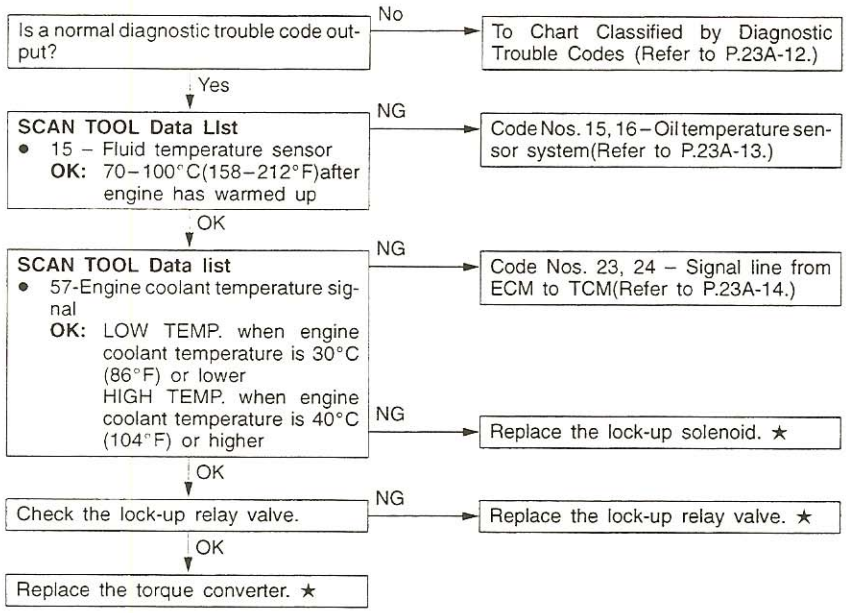


TSB Revision

INSPECTION PROCEDURE 12

• Malfunction of lock-up	Probable cause
[Comment] When lock-up does not operate even though in the lock-up range, and also when lock-up is operating and the engine is idling but then stalls.	• Torque converter • Valve body • Oil temperature sensor

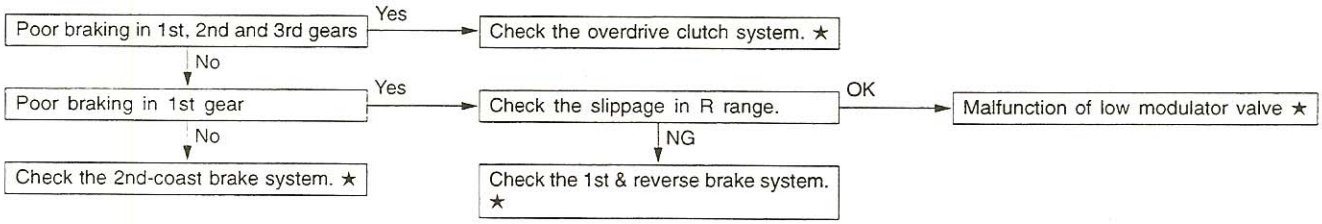
★ : Refer to Automatic Transmission Overhaul.



INSPECTION PROCEDURE 13

• Abnormal engine braking	Probable cause
[Comment] Engine braking effectiveness is poor after downshifting has occurred.	• Overdrive clutch • 1st & reverse brake • 2nd-coast brake • Valve body

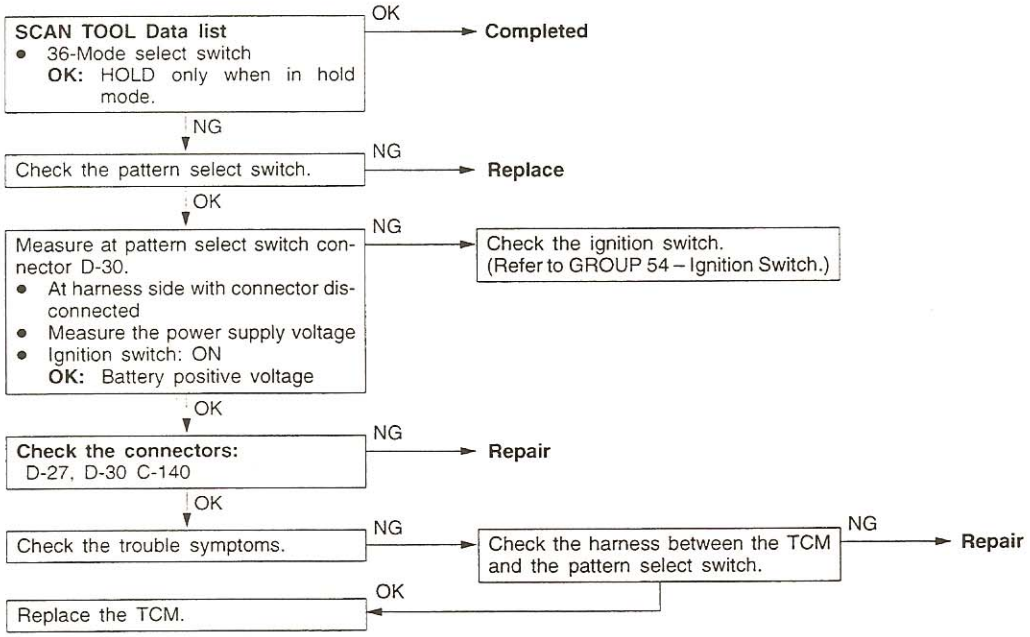
★ : Refer to Automatic Transmission Overhaul.



TSB Revision

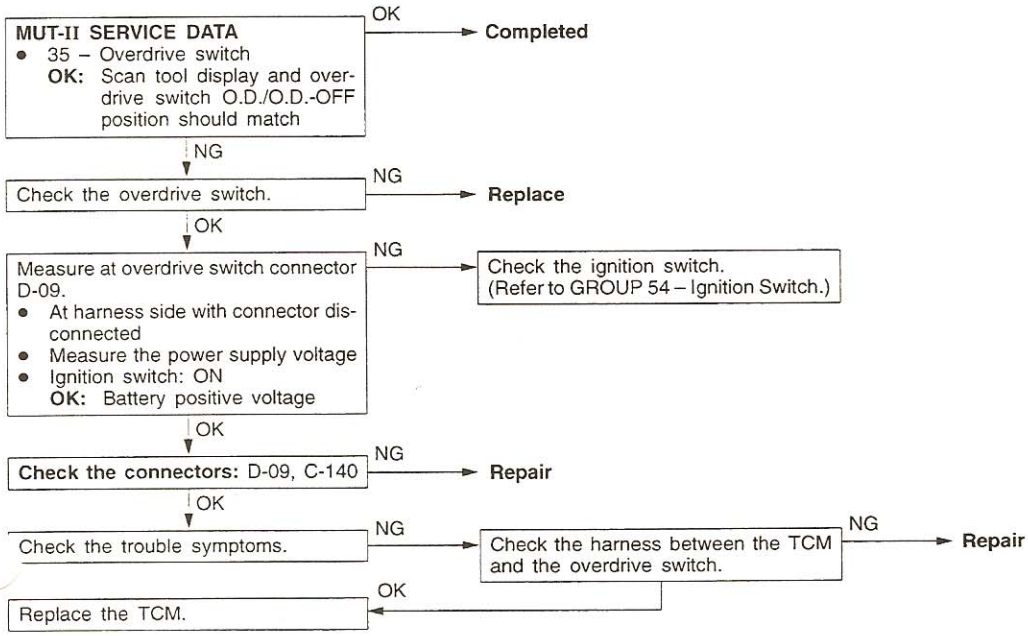
INSPECTION PROCEDURE 14

• Pattern select switch system	Probable cause
[Comment] If the shift pattern does not change when the pattern select switch is operated, the cause is probably a malfunction of the pattern select switch.	• Malfunction of pattern select switch • Malfunction of connector • Malfunction of TCM



INSPECTION PROCEDURE 15

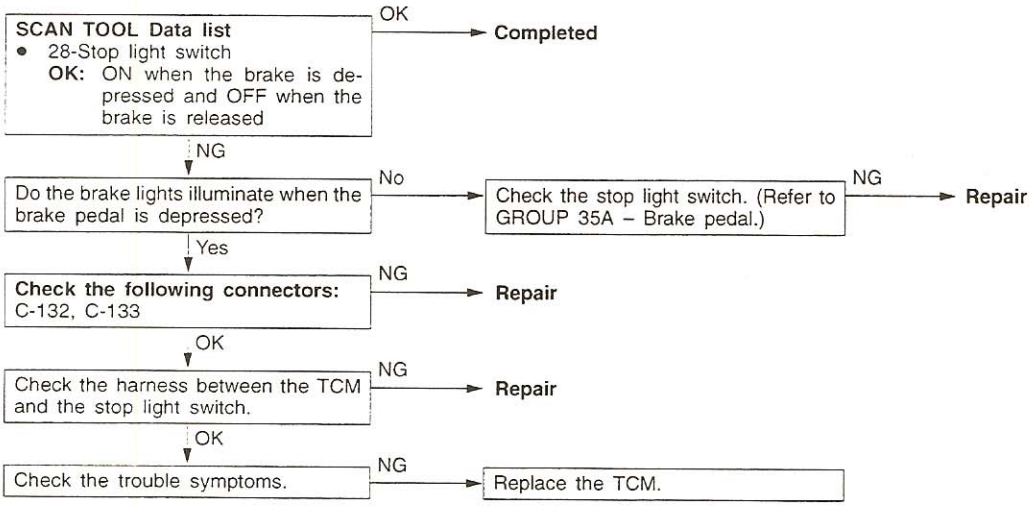
• Overdrive switch system	Probable cause
[Comment] If downshifting does not occur when overdrive is turned off while driving in 4th gear, or if shifting to 4th gear is not possible, the cause is probably a problem in the overdrive switch system.	• Malfunction of overdrive switch • Malfunction of connector • Malfunction of TCM



TSB Revision

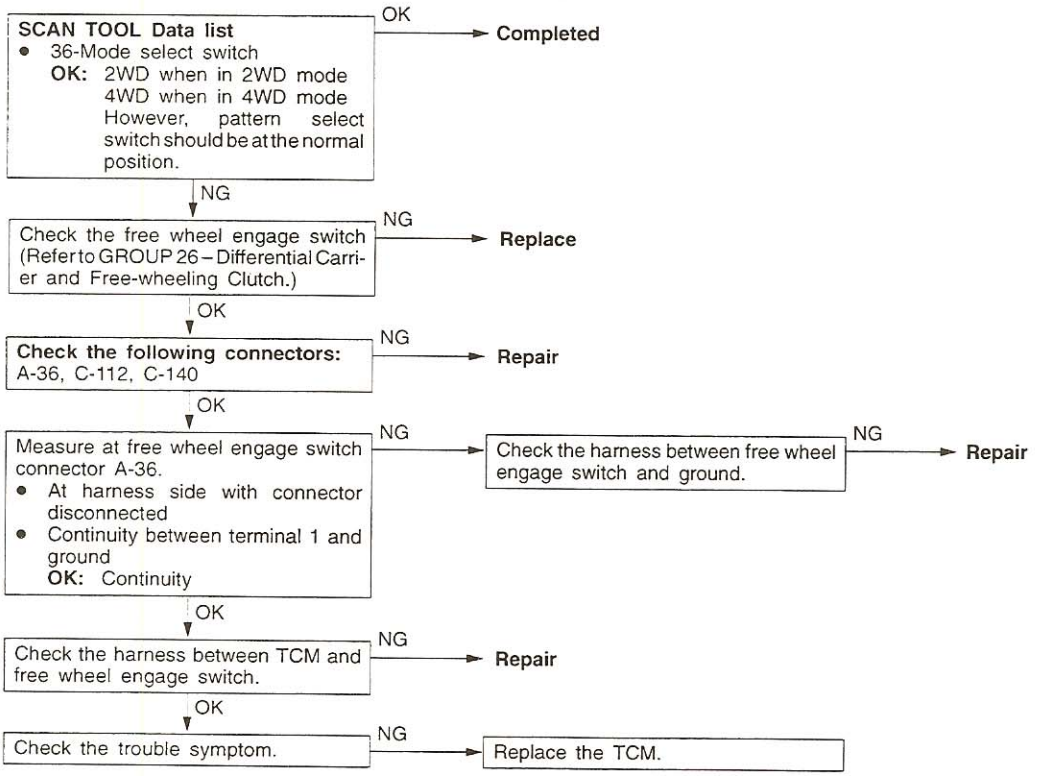
INSPECTION PROCEDURE 16

• Stop light switch system	Probable cause
[Comment] If large shocks occur during squat control, the cause is probably a problem with the stop light switch.	• Malfunction of stop light switch • Malfunction of connector • Malfunction of TCM



INSPECTION PROCEDURE 17

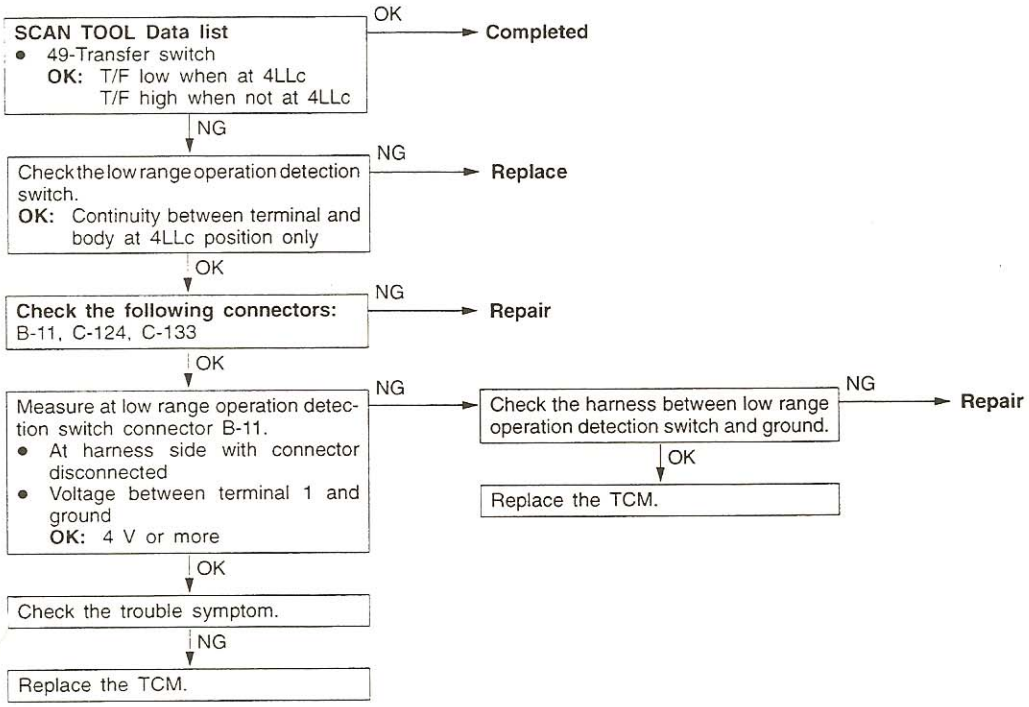
• Free wheel engage switch system	Probable cause
[Comment] If a lock-up occurs in 3rd gear when the transfer lever is at 4H, the overdrive switch is off and the pattern select switch is at the normal position, the cause is probably a malfunction of the free wheel engage switch.	• Malfunction of free wheel engage switch • Malfunction of connector • Malfunction of TCM



TSB Revision

INSPECTION PROCEDURE 18

• Low range operation detection switch system	Probable cause
[Comment] If the transmission will not shift to 4th gear, or if it shifts to 4th gear when the transfer lever is in the 4LLc position, the cause is probably a malfunction of the low range operation detection switch.	• Malfunction of low range operation detection switch • Malfunction of connector • Malfunction of TCM



TSB Revision

SERVICE DATA REFERENCE TABLE

23100810130

Item No.	Inspection item	Inspection conditions		Normal value
11	Throttle position sensor	Engine: Idling Selector lever position: N	Accelerator pedal is not depressed (Throttle valve is fully closed)	0 – 5%
			Accelerator pedal is depressed	Gradually rises from the above value
			Accelerator pedal is fully depressed (Throttle valve is fully open) (up to 2 seconds)	85 – 100%
15	Oil temperature sensor	Warming up	Drive for 15 minutes or more so that the ATF temperature becomes 70 – 90°C (158 – 194°F).	Gradually rises to 70 – 90°C
23	Ignition signal	Select lever position: P range	Idling (vehicle stopped)	600 – 900 rpm
		Select lever position: D range Overdrive: ON Transfer lever position: 2H	Driving at constant speed of 50 km/h (31 mph) (20 seconds or more)	900 – 1500 rpm
27	Shift position signal	Engine: Idling (Vehicle stopped) Selector lever position: D Mode selection: Normal	Accelerator pedal is not depressed (Throttle valve is fully closed)	1st
			N to D shift	1st to 3rd to 1st
		Selector lever position: L Mode selection: Normal	Idling (Vehicle stopped)	1st
		Selector lever position: 2 Mode selection: Normal	Idling (Vehicle stopped)	1st
			Driving at 40 km/h (24 mph) (20 seconds or more)	2
27	Shift position signal	Selector lever position: D Mode selection: Normal Overdrive: OFF	Driving at a constant speed of 50 km/h (31 mph) (20 seconds or more)	3rd
		Selector lever position: D Mode selection: Normal Overdrive: ON	Driving at a constant speed of 50 km/h (31 mph) (20 seconds or more)	4th
28	Stop light switch	Ignition switch: ON Engine: Stopped	Brake pedal is depressed	ON
			Brake pedal is not depressed	OFF
31	Input shaft speed sensor	Selector lever position: D Mode selection: Normal Overdrive: OFF Transfer lever position: 4H	Driving at 30 km/h (19 mph)	800 – 1200 rpm
			Driving at 50 km/h (19 mph)	1300 – 1900 rpm
32	Output shaft speed sensor	Selector lever position: D Mode selection: Normal Overdrive: ON Transfer lever position: 4H	Driving at 30 km/h (19 mph)	800 – 1200 rpm
			Driving at 50 km/h (31 mph)	1300 – 1900 rpm

TSB Revision

Item No.	Inspection item	Inspection conditions		Normal value
35	Overdrive switch	Ignition switch: ON Engine: Stopped	Overdrive switch: ON	O.D.
			Overdrive: OFF	O.D.–OFF
36	Pattern select switch	Ignition switch: ON Engine: Stopped	Pattern select switch Hold mode	Hold
			Pattern select switch Normal mode	2WD (when in 2WD) 4WD (when in 4WD)
39	Cruise control unit (OD OFF signal)	Selector lever position: D Mode selection: Normal	Auto-cruise control OFF	OFF
			Auto-cruise control ON [climbing at 50 km/h (31 mph)]	ON
41	Shift solenoid No. 1	Selector lever position: D Mode selection: Normal	Driving at 10 km/h (6 mph) (Drive 1st)	ON
			Driving at 50 km/h (31 mph) (Drive 4th)	OFF
43	Shift solenoid No. 2	Selector lever position: D Mode selection: Normal Overdrive: OFF	Driving at 10 km/h (6 mph) (Drive 1st)	OFF
			Driving at 50 km/h (31 mph) (Drive 3rd)	ON
47	Lock-up solenoid	Selector lever position: D Mode selection: Normal Overdrive: ON	Driving at 10 km/h (6 mph) (Drive 1st)	OFF
			Driving at 50 km/h (31 mph) (Drive 4th)	ON
49	Transfer switch	Ignition switch: ON Engine: Stopped	Transfer lever position: 4HLc	T/F High
			Transfer lever position: 4LLc	T/F Low
51	P range switch	Ignition switch: ON Engine: Stopped	Select lever position: P	ON
			Select lever position: Other than P	OFF
52	R range switch	Ignition switch: ON Engine: Stopped	Select lever position: R	ON
			Select lever position: Other than R	OFF
53	N range switch	Ignition switch: ON Engine: Stopped	Select lever position: N	ON
			Select lever position: Other than N	OFF
54	D range switch	Ignition switch: ON Engine: Stopped	Select lever position: D	ON
			Select lever position: Other than D	OFF
55	2 range switch	Ignition switch: ON Engine: Stopped	Select lever position: 2	ON
			Select lever position: Other than 2	OFF
56	L range switch	Ignition switch: ON Engine: Stopped	Select lever position: L	ON
			Select lever position: Other than L	OFF
57	Water temperature signal	When engine changes from cold to warm	While engine is cold	LOW TEMP.
			After engine has warmed up	HIGH TEMP.

TSB Revision

REFERENCE FOR FAIL-SAFE/BACKUP FUNCTIONS

23100830068

When malfunctions of the main sensors or actuators are detected by the on-board diagnostic, the ve is controlled by means of the pre-set control logic to maintain safe conditions for driving.

Malfunctioning item	Control contents during malfunction
Output shaft speed sensor	When there is an open circuit in the output shaft speed sensor, 4th gear lock-up does not occur.
Park/neutral position switch	If there is an open circuit in the N, 2 or L signal line, driving is possible in the case of 2 and L (same as D range) so that control can be performed as if the range is D range, and driving is not possible in N range. If more than one of the 2, L or N signals are input, the order of priority for control is L to 2 to N.
Throttle position sensor	If the output is 0.09 V or less or 4.95 V or more, the throttle is fully closed and gear shifting control is carried out.
Lock-up solenoid	If a problem is detected, lock-up is stopped over the whole range and the solenoid is turned off to prevent the engine from stalling during idling.
Shift solenoid Nos. 1 and 2	If a problem is detected, each solenoid stops operating and is turned off. The gear shifting logic when a problem is detected is given in the table below.

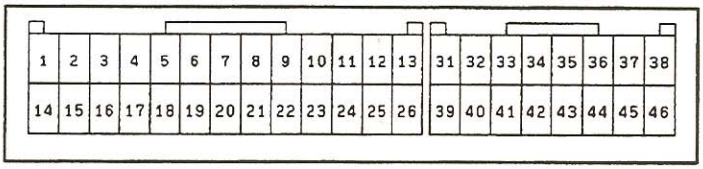
Selector lever position	Normal			If there is a malfunction of solenoid No. 1			If there is a malfunction of solenoid No. 2			If there is a malfunction of solenoid Nos. 1 and 2		
	Gear	S1	S2	Gear	S1	S2	Gear	S1	S2	Gear	S1	S2
D	1	ON	OFF	3		OFF → ON	1	ON		O/D		
	2	ON	ON	3		ON	O/D	ON → OFF		O/D		
	3	OFF	ON	3		ON	O/D	OFF		O/D		
	O/D	OFF	OFF	O/D		OFF	O/D	OFF		O/D		
2	1	ON	OFF	3		OFF → ON	1	ON		3		
	2	ON	ON	3		ON	3	ON → OFF		3		
	3	OFF	ON	3		ON	3	OFF		3		
L	1	ON	OFF	1		OFF	1	ON		1		
	2	ON	ON	2		ON	1	ON		1		

ON : Energized (ON)
OFF : Not energized (OFF)

TSB Revision

TCM TERMINAL VOLTAGE REFERENCE CHART

23100840139



TRA0987

Terminal No.	Inspection item	Inspection conditions	Standard value
1	Lock-up solenoid No.3	When lock-up clutch is operating	System voltage
		When lock-up clutch is not operating	0 V
2	Backup power supply	Ignition switch: OFF	System voltage
3	–	–	–
4	–	–	–
5	Stop light switch	When brake pedal is depressed	0 V
		When brake pedal is released	System voltage
6	–	–	–
7	–	–	–
8	Throttle position sensor	Accelerator pedal: Fully closed	0.3 – 1.0 V
		Accelerator pedal: Fully closed	4.4 – 5.0 V
9	–	–	–
10	–	–	–
11	Park/neutral position switch (P)	Selector lever position: P	System voltage
		Selector lever position: Other than P	0 V
12	Ground	Engine: Idling	0 V
13	–	–	–
14	Shift solenoid No.1	When in 1st or 2nd gear	System voltage
		When in 3rd or 4th gear	0 V
15	Power supply	Ignition switch: ON	System voltage
		Ignition switch: OFF	0 V
16	Shift solenoid No.2	When in 2nd or 3rd gear	System voltage
		When in 1st or 4th gear	0 V
17	Diagnostic test mode control terminal	–	–
18	Diagnostic output terminal	When scan tool is not connected	System voltage
19	–	–	–

TSB Revision

Terminal No.	Inspection item	Inspection conditions	Standard value
20	–	–	–
21	Oil temperature warning lamp	When normal	0 V
		Ignition switch: For seconds after turning ON	System voltage
22	Oil temperature sensor	ATF temperature: 120 °C (248 °F)	Approx. 1.9 V
		ATF temperature: 150 °C (302 °F)	Approx. 1.1 V
23	Low range operation detection switch	Transfer lever position: 4HLc	System voltage
		Transfer lever position: 4LLc	0 V
24	Park/neutral position switch (R)	Selector lever position: R	System voltage
		Selector lever position: Other than R	0 V
25	Ground	Engine: Idling	0 V
26	Ground	Engine: Idling	0 V
31	Park/Neutral position switch (R)	Selector lever position: L	System voltage
		Selector lever position: Other than L	0 V
32	Park/neutral position switch (N)	Selector lever position: N	System voltage
		Selector lever position: Other than N	0 V
33	–	–	–
34	4WD operation detection switch	When in 2WD	4V or more
		When in 4WD	0 – 1 V
35	Output shaft speed sensor ground side	Ignition switch: OFF	0 V
		Ignition switch: ON	2.5 V
36	Input shaft speed sensor ground side	Ignition switch: OFF	0 V
		Ignition switch: ON	2.5 V
37	Cruise control unit (Overdrive OFF signal)	Selector lever position: D Mode selection: Normal Auto cruise control: ON [50km/h (31mph) setting] When driving on a level road surface	System voltage
		Selector lever position: D Mode selection: Normal Auto cruise control: ON [50km/h (31mph) setting When driving up a gradient road surface	0 V
38	Engine ignition signal	Engine: 3000 r/min	0.3 – 3 V
39	Park/neutral position switch (D)	Selector lever position: D	System voltage
		Selector lever position: Other than 2	0 V

TSB Revision

Terminal No.	Inspection item	Inspection conditions	Standard value
40	Park/neutral position switch (2)	Selector lever position: 2	System voltage
		Selector lever position: Other than N	0 V
41	Hold mode signal	When HOLD mode is selected	System voltage
		When NORMAL mode is selected	0 V
42	Overdrive switch	Overdrive switch: ON (O.D.)	System voltage
		Overdrive switch: OFF (O.D. -OFF)	0 V
43	Output shaft speed sensor output side	Vehicle: Stopped	2.5 V
		Vehicle: Moving forward	Other than 2.5 V
44	Input shaft speed sensor output side	Vehicle: Stopped	2.5 V
		Vehicle: Moving forward	Other than 2.5 V
45	Engine coolant temperature signal	Engine coolant temperature: 30 °C (86 °F) or less	0 – 0.1 V
		Engine coolant temperature: 70 °C (158 °F) or more	Approx. 2.5 V
46	MIL request signal	Ignition switch: ON	0.5 – 4.5 V

ON-VEHICLE SERVICE

23100[illegible]75

AUTOMATIC TRANSMISSION FLUID CHECK

Refer to GROUP 00 – Maintenance Service.

AUTOMATIC TRANSMISSION FLUID REPLACEMENT

23100100312

Refer to GROUP 00 – Maintenance Service.

TRANSFER OIL CHECK

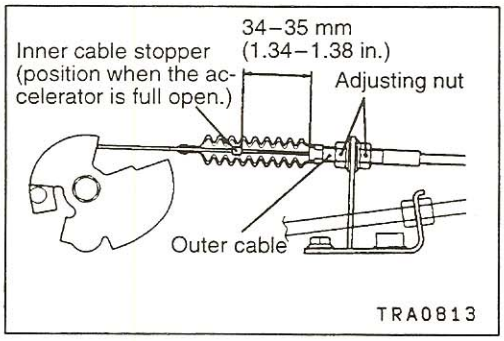
23100110100

Refer to GROUP 00 – Maintenance Service.

TRANSFER OIL REPLACEMENT

23100120103

Refer to GROUP 00 – Maintenance Service.



THROTTLE CABLE CHECK AND ADJUSTMENT

23100280061

(1) Make sure that the throttle lever and the bracket have no transformations.
(2) Remove the boot at the outer cable so that the inner cable stopper can be seen.
(3) Measure the dimension between the end of the inner cable stopper and that of the outer cable with throttle lever full open.

Standard value: 34–35 mm (1.34–1.38 in.)

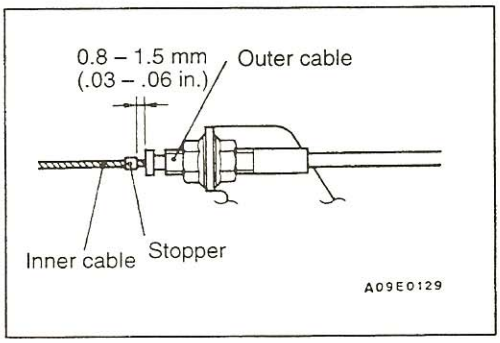
(4) If the distance is outside the standard value, adjust using the adjusting nut.

THROTTLE CABLE STOPPER ADJUSTMENT

23101040033

When replacing the old throttle cable with a new one, the throttle cable stopper will not be secured, and so you will need to secure it by the following procedure.

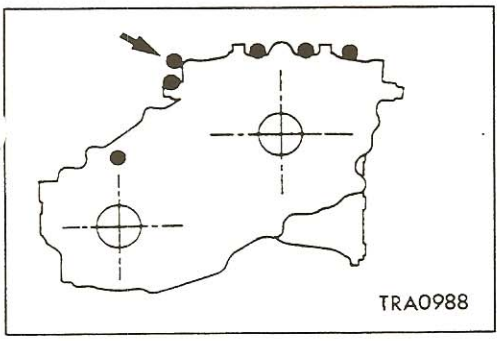
(1) Install the new throttle cable to the automatic transmission assembly so that it is routed correctly, and then secure it. (However, it should not be connected to the throttle body yet.)
(2) Remove the dust cover from the outer cable.
(3) Gently pull the inner cable with a force of approximately 2 N (.44 lbs.) to remove any slack from the cable.
(4) While pulling the cable, move the stopper until it is at the position shown in the illustration, and then crimp it to secure it in that position.
(5) Place the dust cover back over the outer cable.
(6) Connect the inner cable to the throttle body, and the carry out throttle cable adjustment. (Refer to P.23-42.)



CENTER DIFFERENTIAL LOCK DETECTION SWITCH CHECK

23100290026

Check for continuity between the brown connector terminal on the side of the transfer case and the transfer case.

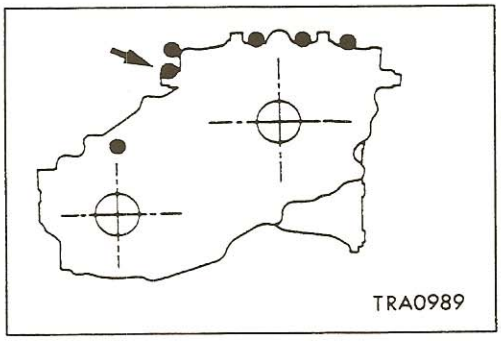


Transfer control lever position	Continuity
4H	No continuity
4HLc	Continuity

2WD/4WD DETECTION SWITCH CHECK

23100300026

Check for continuity between the black connector terminal on the side of the transfer case and the transfer case.

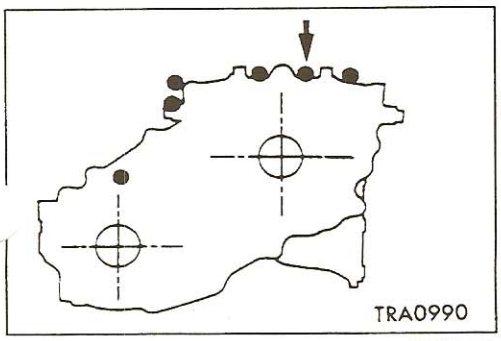


Transfer control lever position	Continuity
2H	Continuity
4H	No continuity

CENTER DIFFERENTIAL LOCK OPERATION DETECTION SWITCH CHECK

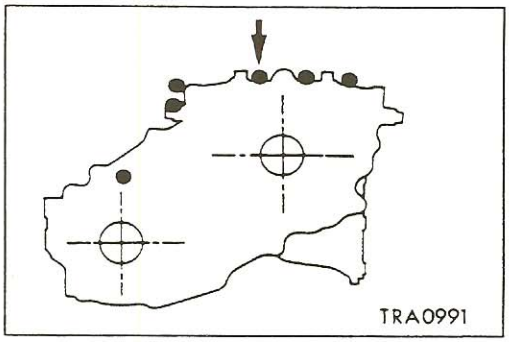
23100310029

Check for continuity between the brown connector terminal on the top of the transfer case and the transfer case.



Transfer control lever position	Continuity
4H	No continuity
4HLc	Continuity

TSB Revision

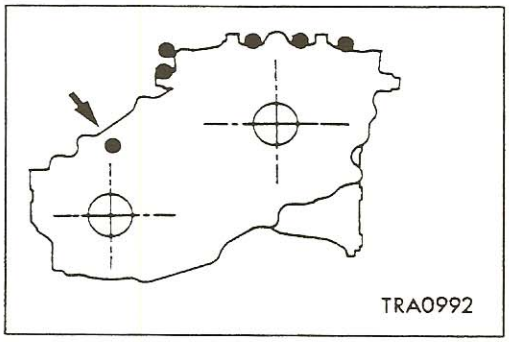

TRA0991

4WD OPERATION DETECTION SWITCH CHECK

231003

Check for continuity between the black connector terminal on the top of the transfer case and the transfer case.

Transfer control lever position	Continuity
2H	No continuity
4H	Continuity

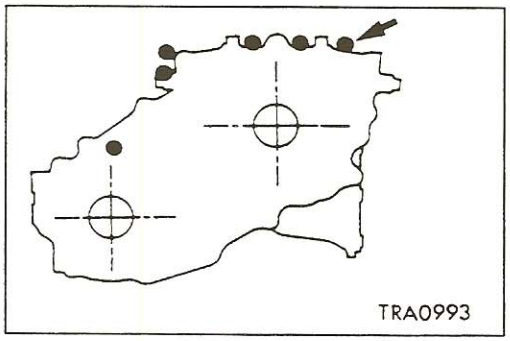

TRA0992

HIGH RANGE/LOW RANGE DETECTION SWITCH CHECK

23100330032

Check for continuity between the white connector terminal on the side of the transfer case and the transfer case.

Transfer control lever position	Continuity
4HLc	Continuity
N (between 4HLc and 4LLc)	No continuity
4LLc	Continuity

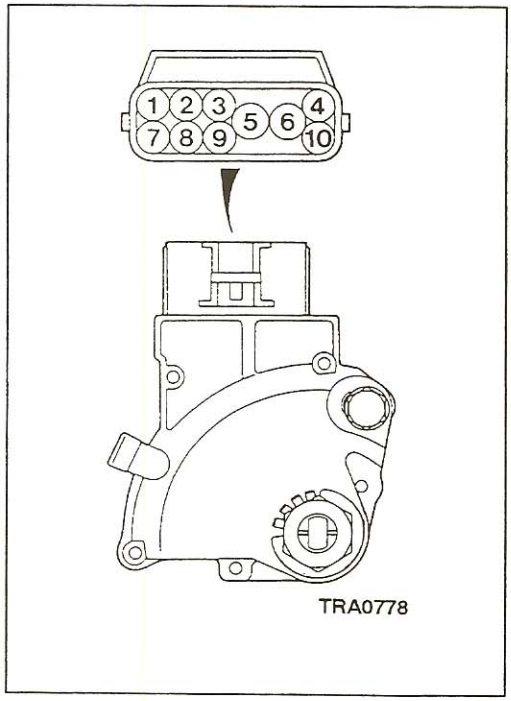

TRA0993

LOW RANGE OPERATION DETECTION SWITCH CHECK

23101180018

Check for continuity between the white connector terminal on the side of the transfer case and the transfer case.

Transfer control lever position	Continuity
4HLc	No continuity
4LLc	Continuity



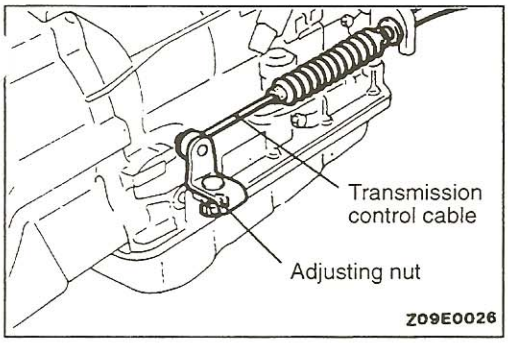
TRA0778

PARK/NEUTRAL POSITION SWITCH CHECK

23100140246

Item	Terminal No.								
	1	2	3	5	6	7	8	9	10
P	○			○	○				○
R	○							○	
N	○			○	○	○			
D	○						○		
2	○		○						
L	○	○							

TSB Revision

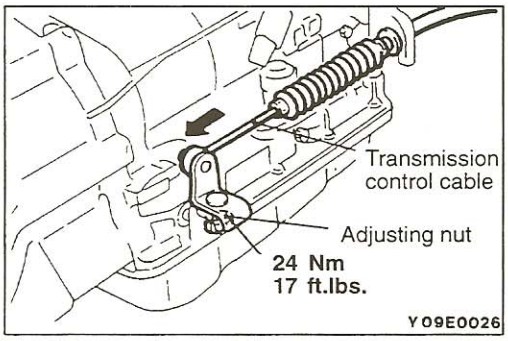


PARK/NEUTRAL POSITION SWITCH AND CONTROL CABLE ADJUSTMENT

23101030023

PARK/NEUTRAL POSITION SWITCH

(1) Move the selector lever to the N position.
(2) Loosen the adjusting nut of the control cable.

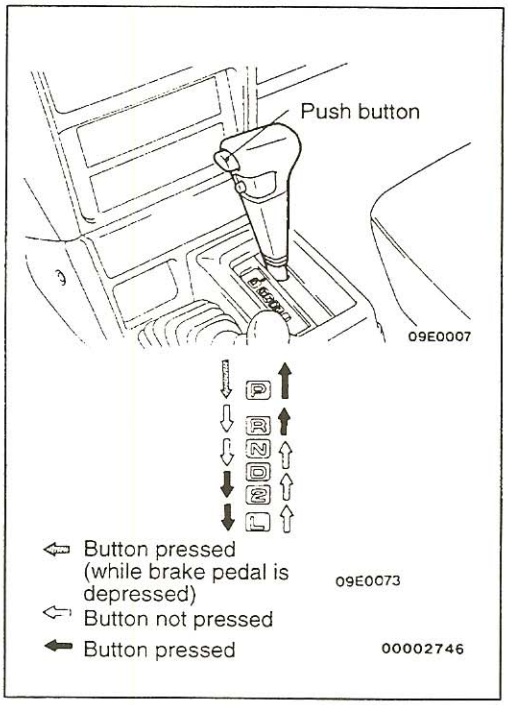


(3) Gently pull the end of the transmission control cable in the direction of the arrow and tighten the adjusting nut to the specified torque.
(4) Check that the selector lever is in the N position.
(5) Check that each range on the transmission side operates and functions correctly for each position of the selector lever.

CONTROL CABLE

It is possible to confirm whether control cable is properly adjusted by checking whether the park/neutral position switch is performing well.

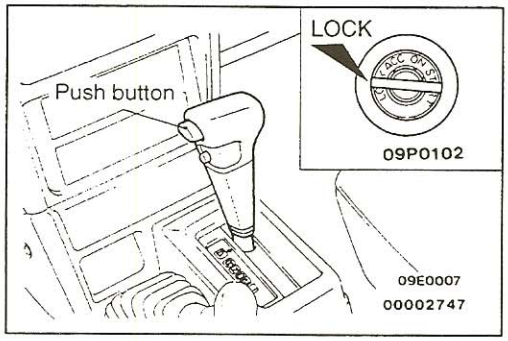
1. Apply the parking and service brakes fully.
2. Set the selector lever to the R position.
3. Turn the ignition key to the START position.
4. Slowly move the selector lever upward until it clicks as it fits into the notch of the P position. If the starter motor operates when the lever makes a click, P position is correct.
5. Then slowly move the selector lever to the N position by the same procedure as in the preceding paragraph. If the starter motor operates when the selector lever is at the N position, then the N position is correct.
6. Also check that the vehicle doesn't begin to move and the lever doesn't stop between P–R–N–D.
7. The control cable is properly adjusted if, as described above, the starter motor starts in both P range and N range.



SELECTOR LEVER OPERATION CHECK 23100130069

1. Move the selector lever to each position and check the lever moves smoothly and is controlled. Check that the position indicator is correct.
2. Check that the selector lever can be moved to each position by button operation as shown in the illustration).
3. Start the engine and check that the vehicle moves forward when the selector lever is shifted from N to D, and moves backward when shifted to R.
4. If there is a malfunction of the shift lever, adjust the control cable and selector lever sleeve. Check for worn shift lever assembly sliding parts.

NOTE
To move the selector lever from the P position to any other position, first turn the ignition key to any position other than LOCK and depress the brake pedal.

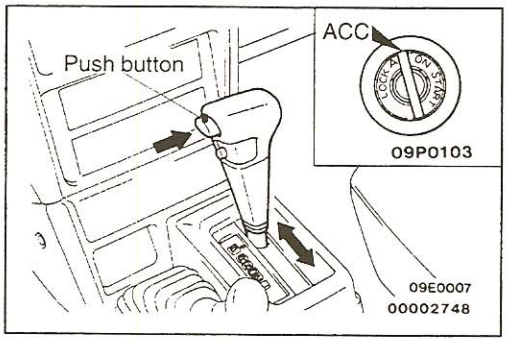


KEY INTERLOCK MECHANISM CHECK 23200090056

Completely stop the vehicle and switch off the engine before making the check.

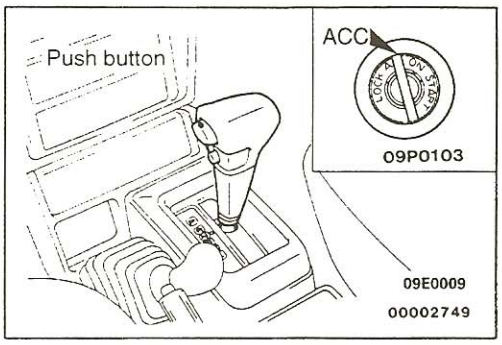
1. Check that the selector lever cannot be moved from P position to any other position under the following conditions.
   At the same time, check that the button cannot be pressed.

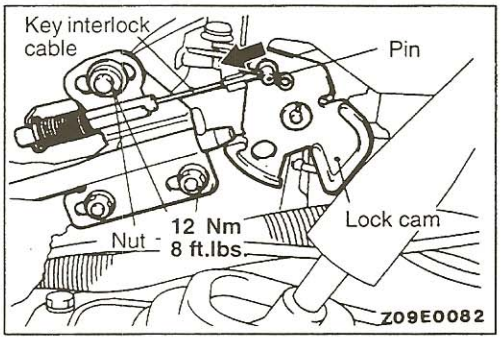
   Ignition key position: LOCK or removed
   Brake pedal: Depressed



2. Check that the selector lever can be moved smoothly from the position to any other position under the following conditions.
   Press the button a few times and check that the selector lever moves smoothly.

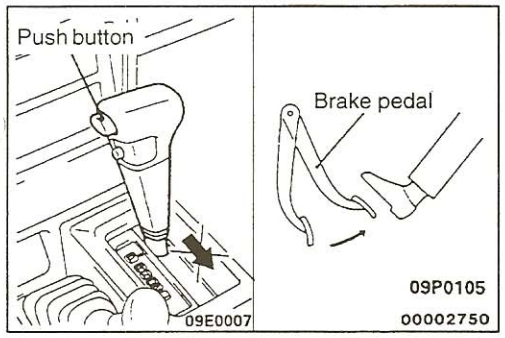
   Ignition key position: ACC
   Brake pedal: Depressed
   Button pressed





3. Check that the ignition key cannot be turned to the LOCK position at all positions of the selector lever other than P.
   Check that the ignition key turns smoothly to the LOCK position when the selector lever is set to the P position and the button is released.
4. If the above checks are not okay, adjust the key interlock cable mechanism as follows.
   (1) Remove the front console assembly.
   (2) Move the selector lever to the P position.
   (3) Turn the ignition key to the LOCK position.
   (4) Loosen the nut clamping the key interlock cable.
   (5) Gently push the lock cam until the pin stops in the direction of the arrow mark as shown in the illustration, and then tighten the nut to the specified torque to clamp the key interlock cable.
   (6) Install the front console assembly.

SHIFT LOCK MECHANISM CHECK 23200100193

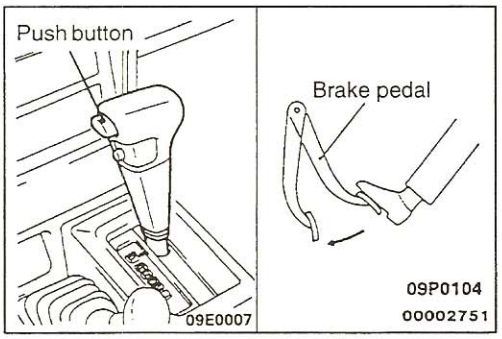


1. Check that the selector lever cannot be moved from the P position to any other position under the following conditions.

   Ignition key position: ACC
   Brake pedal: Released
   Button pressed

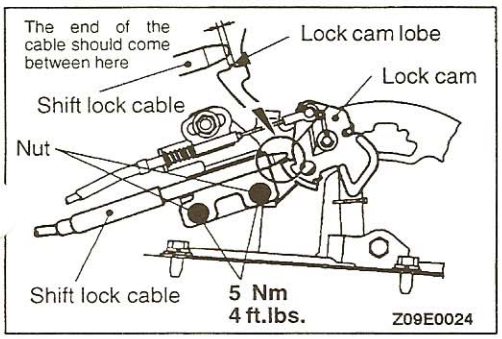
2. Check that the selector lever can be moved smoothly from the P position to other position under the following conditions.

   Ignition key position: ACC
   Brake pedal: Depressed
   Button pressed



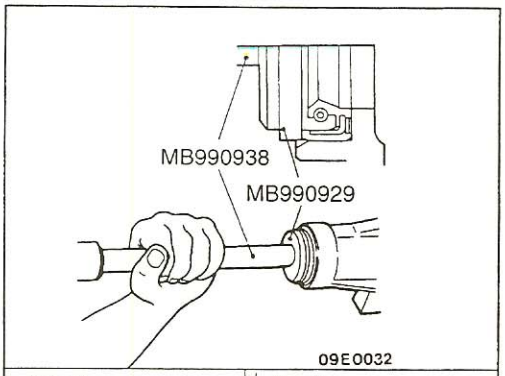
3. Check that the selector lever can be moved smoothly from the R position to the P position under the following conditions.

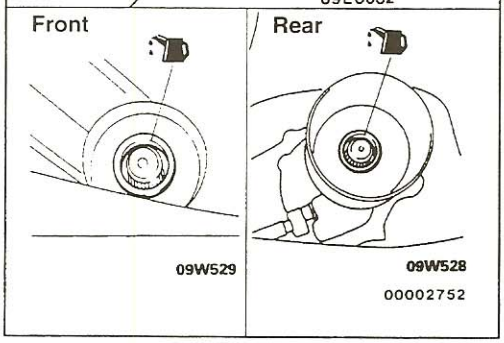
   Ignition key position: ACC
   Brake pedal: Released
   Button pressed



4. If the above operations are defective, adjust the shift lock cable mechanism by the following procedure.
   (1) Remove the front console assembly. (Refer to GROUP 52A – Floor Console.)
   (2) Move the selector lever to the P position.
   (3) Loosen the nut clamping the shift lock cable.
   (4) Adjust the shift lock cable so that the end of the cable (red mark) comes between the lobe of the lock cam, and then tighten the nut to the specified torque to clamp the shift lock cable.
   (5) Install the front console assembly.

TSB Revision

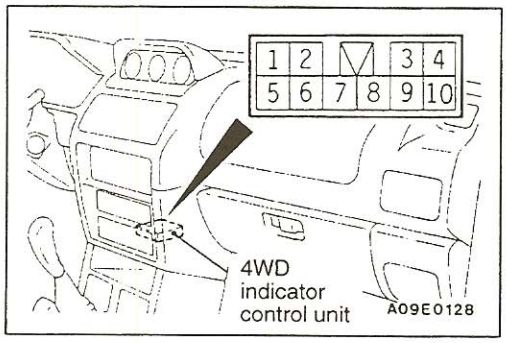


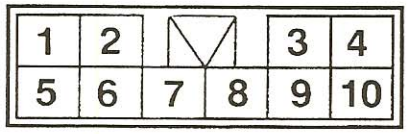


TRANSFER OIL SEAL REPLACEMENT 23100220049

1. Disconnect the propeller shaft from the transfer. (F to GROUP 25 – Propeller Shaft.)
2. Use a flat-tip (–) screwdriver to remove the oil seal.
3. Use the special tool to tap the transfer oil seal into the transfer. Note the direction of installation of the transfer oil seal shown in the illustration.
4. Apply a coating of transmission oil to the lip of the oil seal.

Transmission oil:
Hypoid gear oil SAE 75W-90W or 75W-85W conforming API GL-4 or higher





(Control unit side)

4WD INDICATOR CONTROL UNIT CHECK

23100340042

1. Remove the radio or CD player. (Refer to GROUP 54–Radio and Tape Player.)
2. Remove the 4WD indicator control unit.
3. Measure the voltage at the terminals under each condition.
4. Carry out the voltage measurements with the harness disconnected from the control unit. Insert the probe from the rear of the connector and take the measurement between terminal (8) (ground terminal) and the respective terminals.

Terminal No.	Inspection item		Inspection condition			Terminal voltage
3	Ignition switch (IG2)		Ignition switch (IG2)		OFF	0 V
					ON	Battery positive voltage
4	Combination meter (4WD indicator light)	Center differential lock indicator light	Ignition switch: ON	Transfer lever position	4H	Battery positive voltage
					4HLc	Less than 1.5 V

TSB Revision

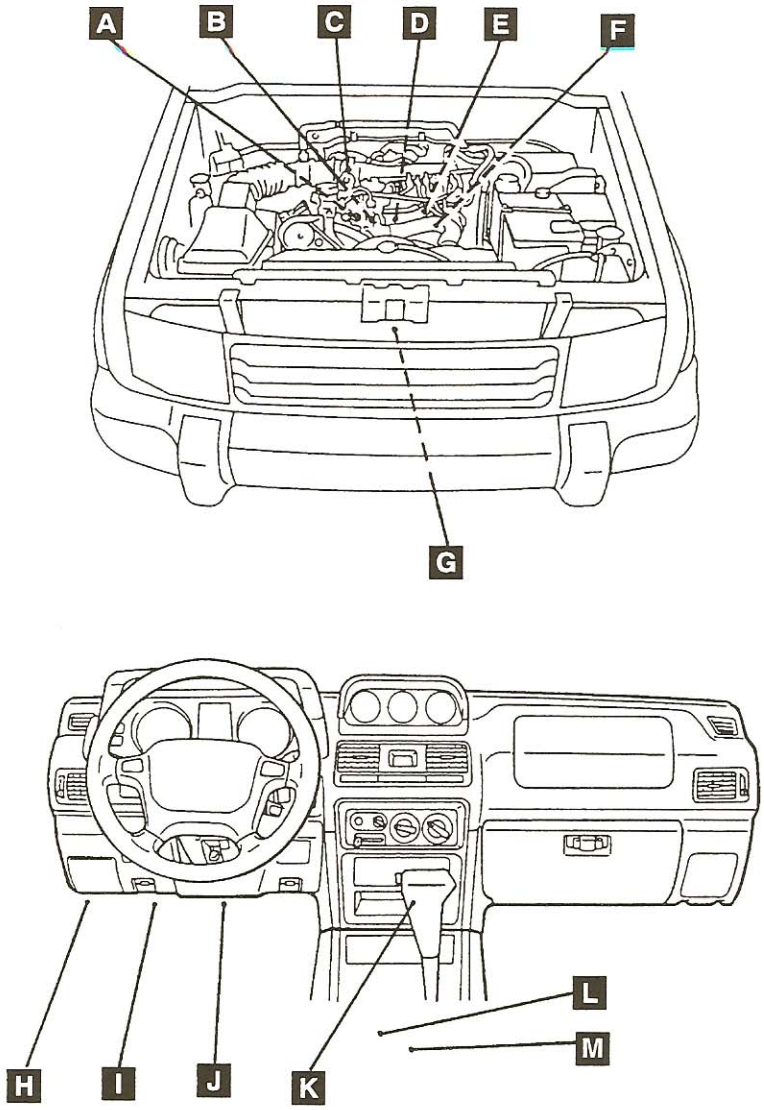
Terminal No.	Inspection item		Inspection condition			Terminal voltage
10	Combination meter (4WD indicator light)	Front wheel light	Ignition switch: ON		In 2WD	0 V
					In 4WD	Battery positive voltage*
9		Rear wheel light	Ignition switch: ON	Transfer lever position	N	0 V
					4HLc, 4LLc	Battery positive voltage*
6	Free-wheel engage switch		Ignition switch: ON		In 2WD	Battery positive voltage*
					In 4WD	0 V
1	HIGH/LOW detection switch		Ignition switch: ON	Transfer lever position	N	Battery positive voltage*
					4HLc, 4LLc	0 V
2	4WD operation detection switch		Ignition switch: ON	Transfer lever position	2H	Battery positive voltage*
					4H	0 V
5	Center differential lock detection switch		Ignition switch: ON	Transfer lever position	4H	Battery positive voltage*
					4HLc	0 V
7	Center differential lock operation detection switch		Ignition switch: ON	Transfer lever position	4H	Battery positive voltage*
					4HLc	0 V

NOTE
Battery positive voltage marked with (*) is 1–2V lower than actual battery positive voltage.

E.L.C. 4TH GEAR AUTOMATIC TRANSMISSION CONTROL COMPONENT LAYOUT

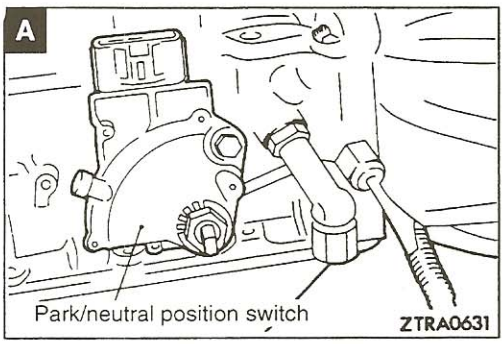
23100860159

Name	Symbol	Name	Symbol
Data link connector	H	Park/neutral position sensor	A
Free wheel engage switch	G	Pattern select switch	L
Input shaft speed sensor	F	Solenoids	D
Low range operation detection switch	M	Stop light switch	J
Overdrive switch	K	TCM	I
Oil temperature sensor	B	Throttle position sensor	C
Output shaft speed sensor	E	–	–

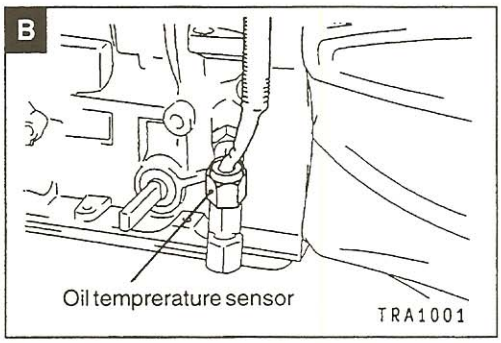


TRA1018

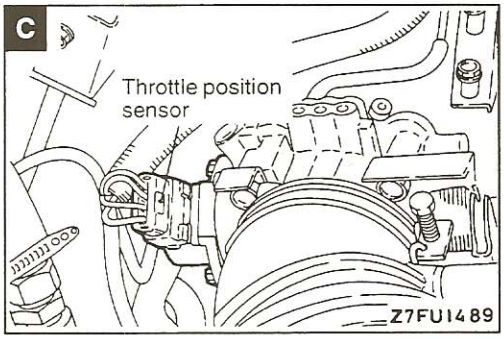
A



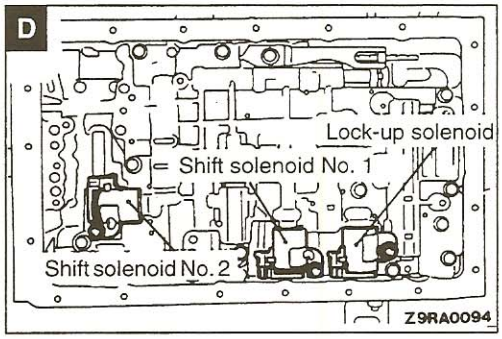
B



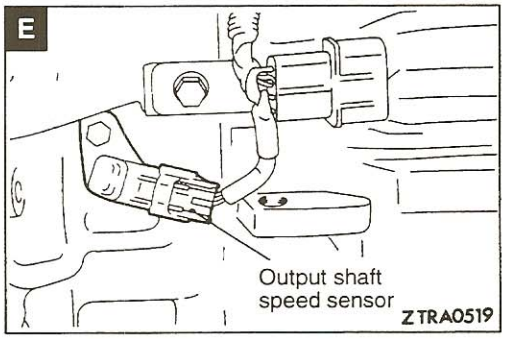
C



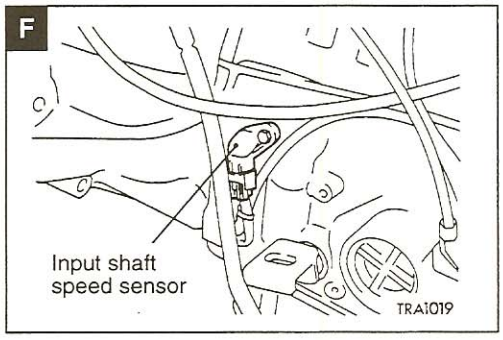
D



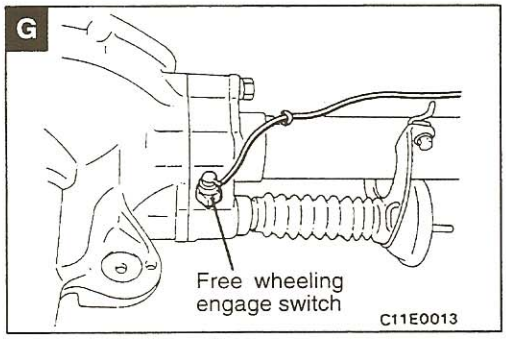
E



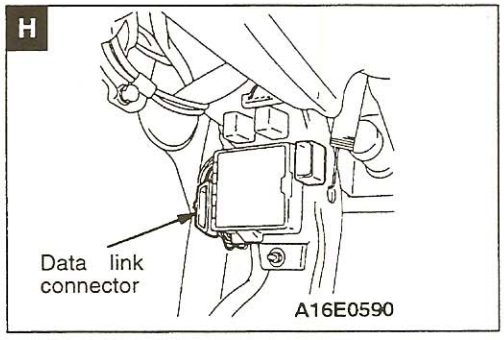
F



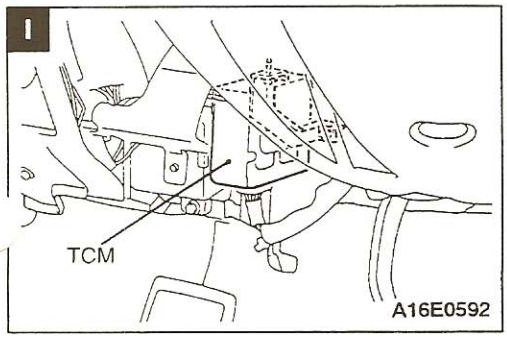
G



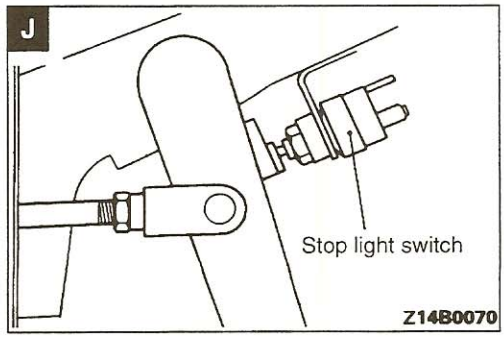
H



I

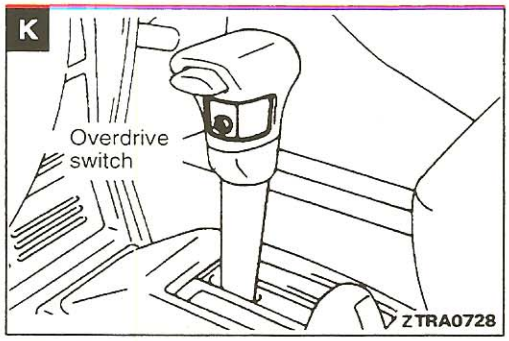


J

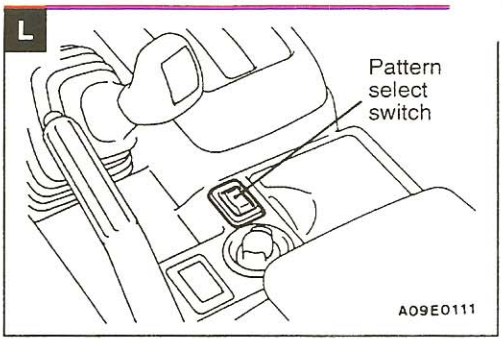


TSB Revision

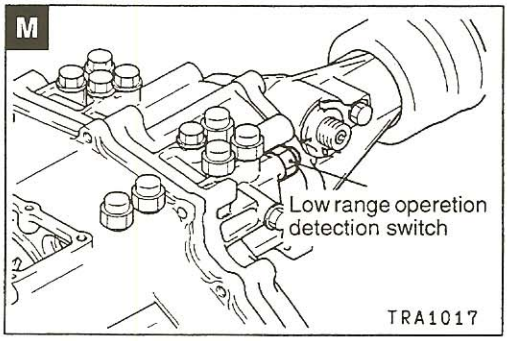
K



L



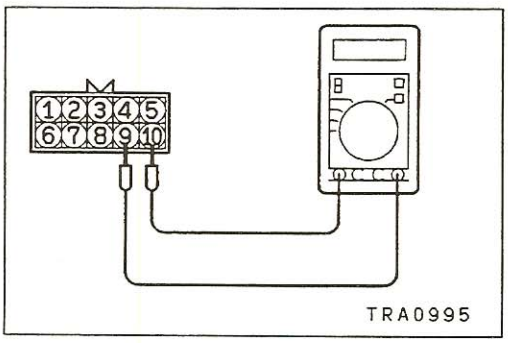
M



A/T CONTROL COMPONENT CHECK 23100390283

THROTTLE POSITION SENSOR CHECK

Refer to GROUP 13A – On-vehicle Inspection of MFI components.



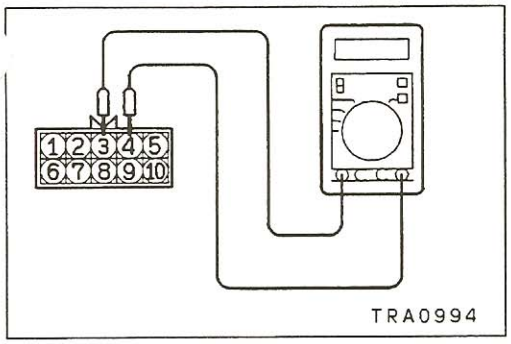
INPUT SHAFT SPEED SENSOR CHECK 23100360079

(1) Disconnect the input shaft speed sensor connector.
(2) Measure the resistance between terminals No. 9 – 10 of the sensor-side connector.

Standard value: 620 ± 60 Ω [at 20 °C (68 °F)]

(3) If the resistance is outside the standard value, replace the vehicle speed sensor.

TSB Revision



OUTPUT SHAFT SPEED SENSOR CHECK 23100370072

(1) Disconnect the vehicle speed sensor connector.
(2) Measure the resistance between terminals No. 3–4 of the sensor-side connector.

Standard value: 620±60 Ω [at 20°C (68°F)]

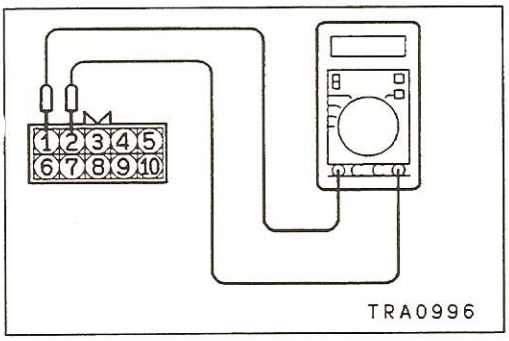
(3) If the resistance is outside the standard value, replace the vehicle speed sensor.

STOP LIGHT SWITCH CHECK 23101010027

Refer to GROUP 35A – Brake Pedal.

FREE-WHEELING ENGAGE SWITCH CHECK 23101210014

Refer to GROUP 26 – Differential Carrier and Free-wheeling Clutch.



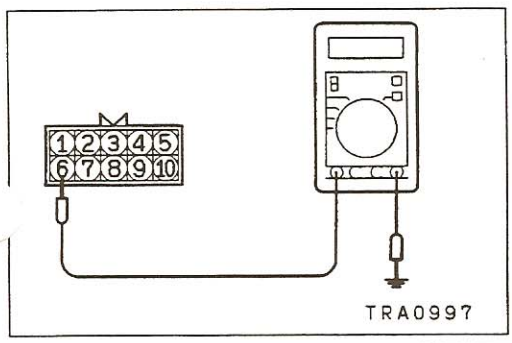
OIL TEMPERATURE SENSOR CHECK 23100450103

(1) Disconnect the oil temperature sensor connector.
(2) Measure the resistances between terminals No. 1–2 of the oil temperature sensor connector and check that they match the values below.

Standard value:

Oil temperature	Resistance value
25°C (77°F)	10 kΩ
120°C (248°F)	615 Ω

(3) If the resistance is outside the standard value, replace the oil temperature sensor.



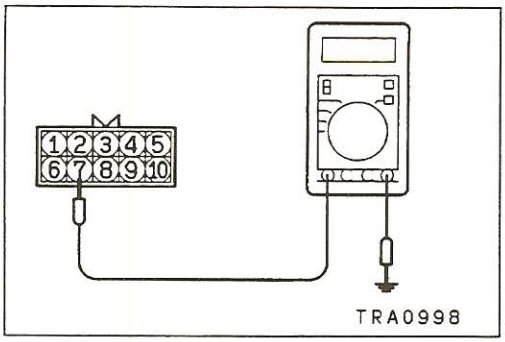
SHIFT SOLENOID NO. 1 CHECK 23100980022

(1) Disconnect the shift solenoid connector.
(2) Measure the resistance between terminal No. 6 and the ground.

Standard value: 13±2 Ω [at 25°C (77°F)]

(3) If the resistance is outside the standard value, replace the solenoid assembly.

TSB Revision



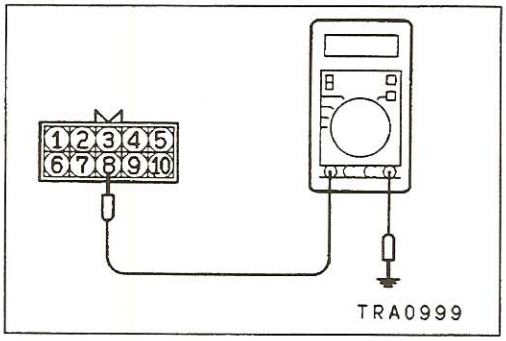
SHIFT SOLENOID NO. 2 CHECK

23100990025

(1) Disconnect the shift solenoid connector.
(2) Measure the resistance between terminal No. 7 and the ground.

Standard value: 13±2 Ω [at 25°C (77°F)]

(3) If the resistance is outside the standard value, replace the solenoid assembly.



LOCK-UP SOLENOID CHECK

23101000024

(1) Disconnect the lock-up solenoid connector.
(2) Measure the resistance between terminal No. 8 and the ground.

Standard value: 13±2 Ω [at 25°C (77°F)]

(3) If the resistance is outside the standard value, replace the solenoid assembly.

CONVERTER STALL TEST

23100540145

In this test, the engine maximum speed when the torque converter stalls with the shift lever in the D or R position is measured to check operation of the torque converter, stator and one-way clutch and check holding performance of the transmission clutch (including brake).

Caution
Do not stand in front or at rear of the vehicle during this test.

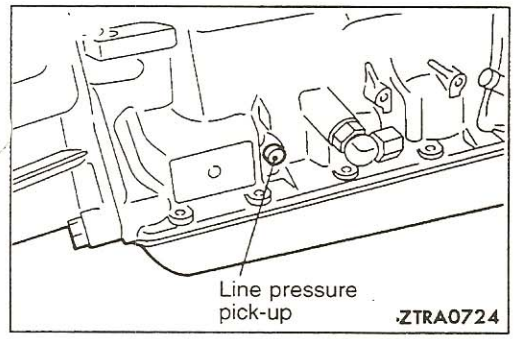
1. Check the transmission fluid level. The fluid temperature should be at the level after normal operation [50–80°C (122–176°F)]. The engine coolant temperature should also be at the level after normal operation [80–90°C (176–194°F)].
2. Apply chocks to the rear wheels (right and left).
3. Connect a tachometer.
4. Apply the parking and service brakes fully.
5. Start the engine.
6. With the selector lever in the D position, depress the accelerator pedal and take a reading of the engine maximum speed.

   Standard value: 2,100–2,600 r/min

   NOTE
   When doing so, do not keep the engine running with the throttle fully open for longer than necessary (5 seconds or more). If two or more stall tests are needed, move the selector lever to the N position and run it at idle for at about 1,000 r/min to allow the transmission fluid to cool before another stall test.
7. Move the selector lever to the R position and perform the test as above.

JUDGEMENT OF STALL TEST RESULTS

Stall speeds in each range are equal to each other but are lower than the standard value.	(1) Throttle valve is not fully open (2) Insufficient engine output (3) Malfunction of stator one-way clutch (Malfunction of torque converter could be the problem if the stall speed is lower than the standard value by 600 r/min or more)
Stall speeds in each range are equal to each other but are higher than the standard value.	(1) Low line pressure (2) Fluid level is not at standard level (insufficient fluid) (3) Malfunction of O.D. one-way clutch
Stall speed in D range is higher than the standard value	(1) Forward clutch slippage (2) Malfunction of O.D. one-way clutch (3) Malfunction of one-way clutch No. 2 (4) Low line pressure
Stall speed in R range is higher than the standard value	(1) Direct clutch slippage (2) 1st & reverse brake slippage (3) Low line pressure (4) Malfunction of O.D. one-way clutch

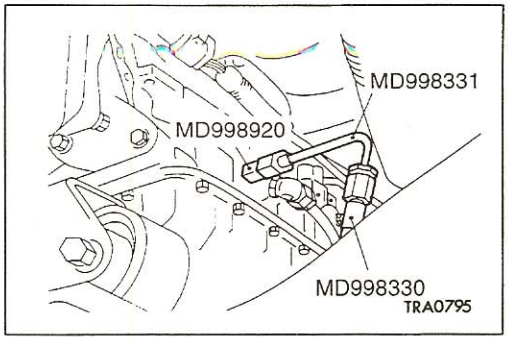


HYDRAULIC PRESSURE TEST 23100550148

The hydraulic pressure test (line pressure test) is important in determining the causes of transmission failures.
Before conducting hydraulic pressure tests, the fluid level and condition and throttle cable adjustment etc. must be checked for defects or abnormalities. When conducting the tests, the engine and transmission should be at the correct operating temperatures, [engine coolant water 80–90°C (176–194°F), transmission fluid 70–80°C (158–176°F)].

LINE PRESSURE TEST

1. Place the vehicle on a chassis dynamometer.
2. Remove the plug from the line pressure take-off port.
3. Install the special tool as shown in the illustration and then place the meter inside the vehicle.
4. Apply the parking brake.
5. Start the engine.
6. Move the selector lever to the D position.
7. Depress the brake pedal firmly with the left foot and operates the accelerator pedal with the right foot to measure the line pressure at each engine rpm. If the measured pressure is not at the standard pressure, check the adjustment of the throttle cable and readjust if necessary before conducting the test again.
8. Move the selector lever to the R position and test as above.



Standard value:

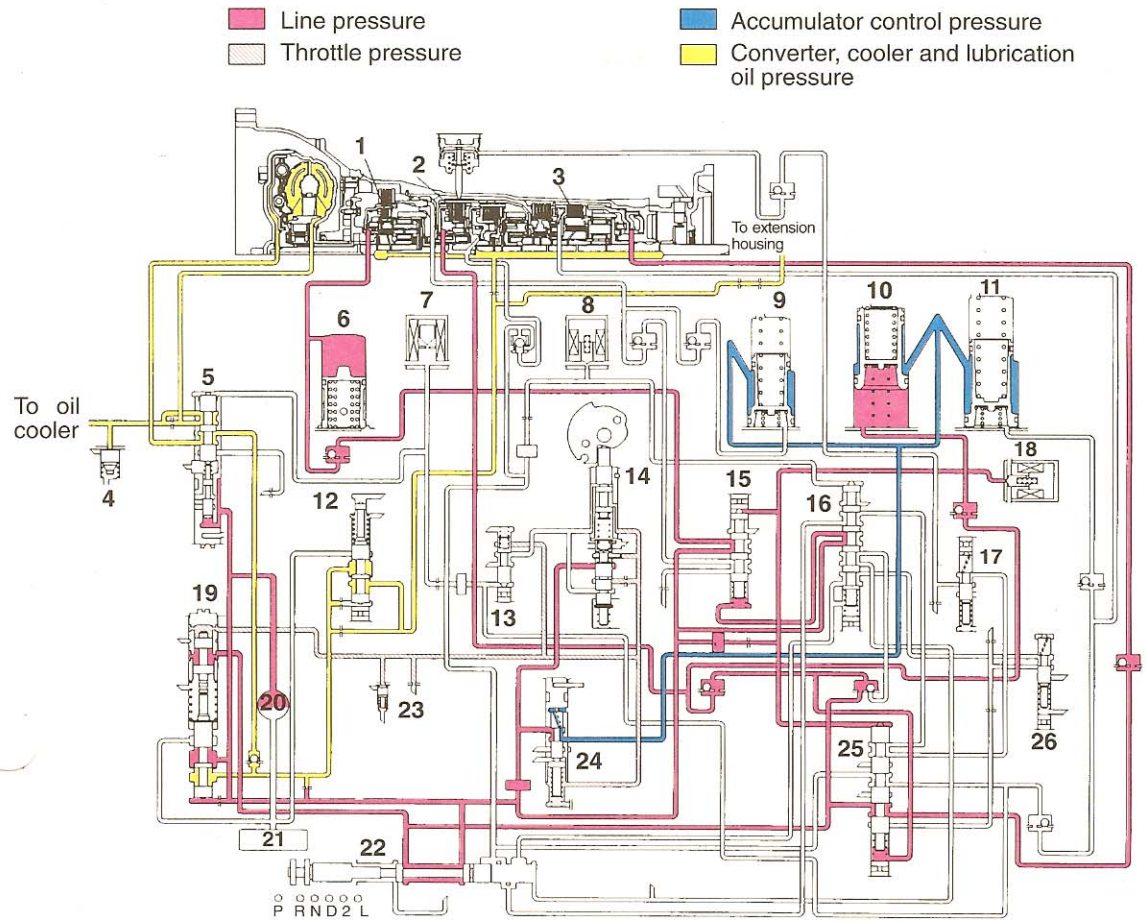
	Line pressure kPa (psi)	
	D range	R range
At idle	430–490 (61–70)	520–620 (74–88)
At stall	1,140–1,390 (162–198)	1,400–1,750 (199–249)

JUDGEMENT BY LINE PRESSURE

Hydraulic pressure in all ranges is higher than the standard value	(1) Malfunction of regulator valve
	(2) Malfunction of throttle valve
	(3) Incorrect throttle cable adjustment
Hydraulic pressure in all ranges is lower than the standard value	(1) Malfunction of oil pump
	(2) Malfunction of regulator valve
	(3) Malfunction of throttle valve
	(4) Incorrect throttle cable adjustment
	(5) Malfunction of O.D. direct clutch
Hydraulic pressure in D range is lower than the standard value	(1) Large fluid leaks in D range hydraulic circuit
	(2) Malfunction of forward clutch
	(3) Malfunction of O.D. direct clutch
Hydraulic pressure in R range is lower than the standard value	(1) Large fluid leaks in R range hydraulic circuit
	(2) Malfunction of 1st & reverse brake
	(3) Malfunction of direct clutch
	(4) Malfunction of O.D. direct clutch

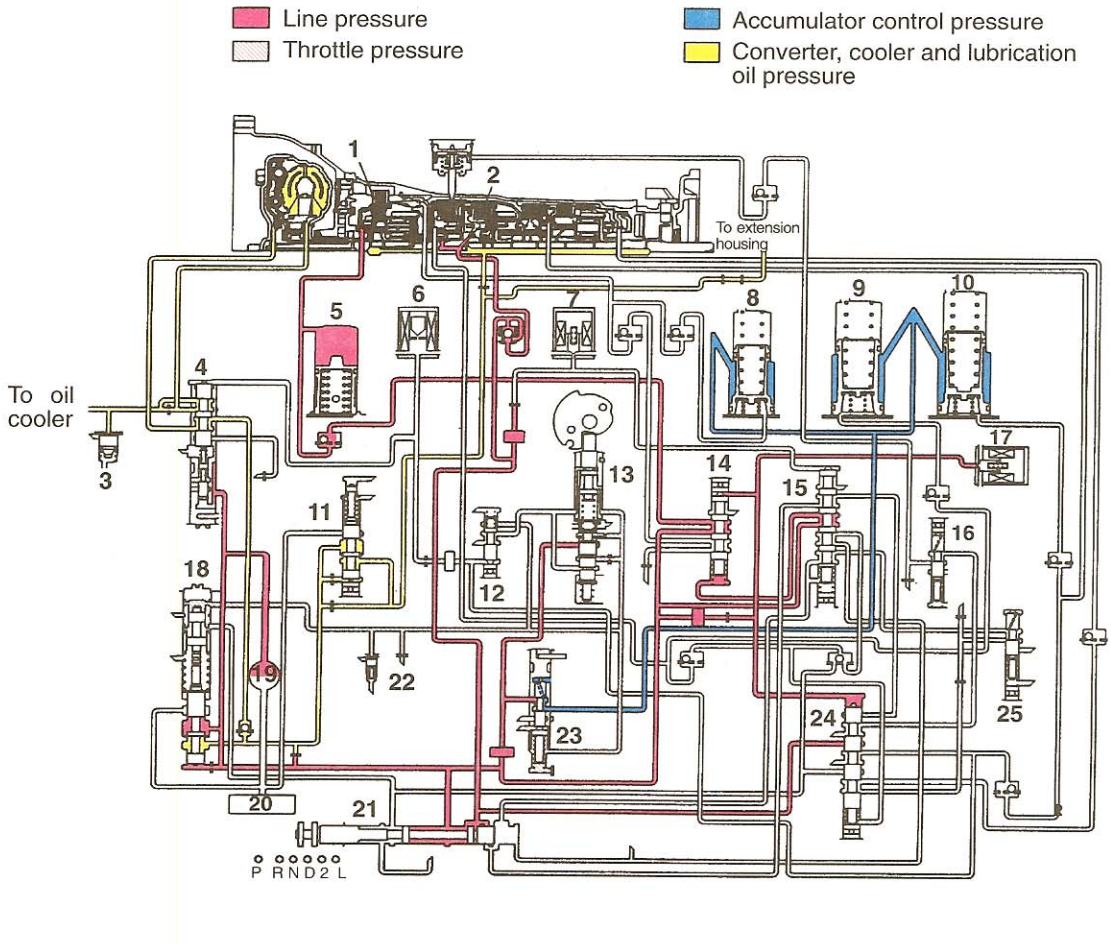
HYDRAULIC CIRCUIT

(REVERSE)



1. Overdrive direct clutch
2. Direct clutch
3. 1st & Rev. brake
4. Cooler by-pass valve
5. Torque converter clutch relay valve
6. C0 Accumulator
7. Lockup solenoid
8. Shift solenoid No. 1
9. B0 Accumulator
10. C2 Accumulator
11. B2 Accumulator
12. Secondary regulator valve
13. Cut back valve
14. Throttle valve
15. 3–4 shift valve
16. 2–3 shift valve
17. 2nd coast modulator valve
18. Shift solenoid No. 2
19. Primary regulator valve
20. Oil pump
21. Strainer
22. Manual valve
23. Pressure release
24. Accumulator control valve
25. 1–2 shift valve
26. Low coast modulator valve

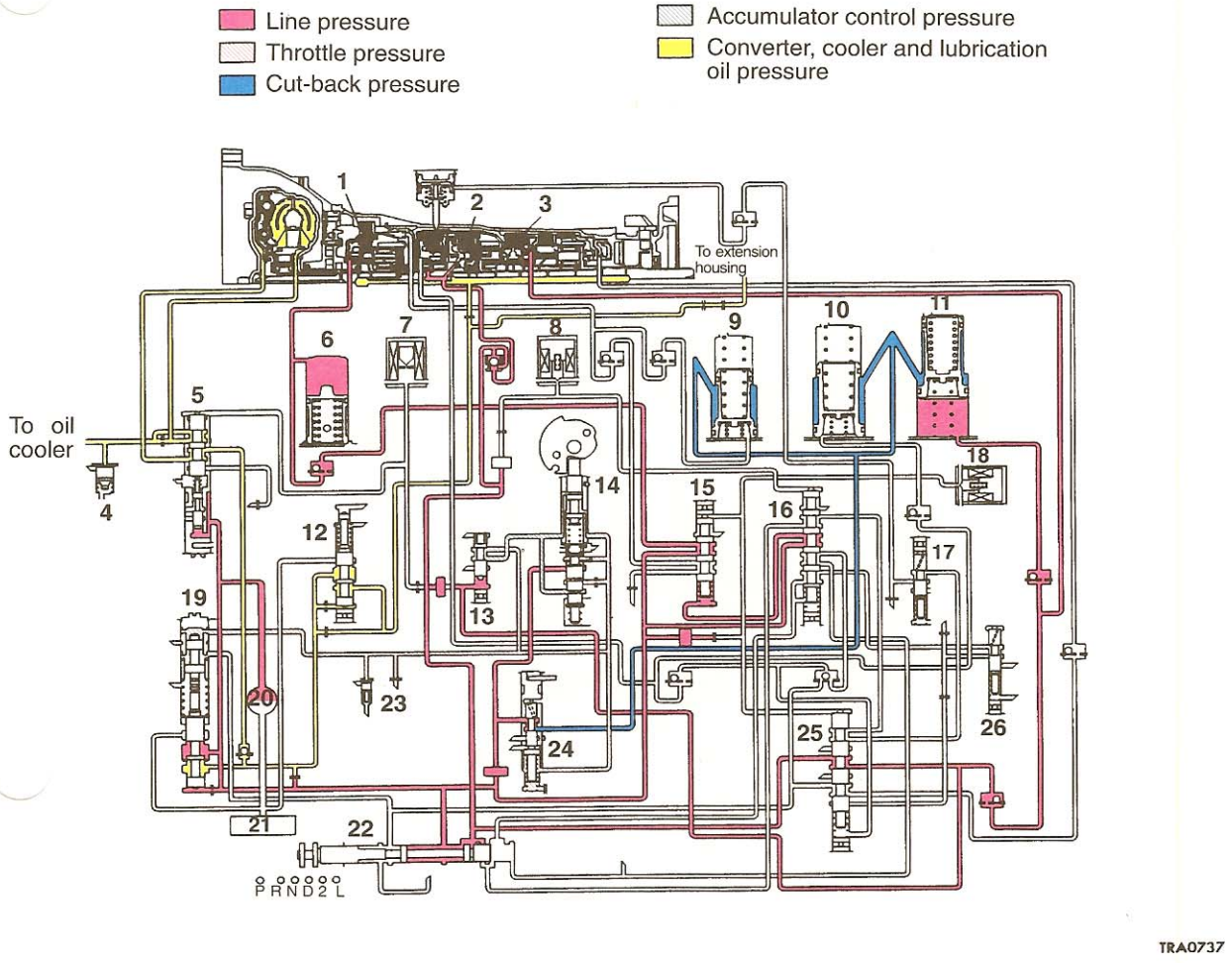
D–1 (DRIVE 1ST)



1. Overdrive direct clutch
2. Forward clutch
3. Cooler by-pass valve
4. Torque converter clutch relay valve
5. C0 Accumulator
6. Lockup solenoid
7. Shift solenoid No. 1
8. B0 Accumulator
9. C2 Accumulator
10. B2 Accumulator
11. Secondary regulator valve
12. Cut back valve
13. Throttle valve
14. 3–4 shift valve
15. 2–3 shift valve
16. 2nd coast modulator valve
17. Shift solenoid No. 2
18. Primary regulator valve
19. Oil pump
20. Strainer
21. Manual valve
22. Pressure release
23. Accumulator control valve
24. 1–2 shift valve
25. Low coast modulator valve

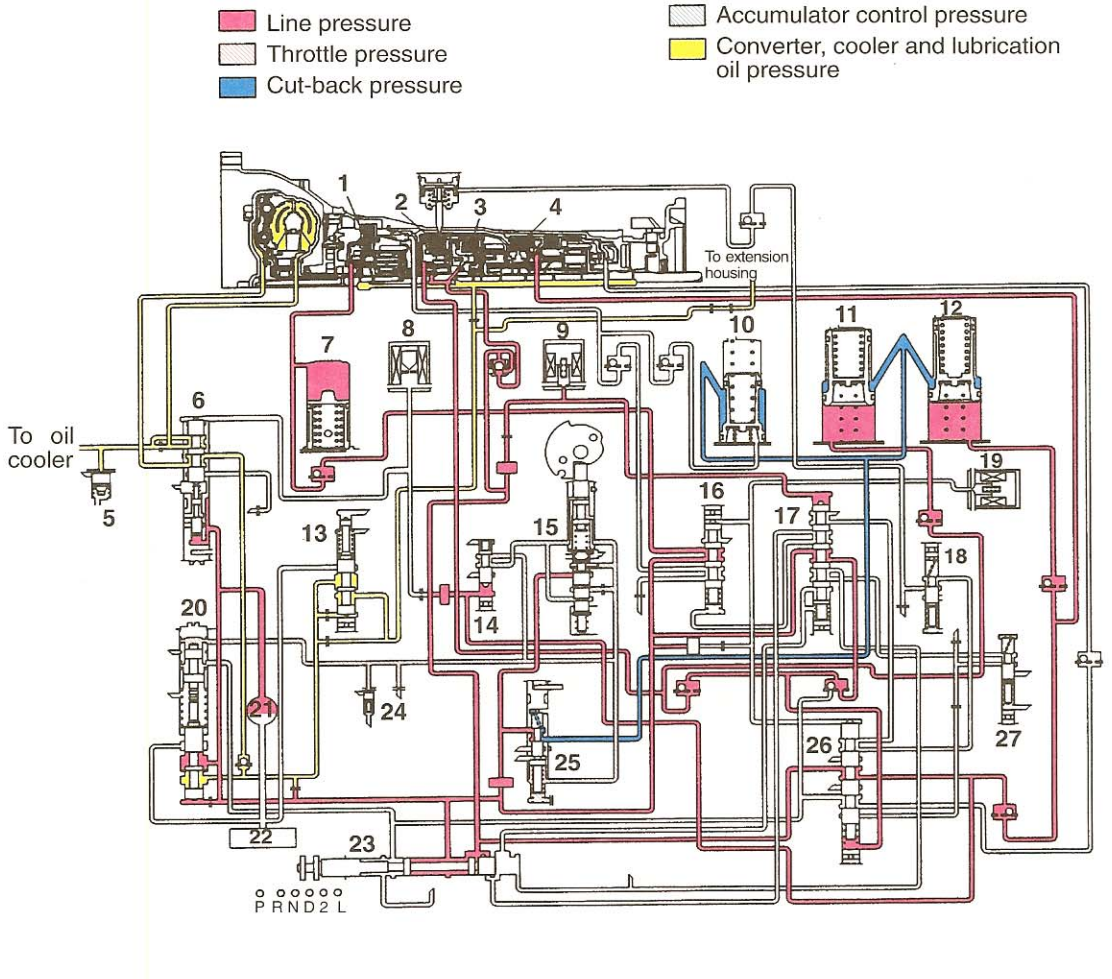
TSB Revision

D–2 (DRIVE 2ND)



1. Overdrive direct clutch
2. Forward clutch
3. 2nd brake
4. Cooler by-pass valve
5. Torque converter clutch relay valve
6. C0 Accumulator
7. Lockup solenoid
8. Shift solenoid No. 1
9. B0 Accumulator
10. C2 Accumulator
11. B2 Accumulator
12. Secondary regulator valve
13. Cut back valve
14. Throttle valve
15. 3–4 shift valve
16. 2–3 shift valve
17. 2nd coast modulator valve
18. Shift solenoid No. 2
19. Primary regulator valve
20. Oil pump
21. Strainer
22. Manual valve
23. Pressure release
24. Accumulator control valve
25. 1–2 shift valve
26. Low coast modulator valve

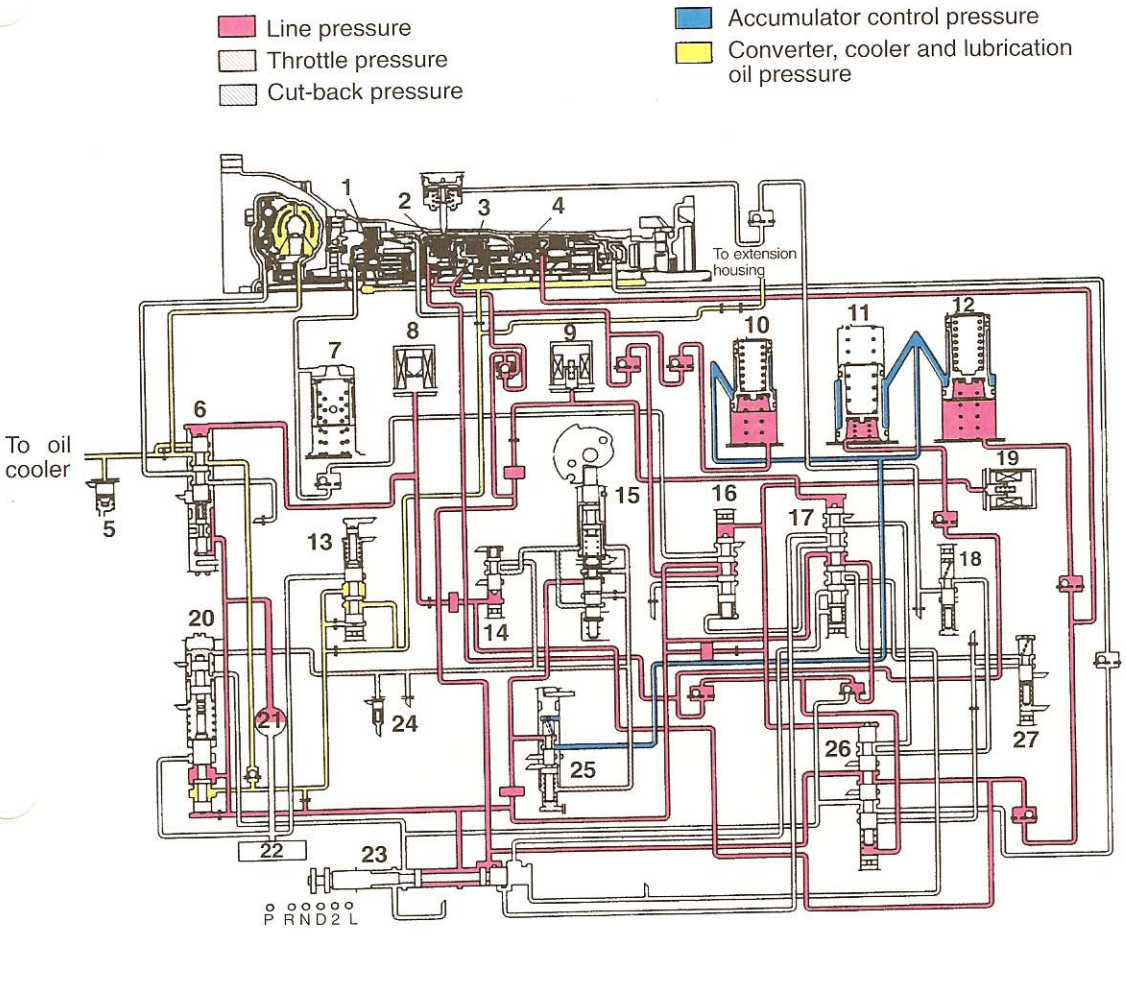
D–3 (DRIVE 3RD)



1. Overdrive direct clutch
2. Direct clutch
3. Forward clutch
4. 1st & Rev. brake
5. Cooler by-pass valve
6. Torque converter clutch relay valve
7. C0 Accumulator
8. Lockup solenoid
9. Shift solenoid No. 1
10. B0 Accumulator
11. C2 Accumulator
12. B2 Accumulator
13. Secondary regulator valve
14. Cut back valve
15. Throttle valve
16. 3–4 shift valve
17. 2–3 shift valve
18. 2nd coast modulator valve
19. Shift solenoid No. 2
20. Primary regulator valve
21. Oil pump
22. Strainer
23. Manual valve
24. Pressure release
25. Accumulator control valve
26. 1–2 shift valve
27. Low coast modulator valve

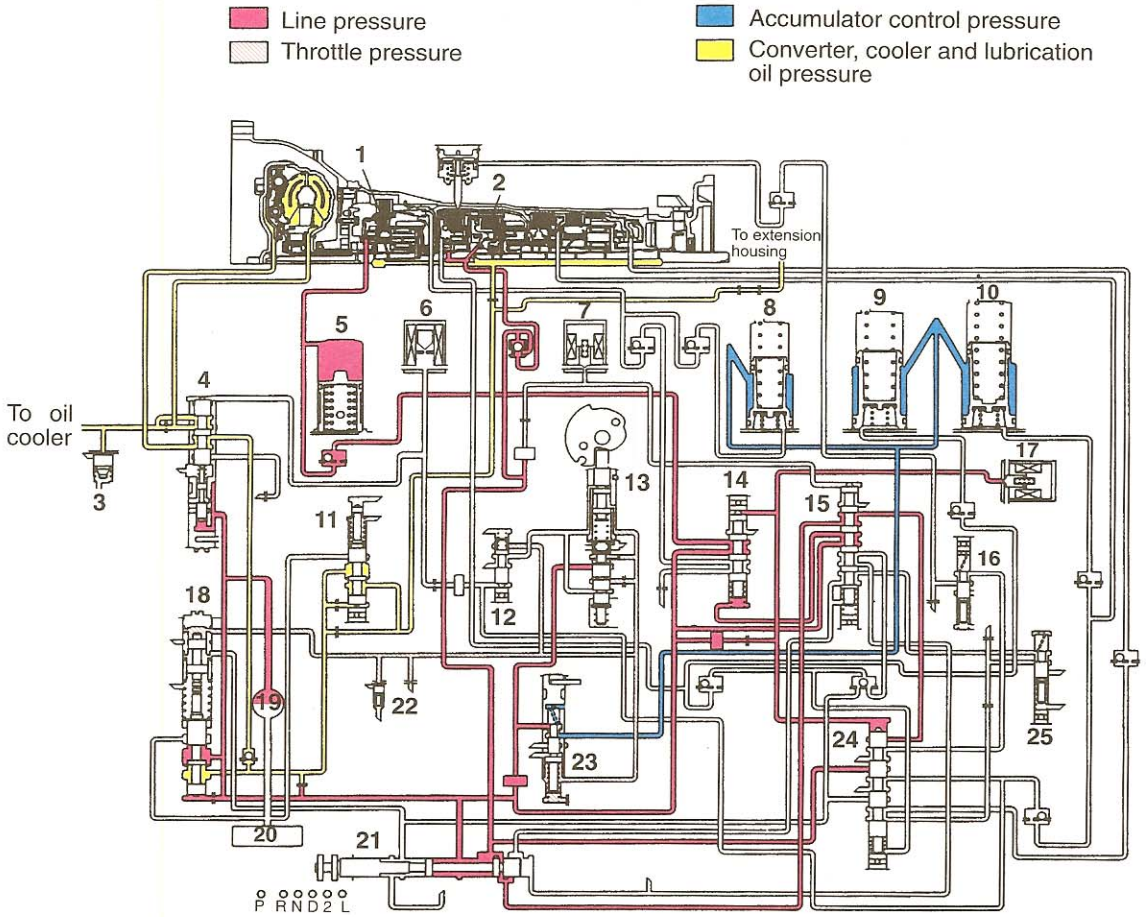
TSB Revision

D–4 (DRIVE 4TH) LOCK UP



1. Overdrive direct clutch
2. Direct clutch
3. Forward clutch
4. 1st & Rev. brake
5. Cooler by-pass valve
6. Torque converter clutch relay valve
7. C0 Accumulator
8. Lockup solenoid
9. Shift solenoid No. 1
10. B0 Accumulator
11. C2 Accumulator
12. B2 Accumulator
13. Secondary regulator valve
14. Cut back valve
15. Throttle valve
16. 3–4 shift valve
17. 2–3 shift valve
18. 2nd coast modulator valve
19. Shift solenoid No. 2
20. Primary regulator valve
21. Oil pump
22. Strainer
23. Manual valve
24. Pressure release
25. Accumulator control valve
26. 1–2 shift valve
27. Low coast modulator valve

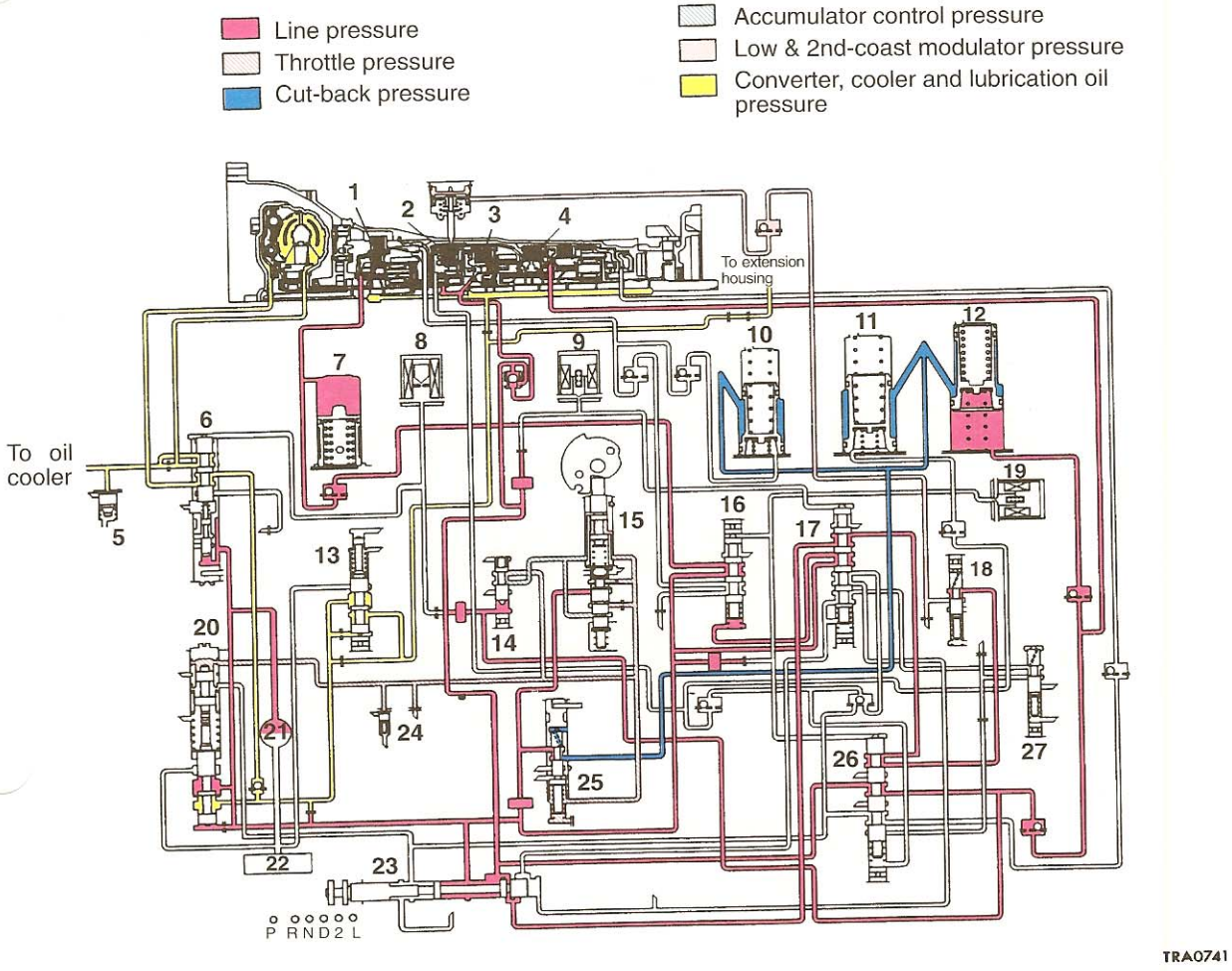
2–1 (SECOND 1ST)



1. Overdrive direct clutch
2. Forward clutch
3. Cooler by-pass valve
4. Torque converter clutch relay valve
5. C0 Accumulator
6. Lockup solenoid
7. Shift solenoid No. 1
8. B0 Accumulator
9. C2 Accumulator
10. B2 Accumulator
11. Secondary regulator valve
12. Cut back valve
13. Throttle valve
14. 3–4 shift valve
15. 2–3 shift valve
16. 2nd coast modulator valve
17. Shift solenoid No. 2
18. Primary regulator valve
19. Oil pump
20. Strainer
21. Manual valve
22. Pressure release
23. Accumulator control valve
24. 1–2 shift valve
25. Low coast modulator valve

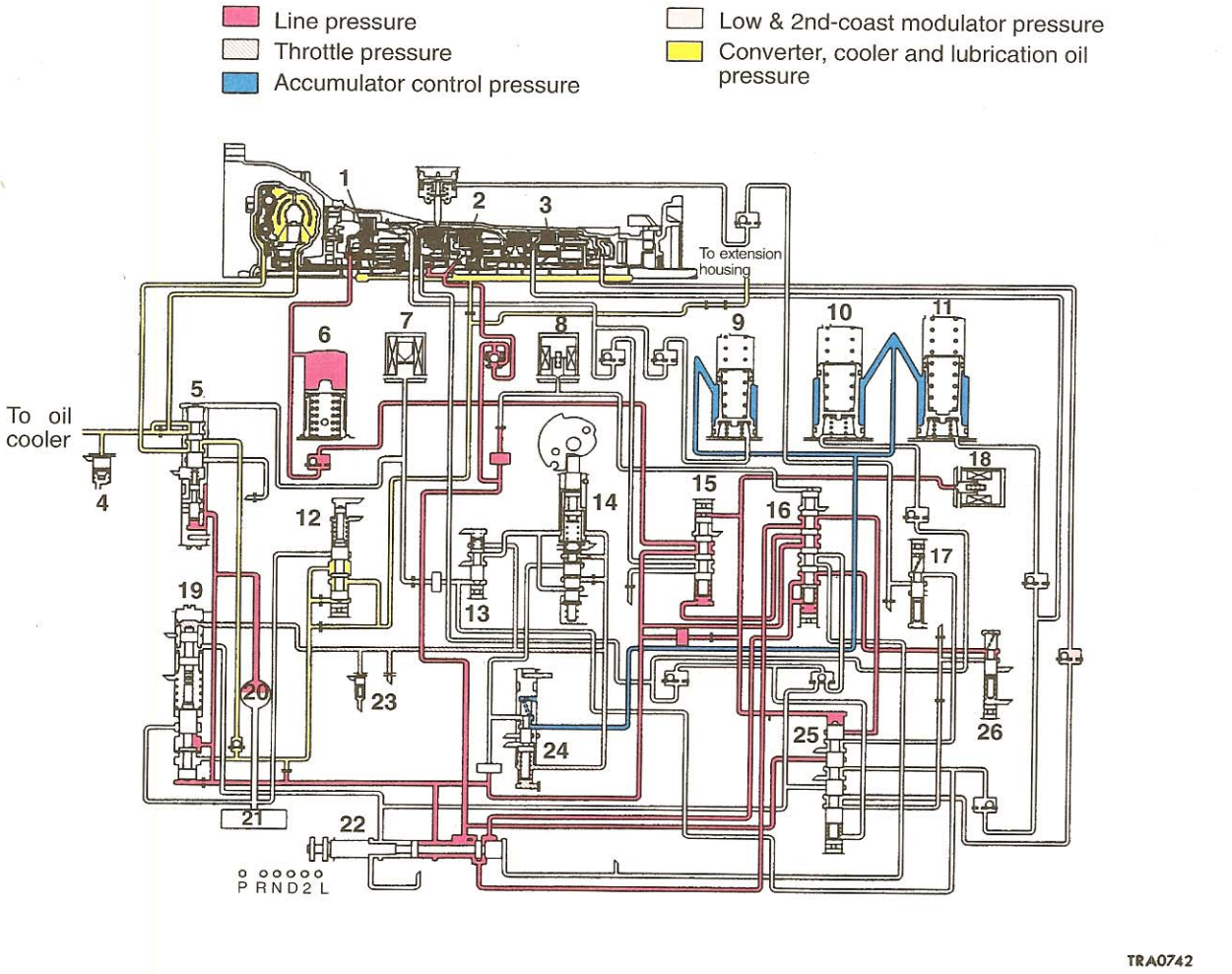
TSB Revision

2–2 (SECOND 2ND)



1. Overdrive direct clutch
2. Direct clutch
3. Forward clutch
4. 1st & Rev. brake
5. Cooler by-pass valve
6. Torque converter clutch relay valve
7. C0 Accumulator
8. Lockup solenoid
9. Shift solenoid No. 1
10. B0 Accumulator
11. C2 Accumulator
12. B2 Accumulator
13. Secondary regulator valve
14. Cut back valve
15. Throttle valve
16. 3–4 shift valve
17. 2–3 shift valve
18. 2nd coast modulator valve
19. Shift solenoid No. 2
20. Primary regulator valve
21. Oil pump
22. Strainer
23. Manual valve
24. Pressure release
25. Accumulator control valve
26. 1–2 shift valve
27. Low coast modulator valve

– (1ST)



1. Overdrive direct clutch
2. Forward clutch
3. 1st & Rev. brake
4. Cooler by-pass valve
5. Torque converter clutch relay valve
6. C0 Accumulator
7. Lockup solenoid
8. Shift solenoid No. 1
9. B0 Accumulator
10. C2 Accumulator
11. B2 Accumulator
12. Secondary regulator valve
13. Cut back valve
14. Throttle valve
15. 3–4 shift valve
16. 2–3 shift valve
17. 2nd coast modulator valve
18. Shift solenoid No. 2
19. Primary regulator valve
20. Oil pump
21. Strainer
22. Manual valve
23. Pressure release
24. Accumulator control valve
25. 1–2 shift valve
26. Low coast modulator valve

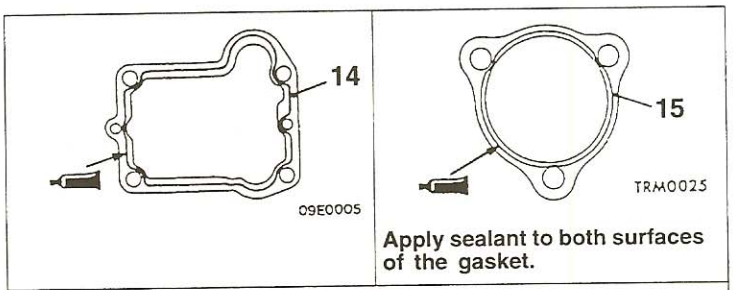
TSB Revision

TRANSMISSION CONTROL

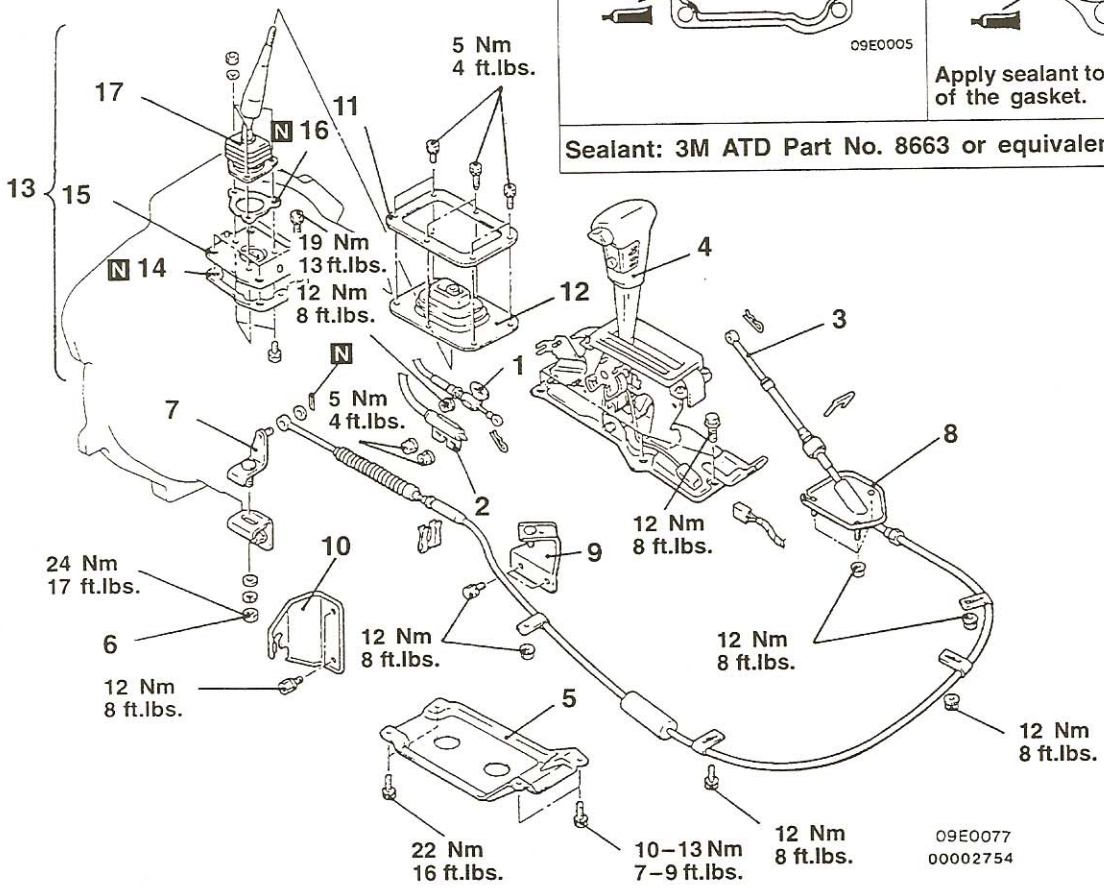
23100660315

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Front Console Assembly Removal and Installation (Refer to GROUP 52A – Floor Console.)



Sealant: 3M ATD Part No. 8663 or equivalent



Selector lever assembly removal steps

- ▶G◀ 1. Key-interlock cable connection (Selector lever assembly side)
- ▶F◀ 2. Shift-lock cable connection (Selector lever assembly side)
- ▶E◀ 3. Transmission control cable connection (Selector lever assembly side)
- 4. Selector lever assembly

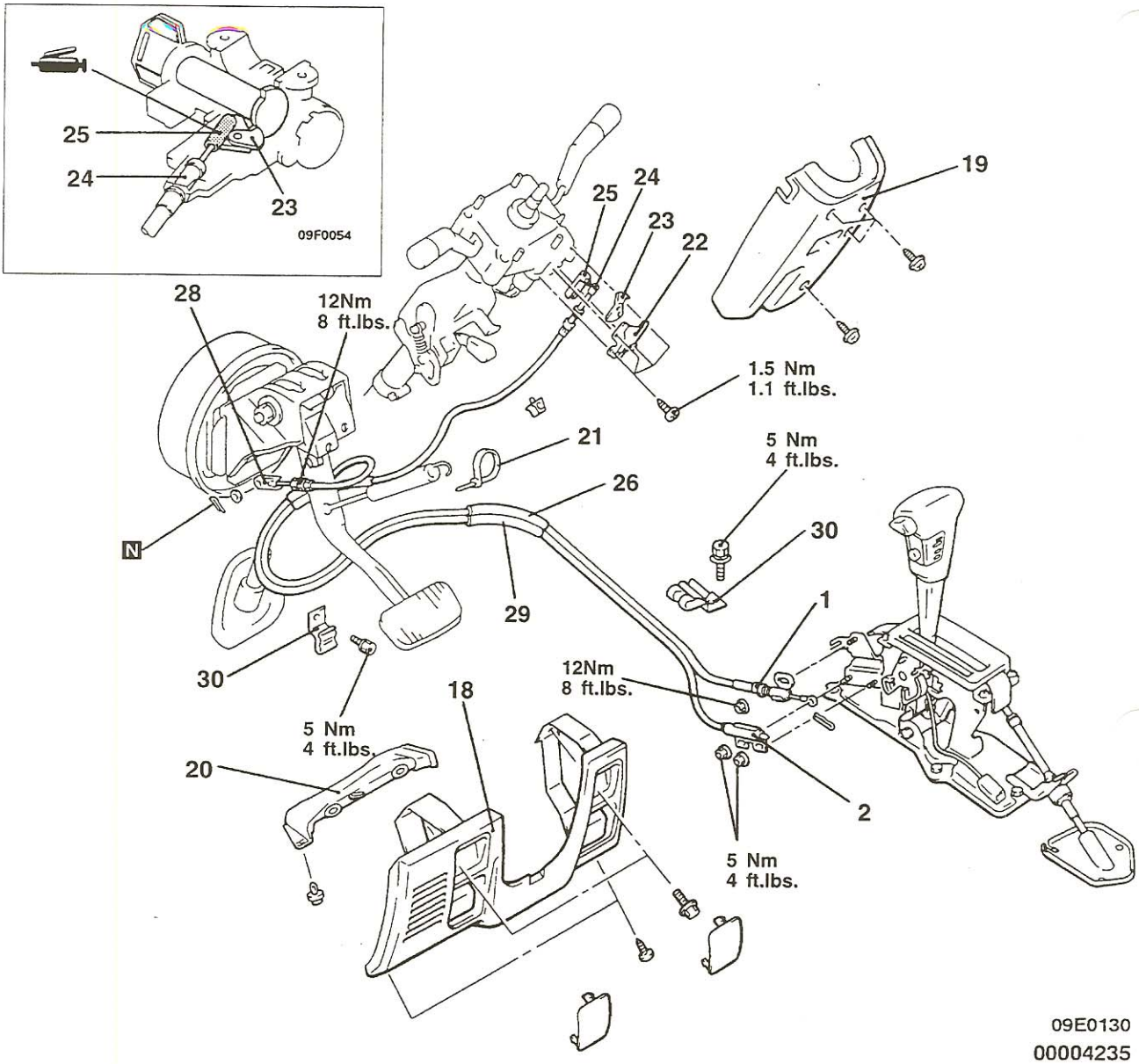
Transmission control cable removal steps

- ▶E◀ 3. Transmission control cable connection (Selector lever assembly side)
- 5. Transfer case protector
- 6. Transmission control cable assembly connection (transmission side)
- 7. Transmission control upper lever
- 8. Transmission control cable
- 9. Cable bracket
- 10. Cable end bracket

Transfer control lever assembly removal steps

- 11. Retainer
- 12. Control lever boot
- ◀A▶ ▶D◀ 13. Transfer control lever assembly
- 14. Gasket
- 15. Stopper plate
- 16. Gasket
- 17. Transfer control lever

TSB Revision



Key-interlock cable removal steps

- ▶G◀ 1. Key-interlock cable connection (Selector lever assembly side)
- 18. Instrument panel under cover
- 19. Column cover lower
- 20. Foot shower duct (left side)
- ▶C◀ 21. Cable band
- 22. Cover
- ▶B◀ 23. Cam lever
- ▶B◀ 24. Key-interlock cable connection (Steering lock assembly side)
- ▶B◀ 25. Slide lever
- 26. Key-interlock cable
- 27. Cable guide
- 30. Clamp

Shift lock cable removal steps

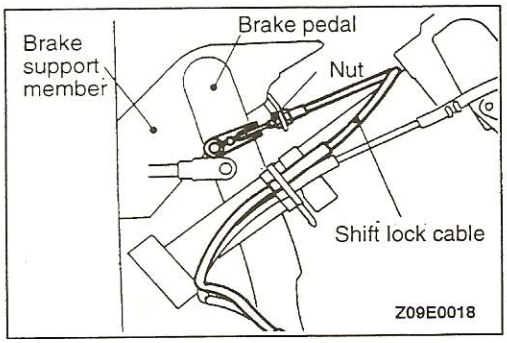
- ▶F◀ 2. Shift lock cable connection (Selector lever assembly side)
- 18. Instrument panel under cover
- 19. Column cover lower
- 20. Foot shower duct (left side)
- ▶C◀ 21. Cable band
- ▶A◀ 28. Shift lock cable connection (Brake pedal side)
- 29. Shift lock cable
- 30. Clamp

TSB Revision

REMOVAL SERVICE POINT

◀A▶ TRANSFER CONTROL LEVER ASSEMBLY REMOVAL

When removing the transfer control lever assembly, move the transfer control lever to the 2H (2 wheel drive-high range) position.

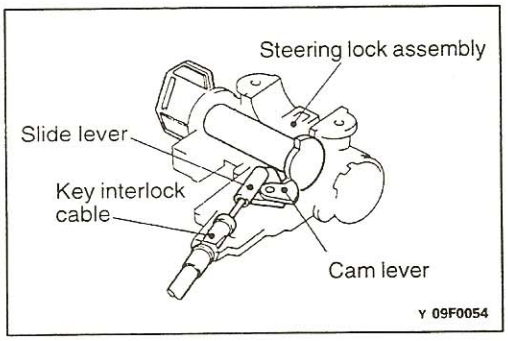


INSTALLATION SERVICE POINTS

▶A◀ SHIFT LOCK CABLE CONNECTION (BRAKE PEDAL SIDE)

(1) Install the shift lock cable to the brake pedal, and clamp the brake support member with the nut.
(2) Route the shift lock cable correctly.

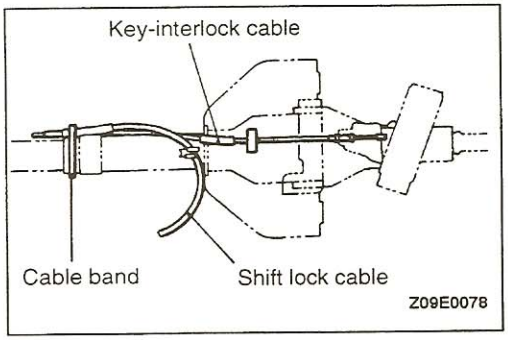
Caution
Do not change the routing of the shift lock cable to the selector lever assembly.



▶B◀ SLIDE LEVER/KEY INTERLOCK CABLE (STEERING LOCK ASSEMBLY SIDE)/CAM LEVER INSTALLATION

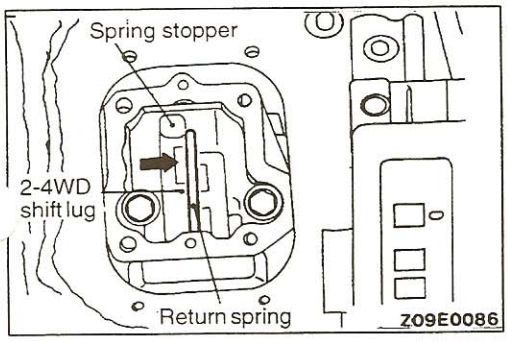
(1) Place the ignition key at the LOCK position or keep it removed.
(2) Install the slide lever, key interlock cable and cam lever to the steering lock assembly as shown in the illustration.

Caution
Do not change the routing of the key interlock cable to the selector lever assembly.



▶C◀ CABLE BAND INSTALLATION

Place the shift lock cable and key interlock cable as shown in the illustration, and clamp them with the cable band.



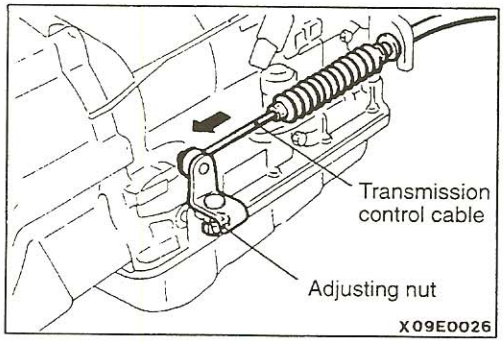
▶D◀ TRANSFER CONTROL LEVER ASSEMBLY INSTALLATION

(1) Remove the adhesive which is sticking to the transfer control lever assembly mounting bolts.
(2) Use a tap (M8×1.25) to remove the adhesive which is sticking to the screw mounting holes in the transfer control lever assembly.

TSB Revision

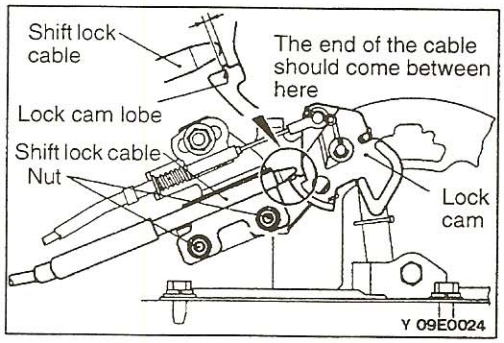
(3) Check that the return spring is set to the spring stopper of the 2-4WD shift lug, and then install the control le in the position shown by the arrow.
(4) Apply specified adhesive to the threads of the lever assembly mounting bolts, and then tighten the transfer control lever.

Specified adhesive:
3M Stud Locking No. 4170 or equivalent



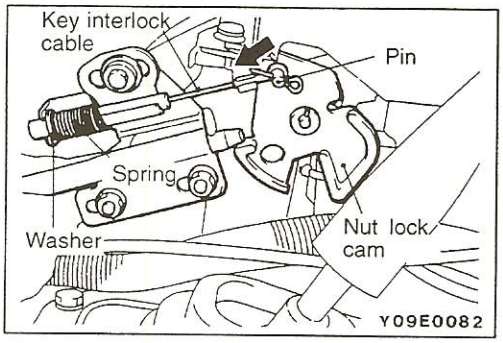
▶E◀ TRANSMISSION CONTROL CABLE INSTALLATION (SELECTOR LEVER ASSEMBLY SIDE)

After installing the transmission control cable, adjust it by the following procedure.
(1) Move the selector lever to the N position.
(2) Loosen the adjusting nut, gently pull the end of the transmission control cable in the direction of the arrow and then tighten the adjusting nut to the specified torque.



▶F◀ SHIFT LOCK CABLE INSTALLATION (SELECTOR LEVER ASSEMBLY SIDE)

(1) Move the selector lever to the P position.
(2) Adjust the shift lock cable so that the end of the ca (red mark) is at the position shown in the illustratic and then tighten the nut to the specified torque to clamp the shift lock cable.
(3) After installing the shift lock cable, check the shift lock mechanism. (Refer to P.23-47.)



▶G◀ KEY INTERLOCK CABLE INSTALLATION (SELECTOR LEVER ASSEMBLY SIDE)

(1) Move the selector lever to the P position.
(2) Install the spring and washer that are inserted onto the key interlock cable as shown in the illustration.
(3) Gently push the lock cam until the pin stops in the direction of the arrow mark as shown in the illustration, and then tighten the nut to the specified torque to clamp the key interlock cable.
(4) After installing the key interlock cable, check the key interlock mechanism. (Refer to P.23A-46.)

INSPECTION

23100670028

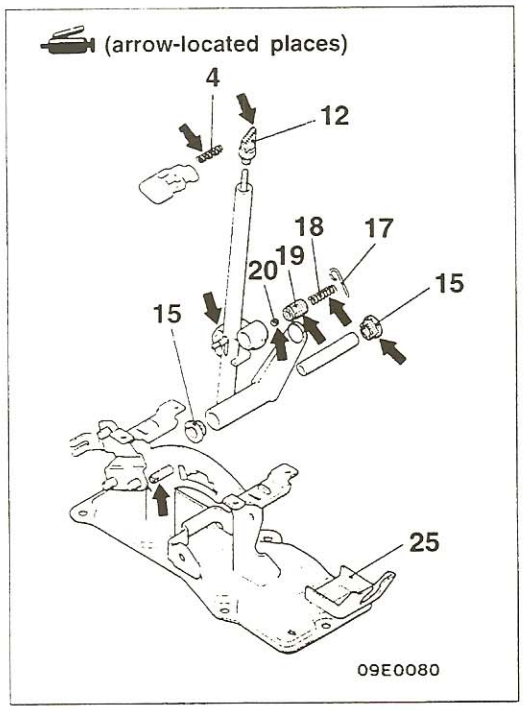
- Check the transmission control cable assembly for function and for damage.
- Check the outer cable (key interlock cable, shift lock cable) for damage and check the spring for breakage and correct tension.
- Check the inner cable (key interlock cable, shift lock ca for elongation.

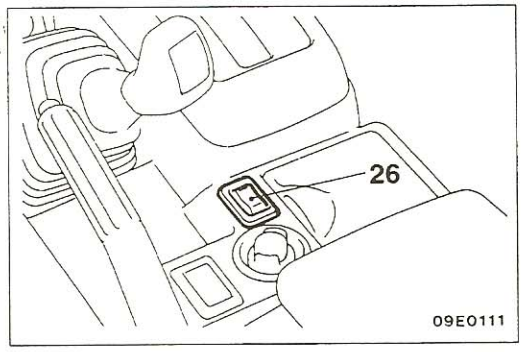
TSB Revision

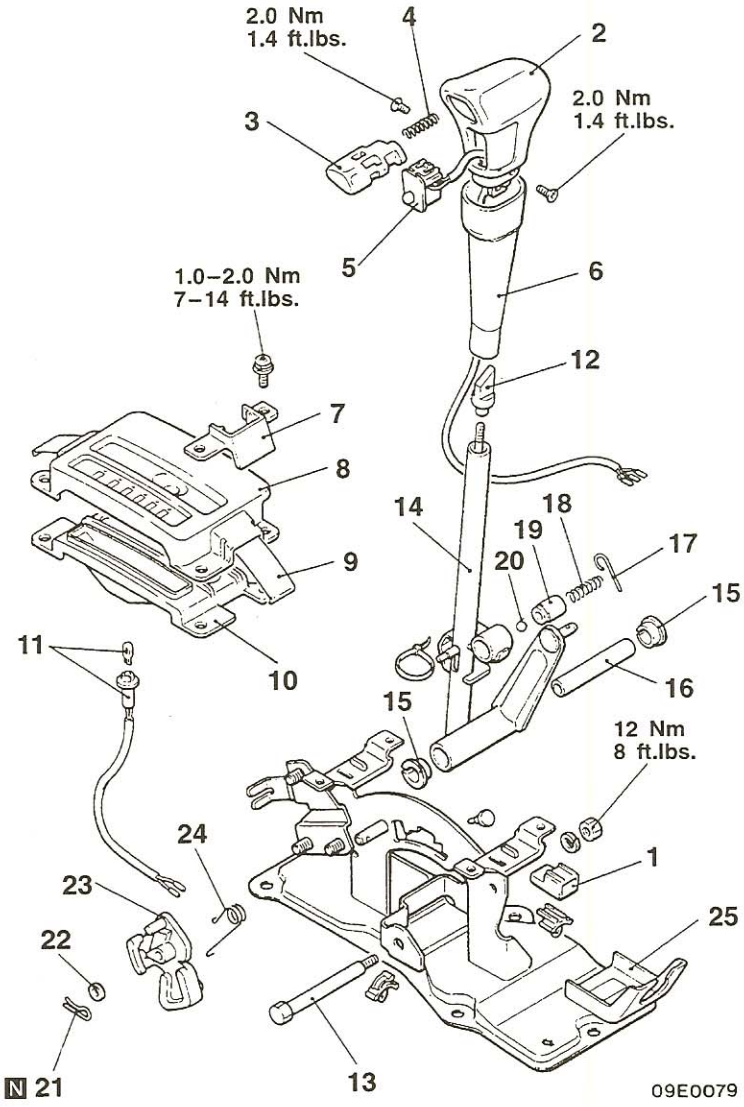
SELECTOR LEVER ASSEMBLY

23100680137

DISASSEMBLY AND REASSEMBLY



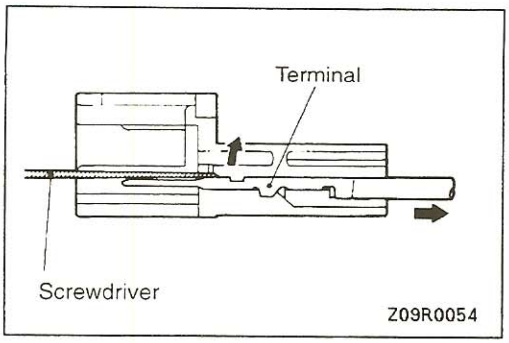




Removal steps

◀A▶ 1. Overdrive switch/position light switch connector case
◀B▶ 2. Selector knob
3. Push button
4. Spring
◀C▶ 5. Overdrive switch
6. Knob cover
7. Guide
8. Upper panel
9. Slider
10. Lower panel
11. Position indicator light assembly
▶A◀ 12. Sleeve
13. Bolt
14. Selector lever assembly
15. Bushing
16. Pipe
17. Pin
18. Spring
19. Support
20. Steel ball
21. Snap pin
22. Washer
23. Lock cam
24. Spring
25. Bracket assembly
26. Pattern select switch

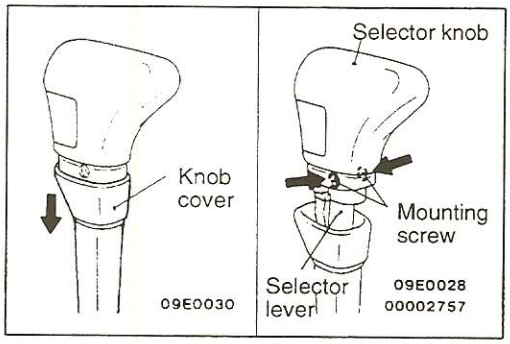
TSB Revision



DISASSEMBLY SERVICE POINTS

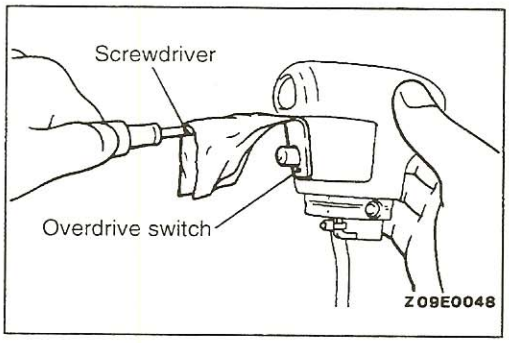
◀A▶ OVERDRIVE SWITCH/POSITION LIGHT SWITC CONNECTOR CASE REMOVAL

Use a flat-tip (–) screwdriver or similar tool to remove the overdrive switch/position light connector case from the terminal.



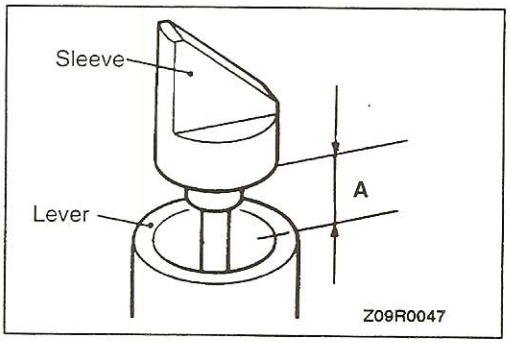
◀B▶ SELECTOR KNOB REMOVAL

(1) Press the knob cover downwards.
(2) Remove the front and back mounting screws, and then remove the selector knob from the selector lever.



◀C▶ OVERDRIVE SWITCH REMOVAL

Use a flat-tip (–) screwdriver or similar tool to remove the overdrive switch.



REASSEMBLY SERVICE POINT

▶A◀ SLEEVE INSTALLATION

Move the selector lever to the N position and adjust the sleeve by turning it so that the distance A between the sleeve and the tip of the lever is at the standard value.

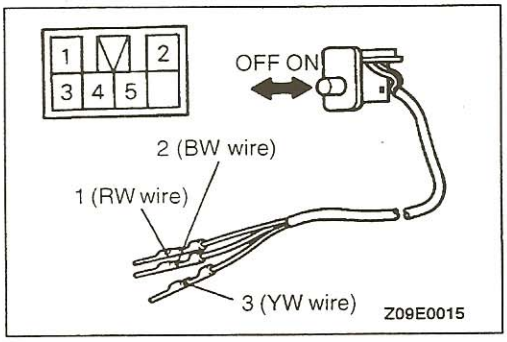
Standard value (A): 18.2–18.9 mm (.717–.744 in.)

TSB Revision

INSPECTION

23100690079

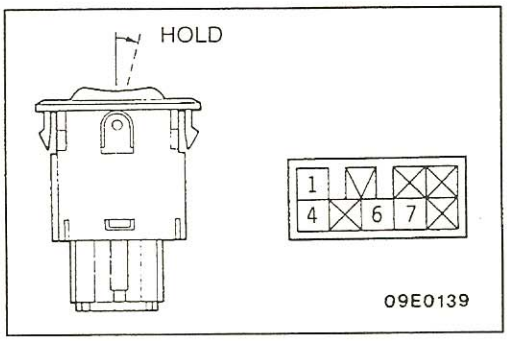
- Check the detent plate for wear.
- Check the bushing for wear or damage.
- Check the spring for damage or deterioration.



OVERDRIVE SWITCH

Check for continuity between the terminals when the switch is turned off and on.

Switch position	Terminal No.		
	3	4	5
O.D. ON	○		○
O.D. OFF	○	○	



PATTERN SELECT SWITCH

Switch position	Terminal No.				
	1	6	4		7
HOLD	○	○	○	⊖	○

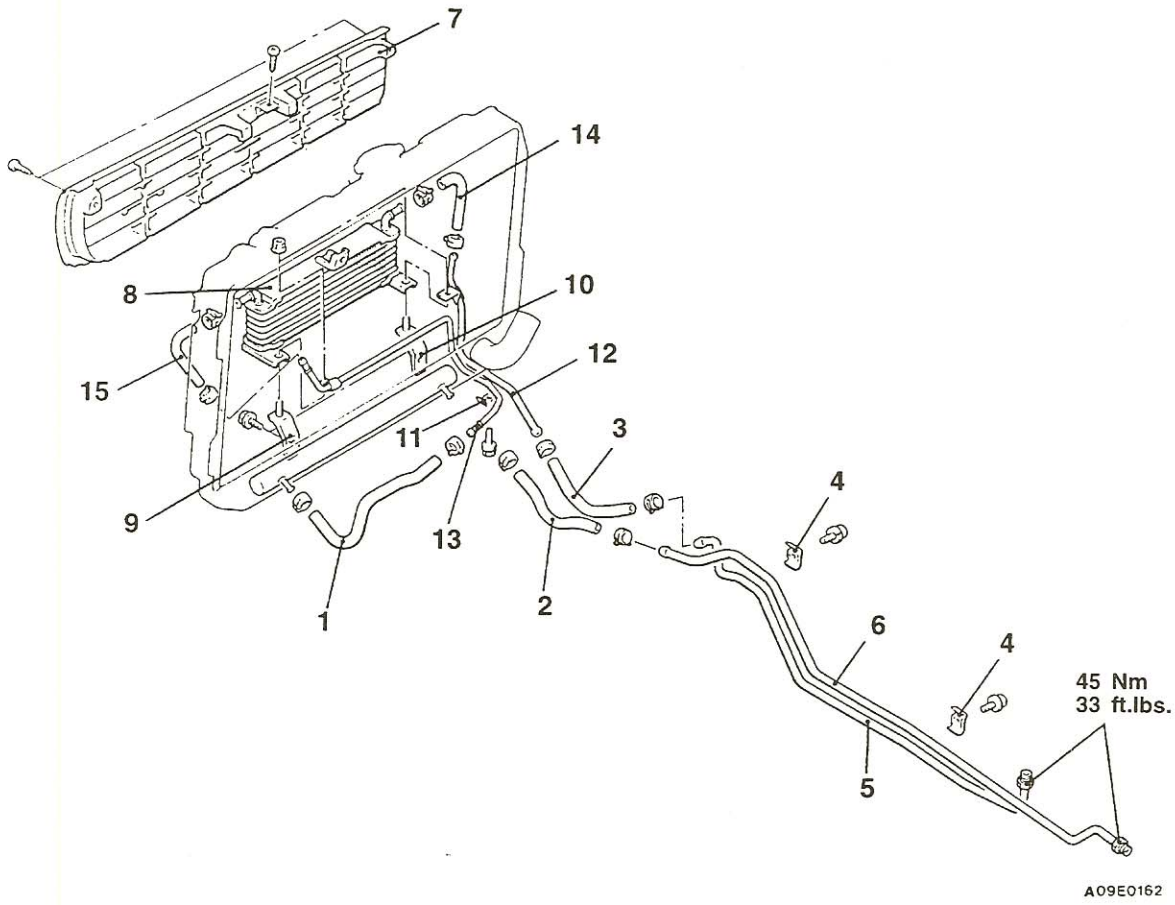
TSB Revision

TRANSMISSION FLUID COOLER, HOSES AND PIPES

2310071088

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operations
- Under Cover and Under Skid Plate Removal and Installation
- Automatic Transmission Fluid Bleeding and Supplying. (Refer to GROUP 00 – Maintenance Service.)



▶C◀ 1. Hose A
▶C◀ 2. Hose B
▶C◀ 3. Hose C

Feed pipe A and return pipe A removal steps

▶B◀ 4. Clamp
▶B◀ 5. Feed pipe A
▶B◀ 6. Return pipe A

Fluid cooler assembly removal steps

7. Radiator grille
8. Fluid cooler assembly
9. Fluid cooler bracket (L.H.)
10. Fluid cooler bracket (R.H.)

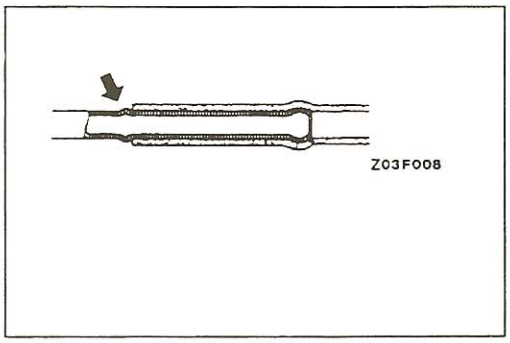
Feed pipe B and return pipe B removal steps

7. Radiator grille
11. Clamp
▶A◀ 12. Feed pipe B
▶A◀ 13. Return pipe B

Hose D and hose E removal steps

7. Radiator grille
▶A◀ 14. Hose D
▶A◀ 15. Hose E

TSB Revision



INSTALLATION SERVICE POINTS

▶A◀ HOSE E/HOSE D/RETURN PIPE B/FEED PIPE B INSTALLATION

When connecting hoses to pipes with a stepped part, insert securely as far as the stepped part.

▶B◀ RETURN PIPE A/FEED PIPE A/CLAMP INSTALLATION

(1) Provisionally tighten the return pipe A and feed pipe A flare nuts to the transmission and transfer, and after clamping the pipes with each clamp, fully tighten the flare nuts.
Also, tighten all of the clamps, starting with those that are the closest to the transmission and transfer assembly.
(2) When connecting the pipes to the hoses, insert securely as far as the stepped part.

▶C◀ HOSE C/HOSE B/HOSE A INSTALLATION

When connecting the pipes to the hoses, insert securely as far as the stepped part.

INSPECTION

23100720037

- Check the hose and pipe for crack, damage and clogging.
- Check for rusted or clogged radiator oil cooler.
- Check the fluid cooler fins for bends, damage or foreign materials.

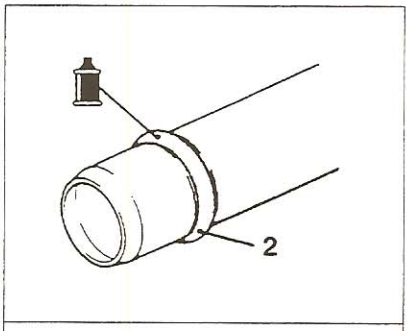
TSB Revision

TRANSMISSION AND TRANSFER ASSEMBLY

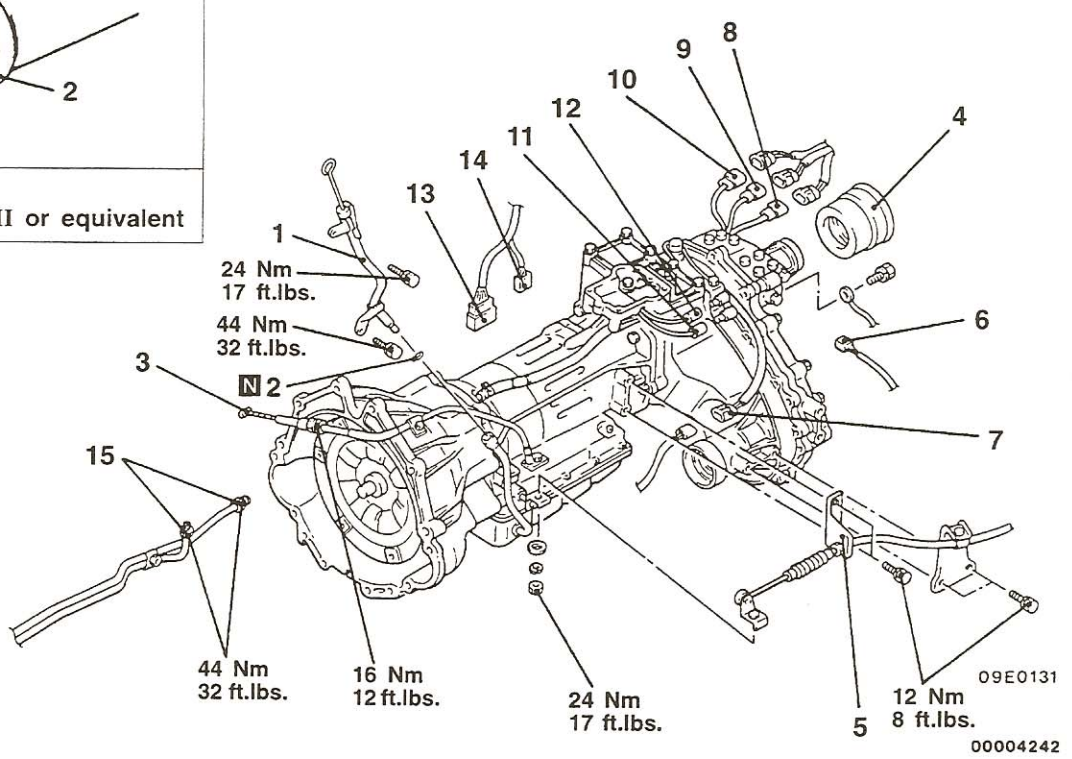
2310062[illegible]8

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
- Transfer Control Lever Assembly Removal and Installation (Refer to P.23A-65.)
- Front Exhaust Pipe Removal and Installation
- Automatic Transmission Fluid Draining and Supplying (Refer to GROUP 00 – Maintenance Service.)
- Transfer Oil Draining and Supplying (Refer to GROUP 00 – Maintenance Service.)
- Front and Rear Propeller Shaft Removal and Installation (Refer to GROUP 25 – Propeller Shaft.)



Fluid:
ATF DEXRON II or equivalent

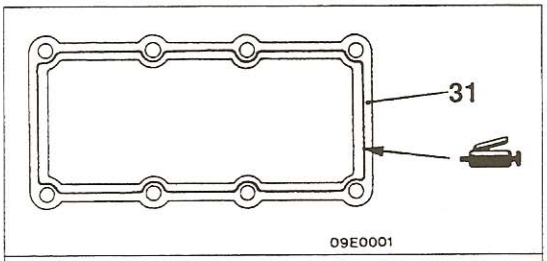


Removal steps

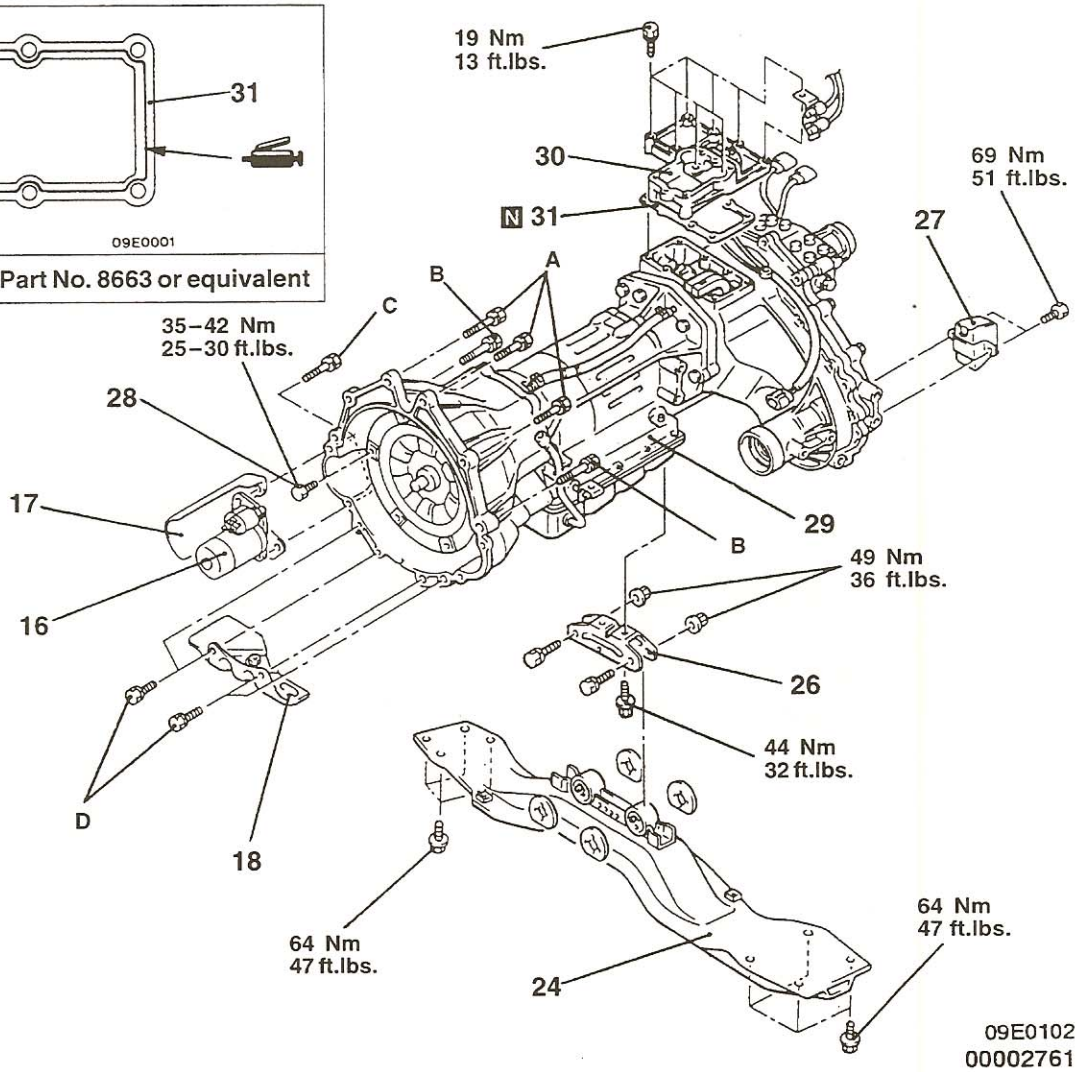
1. Fluid filler pipe
2. O-ring
- ▶D◀ 3. Throttle cable connection
4. Dust seal guard
- ▶C◀ 5. Transmission control cable connection
6. Speed sensor connector
7. High range/Low range detection switch connector
8. Low range operation detection switch
9. 4WD operation detection switch connector
10. Center differential lock operation detection switch connector
11. Center differential lock detection switch connector
12. 2WD/4WD detection switch connector
13. Park/Neutral position switch connector
14. Solenoid valve connector
15. Fluid cooler pipe connection

TSB Revision

	Nm	ft.lbs.	O.D. × Length mm (in.)	Bolt identification
A	74	54	"7" 12 × 40 (.5 × 1.6)	"7" D × L
B	88	65	"7" 12 × 55 (.5 × 2.2)	
C	30	22	"7" 10 × 55 (.4 × 2.2)	
D	35	26	"7" 10 × 40 (.4 × 1.6)	Z09Y512

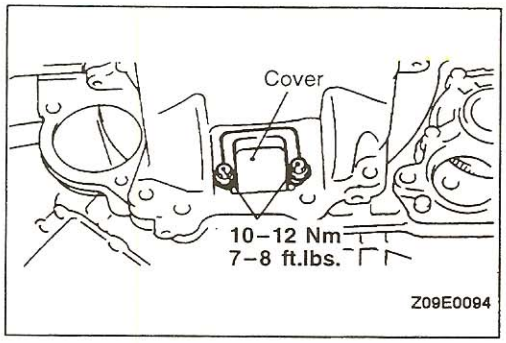


Sealant: 3M ATD Part No. 8663 or equivalent



16. Starter motor
17. Starter cover
18. Heat protector
24. No. 2 crossmember
26. Engine rear mount bracket
27. Mass damper
28. Torque converter connecting bolt
◀A▶ ◀A▶ ▶B◀ ▶A◀ 29. Transmission and transfer assembly
30. Control housing
31. Gasket

TSB Revision



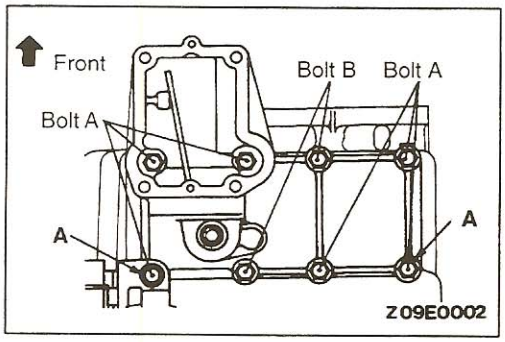
REMOVAL SERVICE POINT

◀A▶ TORQUE CONVERTER CONNECTING BOLT/ TRANSMISSION AND TRANSFER ASSEMBLY REMOVAL

(1) Remove the cover from the oil pan upper.
(2) Remove the connecting bolts (6 places) while turning the crankshaft.
(3) Gently lower the rear section of the transmission and transfer assembly to remove the assembly from the engine.

Caution
When removing the transmission and transfer assembly, push the torque converter over to the transmission and transfer assembly side so it does not remain on the engine side.

(4) Next, tilt the front section of the transmission and transfer assembly downwards and gently lower it, being careful that the rear section of the transfer does not touch the No. 4 crossmember.



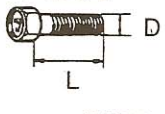
INSTALLATION SERVICE POINTS

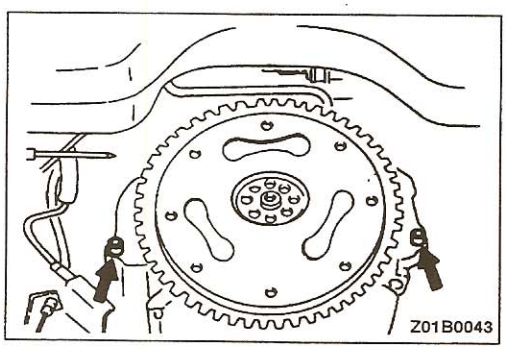
▶A◀ CONTROL HOUSING INSTALLATION

(1) Remove the adhesive which is sticking to the bolts attached to section A.
(2) Use a tap (M8×1.25) to remove the adhesive which is sticking to the screw holes (section A).
(3) Apply specified adhesive to the threads of the mounting bolts (section A).

Specified adhesive:
3M Stud Locking No. 4170 or equivalent

(4) The dimensions of the mounting bolts vary according to their mounting locations, so do not confuse them when installing.

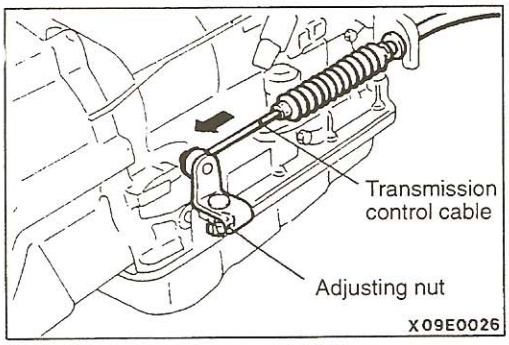
Bolt to be used	O.D.×Length mm (in.)	Bolt identification
A	8×25 (.3×1.0)	"7" D X L  Z09Y512
B	8×257(.3×1.0) <Reamer bolt>	



▶B◀ TRANSMISSION AND TRANSFER ASSEMBLY INSTALLATION

Align the engine transmission mounting bolt holes with the transmission and transfer assembly as shown in the illustration, and then connect the transmission and transfer assembly to the engine.

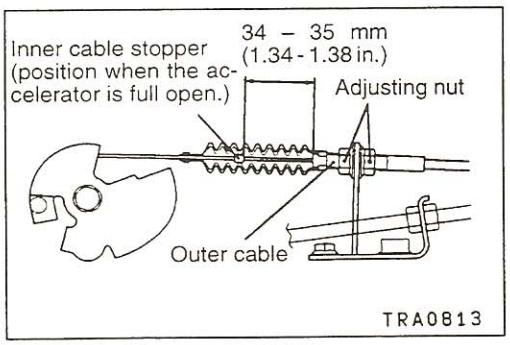
TSB Revision



▶C◀ TRANSMISSION CONTROL CABLE INSTALLATION

After installing the transmission control cable, adjust it by the following procedure.

(1) Move the selector lever to the N position.
(2) Loosen the adjusting nut, gently pull the end of the transmission control cable in the direction of the arrow and then tighten the adjusting nut to the specified torque.



▶D◀ THROTTLE CABLE INSTALLATION

After installing the throttle cable, adjust it by the following procedure.

(1) Remove the boot at the outer cable so that the inner cable stopper can be seen.
(2) Adjust the dimension between the end of the inner cable stopper and that of the outer cable with throttle lever full open.

Standard value: 34 – 35 mm (1.34 – 1.38 in.)

NOTES

AUTOMATIC TRANSMISSION OVERHAUL

CONTENTS

23309000145

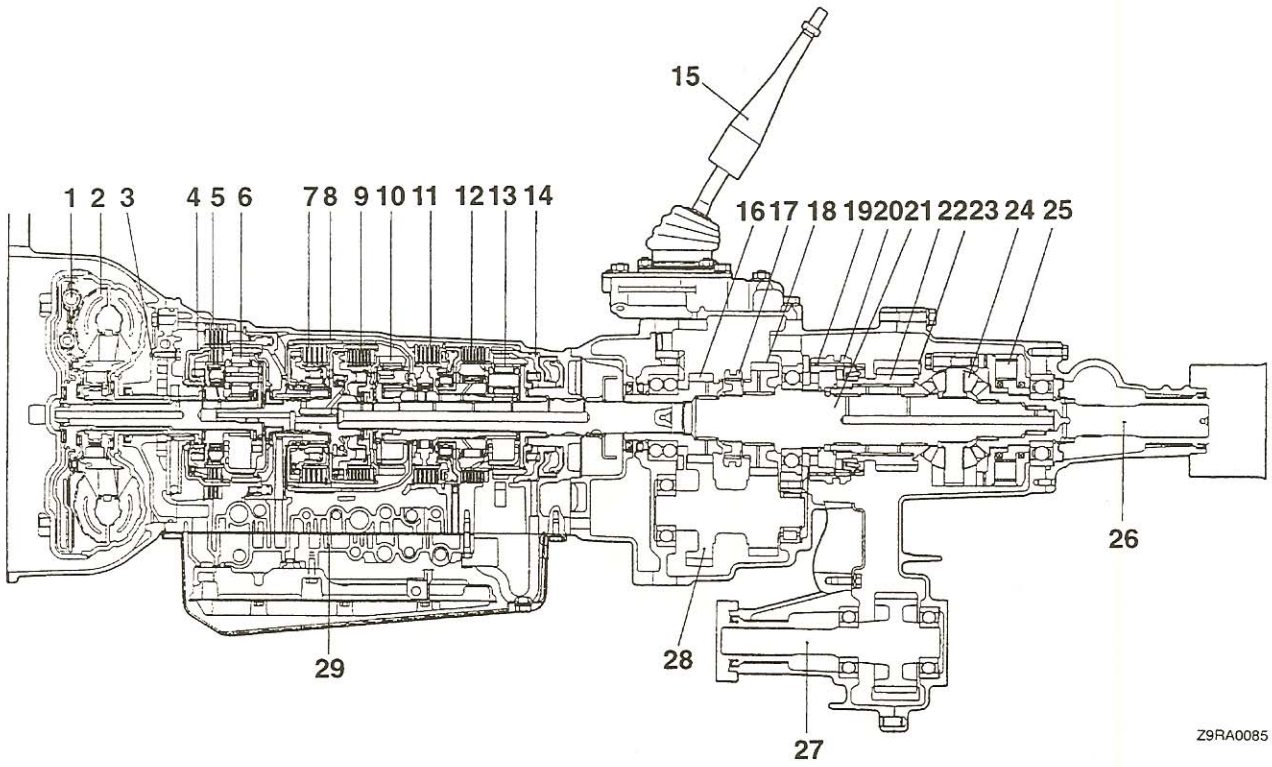
GENERAL INFORMATION

2330001[illegible]

Precautions to be taken when disassembling and reassembling the transmission

- Because the automatic transmission is composed of component parts of an especially high degree of precision, these parts should be very carefully handled during disassembly and assembly so as not to scar or scratch them.
- A rubber mat should be placed on the workbench, and it should always be kept clean.
- During disassembly, cloth gloves or shop towels should not be used. If such items must be used, either use articles made of nylon, or use paper towels.
- All disassembled parts must be thoroughly cleaned.
  Metal parts may be cleaned with ordinary detergents, but must be thoroughly air dried.
- Clean the clutch disc, resin thrust plate and rubber parts by using ATF (automatic transmission fluid), being very careful that dust, dirt, etc. do not adhere to them.
- Do not reuse gaskets, oil seals, or rubber parts.
  Replace such parts with new ones at every ressembly. The O-ring of the oil level gauge need not be replaced.
- Do not use grease other than petrolatum jelly.
- Apply ATF to friction components, rotating parts, and sliding parts before installation.
- Do not apply sealer or adhesive to gaskets.
- When a bushing must be replaced, replace the assembly in which it is incorporated.
- If the transmission main unit is damaged, also disassemble and clean the cooler system.

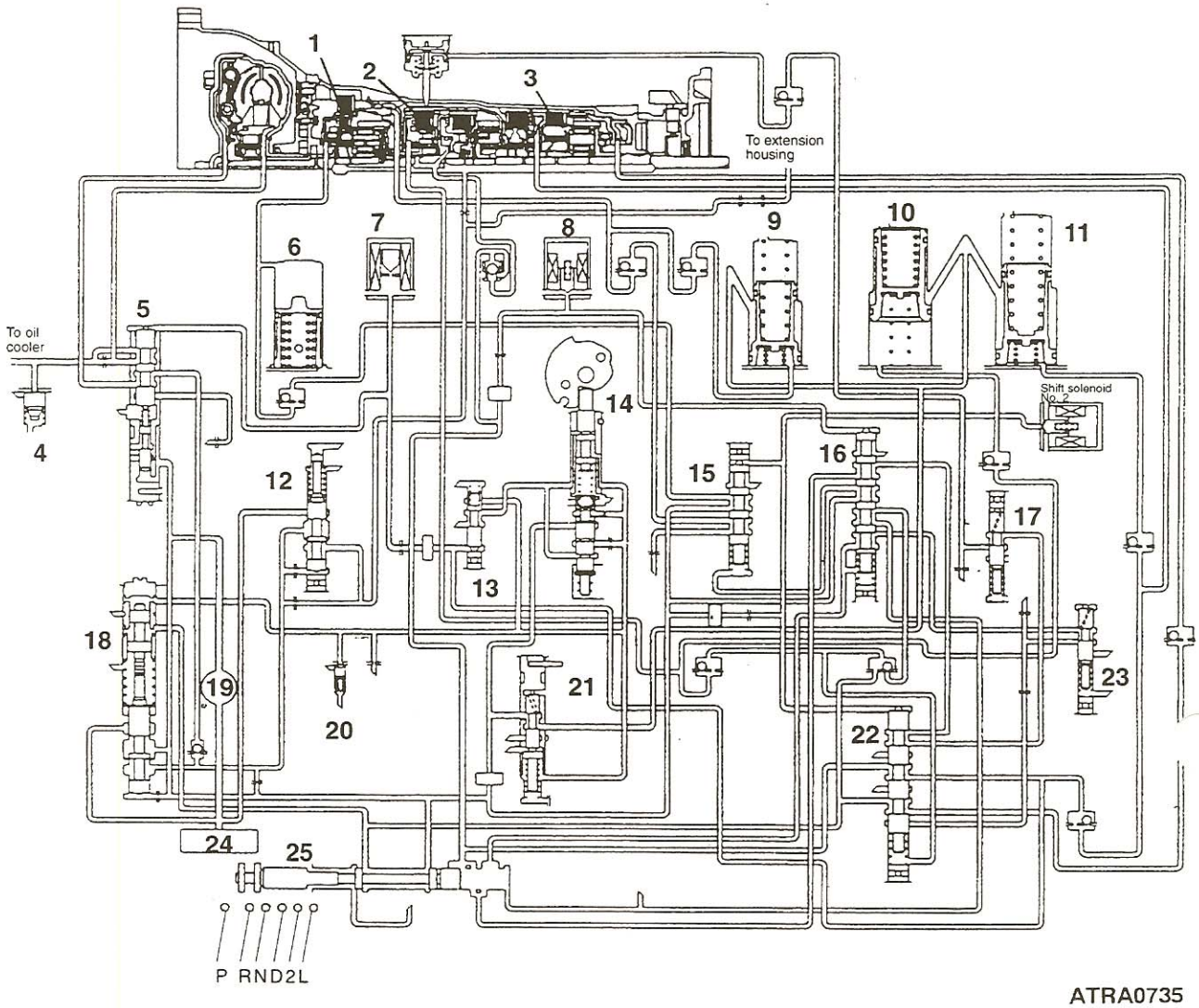
SECTIONAL VIEW



1. Torque converter clutch
2. Torque converter
3. Oil pump
4. Overdrive clutch
5. Overdrive brake
6. Overdrive planetary gear
7. Direct clutch
8. Second coast brake
9. Forward clutch
10. Front planetary gear
11. Second brake
12. First & reverse brake
13. Rear planetary gear
14. First & reverse brake piston
15. Transfer control lever
16. Input gear
17. High-low clutch
18. Low speed gear
19. Differential lock hub
20. 2-4WD synchronizer sleeve
21. Transfer drive shaft
22. Drive sprocket
23. Chain
24. Center differential
25. Viscous coupling
26. Rear output shaft
27. Front output shaft
28. Counter gear
29. Valve body

TSB Revision

HYDRAULIC CONTROL SYSTEM



ATRA0735

1. Overdrive direct clutch
2. Direct clutch
3. 1st & Rev. brake
4. Cooler bypass valve
5. Torque converter clutch relay valve
6. C_0 accumulator
7. Lock-up solenoid
8. Shift solenoid No.1
9. B_0 accumulator
10. C_2 accumulator
11. B_2 accumulator
12. Secondary regulator valve
13. Cut back valve
14. Throttle valve
15. 3-4 shift valve
16. 2-3 shift valve
17. Second coast modulator valve
18. Primary regulator valve
19. Oil pump
20. Pressure release
21. Accumulator control valve
22. 1-2 shift valve
23. Low coast modulator valve
24. Strainer
25. Manual valve

TSB Revision

SPECIFICATIONS

23300020256

TRANSMISSION MODEL TABLE

Transmission model	Gear ratio	Torque converter clutch	VCU	Speedometer gear ratio	Vehicle model	Engine model
V4AW3-B-NERL	A	×	×	25/9	V45W	6G74
V4AW3-B-NFRL	A	×	×	26/9	V45W	6G74

GEAR RATIO TABLE

23302280027

Items		A
Transmission	1st	2.804
	2nd	1.531
	3rd	1.000
	4th	0.754
	Reverse	2.393
Transfer	High	1.000
	Low	1.900

SERVICE SPECIFICATIONS

23300030105

mm (in.)

Transmission

Items	Standard value	Limit
Clearance between second brake drum and plate	0.70 – 1.22 (.0275 – .0480)	–
Clearance between snap ring and flange	0.62 – 1.98 (.0244 – .0779)	–
Second brake piston stroke	1.5 – 3.0 (.059 – .118)	–
Output shaft end play	0.27 – 0.86 (.0106 – .0339)	–
Torque converter housing clearance	31.1 or more (1.22 or more)	–
Oil pump body clearance	0.07 – 0.15 (.0028 – .0059)	0.3 (.012)
Oil pump tip clearance	0.11 – 0.14 (.0043 – .0055)	0.3 (.012)
Oil pump side clearance	0.02 – 0.05 (.0008 – .0020)	0.3 (.012)
Overdrive direct clutch disc thickness	–	1.84 (.0724)
Overdrive direct clutch return spring free length	Approx. 15.8 (Approx. .622)	–
Overdrive direct piston stroke	1.85 – 2.15 (.0728 – .0846)	–
Overdrive support assembly return spring free length	Approx. 18.6 (Approx. .732)	–
Direct clutch disc thickness	–	1.84 (.0724)
Direct clutch return spring free length	Approx. 19.8 (Approx. .780)	–
Direct clutch piston stroke	1.37 – 1.67 (.0539 – .0657)	–

TSB Revision

Items	Standard value	Limit
Forward clutch disc thickness	–	1.84 (.0724)
Forward clutch return spring free length	Approx. 11.55 (Approx. .4547)	–
Forward clutch piston stroke	2.90 – 4.29 (.1141 – .1689)	–
Second brake assembly return spring free length	Approx. 15.05 (Approx. .5925)	–
First & reverse brake disc thickness	–	1.51 (.0594)
First & reverse brake return spring free length	Approx. 13.09 (Approx. .5154)	–
Oil pump body busing ID	–	38.18 (1.503)
Oil pump stator shaft bushing ID (Front)	–	21.57 (.849)
Oil pump stator shaft bushing ID (Rear)	–	27.07 (1.066)
Overdrive direct clutch drum bushing ID	–	27.11 (1.067)
Overdrive planetary gear bushing ID	–	11.27 (.444)
Direct clutch drum bushing ID	–	53.97 (2.125)
Forward clutch drum bushing ID	–	24.07 (.948)
Front planetary ring gear bushing ID	–	24.07 (.948)
Planetary sun gear bushing ID	–	24.07 (.948)

Transfer

Items	Standard value	Limit
H-L clutch hub end play	0 – 0.08 (0 – .0031)	–
Input gear bearing end play	0 – 0.06 (0 – .0024)	–
Center differential end play	0.025 – 0.150 (.00098 – .00591)	–
Differential lock hub end play	0 – 0.08 (0 – .0031)	–
2-4WD synchronizer hub end play	0 – 0.08 (0 – .0031)	–
Rear output shaft bearing end play	0 – 0.08 (0 – .0031)	–
Countershaft gear end play	0 – 0.15 (0 – .0059)	–
Countershaft gear bearing end play	0 – 0.08 (0 – .0031)	–
Clearance between outer synchronizer ring back side and drive sprocket	–	0.3 (.012)

VALVE BODY SPRING IDENTIFICATION

23302290013

mm (in.)

Lower valve body

Spring	Free height	Outside diameter	Number of loops	Wire diameter
1 – 2 shift valve spring	30.8 (1.213)	9.7 (.381)	8.5	0.9 (.035)
Primary regulator valve spring	62.3 (2.453)	18.6 (.732)	12.5	1.7 (.067)
Accumulator control valve spring	33.9 (1.335)	8.8 (.346)	10	0.8 (.031)
Check valve spring	17.53 (.6902)	12.1 (.476)	3.2	1.1 (.043)
Relief valve spring	11.2 (.441)	6.4 (.252)	7.5	0.9 (.035)

Upper valve body

Spring	Free height	Outside diameter	Number of loops	Wire diameter
Down shift valve spring	27.3 (1.075)	8.7 (.343)	10.5	1.0 (.039)
Throttle valve spring	20.6 (.811)	9.2 (.362)	7.5	0.7 (.028)
3 – 4 shift valve spring	30.8 (1.213)	9.7 (.382)	8.5	0.9 (.035)
Second coast modulator valve spring	30.9 (1.217)	8.6 (.339)	9.5	1.1 (.043)
Lock-up relay valve spring	21.4 (.843)	5.5 (.217)	15.5	0.6 (.024)
Secondary regulator valve spring	30.9 (1.217)	11.2 (.441)	8.5	1.5 (.059)
Cut check valve spring	21.8 (.858)	6.0 (.236)	11.5	0.6 (.024)
2 – 3 shift valve spring	30.8 (1.213)	9.7 (.382)	8.5	0.9 (.035)
Low coast modulator valve spring	30.4 (1.197)	8.3 (.327)	8.5	0.8 (.031)

ACCUMULATOR PISTON SPRING IDENTIFICATION

23302430057

mm (in.)

Spring		Free height	Outside diameter	Number of loops	Wire diameter
C_0	Outer spring 1 Outer spring 2	74.6 (2.937) 46.1 (1.811)	20.9 (.823) 14.0 (.551)	12.3 12.5	2.3 (.091) 2.2 (.087)
C_2	Outer spring Inner spring 1 Inner spring 2	22.0 (.787) 64.0 (2.520) 42.1 (1.657)	12.0 (.472) 20.2 (.795) 14.7 (.579)	5.3 12.3 7.3	1.7 (.067) 2.2 (.087) 2.5 (.098)
B_0	Outer spring Inner spring	14.5 (.571) 62.0 (2.441)	13.0 (.512) 16.0 (.630)	3.0 11.9	2.1 (.083) 2.1 (.083)
B_2	Outer spring Inner spring	19.0 (.748) 75.3 (2.965)	14.0 (.551) 20.0 (.787)	5.7 14.3	2.0 (.079) 2.7 (.106)
Accumulator control valve spring		29.8 (1.173)	8.8 (.346)	16.0	0.8 (.031)

TSB Revision

TORQUE SPECIFICATIONS

23302310023

Transmission

Items	Nm	ft.lbs.
Transmission case	36	26
Case adapter	36	26
Transmission control shaft lever	16	12
Parking lock rod	7	5
Speed sensor	16	12
O/D support mounting bolt	26	19
Oil pump	22	16
Throttle cable	6	4.3
Valve body mounting bolt	10	7.2
Transmission wire	6	4.3
Oil strainer	10	7.2
Oil screen	7	5
Oil pan	8	5.8
Drain plug	21	15
Oil temperature sensor	15	11
Converter housing 10 mm (.39 in.) diameter bolt	35	25
Converter housing 12 mm (.47 in.) diameter bolt	58	42
Park/neutral position switch bolt	13	9
Park/neutral position switch nut	4	2.9
Oil pump stator	8	5.8
Valve body upper bolt	7	5
Manual detent spring	10	7.2
Throttle valve cam	10	7.2
Shift solenoid No.1	10	7.2
Shift solenoid No.2	10	7.2
Lock up solenoid	10	7.2

Transfer

Items	Nm	ft.lbs.
Rear cover	36	26
Chain cover	36	26
Center differential case	65	47
Bearing retainer	19	14
Oil pool cover	9	6.5
Lock plate	19	14
Detection switch	36	26
Plug	36	26

TSB Revision

Items	Nm	ft.lbs.
Poppet plug	36	26
H-L shift rail plug	33	24
Dynamic damper	36	26
Side cover	19	14
Sleeve clamp	19	14

ADJUSTMENT SNAP RINGS AND SPACERS

23302300020

Snap ring (For adjustment of input gear bearing end play)

Thickness mm (in.)	Identification symbol	Part No.	Thickness mm (in.)	Identification symbol	Part No.
2.30 (.0906)	None	MD704199	2.45 (.0965)	Blue	MD704202
2.35 (.0925)	Red	MD704200	2.50 (.0984)	Green	MD704203
2.40 (.0945)	White	MD704201			

Snap ring (For adjustment of H-L clutch hub end play)

Thickness mm (in.)	Identification symbol	Part No.	Thickness mm (in.)	Identification symbol	Part No.
2.18 (.0858)	Blue	MR110983	2.32 (.0913)	Brown	MR110985
2.25 (.0886)	None	MR110984	2.39(.0941)	White	MR110986

Snap ring (For adjustment of differential lock hub end play)

Thickness mm (in.)	Identification symbol	Part No.	Thickness mm (in.)	Identification symbol	Part No.
2.56 (.1009)	None	MD738386	2.84 (.1118)	Yellow	MD738390
2.63 (.1035)	Red	MD738387	2.91 (.1146)	Green	MD738391
2.70 (.1063)	White	MD738388	2.98 (.1173)	Purple	MD738392
2.77 (.1091)	Blue	MD738389			

Snap ring (For adjustment of 2-4WD synchronizer hub end play)

Thickness mm (in.)	Identification symbol	Part No.	Thickness mm (in.)	Identification symbol	Part No.
2.56 (.1009)	None	MD738393	2.77 (.1091)	Blue	MD738396
2.63 (.1035)	Red	MD738394	2.84 (.1118)	Yellow	MD738397
2.70 (.1063)	White	MD738395			

Snap ring (For adjustment of transfer counter gear bearing end play)

Thickness mm (in.)	Identification symbol	Part No.	Thickness mm (in.)	Identification symbol	Part No.
1.48 (.0583)	Blue	MB919176	1.62 (.0638)	None	MB919177

Snap ring (For adjustment of transfer counter gear end play)

Thickness mm (in.)	Identification symbol	Part No.	Thickness mm (in.)	Identification symbol	Part No.
1.77(.0697)	None	MB896728	2.19(.0862)	White	MB896731
1.91 (.0752)	Blue	MB896729	2.33 (.0917)	Red	MB896732
2.05 (.0807)	Brown	MB896730			

Snap ring (For adjustment of rear output shaft bearing end play)

Thickness mm (in.)	Identification symbol	Part No.	Thickness mm (in.)	Identification symbol	Part No.
2.26 (.0890)	None	MD734311	2.40 (.0945)	White	MD734313
2.33 (.0917)	Red	MD734312	2.47 (.0972)	Blue	MD734314

Snap ring (For adjustment of center differential end play)

Thickness mm (in.)	Identification symbol	Part No.	Thickness mm (in.)	Identification symbol	Part No.
0.84 (.0331)	84	MD734326	1.47 (.0579)	47	MD734333
0.93 (.0366)	93	MD734327	1.56 (.0614)	56	MD734334
1.02 (.0402)	02	MD734328	1.65 (.0650)	65	MD734335
1.11 (.0437)	11	MD734329	1.74 (.0685)	74	MD734336
1.20 (.0472)	20	MD734330	1.83 (.0720)	83	MD734337
1.29 (.0508)	29	MD734331	1.92 (.0756)	92	MD734338
1.38 (.0543)	38	MD734332	2.01 (.0791)	01	MD734339

SEALANTS

23300050033

Transmission

Item	Specified sealant	Quantity
Oil pan	Mitsubishi genuine sealant Part No.MR166584 or equivalent	As required

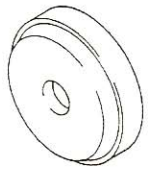
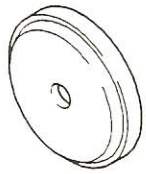
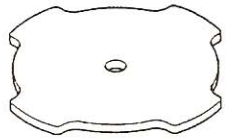
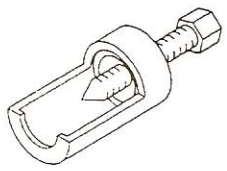
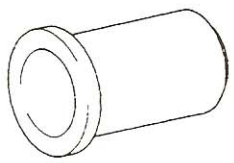
Transfer

Item	Specified sealants and adhesives	Quantity
Adapter gasket (transmission side)	Mitsubishi genuine sealant Part No.MR166584 or equivalent	As required
Adapter gasket (transfer side)	Mitsubishi genuine sealant Part No.MD997740 or equivalent	As required
Chain cover	Mitsubishi genuine sealant Part No.MD997740 or equivalent	As required
Rear cover	Mitsubishi genuine sealant Part No.MD997740 or equivalent	As required
Transfer case plate	Mitsubishi genuine sealant Part No.MD997740 or equivalent	As required
Poppet plug	3M ATD Part No.8660 or equivalent	As required
Plug	3M ATD Part No.8660 or equivalent	As required
Bolt (threads)	3M STUD Locking 4170 or equivalent	As required

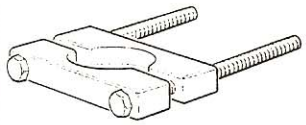
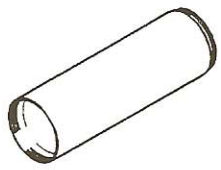
TSB Revision

SPECIAL TOOLS

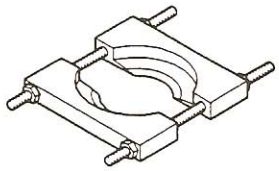
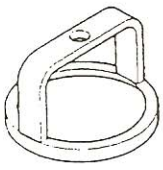
23300060098

Tool	Tool number and name	Supersession	Application
	MB990929 Installer adapter	MB990929	Installation of the oil seal
	MB990936 Installer adapter	MB990936-01	Installation of the oil seal
	MB990938 Installer bar	MB990938-01	Installation of the oil seal
	MB991556 Spring compressor	–	Removal and installation of O/D support snap ring
	MD998192 Counter gear bearing puller	MD998192	Installation of the bearing
	MD998212 Oil pump puller	MD998212	Removal of oil pump
	MD998382 Countershaft front oil seal installer	MD998382-01	Installation of oil pump oil seal

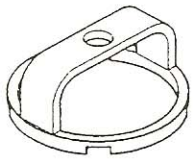
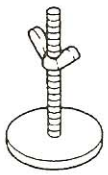
TSB Revision

Tool	Tool number and name	Supersession	Application
	MD998727 Oil pan remover	MD998727-01	Removal of oil pan
	MD998801 Bearing remover	MD998348-01	Removal of bearing
	MD998812 Installer cap	GENERAL SERVICE TOOL	Use with installer handle and adapter
	MD998813 Installer-100	GENERAL SERVICE TOOL	Use with installer cap and adapter
	MD998814 Installer-200	MIT304180	Use with installer cap and adapter
	MD998818 Installer adapter (38)	MD998818	Installation of the bearing
	MD998819 Installer adapter (40)	MD998819	Installation of the bearing

TSB Revision

Tool	Tool number and name	Supersession	Application
	MD998821 Installer adapter (44)	–	Installation of the bearing
	MD998823 Installer adapter (48)	–	Installation of the bearing
	MD998824 Installer adapter (50)	GENERAL SERVICE TOOL	Installation of the bearing
	MD998829 Installer adapter (60)	MD998829-01	Installation of the bearing
	MD998830 Installer adapter (66)	MD998830-01	Installation of the bearing
	MD998917 Bearing remover	MD998917-01	Removal of bearing
	MD998921 Spring compressor	–	Removal and installation of snap ring for O/D direct clutch, direct clutch, forward clutch and first & reverse brake

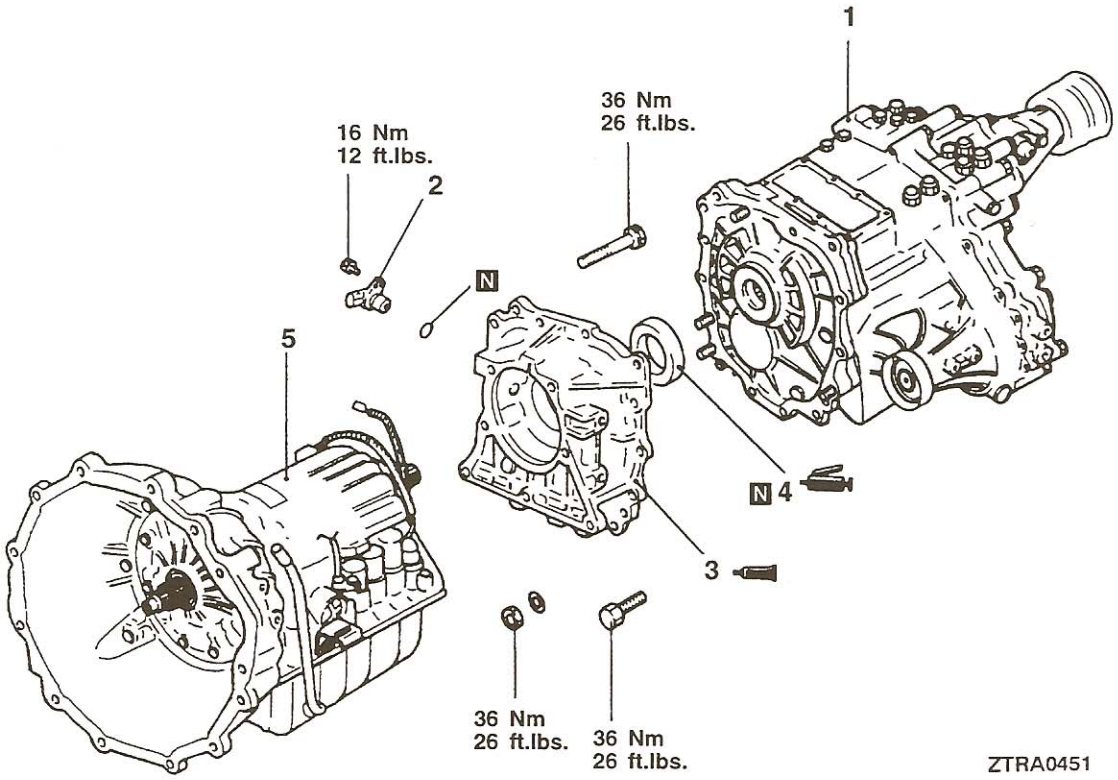
TSB Revision

Tool	Tool number and name	Supersession	Application
	MD998923 Spring compressor	–	Removal and installation of second brake snap ring
	MD998924 Spring ring compressor retainer	–	Used with MD998921, MD998922 and MD998923

TRANSMISSION AND TRANSFER

23302330012

DISASSEMBLY AND REASSEMBLY

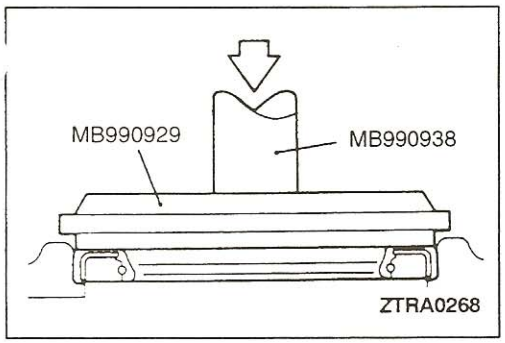


Disassemly steps

1. Transfer assembly
2. Speed sensor

▶B◀ 3. Transfer case adapter
▶A◀ 4. Oil seal
5. Transmission assembly

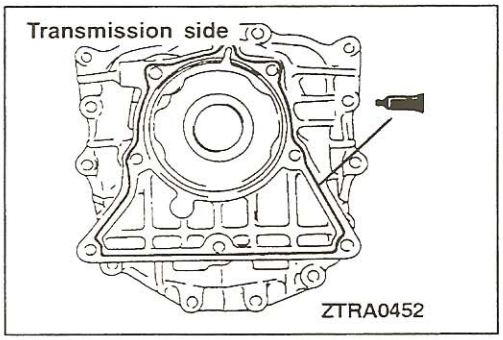
TSB Revision



REASSEMBLY SERVICE POINTS

▶A◀ OIL SEAL INSTALLATION

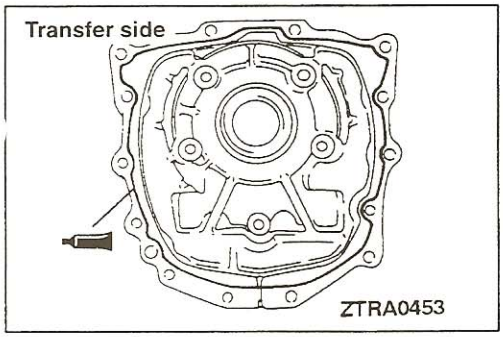
(1) Using the special tool, install an oil seal on the adapter, and then pack the oil seal lips with grease.



▶B◀ TRANSFER CASE ADAPTER INSTALLATION

Specified sealant:
Mitsubishi genuine sealant Part No. MR166584 or equivalent: Transmission side
Mitsubishi genuine sealant Part No. MD997740 or equivalent: Transfer side

Caution
Squeeze the sealant out evenly to make sure that it is not broken or excessively supplied.



TSB Revision

TRANSMISSION

2330082000001

DISASSEMBLY

Caution

1. **When removing the transmission assembly from the vehicle, care must be taken to make sure that the oil pan is not struck by the transmission jack.**
2. **The automatic transmission is composed of component parts of an especially high degree of precision. Therefore, handle these component parts very carefully during disassembly so as not to scar or scratch them.**
3. **When separating cases and other parts made of light alloys from the junctions, lightly hit them with a soft hammer (plastic hammer) if it is difficult to release them. Don't jimmy them free using a screwdriver or the like.**
4. **Replace a rubber mat on the workbench so that it may always be kept clean.**
5. **During disassembly, do not use cloth gloves or shop towels. If such items are required, use either articles made of nylon or paper towels.**
6. **Clean all disassembled parts thoroughly. Metal parts may be cleaned with ordinary detergents, but must be thoroughly air-dried.**
7. **Clean the clutch discs, brake discs, and other resin and rubber parts by using ATF (automatic transmission fluid), being very careful that dust, dirt, etc. not adhere to them.**
8. **If the transmission proper is damaged, also disassemble and clean the cooler system.**

(1) Remove sand, mud, etc. from the exterior of the transmission.

(2) Place the transmission assembly on a bench with the oil pan down.

Caution

Do not place the assembly with the oil pan up before the oil pan is removed. This is necessary to prevent foreign matter in the oil pan from entering the valve body.

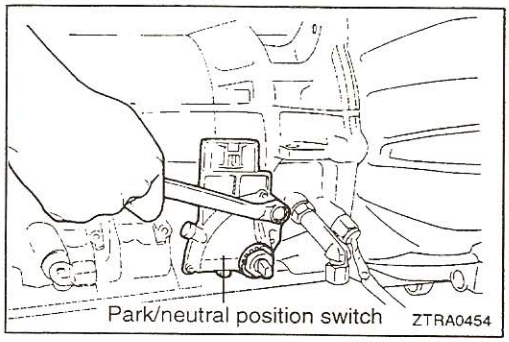
(3) Remove the torque converter.

(4) Remove the oil level gauge and oil filler tube. Remove the O-rings from the oil filler tube.

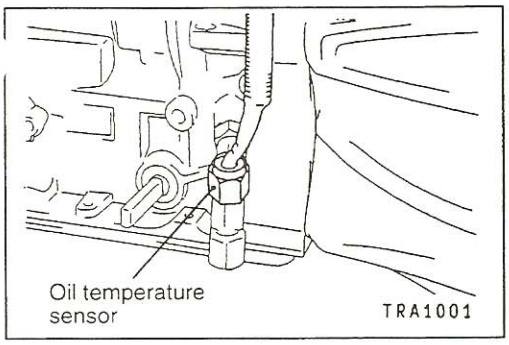
(5) Remove the harness connector bracket and throttle cable clamp.

(6) Remove the control shaft lever.

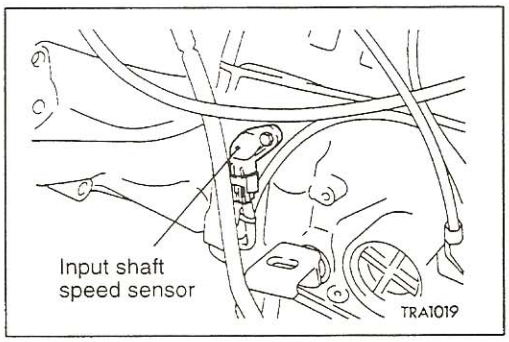
(7) Unlock the lock washer and remove the park/neutral position switch. Remove the lock washer and grommet.



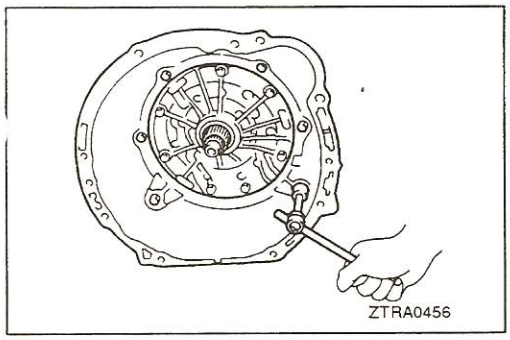
TSB Revision



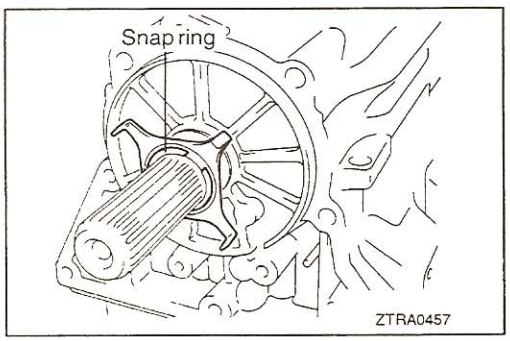
(8) Remove the oil temperature sensor.



(9) Remove the input shaft speed sensor.

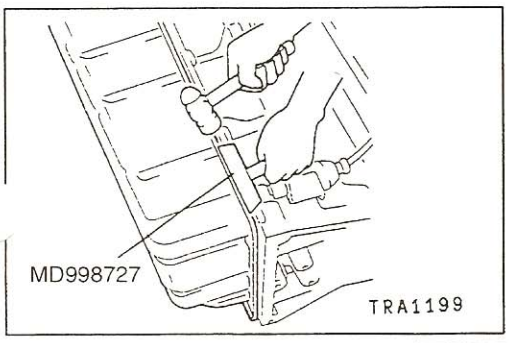


(10) Remove the torque converter housing.



(11) Remove the snap ring. Remove the sensor rotor and then the key.

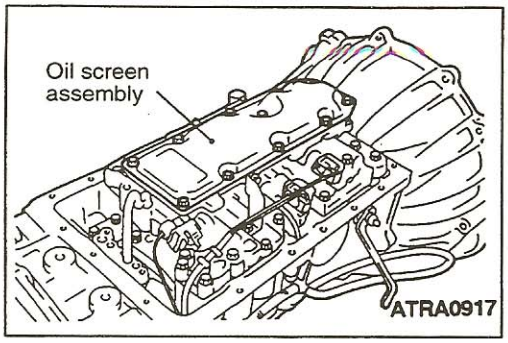
Caution
Be careful not to bend the blades of the sensor rotor.



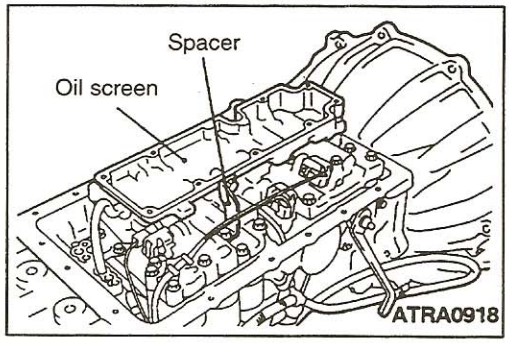
(12) Remove the 19 oil pan bolts and use the special tool (oil pan remover) to remove the oil pan.

Caution
Drive in the special tool carefully so as not to deform the oil pan.

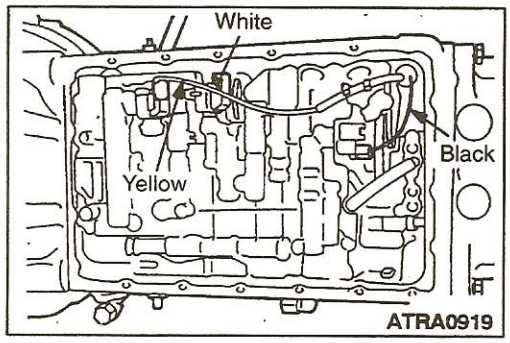
TSB Revision



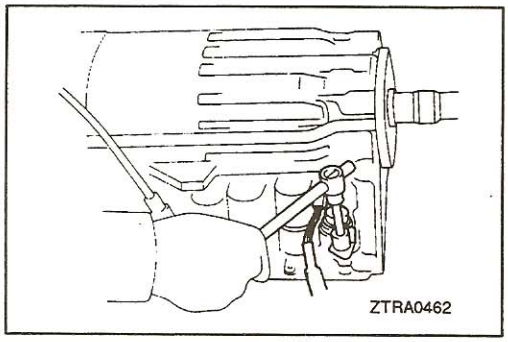
(13)Remove the 11 bolts and then remove the oil screen assembly and gasket.



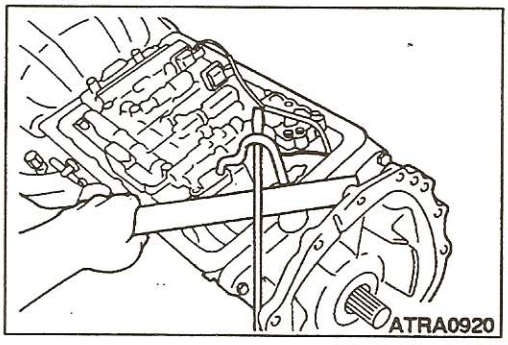
(14)Remove the 5 bolts and then remove the spacer and oil screen.
(15)Remove the two gaskets.



(16)Separate the 3 transmission solenoid connectors.



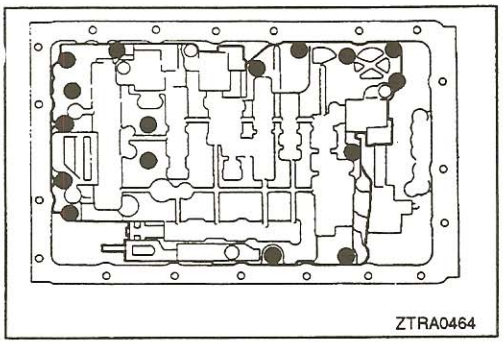
(17)Remove the grommet stopper plate from the transmission case and then remove the transmission wire.
(18)Remove the O-ring from the grommet.



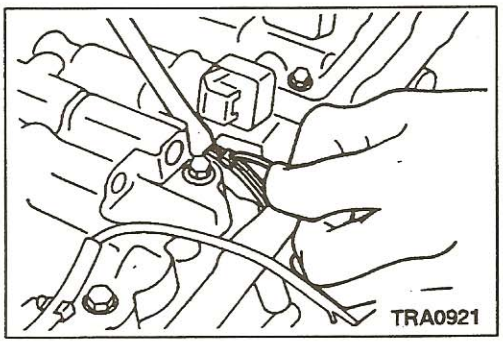
(19)Using a screwdriver, wood piece, etc., remove the first & reverse brake tube.

Caution
Be careful not to deform the brake tube.

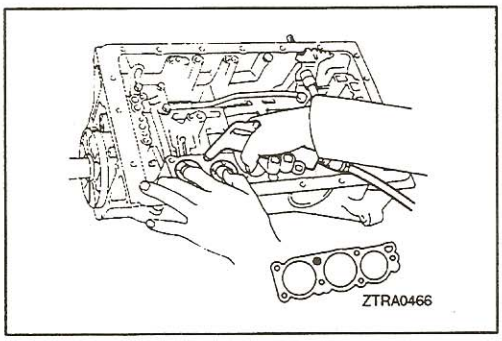
TSB Revision



(20)Remove the 16 mounting bolts from the valve body.

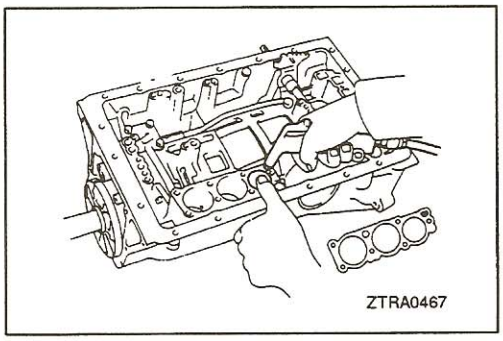


(21)Remove the throttle cable from the throttle cam. Then, remove the valve body.

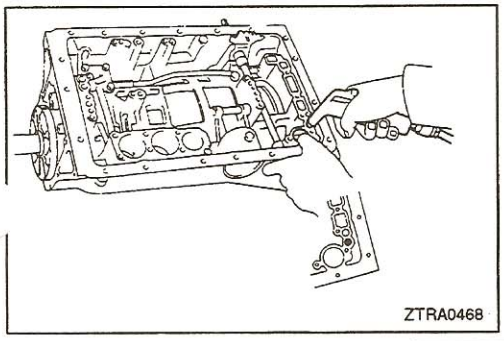


(22)Remove the two springs from the C_0 accumulator piston.
(23)Remove the check ball body and spring.
(24)Remove the B_2 and C_2 accumulator pistons and two springs by blowing air slowly from the illustrated oil hole.

NOTE
Both B_2 and C_2 pistons can be released by blowing air while pushing the B_2 piston stronger.

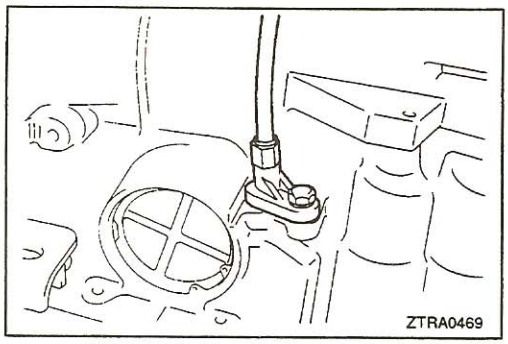


(25)Remove the B_0 accumulator piston and spring by blowing air slowly from the illustrated oil hole.

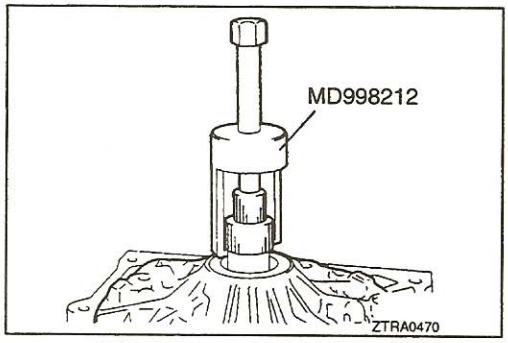


(26)Remove the C_0 accumulator piston and spring by blowing air slowly from the illustrated oil hole.
(27)Remove the O-ring from each piston.

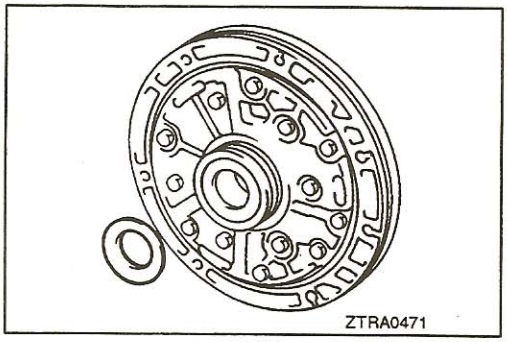
TSB Revision



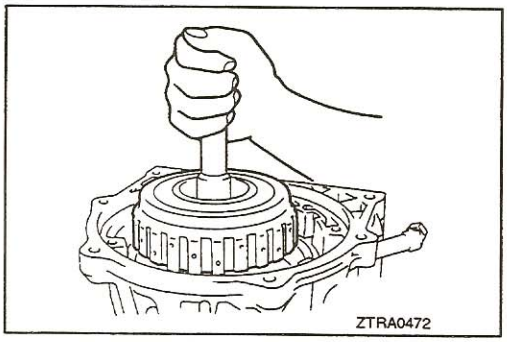
(28)Remove the bolt. Pull out the throttle cable while holding the retainer.
(29)Remove the O-ring from the throttle cable.



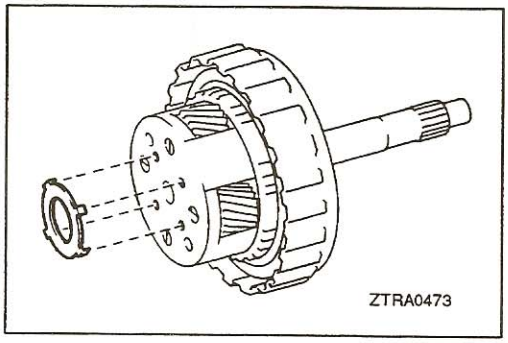
(30)Remove the 7 bolts attaching the oil pump.
(31)Using the special tool, remove the oil pump.



(32)Remove the race from the rear side of the oil pump.

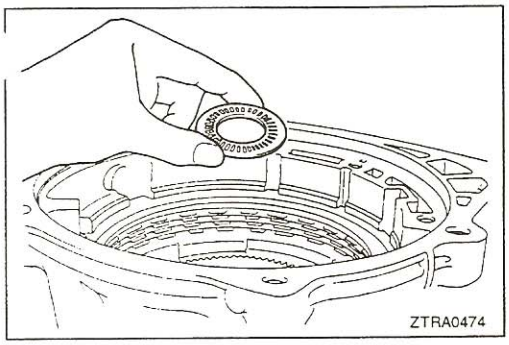


(33)Holding the input shaft by hand, remove the overdrive planetary gear assembly and overdrive direct clutch assembly.

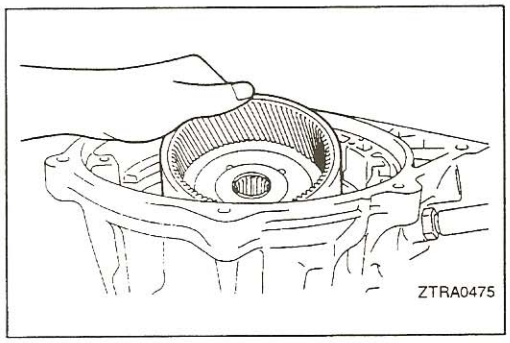


(34)Remove the race from the rear side of the overdrive planetary gear.

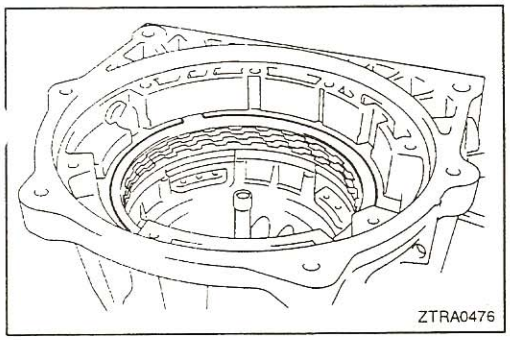
TSB Revision



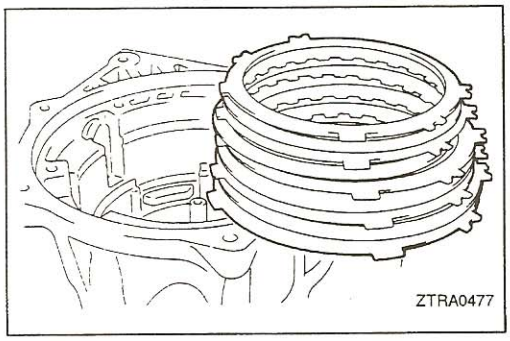
(35)Remove the bearing and race.



(36)Remove the overdrive planetary ring gear.

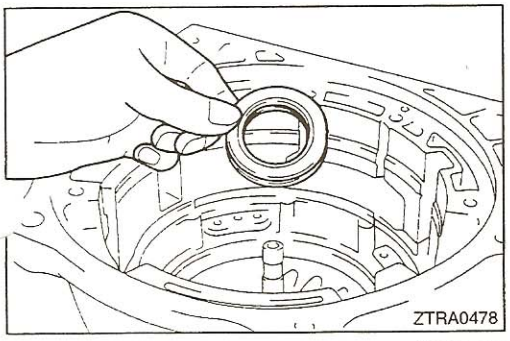


(37)Remove the snap ring.



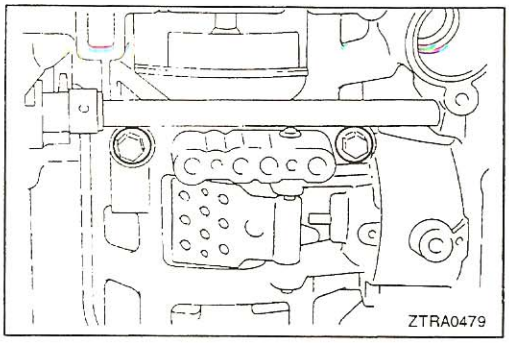
(38)Remove the two flanges, four discs and three plates of the overdrive brake.

NOTE
Remember the direction in which the brake flanges have been installed.

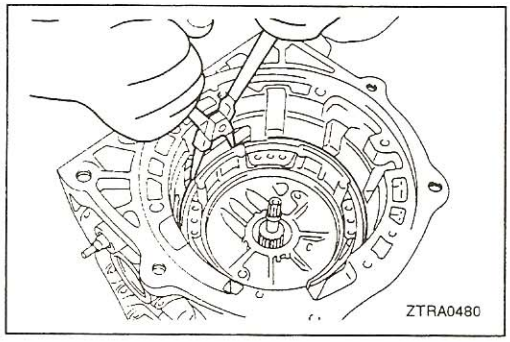


(39)Remove the race and bearing.

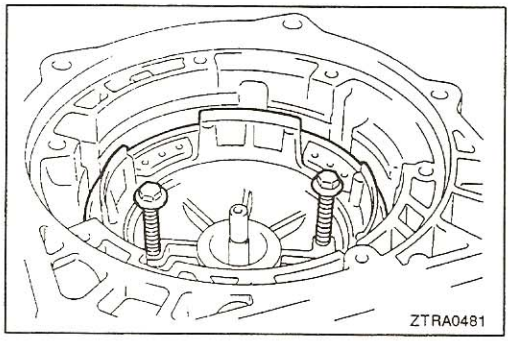
TSB Revision



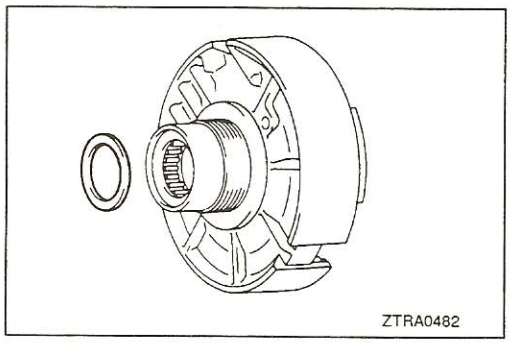
(40)Remove the two bolts attaching the overdrive support.



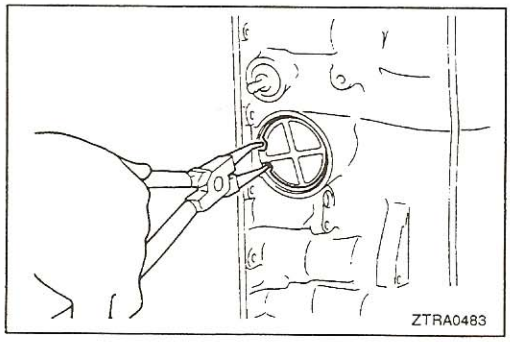
(41)Remove the snap ring.



(42)Remove the overdrive support assembly by making use of the two overdrive support mounting bolts.

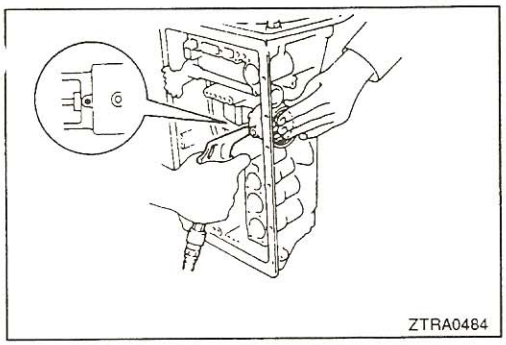


(43)Remove the race from the rear side of the overdrive support assembly.



(44)Remove the snap ring from the second coast brake piston.

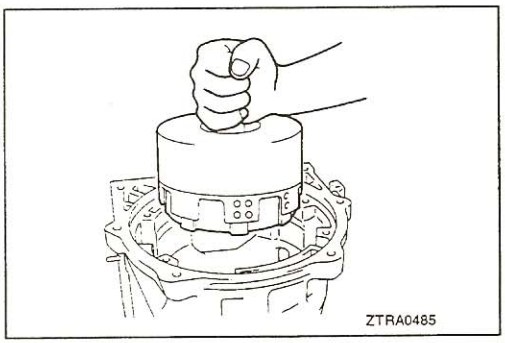
TSB Revision



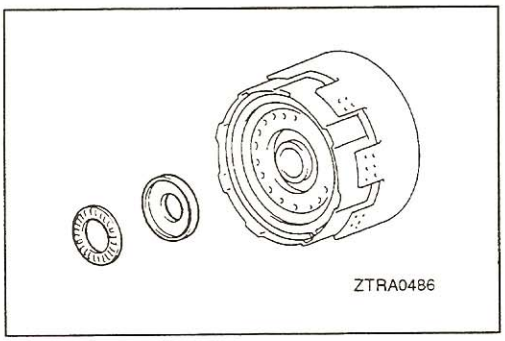
(45)Remove the second coast brake cover, piston assembly and spring by blowing air slowly from the illustrated oil hole.

Caution
Use a shop towel, etc. to prevent the cover and fluid from popping and gushing out.

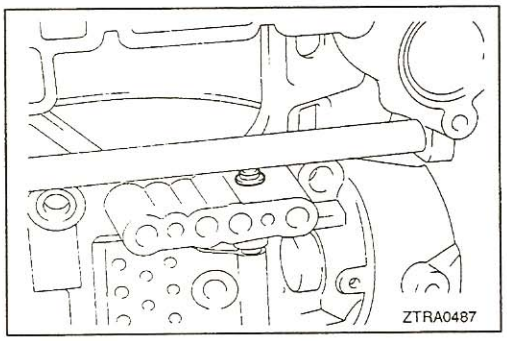
(46)Remove the two O-rings from the piston cover.



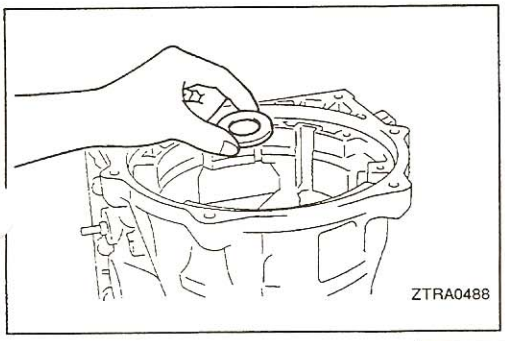
(47)Holding the input shaft of the forward clutch, remove the forward clutch assembly and direct clutch assembly.



(48)Remove the race and bearing from the rear side of the forward clutch assembly.

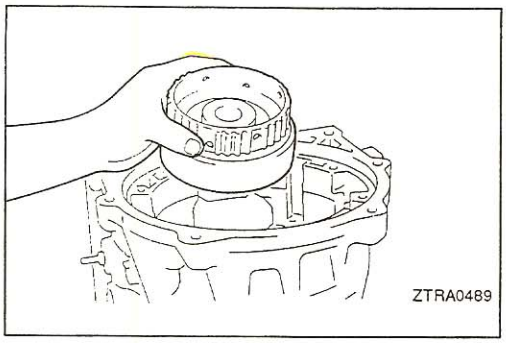


(49)Push the E-ring out of position and pull out the pin downward. Then remove the second coast brake band.
(50)Remove the E-ring from the pin.

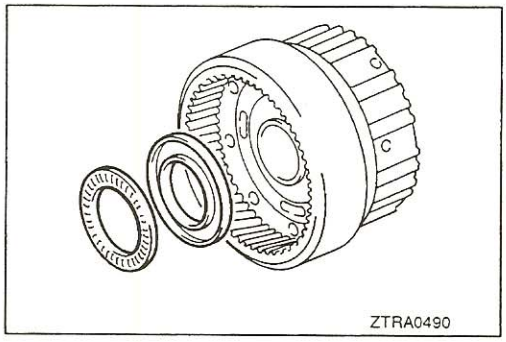


(51)Remove the race.

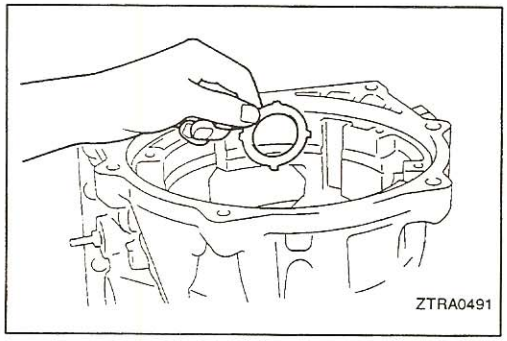
TSB Revision



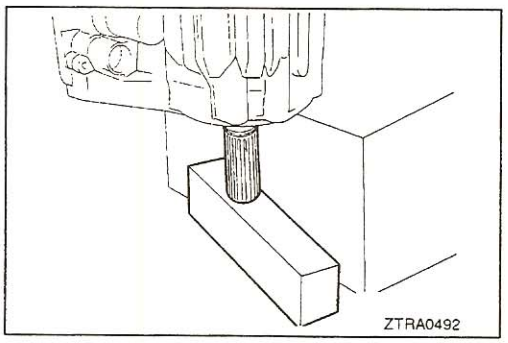
(52)Remove the front planetary ring gear.



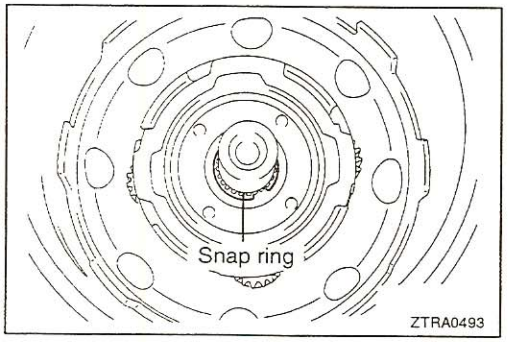
(53)Remove the race and bearing from the rear side of the front planetary ring gear.



(54)Remove the race.

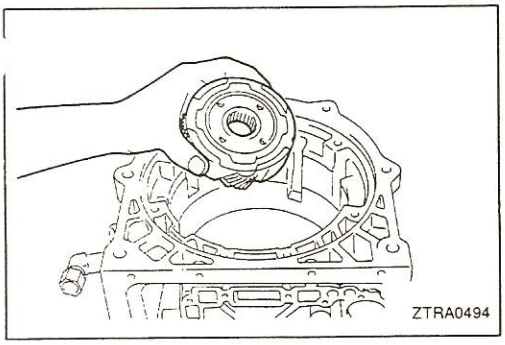


(55)Use wood pieces or the like so as to push the output shaft a little toward the front side.

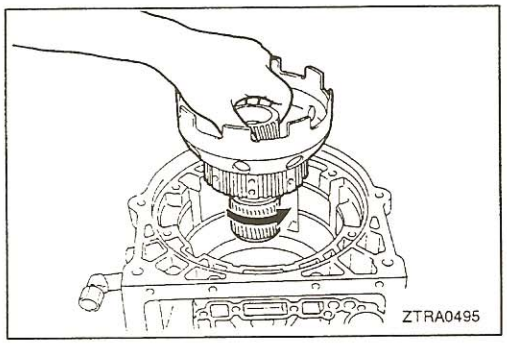


(56)Remove the snap ring.

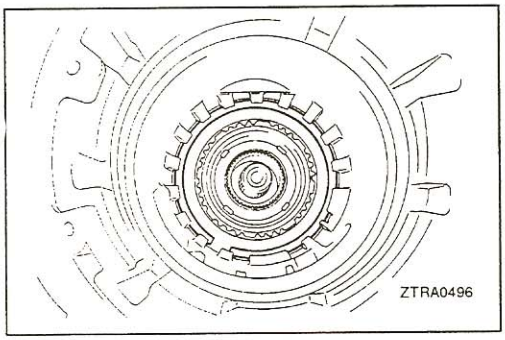
TSB Revision



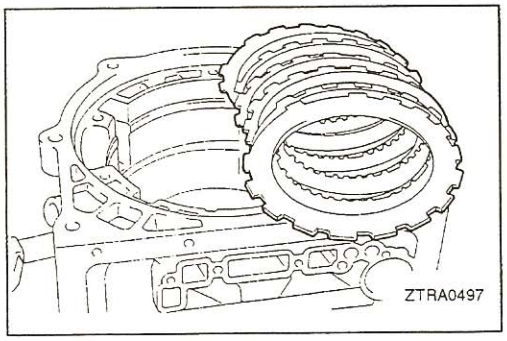
(57)Remove the front planetary gear assembly.
(58)Remove the bearing.



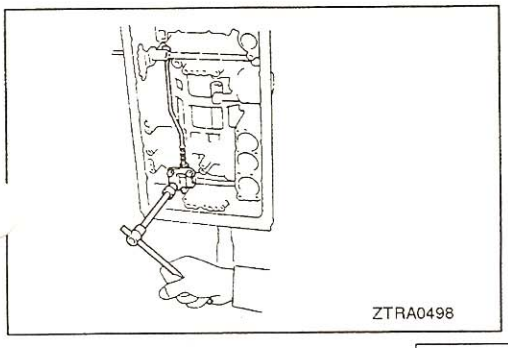
(59)Rotate the sun gear input drum counterclockwise to remove it together with the one-way clutch assembly.



(60)Remove the snap ring.

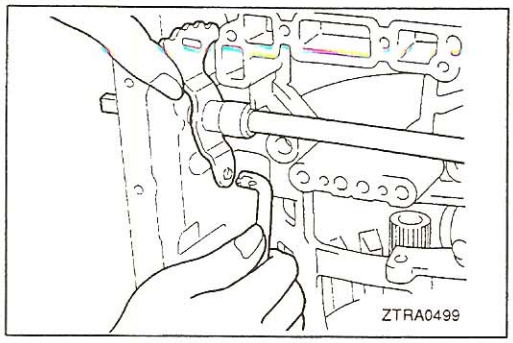


(61)Remove the flange, five discs and five plates of the flange.

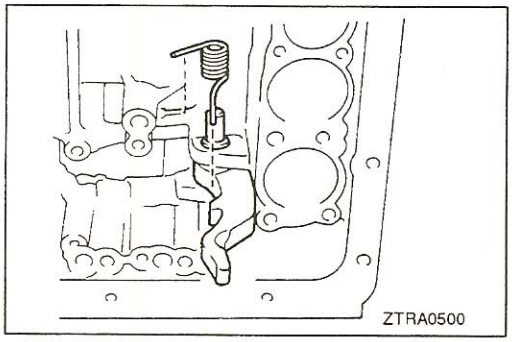


(62)Remove the three bolts and then remove the parking lock pawl bracket.

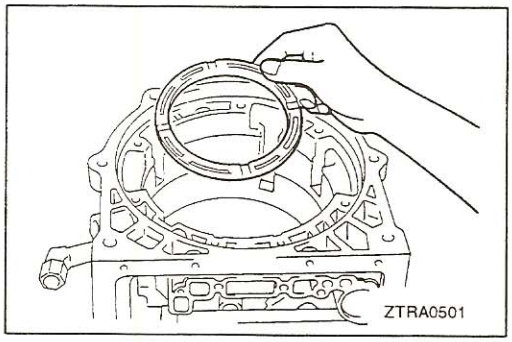
TSB Revision



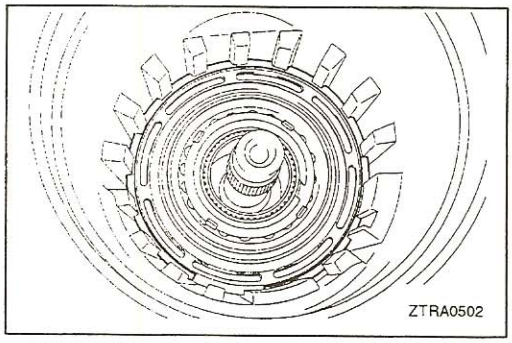
(63)Remove the parking lock rod from the manual valve lever.



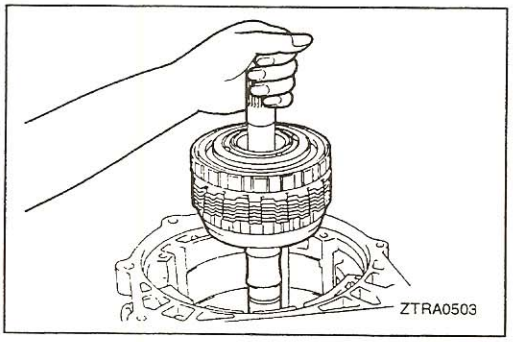
(64)Remove the spring, parking lock pawl shaft and pawl.
(65)Remove the E-ring from the parking lock pawl shaft.



(66)Remove the second brake piston sleeve.

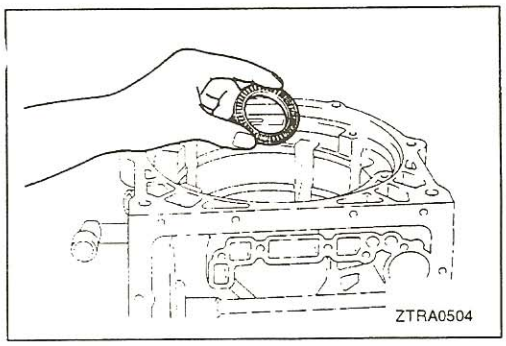


(67)Remove the snap ring.

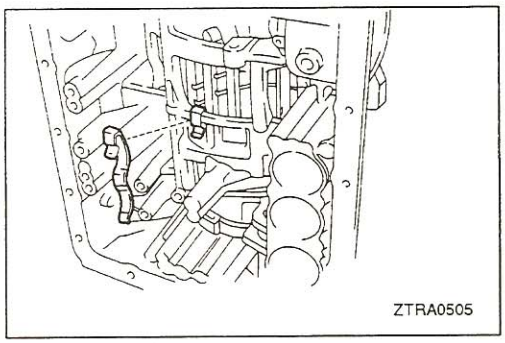


(68)Remove the output shaft, second brake drum sub-assembly and rear planetary gear assembly together.

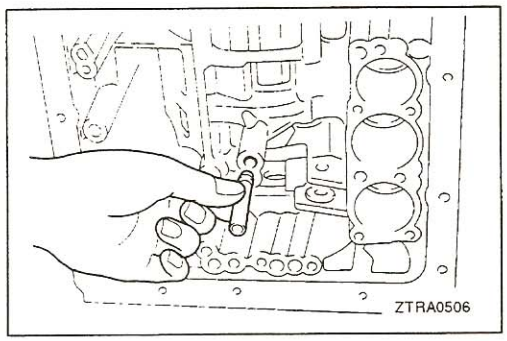
TSB Revision



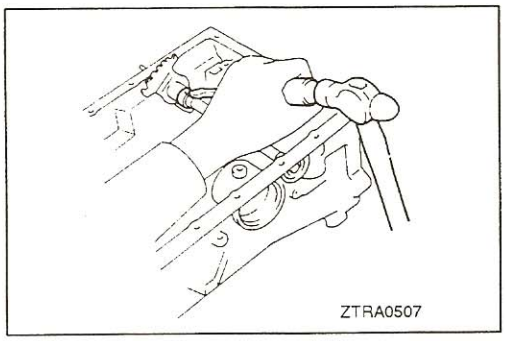
(69)Remove the bearing with the attached race from the transmission case.



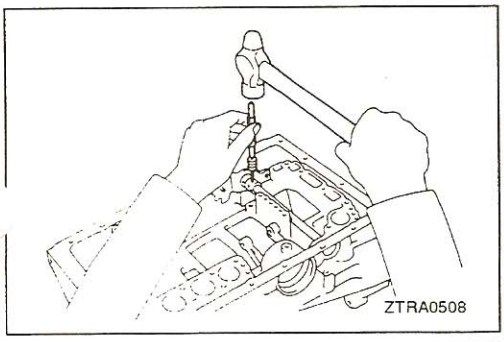
(70)Remove the leaf spring from the transmission case.



(71)Remove the brake drum gasket.

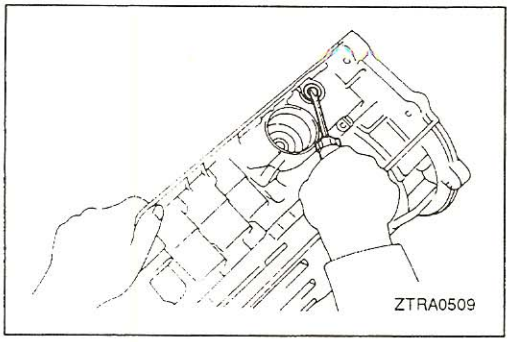


(72)Using a screwdriver, etc., unstake the spacer.



(73)Using a pin punch, drive out the slotted spring pin.
(74)Pull out the manual valve lever shaft and remove the manual valve lever.
(75)Remove the spacer from the manual valve lever.

TSB Revision

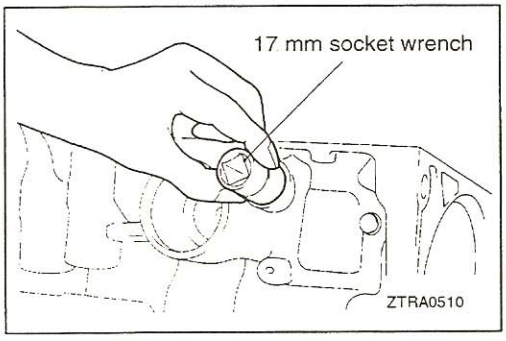


(76) Remove the two oil seals from the manual valve lever shaft.

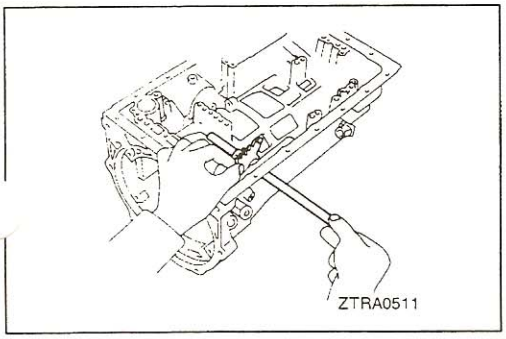
REASSEMBLY

Caution

1. **The automatic transmission is composed of component parts of an especially high degree of precision. During reassembly, therefore, handle these component parts very carefully so as not to scar or scratch them.**
   Damage may cause fluid leakage and degeneration in performance. Check each part carefully before installation.
2. **Clean all parts thoroughly before reassembly. Metal parts may be cleaned with ordinary detergents, but must be thoroughly air-dried.**
3. **Clean the clutch discs, brake discs, resin thrust plates and rubber parts by using ATF (automatic transmission fluid), being very careful that dust, dirt, etc. do not adhere to them.**
4. **Do not reuse gaskets, oil seals, or other rubber parts. Be sure to replace them with new ones.**
5. **Do not use grease other than petrolatum jelly.**
6. **Apply ATF to friction components, rotating parts, and sliding parts before installation.**
7. **Dip the new clutch discs and brake discs in ATF for at least two hours before installation.**
8. **Do not apply sealer or adhesive to gaskets.**
9. **When a bushing must be replaced, replace the assembly in which it is incorporated.**
10. **Tighten each component to the specified torque.**

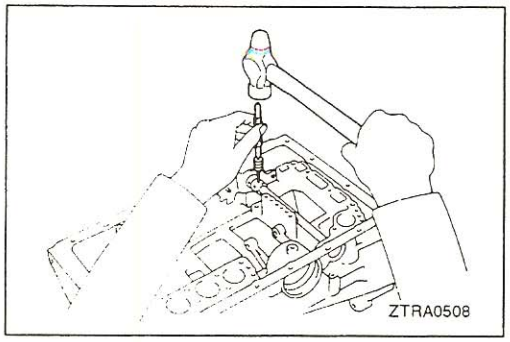


(1) Using an appropriate socket wrench, etc., drive in the two oil seals until they are flush with the end face of the transmission case.

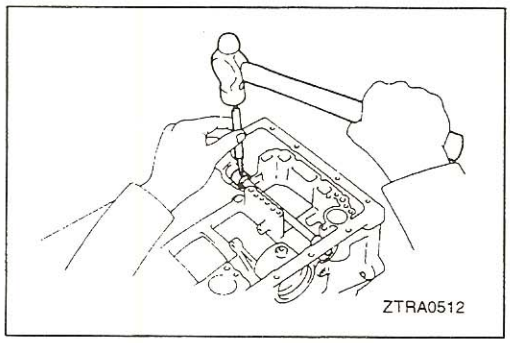


(2) Install a new spacer to the manual valve lever.
(3) Install the manual valve lever and shaft in the transmission case.

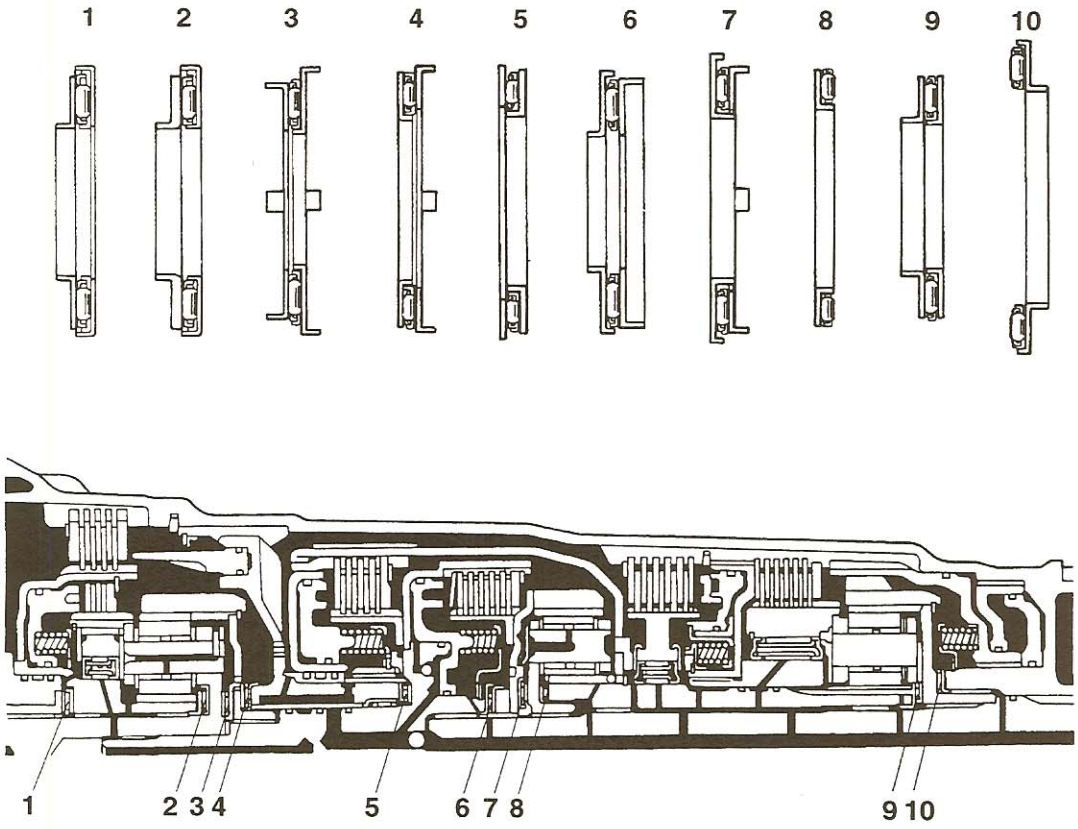
TSB Revision



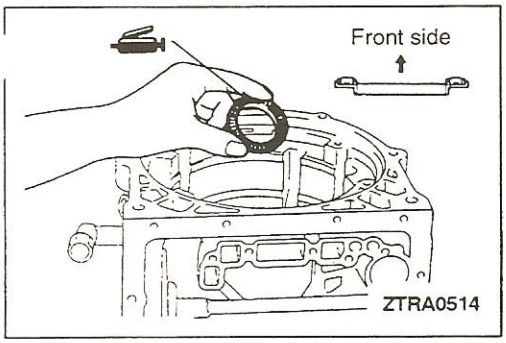
(4) Align the hole in the manual valve lever with that in the shaft and drive in a new slotted spring pin to fix th



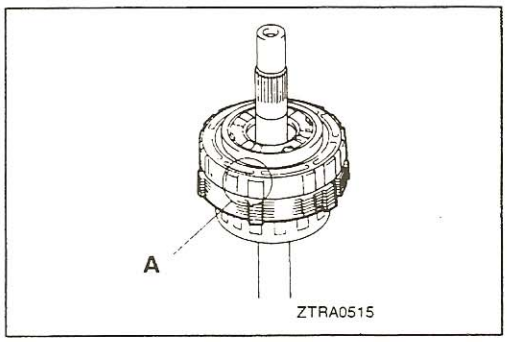
(5) Align the indentation in the manual valve lever with the spacer hole and stake it firmly using a punch.
(6) Check that the manual valve lever shaft rotates smoothly.
(7) Place wood pieces (used in disassembly) below the transmission case to prevent the output shaft from dropping.



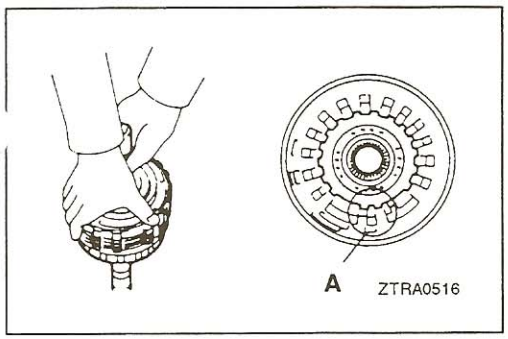
ZTRA0513



(8) Apply petrolatum to the bearing with race [57.7mm (2.272 in.) in outer diameter and 39.2 mm (1.543 in.) in inner diameter] and attach it in the transmission case.

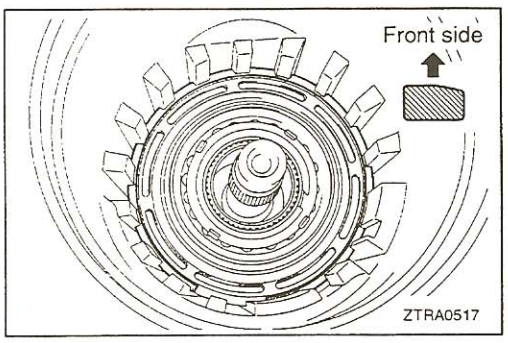


(9) As illustrated, align the lugs of the flange, disc, plate and second brake drum.

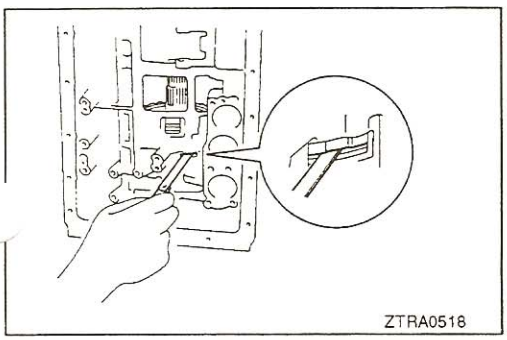


(10) Align the portion A illustrated in step (9) with the portion A of the transmission case. Install the output shaft, second brake drum sub assembly and rear planetary gear assembly together.

NOTE
While holding the input shaft, push the second brake drum.



(11) Install the snap ring along the groove.

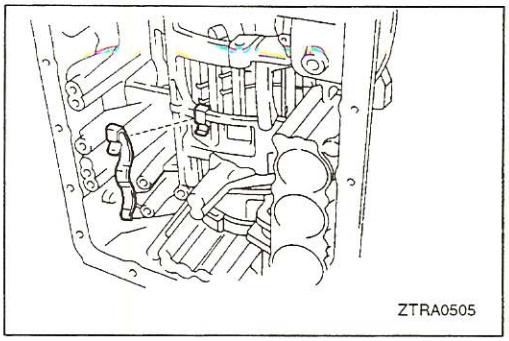


(12) Check the clearance between the second brake drum and the plate inserting a feeler gauge from the service hole on the valve body side.

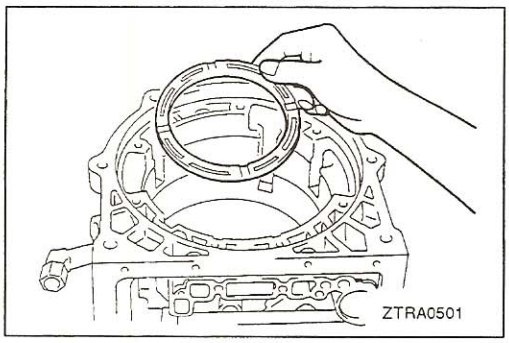
Standard value: 0.70–1.22 mm (.0275–.0480 in.)

If the clearance is not within this range, the second brake drum may have not be installed properly. In this case, reinstall it and check the clearance again.

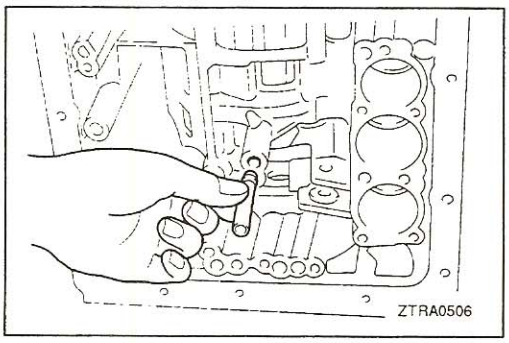
TSB Revision



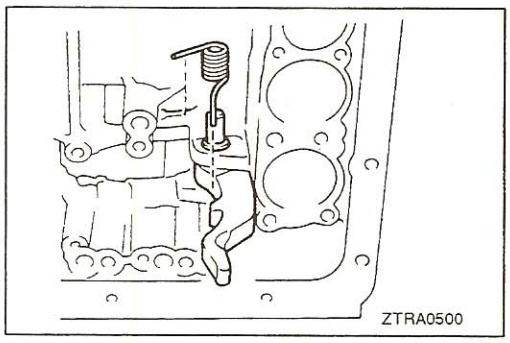
(13)Install the leaf spring.



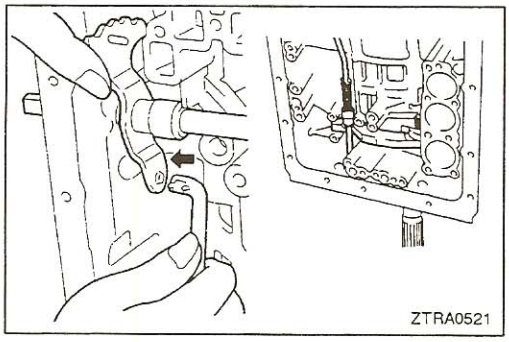
(14)With the indented side of the second brake piston sleeve up, install it firmly.
(15)Check that the thrust washer No.2 is installed on the second brake drum.



(16)Apply ATF to the new brake drum gasket and install it from the valve body side.

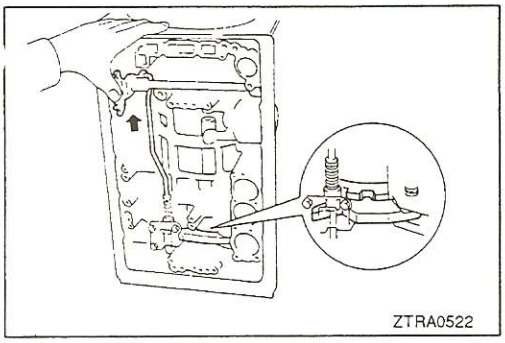


(17)Install the E-ring to the parking lock pawl shaft.
(18)Install the parking lock pawl, shaft and spring.

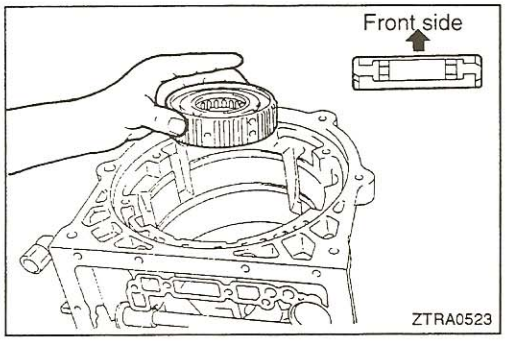


(19)Install the parking lock rod to the manual valve lever and place it on the lock pawl.
(20)With three bolts, install the parking lock pawl bracket.

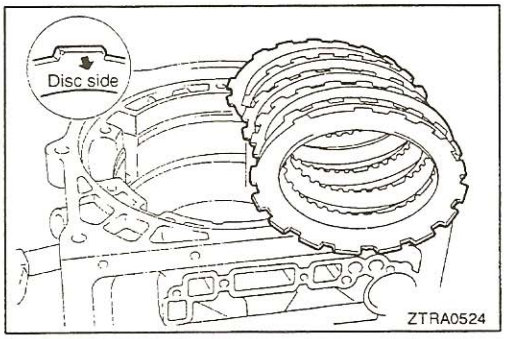
TSB Revision



(21)By shifting the manual valve lever toward the P range, check that the lock pawl locks the planetary ring gear.

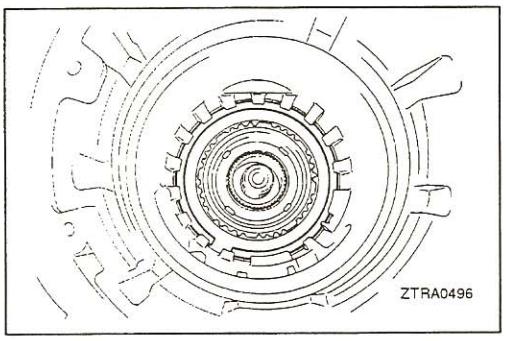


(22)Install the one-way clutch assembly in the illustrated direction.

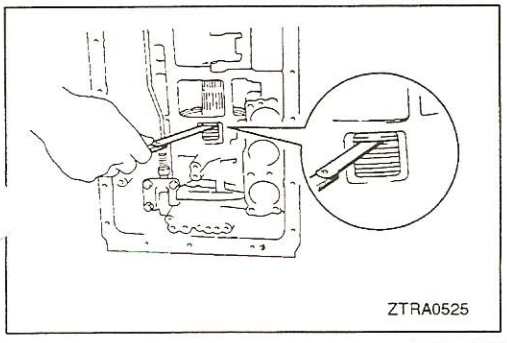


(23)Install the 1.8 mm (.070 in.) plate and then install the five discs and four 2.5 mm (.098 in.) plates alternately.
(24)Install the brake flange.

NOTE
The 1.8 mm (.070 in.) plate and the brake flange must be installed in such a way that their chamfers face the disc side.



(25)Install the snap ring.

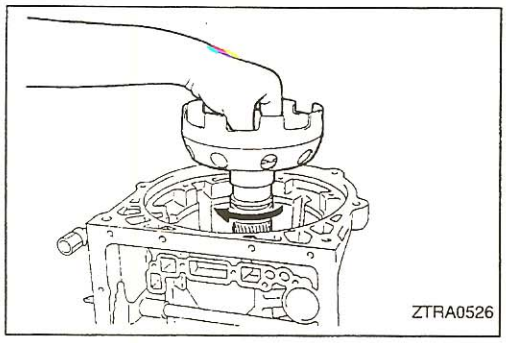


(26)Check the clearance between the snap ring and flange by inserting a feeler gauge from the service hole on the valve body side.

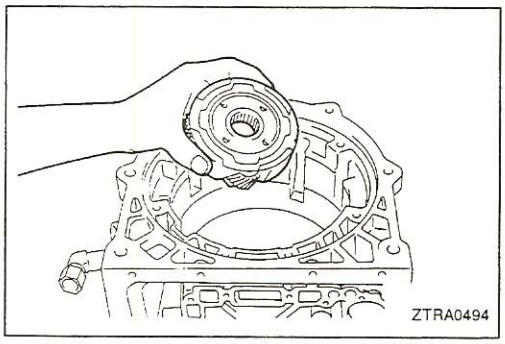
Standard value: 0.62–1.98 mm (.0244–.0779 in.)

If the clearance is not within this range, an improper installation is suspected. In this case, reassemble and check the clearance again.

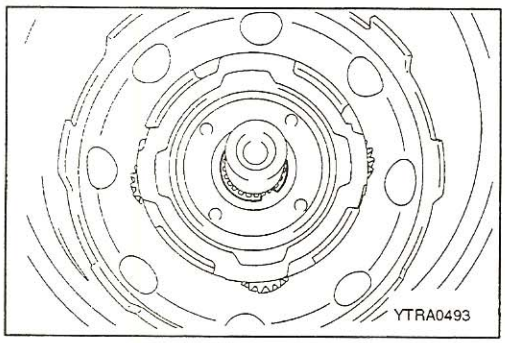
TSB Revision



(27)Check that the one-way clutch No.1 washer is installed to the sun gear input drum. Push in the sun gear i drum fully while rotating it clockwise.

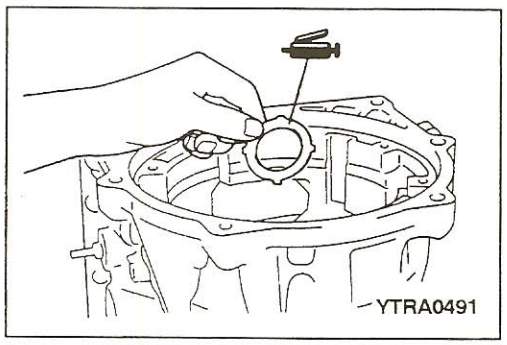


(28)Check that the race and bearing are installed to the rear side of the front planetary gear. Install the planetary gear assembly to the sun gear.

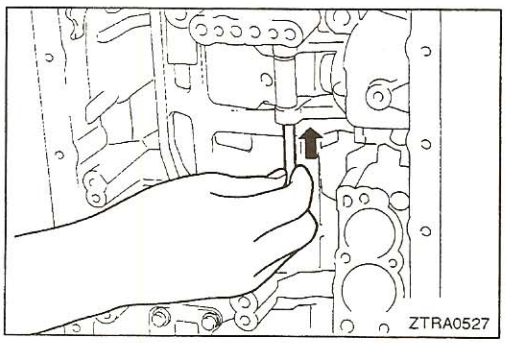


(29)While pushing the output shaft to the front side, install a new snap ring [23.7 mm (.933 in.) in inner diameter] to the output shaft.

Caution
Do not open the snap ring more than necessary.

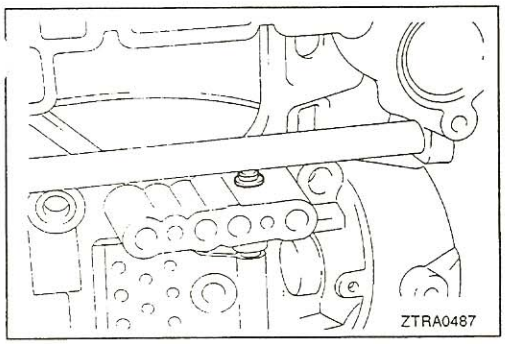


(30)Apply petrolatum to the race [47.8 mm (1.882 in.) in outer diameter and 34.3 mm (1.350 in.) in inner diameter]. Aligning its four lugs with the holes in the planetary gear assembly, install it thereon.

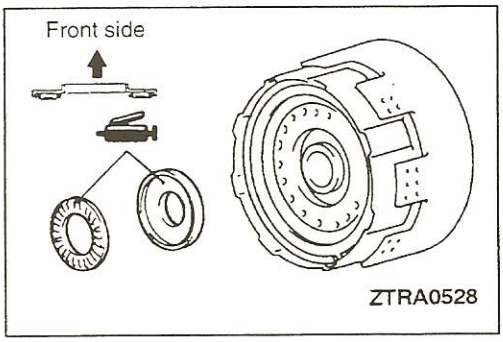


(31)Insert the second coast brake band in the transmission case.
(32)Attach a new E-ring to one side of the pin and install it through the second coast brake band.

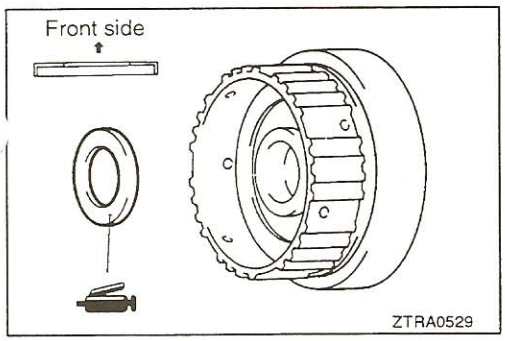
TSB Revision



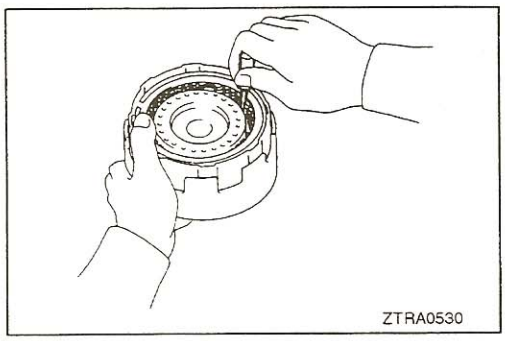
(33) Attach a new E-ring to the upper side of the pin.



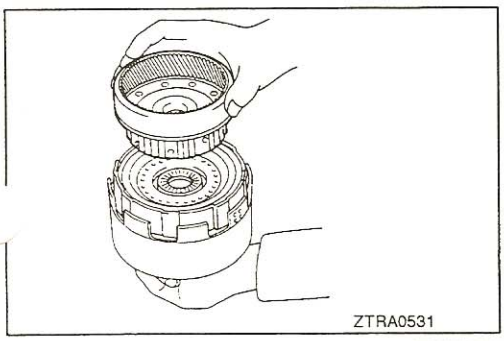
(34) Apply petrolatum to the front side race [48.9 mm (1.925 in.) in outer diameter and 26.0 mm (1.024 in.) in inner diameter] and bearing [46.7 mm (1.839 in.) in outer diameter and 26.0 mm (1.024 in.) in inner diameter] and install them to the rear side of the forward clutch.



(35) Apply petrolatum to the rear side race [47.0 mm (1.850 in.) in outer diameter and 26.8 mm (1.055 in.) in inner diameter] and install it to the front side of the front planetary ring gear.

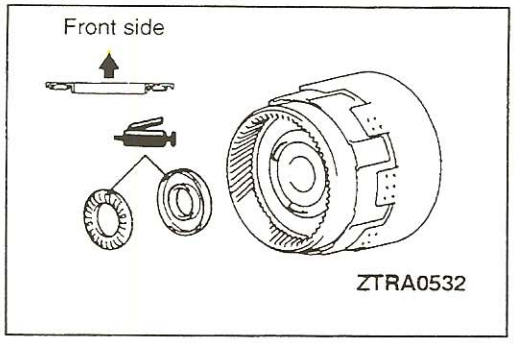


(36) Using a screwdriver, align the forward clutch disc lugs.

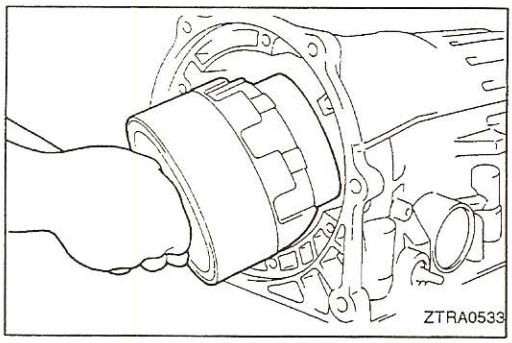


(37) Install the front planetary ring gear to the forward clutch assembly by lightly pushing and rotating it.

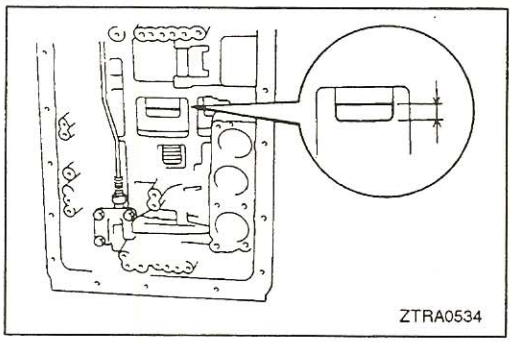
TSB Revision



(38) Apply petrolatum to the race [53.6 mm (2.110 in.) in outer diameter and 30.6 mm (1.205 in.) in inner diameter] bearing [47.4 mm (1.866 in.) in outer diameter and [illegible] mm (1.283 in.) in inner diameter] and install them to the ring gear.



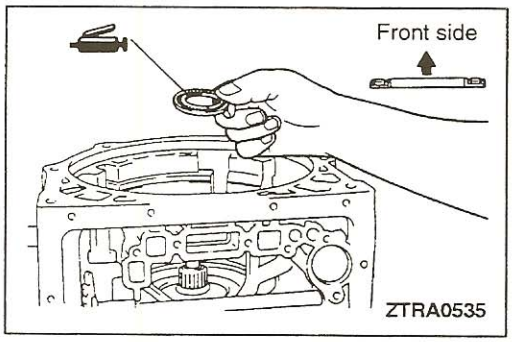
(39) Install the direct clutch assembly, forward clutch assembly and ring gear together in the transmission case.



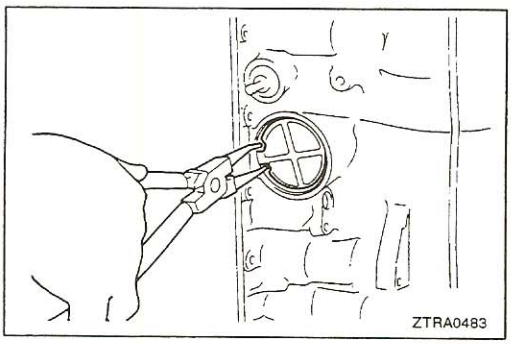
(40) Using a caliper, check the clearance between the sun gear input drum and the lug edge of the direct clutch drum.

Reference value: 5.3 – 7.3 mm (.209 – .287 in.)

If the clearance is not within this range, the direct clutch, forward clutch and ring gear may have not be installed properly. In this case, reinstall them and check the clearance again.

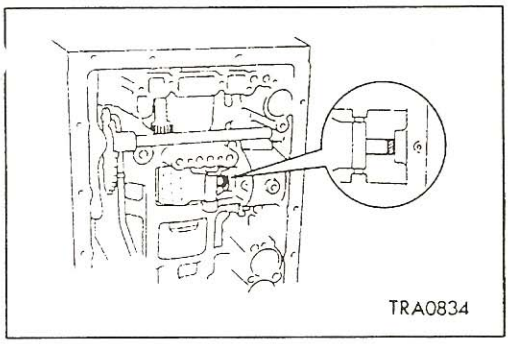


(41) Apply petrolatum to the bearing with race [47.6 mm (1.874 in.) in outer diameter and 33.7 mm (1.327 in.) in inner diameter] and slide it over the input shaft of the forward clutch.

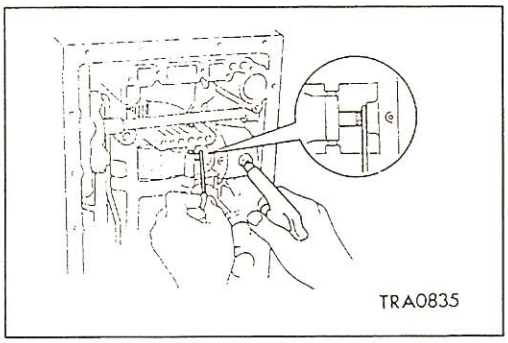


(42) Apply ATF to two new O-rings and attach them to the piston cover.
(43) Install the spring, piston assembly and piston cover.
(44) Install the snap ring.

TSB Revision



(45)Apply minium on the second coast brake piston rod.

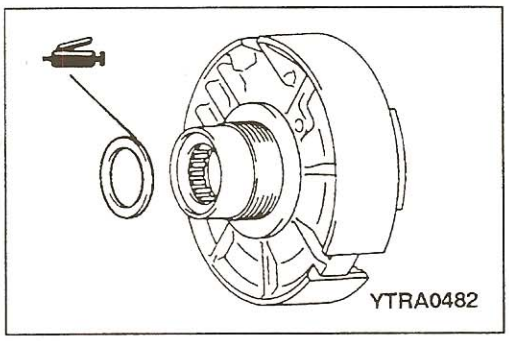


(46)Apply air pressure (400 – 800 kPa, 56 – 113 psi) to the oil hole shown in the illustration, and measure the stroke of the second coast brake piston using wire gauges.

Standard value: 1.5 – 3.0 mm (.059 – .118 in.)

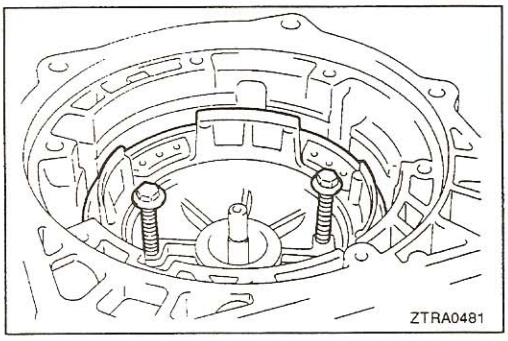
NOTE
Measure the stroke several times and take an average.

(47)If the stroke is out of specification, reinstall the piston and measure the piston stroke again.

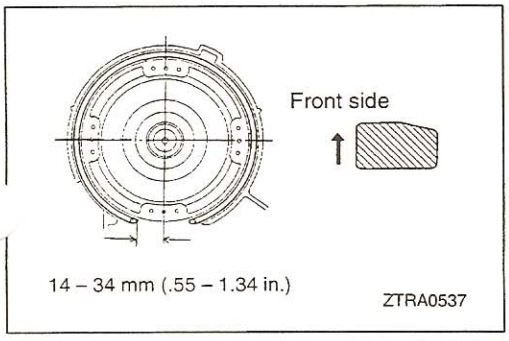


(48)Check that the clutch drum thrust washer is attached to the rear side of the overdrive support.

(49)Apply petrolatum to the race [50.9 mm (2.00 in.) in outer diameter and 36.8 mm (1.449 in.) in inner diameter] and attach it to the rear side of the overdrive support.



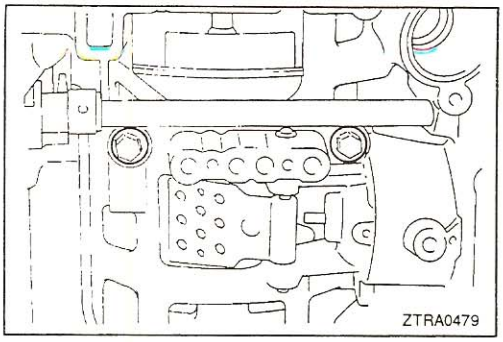
(50)While aligning the oil hole and bolt hole of the overdrive support with the bolt holes in the the transmission case using the two overdrive support attaching bolts, insert the overdrive support in the transmission case toward the valve body side.



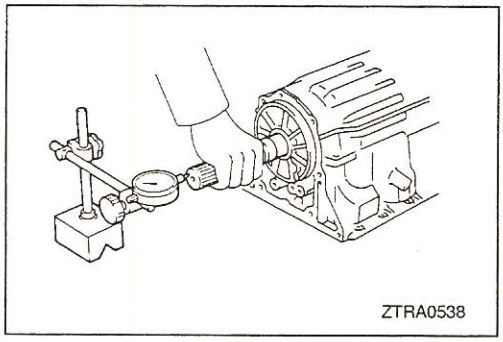
(51)Install the snap ring as illustrated.

Standard value: 14 – 34 mm (.55 – 1.34 in.)

TSB Revision



(52) Alternately tighten the two overdrive support attaching bolts uniformly and little by little.

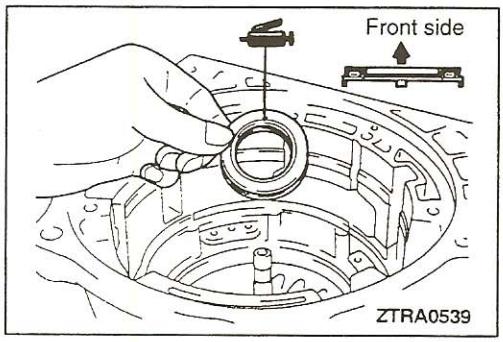


(53) Apply a dial gauge to the end of the output shaft and check its end play.

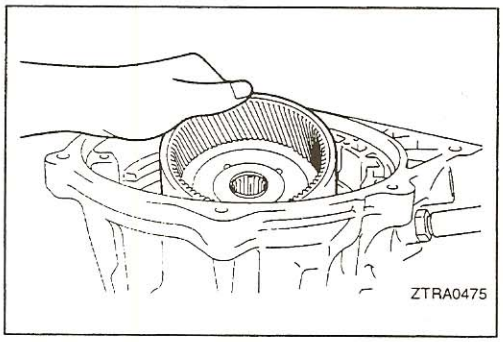
Standard value: 0.27 – 0.86 mm (.0106 – .0339 in.)

(54) Check that the output shaft rotates smoothly.

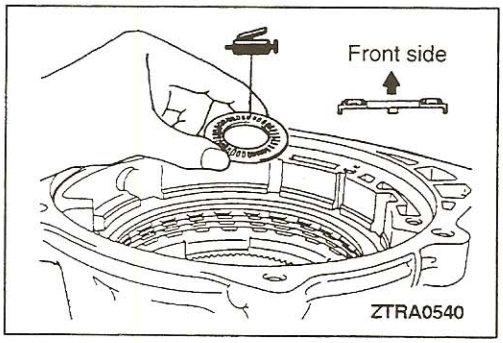
NOTE
Check that the output shaft is not in the parking state.



(55) Apply petrolatum to the races [58.8 mm (2.315 in.) in outer diameter and 37.2 mm (1.465 in.) in inner diameter] and bearing [51.1 mm (2.012 in.) in outer diameter and 33.7 mm (1.327 in.) in inner diameter]. Aligning the four bearing lugs with the overdrive support notches, attach the bearing and then the races to the overdrive support.

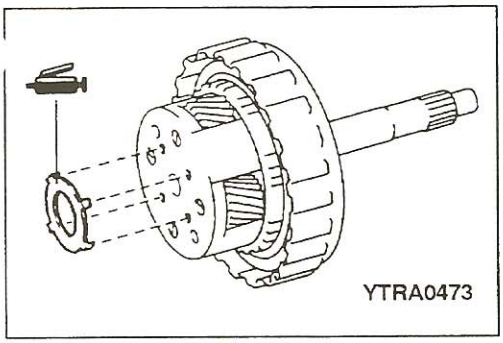


(56) Install the overdrive planetary ring gear.

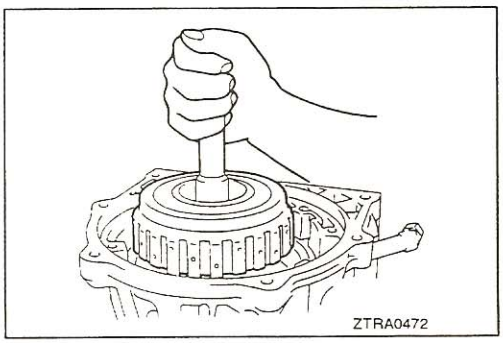


(57) Apply petrolatum to the race [47.8 mm (1.882 in.) in outer diameter and 24.2 mm (.953 in.) in inner diameter] and bearing [46.8 mm (1.843 in.) in outer diameter and 26.0 mm (1.024 in.) in inner diameter]. Aligning the four bearing lugs with the holes of the ring gear, attach the race and bearing to the gear.

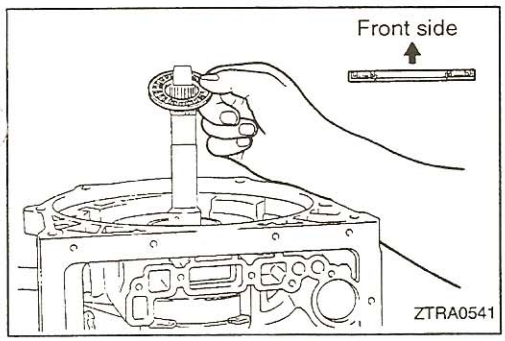
TSB Revision



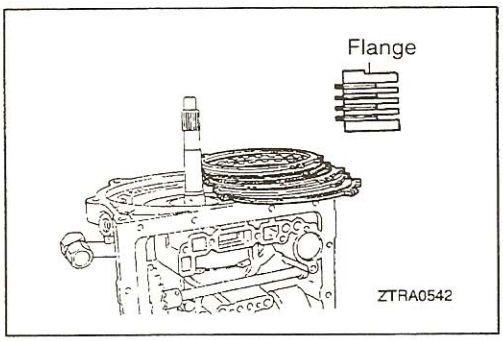
(58) Apply petrolatum to the race [41.8 mm (1.646 in.) in outer diameter and 27.3 mm (1.075 in.) in inner diameter]. Aligning the four race lugs with the holes of the overdrive planetary gear, attach it to the gear.



(59) Holding the input shaft, install the overdrive planetary gear assembly and overdrive direct clutch assembly together.

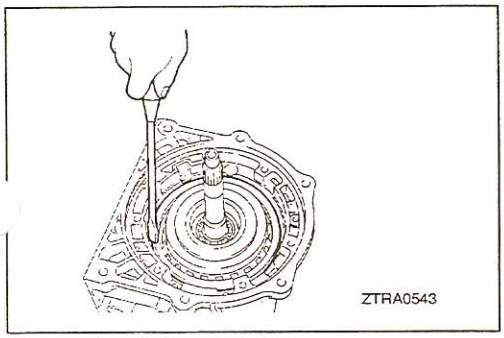


(60) Install the race with bearing [50.2 mm (1.976 in.) in outer diameter and 28.9 mm (1.138 in.) in inner diameter] through the input shaft.



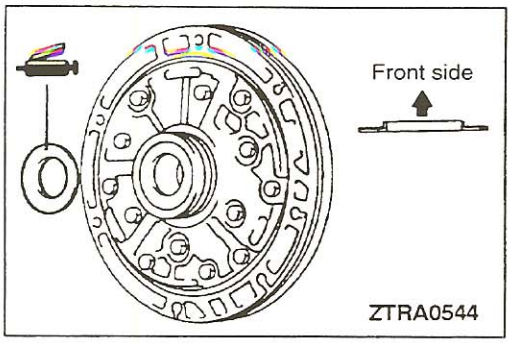
(61) Install one 4.0 mm (.157 in.) thickness flange in such a way that its chamfer faces the disc side. Install the four discs and three plates alternately. Install the other flange in the illustrated direction.

Caution
When the 4.0 mm (.157 in.) flange is used also on the front side, its chamfer must also face the disc side.

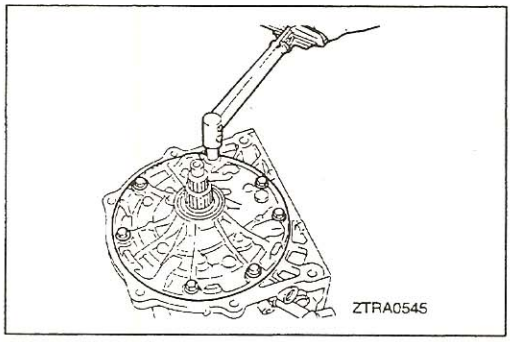


(62) Install the snap ring.

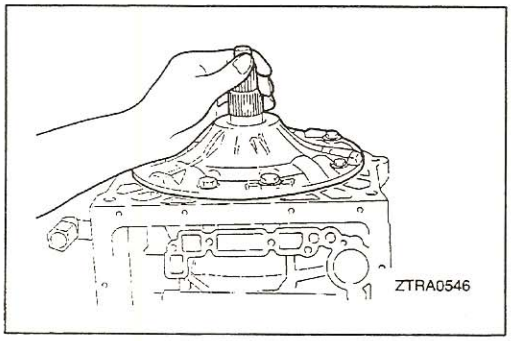
TSB Revision



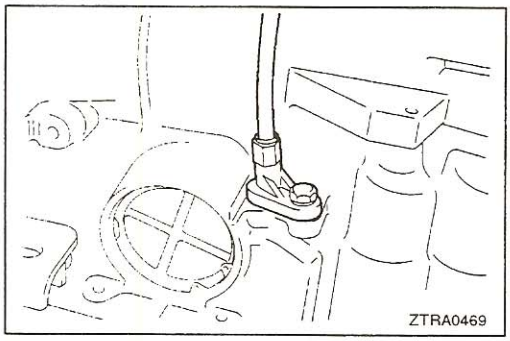
(63) Apply petrolatum to the race [47.3 mm (1.862 in.) in outer diameter and 28.1 mm (1.106 in.) in inner diameter] attach it to the rear side of the oil pump.



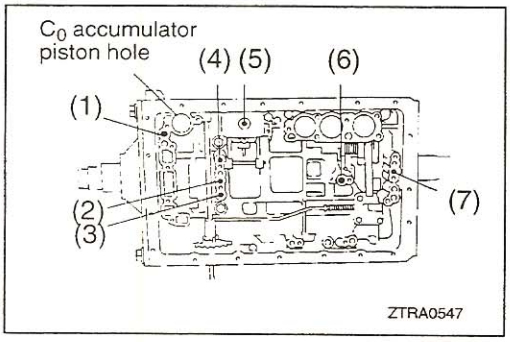
(64) Align the bolt holes in the oil pump with those in the transmission case.
(65) Install the oil pump by hitting at its upper face lightly and uniformly with a plastic hammer. Then, fix it by tightening the seven bolts uniformly and little by little.



(66) Check that the input shaft rotates smoothly.



(67) Apply ATF to a new O-ring and attach it to the throttle cable.
(68) Install the throttle cable to the transmission case.

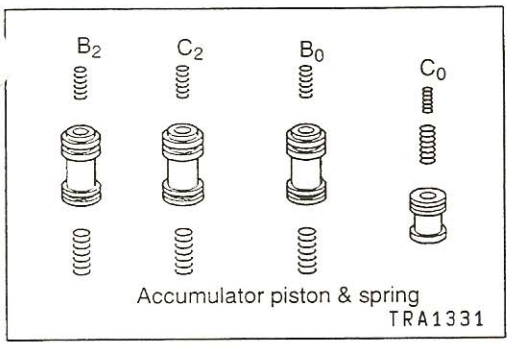


(69) Blow air in each illustrated oil hole to check for operation noise.
(1) Overdrive direct clutch
(2) Direct clutch
(3) Forward clutch
(4) Overdrive brake
(5) Second coast brake
(6) Second brake
(7) First & reverse brake

Caution
When checking the overdrive direct clutch, clos
C_0 accumulator piston hole.

If no operation noise is recognized, disassemble the structure and check if each part is installed properly.

TSB Revision



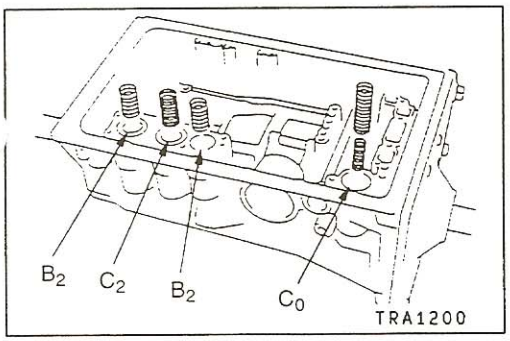
(70)Apply ATF to the new O-rings.
(71)Install the spring, accumulator piston.

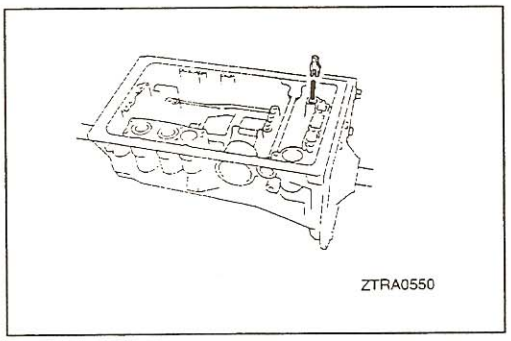
Accumulator piston

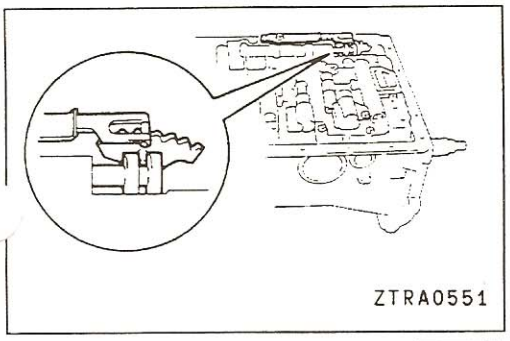
mm (in.)

Place	Outer diameter	Length
B_2	36.9 (1.453)	62.5 (2.461)
C_2	36.9 (1.453)	56.6 (2.228)
B_0	31.9 (1.256)	52.0 (2.047)
C_0	29.9 (1.177)	44.0 (1.732)

[Reference]
Each piston has an identification code (B_2, C_2, B_0 or C_0), indicating the accumulator to which it is to be installed.







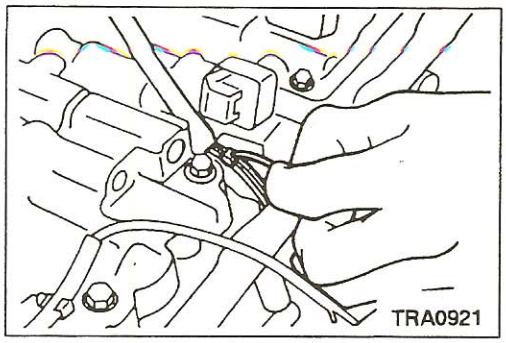
Spring

mm (in.)

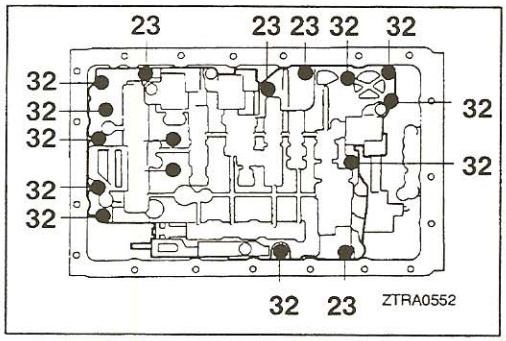
Place		Free height	Outside diameter	Number of loops	Wire diameter
C_0	Outer spring 1	74.6 (2.937)	20.9 (.823)	12.3	2.3 (.091)
	Outer spring 2	46.0 (1.811)	14.0 (.551)	12.5	2.2 (.087)
C_2	Outer spring	22.0 (.787)	12.0 (.472)	5.3	1.7 (.067)
	Inner spring 1	64.0 (2.520)	20.2 (.795)	12.3	2.3 (.087)
	Inner spring 2	42.1 (1.657)	14.7 (.579)	7.3	2.5 (.098)
B_0	Outer spring	14.5 (.571)	13.0 (.512)	3.0	2.1 (.083)
	Inner spring	62.0 (2.441)	16.0 (.630)	11.9	2.1 (.083)
B_2	Outer spring	19.0 (.748)	14.0 (.551)	5.7	2.0 (.079)
	Inner spring	75.3 (2.965)	20.0 (.787)	14.3	2.7 (.106)
Accumulator control valve spring		29.8 (1.173)	8.8 (.346)	16.0	0.8 (.031)

(72)Install the spring and check ball body.
(73)Align the groove of the manual valve with the pin of the manual valve lever.

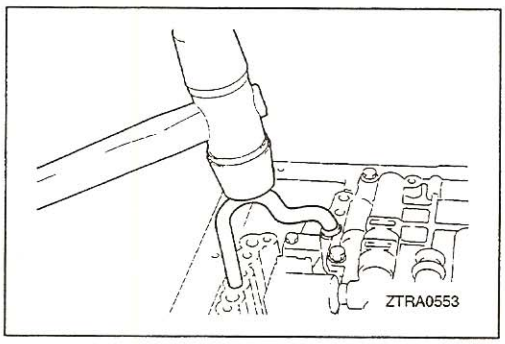
TSB Revision



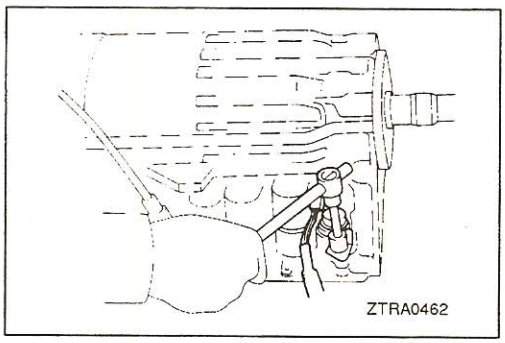
(74)Lifting up the valve body, install the throttle cable nipple to the throttle cam.
(75)Check that the spring and collar of the accumulator pis... are installed on the valve body side.



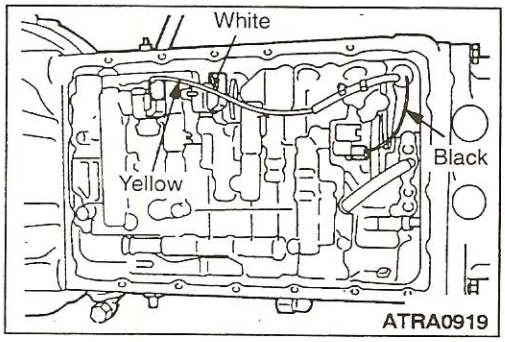
(76)Install the valve body by tightening the 16 bolts uniformly step by step. (The values in the illustration denote the shank length of each bolt.)



(77)Using a plastic hammer, install the brake tube.

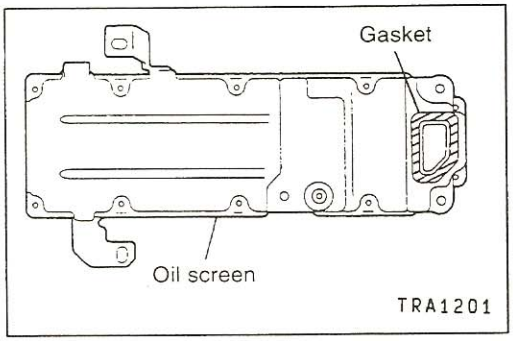


(78)Apply ATF to a new O-ring.
(79)Insert the transmission wire in the transmission case and secure it with the stopper plate.

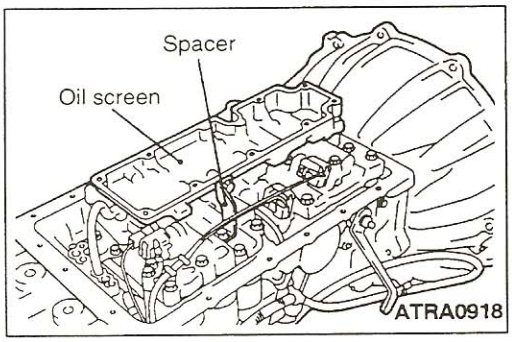


(80)Install the three connectors to the transmission solenoid.

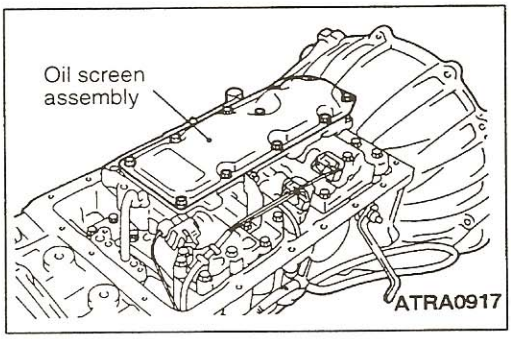
TSB Revision



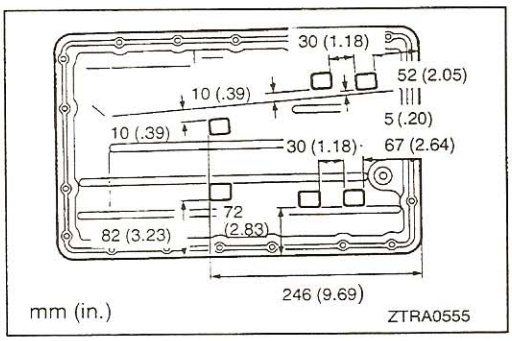
(81)With a scraper and wire brush and by air blow, clean the gasket mounting surface of the oil strainer.
(82)Attach the new gasket to the oil screen.



(83)Using five bolts, install the spacer and oil screen.



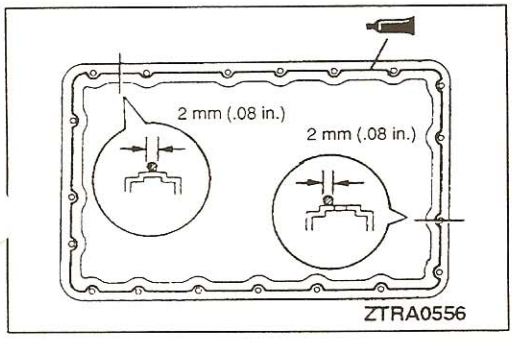
(84)After setting a new gasket, install the oil screen assembly using the 11 bolts.



(85)Using a scraper and wire brush, remove sealer sticking on the transmission case and oil pan. Then, wash off oil with detergent.

Caution
When cleaning and washing the transmission case, the valve body side must be kept down.

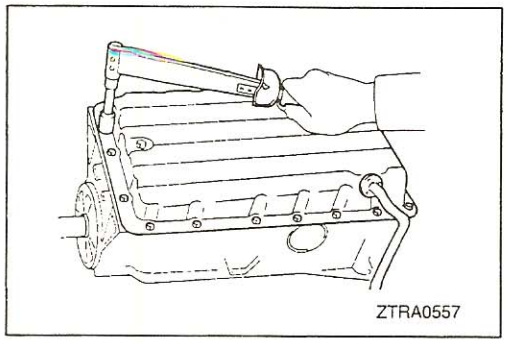
(86)Wash the 6 magnets and attach them as illustrated.



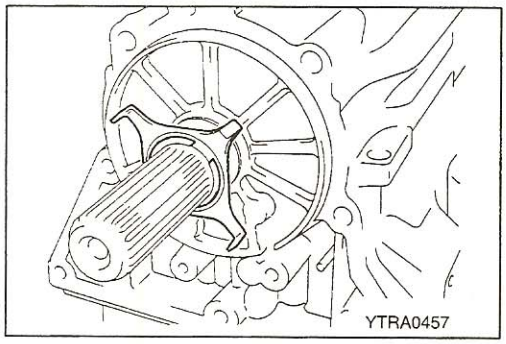
(87)Apply sealer to the oil pan and install it to the transmission case.

Specified sealant:
Mitsubishi genuine sealant Part No. MR166584 or equivalent

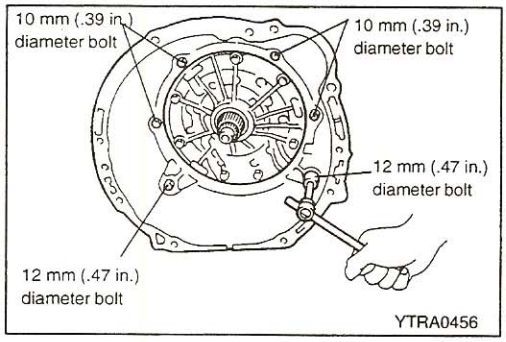
TSB Revision



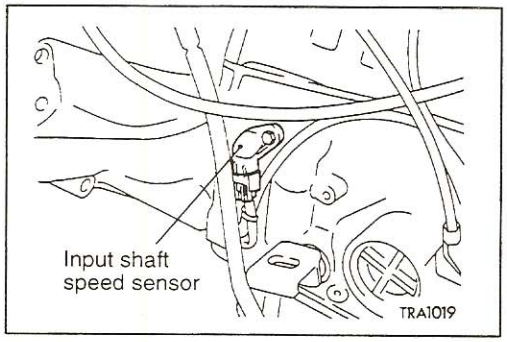
(88)Tighten the 19 bolts uniformly and step by step.



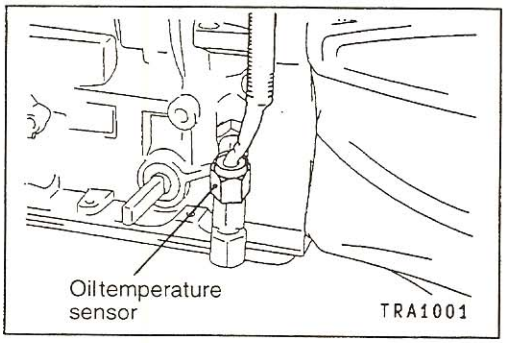
(89)Install the key and then the sensor rotor to the output shaft.
(90)Install the snap ring.



(91)Using the 6 bolts, install the housing to the transmission case.

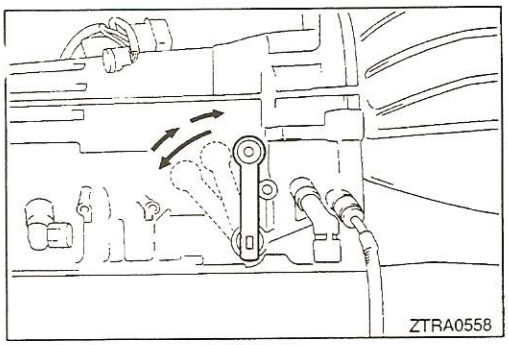


(92)Install the input shaft speed sensor.

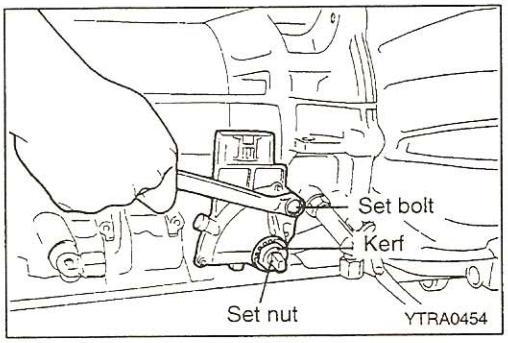


(93)Apply ATF to a new O-ring and attach it to the oil temperature sensor.
(94)Install the oil temperature sensor.

TSB Revision



(95)Set the control shaft lever to the N range position by rotating the manual control shaft fully backward and then returning it by two notches.
(96)Insert park/neutral position switch in the manual valve shaft and tentatively tighten the set bolt.

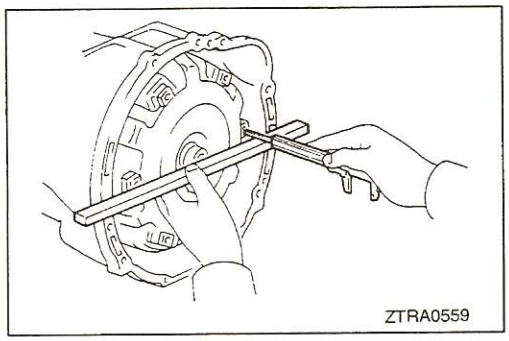


(97)Install the new gasket and lock washer and tighten the set nut.
(98)Aligning the kerf in the switch with the neutral reference line, tighten the set bolt firmly.
(99)Bend lock washer tabs.

Caution
Two or more lugs must be bent.

(100) Install the control shaft lever.

(101) Install the harness connector bracket and throttle cable clamp.
(102) Apply ATF to a new O-ring and attach it to the oil filler tube. Install the tube to the oil pan.
(103) Install the oil level gauge.



(104) Aligning the notch of the torque converter with the inner lug of the oil pump, install the torque converter.
(105) Check the illustrated dimension of the installed torque converter.

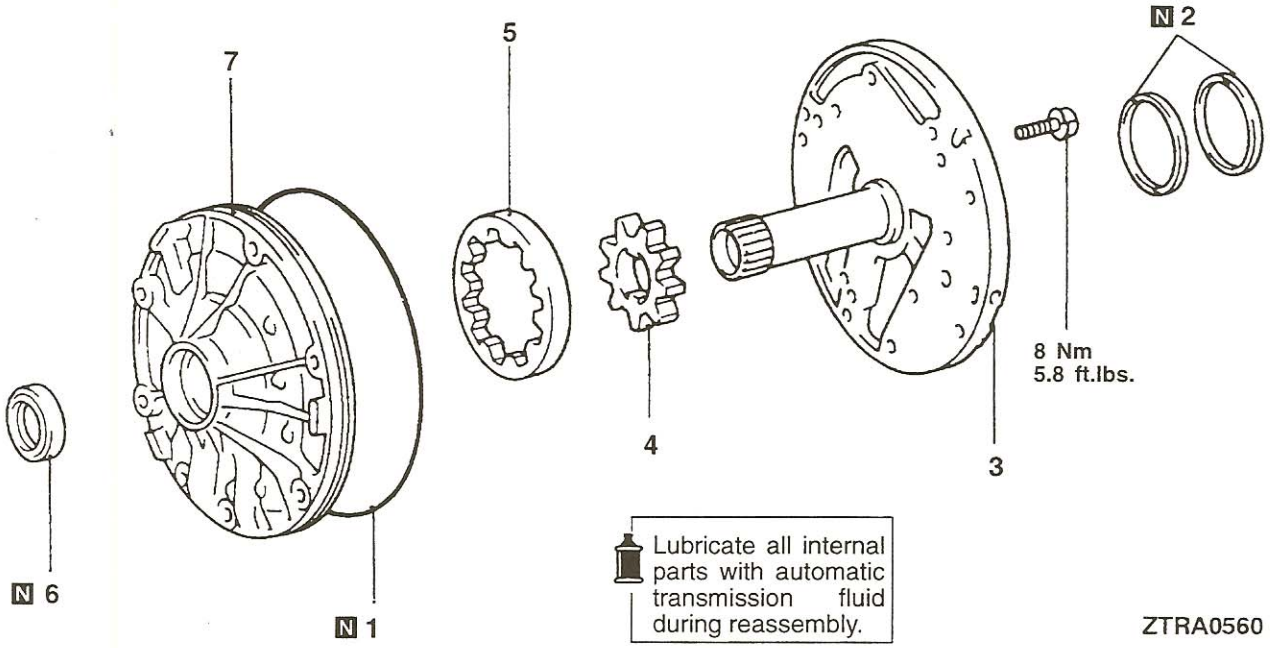
Standard value: 31.1 mm (1.224 in.) or more

TSB Revision

OIL PUMP

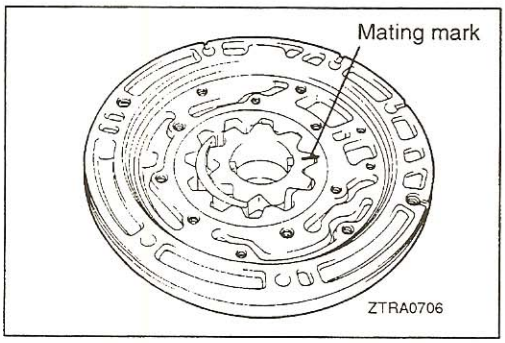
23300850022

DISASSEMBLY AND REASSEMBLY



Disassembly steps

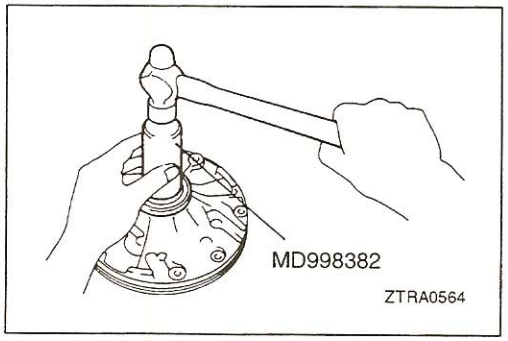
- ▶B◀ 1. O-ring
- ▶B◀ 2. Seal ring
- 3. Stator shaft
- ◀A▶ 4. Drive gear
- ◀A▶ 5. Driven gear
- ▶A◀ 6. Oil seal
- 7. Oil pump body



DISASSEMBLY SERVICE POINT

◀A▶ DRIVE GEAR / DRIVEN GEAR REMOVAL

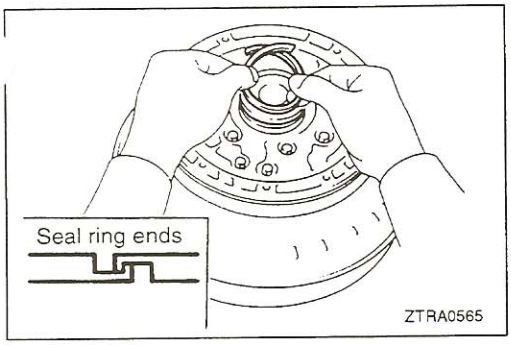
(1) Put mating marks on the side of removed gears for their reassembly in correct direction. (Use a felt marker or equivalent.)



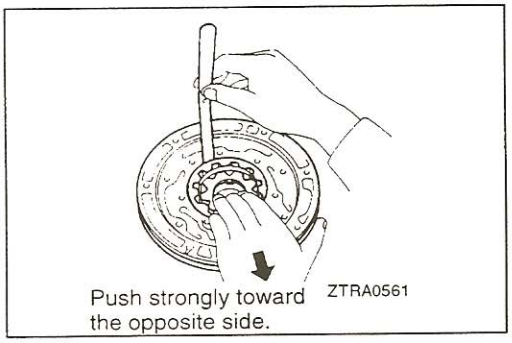
REASSEMBLY SERVICE POINTS

▶A◀ OIL SEAL INSTALLATION

TSB Revision



▶B◀ SEAL RING INSTALLATION



INSPECTION

23300860018

DRIVE GEAR AND DRIVEN GEAR

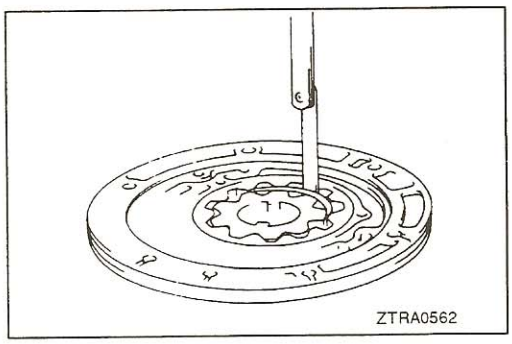
Body Clearance

(1) Measure the clearance between the driven gear and oil pump body with a feeler gauge while pushing the driven gear strongly toward the opposite side.

Standard value: 0.07 – 0.15 mm (.0028 – .0059 in.)

Limit: 0.3 mm (.012 in.)

If the limit is exceeded, replace the driven gear or oil pump body.



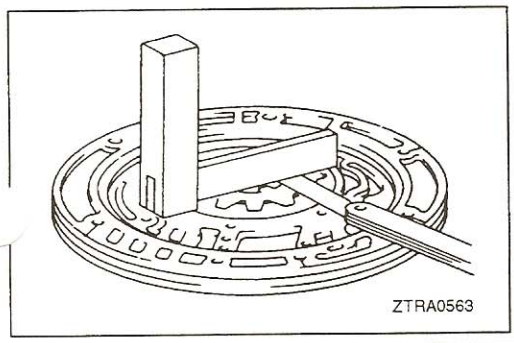
Tip Clearance

(1) Using a feeler gauge, measure the crescent-to-driven gear clearance.

Standard value: 0.11 – 0.14 mm (.0043 – .0055 in.)

Limit: 0.3 mm (.012 in.)

If the limit is exceeded, replace the driven gear or oil pump body.



Side Clearance

(1) Using a square and feeler gauge, measure the side clearance of the gears with respect to the stator shaft mounting surface.

Standard value: 0.02 – 0.05 mm (.0008 – .0020 in.)

Limit: 0.3 mm (.012 in.)

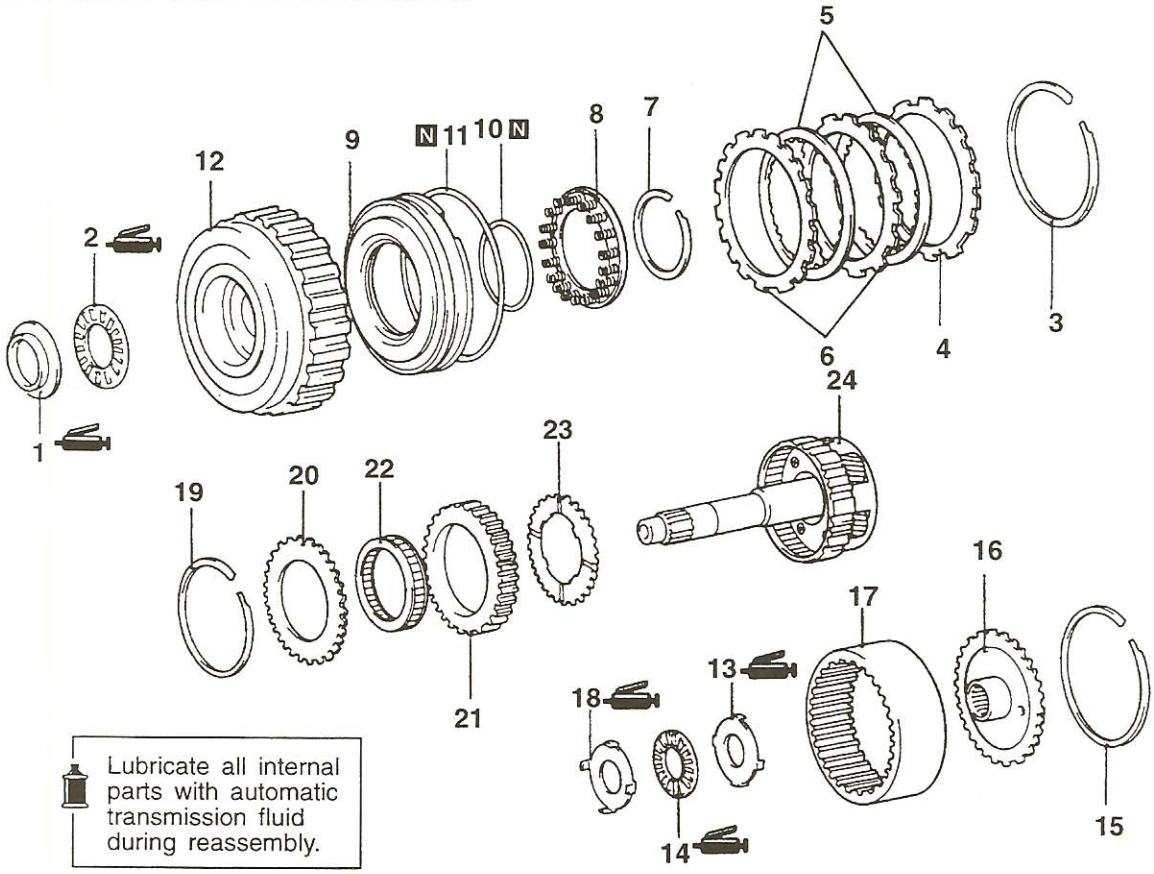
If the limit is exceeded, replace the drive gear, driven gear or oil pump body.

TSB Revision

OVERDRIVE PLANETARY GEAR AND OVERDRIVE DIRECT CLUTCH

233005

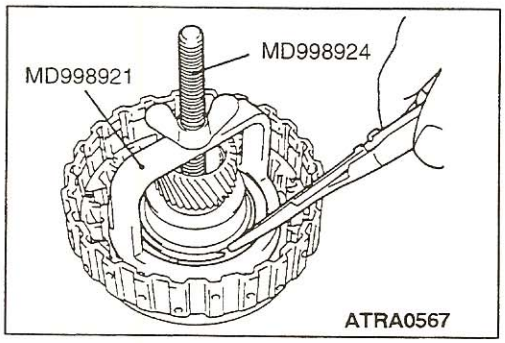
DISASSEMBLY AND REASSEMBLY



ZTRA0566

Disassembly steps

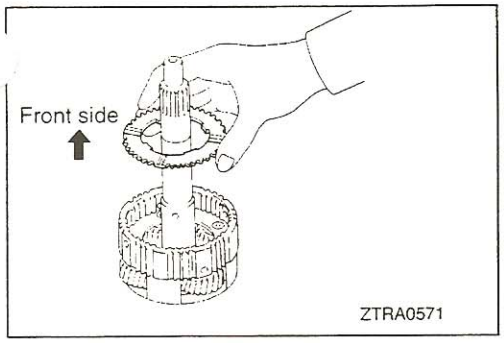
1. Thrust race
2. Thrust bearing
3. Snap ring
▶D◀ 4. Clutch flange
5. Clutch disc
6. Clutch plate
◀A▶ ▶C◀ 7. Snap ring
8. Return spring assembly
9. Overdrive direct clutch piston
10. O-ring
11. O-ring
12. Overdrive direct clutch drum
13. Thrust race
14. Thrust bearing
15. Snap ring
16. Overdrive planetary ring gear flange
17. Overdrive planetary ring gear
18. Thrust race
19. Snap ring
20. Retaining plate
21. One-way clutch outer race
▶B◀ 22. Overdrive one-way clutch
▶A◀ 23. Overdrive planetary gear thrust washer No.3
24. Overdrive planetary gear assembly



DISASSEMBLY SERVICE POINT

◀A▶ SNAP RING REMOVAL

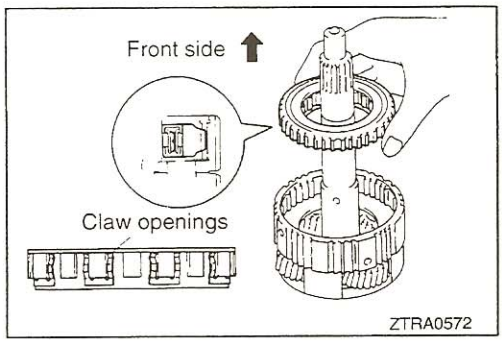
TSB Revision



REASSEMBLY SERVICE POINTS

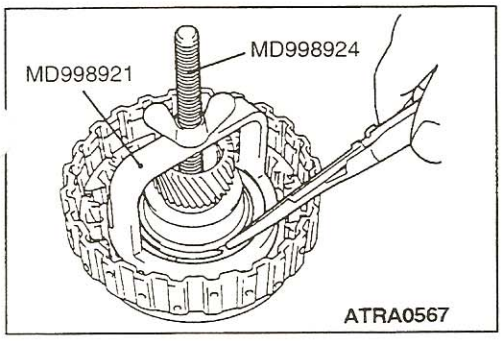
▶A◀ OVERDRIVE PLANETARY GEAR THRUST WASHER NO.3 INSTALLATION

(1) Install the thrust washer so that its oil groove is oriented to the front side.



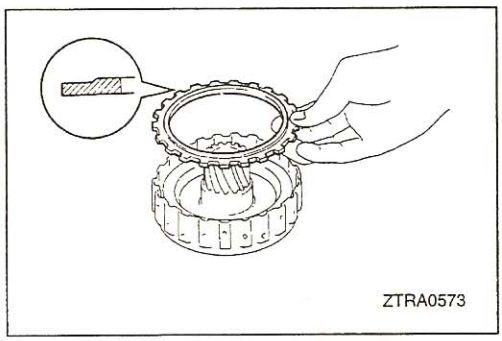
▶B◀ OVERDRIVE ONE-WAY CLUTCH INSTALLATION

(1) Install the clutch so that its claw openings are oriented to the front side as illustrated.



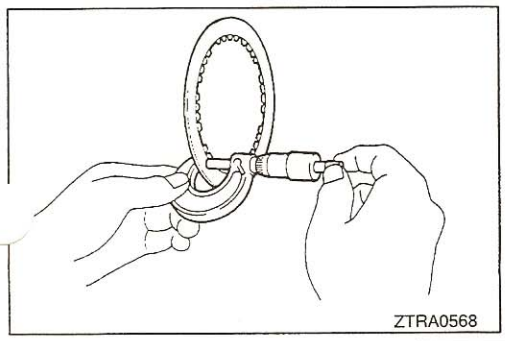
▶C◀ SNAP RING INSTALLATION

Caution
Be sure the end gap of the snap ring is not aligned with the stopper of the spring seat.



▶D◀ CLUTCH FLANGE INSTALLATION

(1) Install the clutch flange to the overdrive direct clutch drum so that the flange's convex side faces up as illustrated.



INSPECTION

23300920020

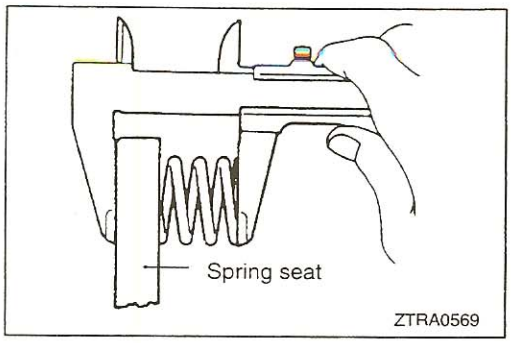
OVERDRIVE DIRECT CLUTCH DISC

(1) Using a micrometer, measure the thickness of the clutch disc.

Limit: 1.84 mm (.0724 in.)

NOTE
The thickness must be measured at two or three points. Compare the average value with the limit.

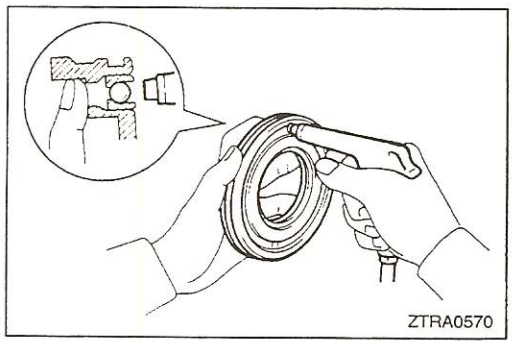
TSB Revision



RETURN SPRING ASSEMBLY

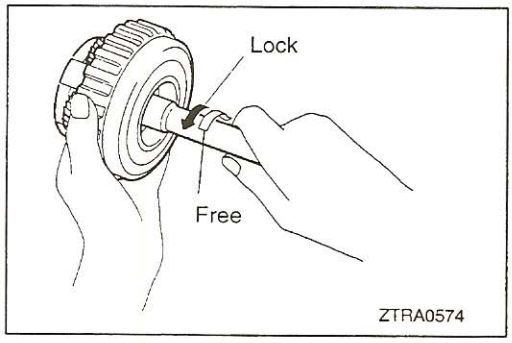
(1) Measure the free length of the spring including the sp seat.

Standard value: Approx. 15.8 mm (.622 in.)



OVERDRIVE DIRECT CLUTCH PISTON

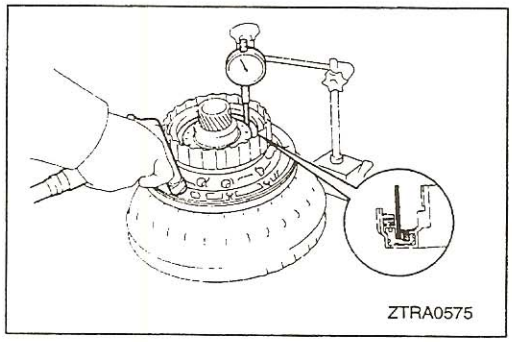
(1) Check that the check ball is free by shaking the piston.
(2) Check that the valve does not leak by applying low-pressure compressed air.



OPERATION OF ONE-WAY CLUTCH

(1) While holding the overdrive direct clutch drum, turn the input shaft clockwise to see that the shaft turns smoothly and turn it counterclockwise to see that the shaft is lock

NOTE
(1) If the shaft turns or locks in both directions, replace the one-way clutch.
(2) If the shaft turns counterclockwise while it doesn't turn clockwise, the one-way clutch may have been assembled in the reverse direction.



OVERDRIVE DIRECT CLUTCH PISTON STROKE

(1) Install the oil pump to the torque converter. Install the overdrive direct clutch assembly to the oil pump.
(2) Using a dial gauge, measure the piston stroke by applying compressed air (400–800 kPa, 57–113 psi) into the oil hole of the oil pump as shown and then releasing the air.

Standard value: 1.85–2.15 mm (.0728–.0846 in.)

If the stroke is out of this range, replace the clutch flange with an appropriate one so that the stroke becomes within this range.

NOTE
When selecting the flange, aim at the center of the range.

[Available flange]

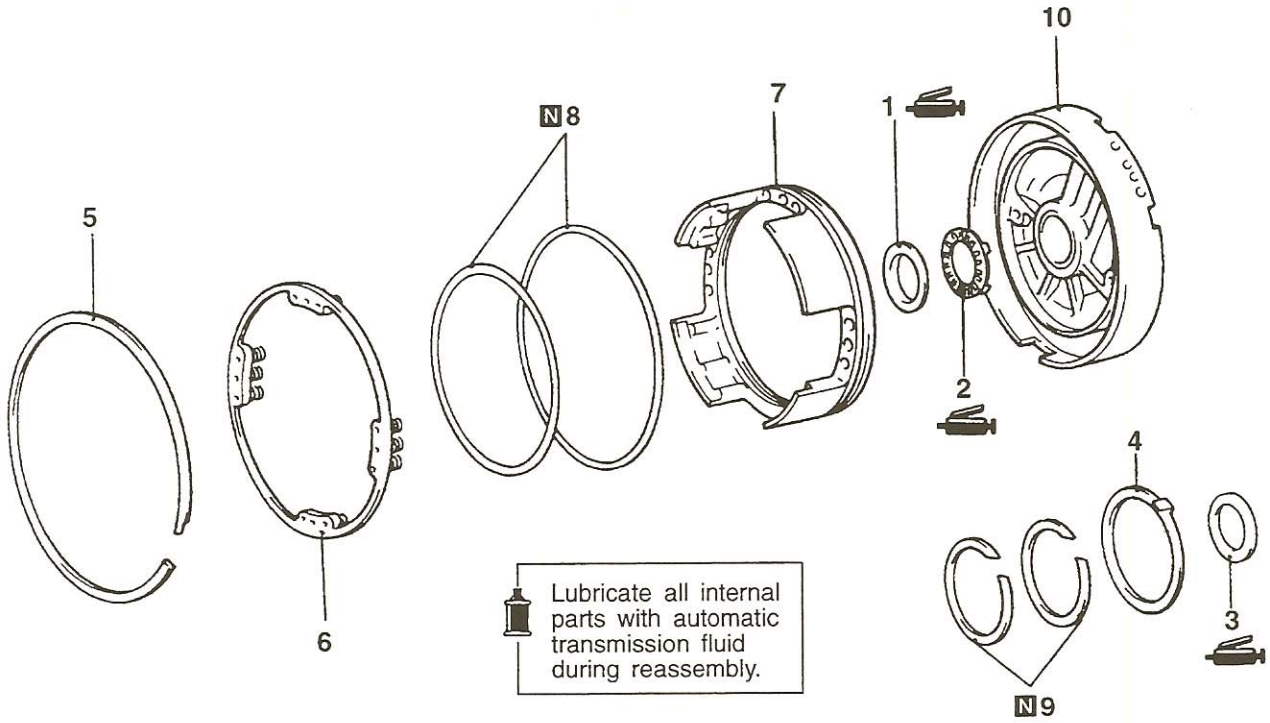
Identification code	16	17	18	19	20	21
Thickness mm (in.)	3.6 (.142)	3.5 (.138)	3.4 (.134)	3.3 (.130)	3.2 (.126)	3.1 (.122)

TSB Revision

OVERDRIVE SUPPORT

23302350018

DISASSEMBLY AND REASSEMBLY



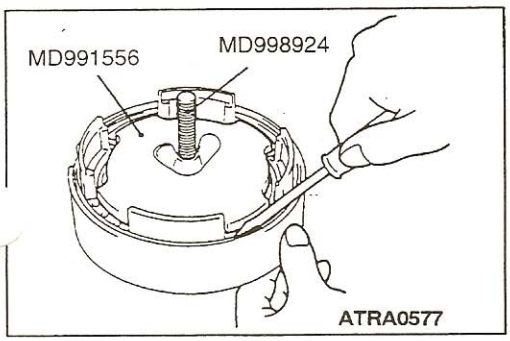
ZTRA0576

Disassembly steps

1. Thrust race
2. Thrust bearing
3. Thrust race
4. Clutch drum thrust washer

◀A▶ ▶A◀ 5. Snap ring

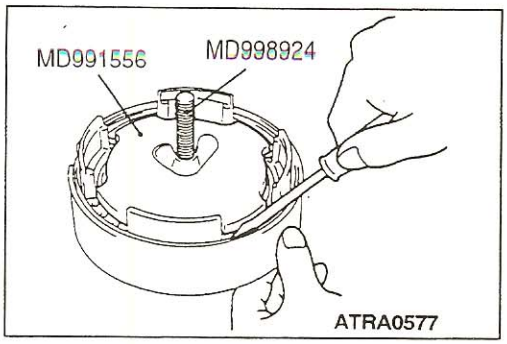
6. Return spring assembly
7. Overdrive brake piston
8. O-ring
9. Seal ring
10. Overdrive support assembly



DISASSEMBLY SERVICE POINT

◀A▶ SNAP RING REMOVAL

TSB Revision

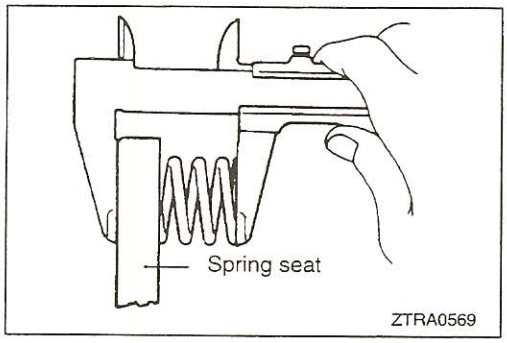


REASSEMBLY SERVICE POINT

▶A◀ SNAP RING INSTALLATION

Caution

1. **Be sure the end gap of the snap ring is not aligned with the cutout of the support.**
2. **Set the support in such a way that its central convex portion doesn't touch the workbench.**



INSPECTION

23302360011

RETURN SPRING ASSEMBLY

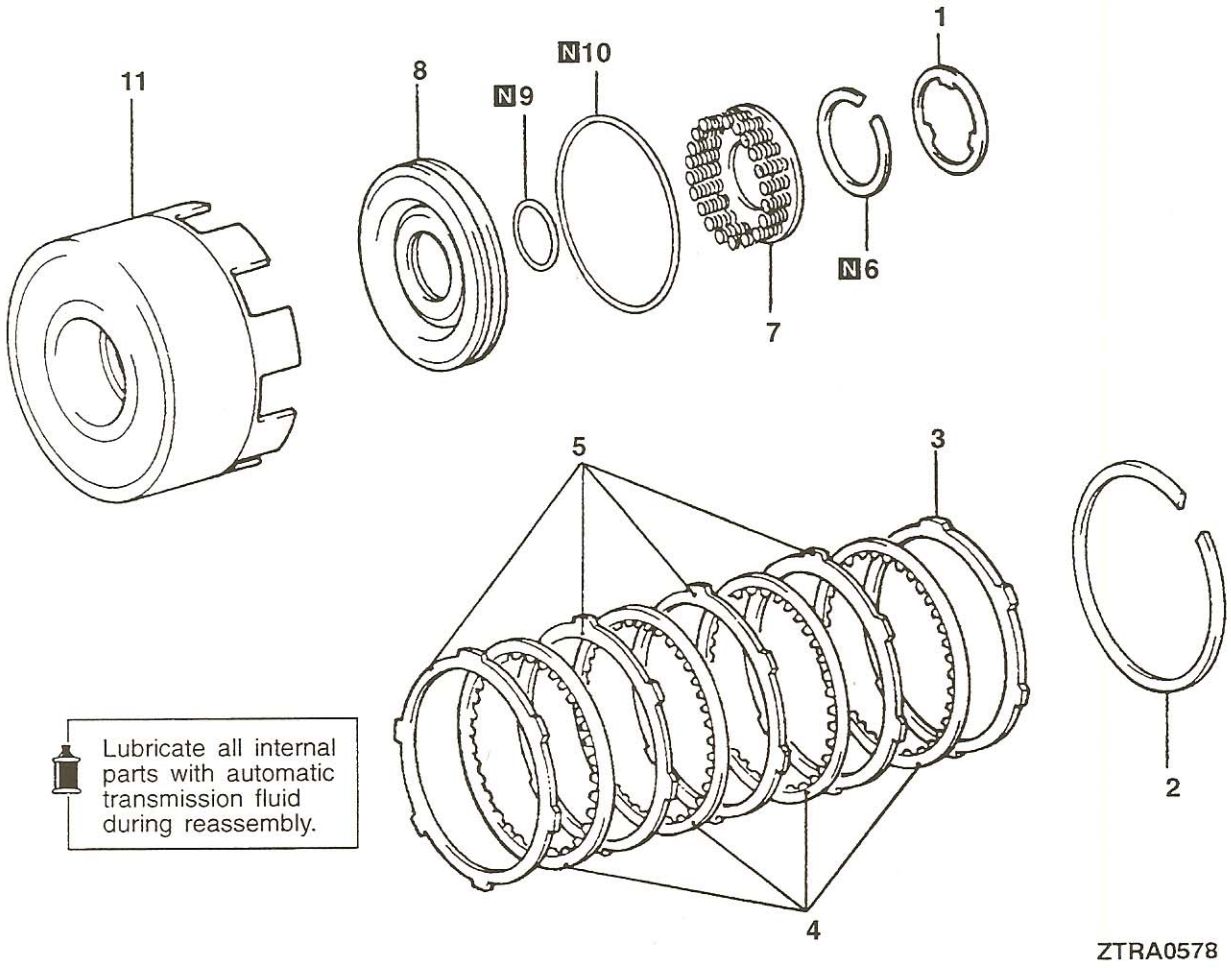
(1) Measure the free length of the spring including the spring seat.

Standard value: Approx. 18.6 mm (.732 in.)

DIRECT CLUTCH

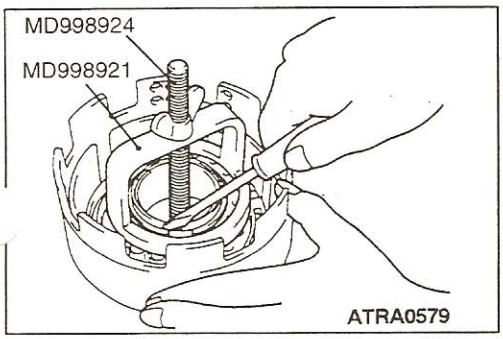
23300970025

DISASSEMBLY AND REASSEMBLY



Disassembly steps

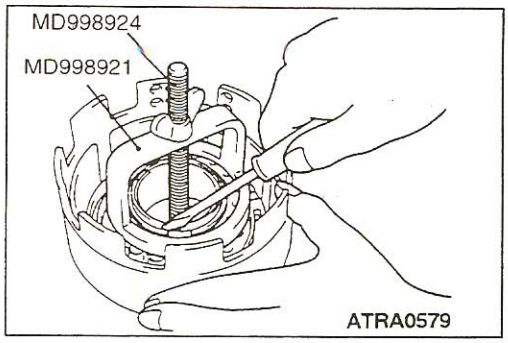
1. Thrust washer No.2
2. ▶C◀ Snap ring
3. ▶B◀ Clutch flange
4. Clutch disc
5. Clutch plate
6. ◀A▶ ▶A◀ Snap ring
7. Return spring assembly
8. Direct clutch piston
9. O-ring
10. O-ring
11. Direct clutch drum



DISASSEMBLY SERVICE POINT

◀A▶ SNAP RING REMOVAL

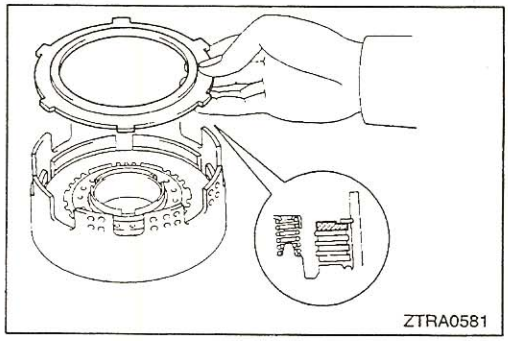
TSB Revision



REASSEMBLY SERVICE POINTS

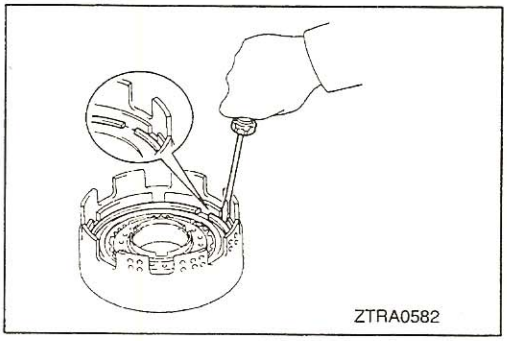
▶A◀ SNAP RING INSTALLATION

Caution
Be sure the end gap of the snap ring is not aligned with the stopper of the spring seat.



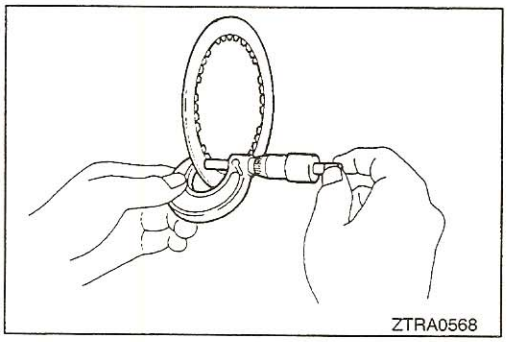
▶B◀ CLUTCH FLANGE INSTALLATION

(1) Install the clutch flange to the direct clutch drum so that the flange's convex side is oriented to the rear side.



▶C◀ SNAP RING INSTALLATION

(1) Install the snap ring so that the end gap of the snap ring is not aligned with the inner cutout of the direct clutch drum.



INSPECTION

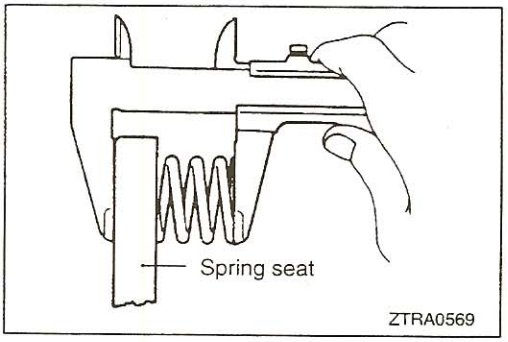
23300980011

DIRECT CLUTCH DISC

(1) Using a micrometer, measure the thickness of the clutch disc.

Limit: 1.84 mm (.072 in.)

NOTE
The thickness must be measured at two or three points. Compare the average value with the limit.

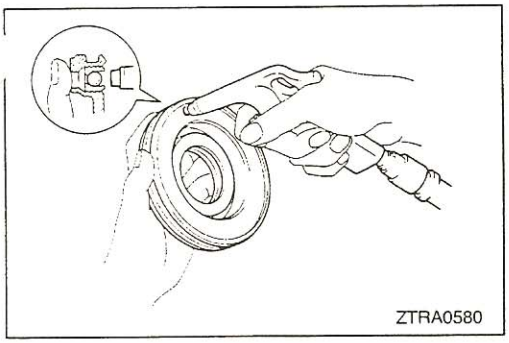


RETURN SPRING ASSEMBLY

(1) Measure the free length of the spring including the spring seat.

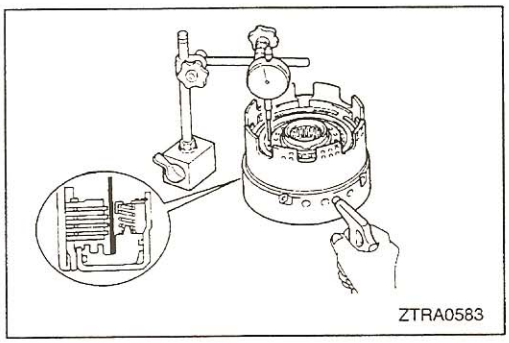
Standard value: Approx. 19.8 mm (.780 in.)

TSB Revision



DIRECT CLUTCH PISTON

(1) Check that the check ball is free by shaking the piston.
(2) Check that the valve does not leak by applying low-pressure compressed air.



DIRECT CLUTCH PISTON STROKE

(1) Install the direct clutch to the overdrive support assembly.
(2) Using a dial gauge, measure the piston stroke by applying compressed air (400–800 kPa, 57–113 psi) into the oil hole of the overdrive support as shown and then releasing the air.

Standard value: 1.37–1.67 mm (.0539–.0657 in.)

If the stroke is out of this range, replace the clutch flange with an appropriate one so that the stroke becomes within this range.

NOTE
When selecting the flange, aim at the center of the range.

[Available flanges]

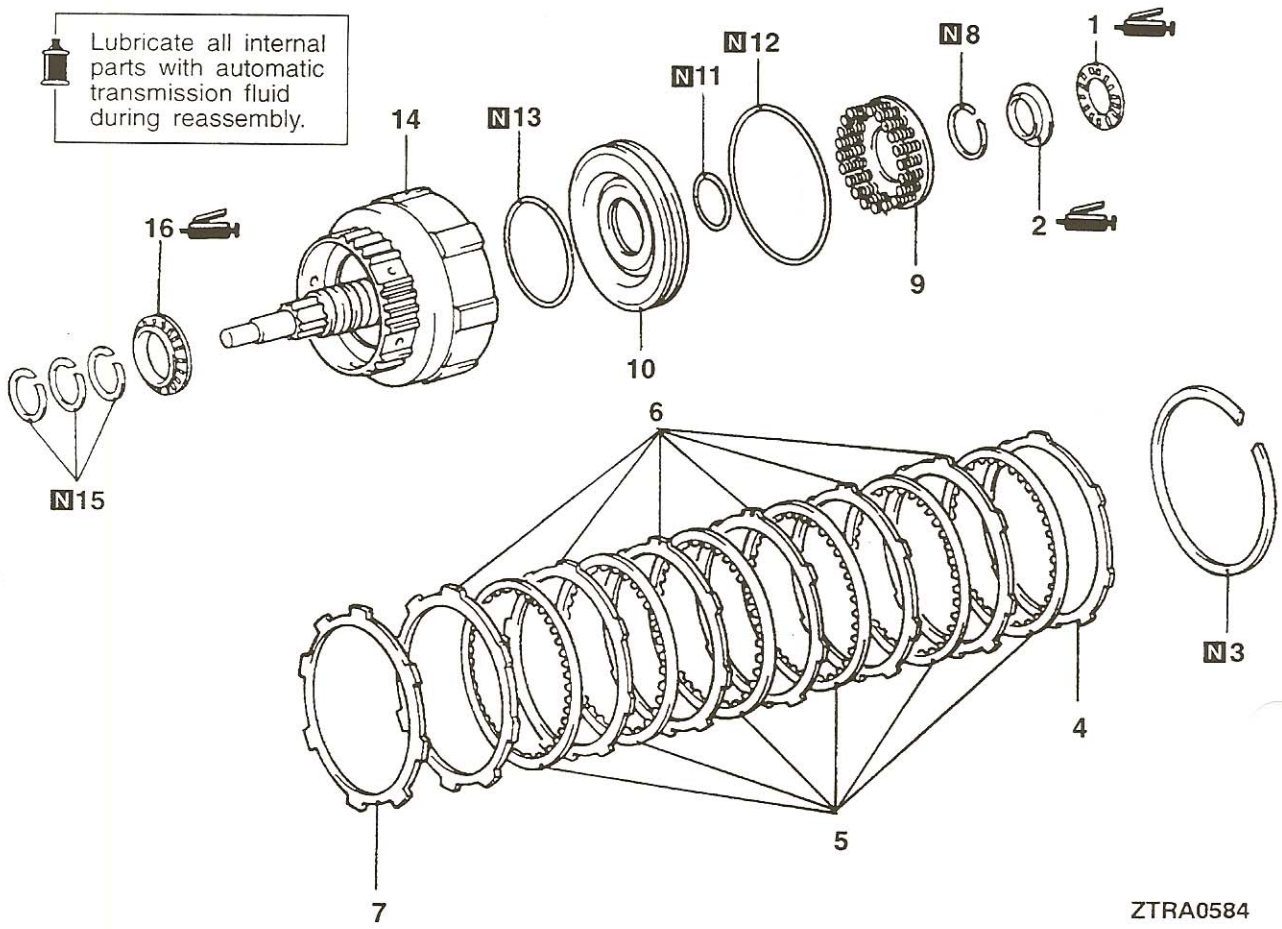
Identification code	33	32	31	30	29	28	27	34
Thickness mm (in.)	3.0 (.118)	3.1 (.122)	3.2 (.126)	3.3 (.130)	3.4 (.134)	3.5 (.138)	3.6 (.142)	3.7 (.146)

TSB Revision

FORWARD CLUTCH

2330102[illegible]29

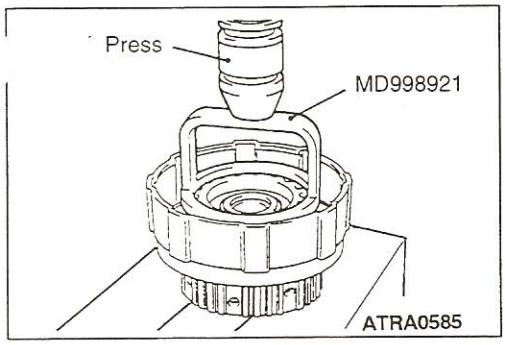
DISASSEMBLY AND REASSEMBLY



Disassembly steps

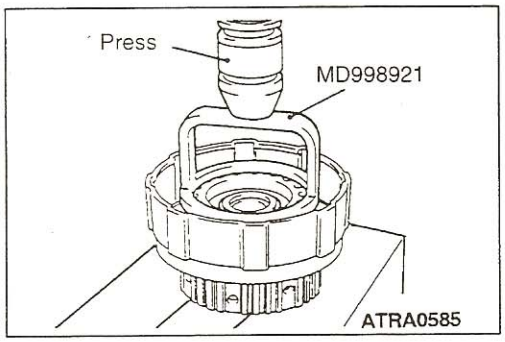
1. Thrust bearing
2. Thrust race
▶D◀ 3. Snap ring
▶C◀ 4. Clutch flange
5. Clutch disc
6. Clutch plate
▶B◀ 7. Cushion plate
◀A▶ ▶A◀ 8. Snap ring
9. Return spring assembly
10. Forward clutch piston
11. O-ring
12. O-ring
13. O-ring
14. Forward clutch drum
15. Seal ring
16. Thrust bearing

TSB Revision



DISASSEMBLY SERVICE POINT

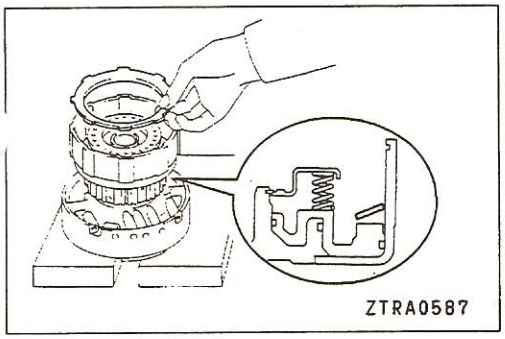
◀A▶ SNAP RING REMOVAL



REASSEMBLY SERVICE POINTS

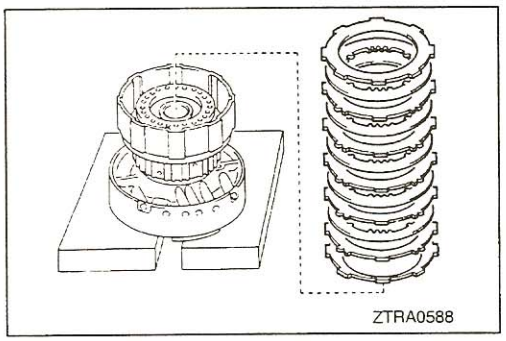
▶A◀ SNAP RING INSTALLATION

Caution
Be sure the end gap of the snap ring is not aligned with the stopper of the spring seat.



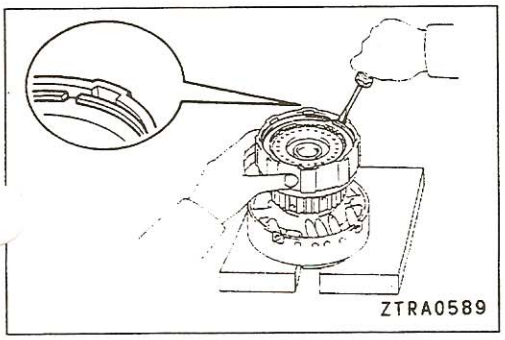
▶B◀ CUSHION PLATE INSTALLATION

(1) Install the cushion plate to the forward clutch drum so that its convex side is oriented to the piston side.



▶C◀ CLUTCH FLANGE INSTALLATION

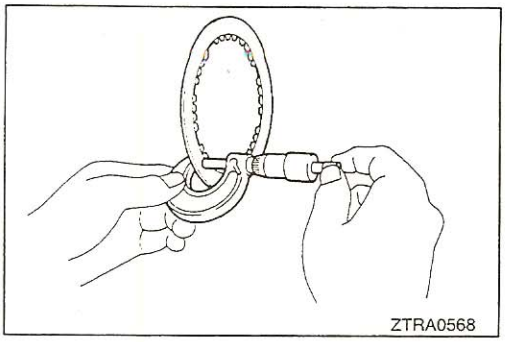
(1) Install the clutch flange to the forward clutch drum so that the flange's chamfer is oriented to the disc side.



▶D◀ SNAP RING INSTALLATION

(1) Install the snap ring so that the end gap of the snap ring is not aligned with the inner cutout of the direct clutch drum.

TSB Revision


ZTRA0568

INSPECTION

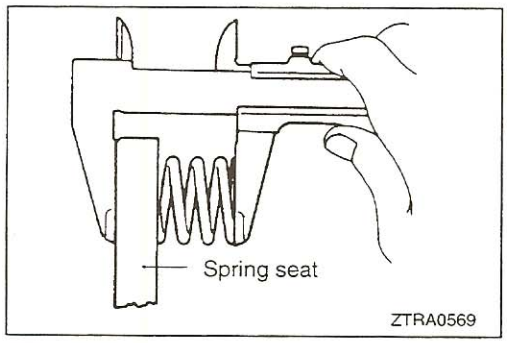
23301040015

FORWARD CLUTCH DISC

(1) Using a micrometer, measure the thickness of the clutch disc.

Limit: 1.84 mm (.0724 in.)

NOTE
The thickness must be measured at two or three points. Compare the average value with the limit.

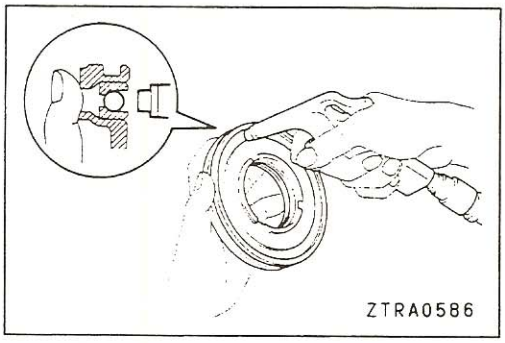


ZTRA0569

RETURN SPRING ASSEMBLY

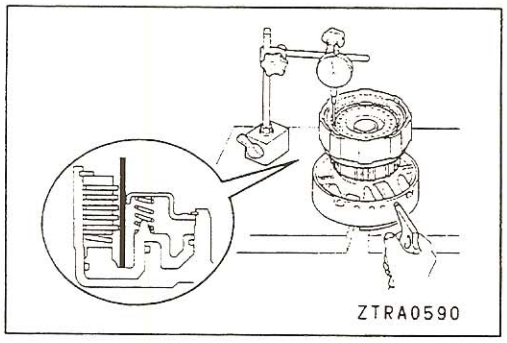
(1) Measure the free length of the spring including the spring seat.

Standard value: Approx. 11.55 mm (.4547 in.)


ZTRA0586

FORWARD CLUTCH PISTON

(1) Check that the check ball is free by shaking the piston.
(2) Check that the valve does not leak by applying low-pressure compressed air.


ZTRA0590

FORWARD CLUTCH PISTON STROKE

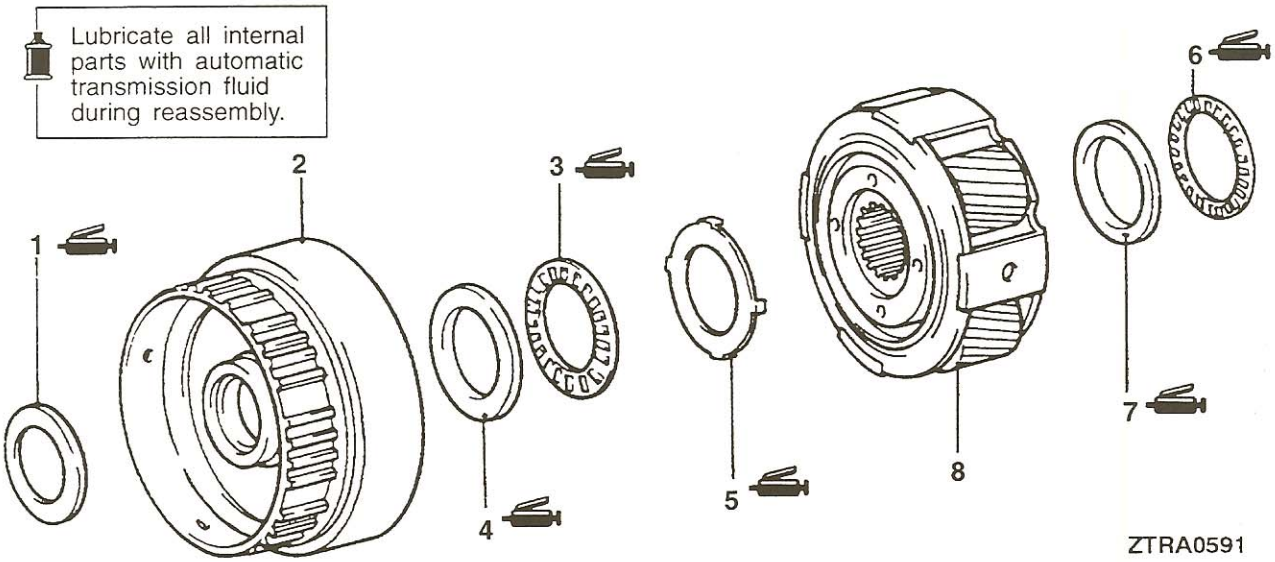
(1) Install the forward clutch to the overdrive support assembly.
(2) Using a dial gauge, measure the piston stroke by applying compressed air (400–800 kPa, 57–113 psi) into the oil hole of the overdrive support as shown and then releasing the air.

Standard value: 2.90–4.29 mm (.1141–.1689 in.)

FRONT PLANETARY GEAR

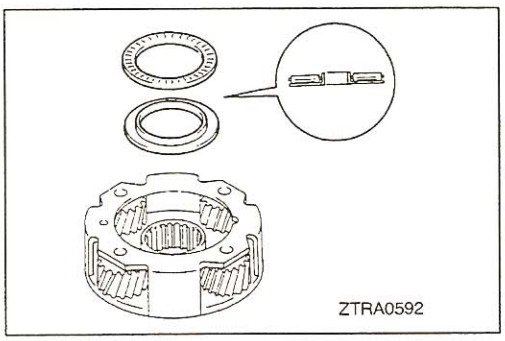
23301060028

DISASSEMBLY AND REASSEMBLY



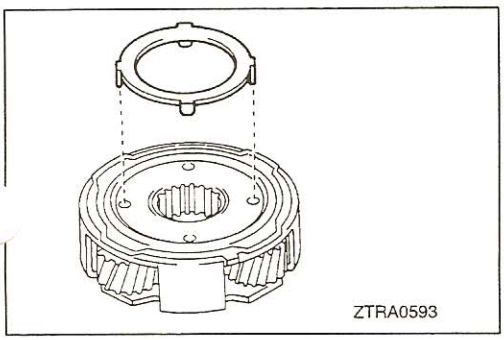
Disassembly steps

1. Thrust race
2. Front planetary ring gear assembly
▶C◀ 3. Thrust bearing
▶C◀ 4. Thrust race
▶B◀ 5. Thrust race
▶A◀ 6. Thrust bearing
▶A◀ 7. Thrust race
8. Front planetary gear assembly



REASSEMBLY SERVICE POINTS

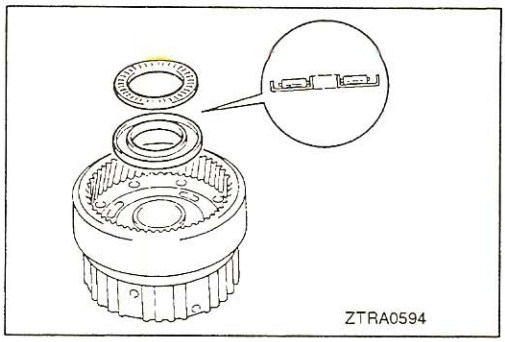
▶A◀ THRUST RACE / THRUST BEARING INSTALLATION



▶B◀ THRUST RACE INSTALLATION

(1) Install the thrust race to the planetary gear assembly while aligning its claws with the holes of the front planetary gear.

TSB Revision

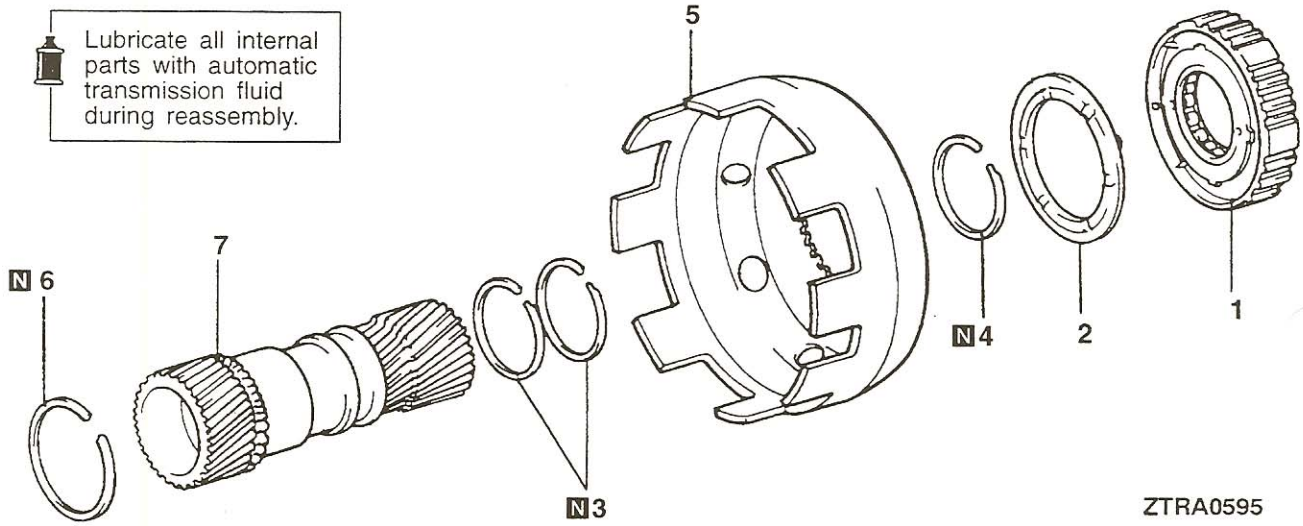


▶C◀ THRUST RACE / THRUST BEARING INSTALLATION

PLANETARY SUN GEAR AND ONE-WAY CLUTCH NO.1

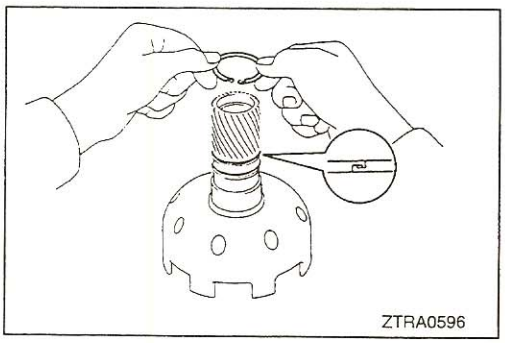
23301180014

DISASSEMBLY AND REASSEMBLY



Disassembly steps

- ▶C◀ 1. One-way clutch assembly
- ▶B◀ 2. One-way clutch thrust washer No.1
- ▶A◀ 3. Seal ring
- 4. Snap ring
- 5. Sun gear input drum
- 6. Snap ring
- 7. Planetary sun gear

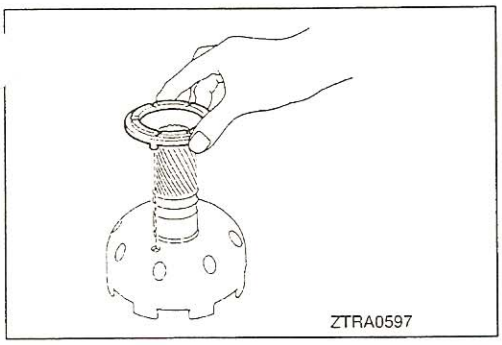


REASSEMBLY SERVICE POINTS

▶A◀ SEAL RING INSTALLATION

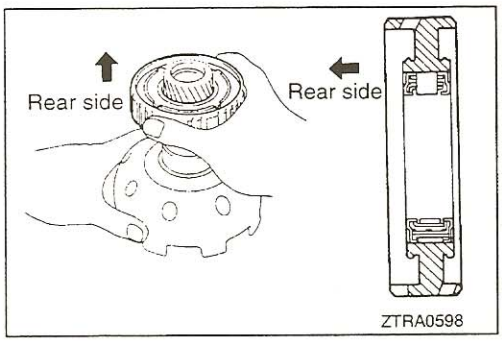
(1) Don't open the seal ring wider than necessary. Be careful not to bend the claws.

TSB Revision



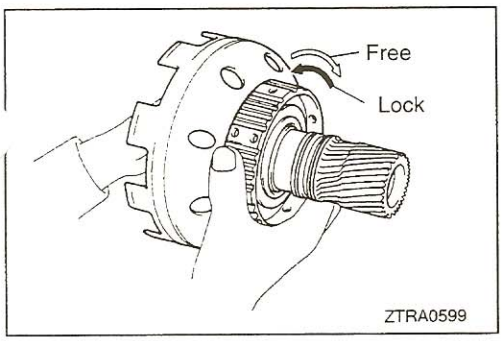
▶B◀ ONE-WAY CLUTCH THRUST WASHER NO.1 INSTALLATION

(1) Install the thrust washer to the sun gear input drum while aligning its convex with the hole of the drum.



▶C◀ ONE-WAY CLUTCH ASSEMBLY INSTALLATION

(1) Install the one-way clutch assembly to the planetary sun gear in the direction shown in the illustration.



INSPECTION

23301190017

OPERATION OF ONE-WAY CLUTCH

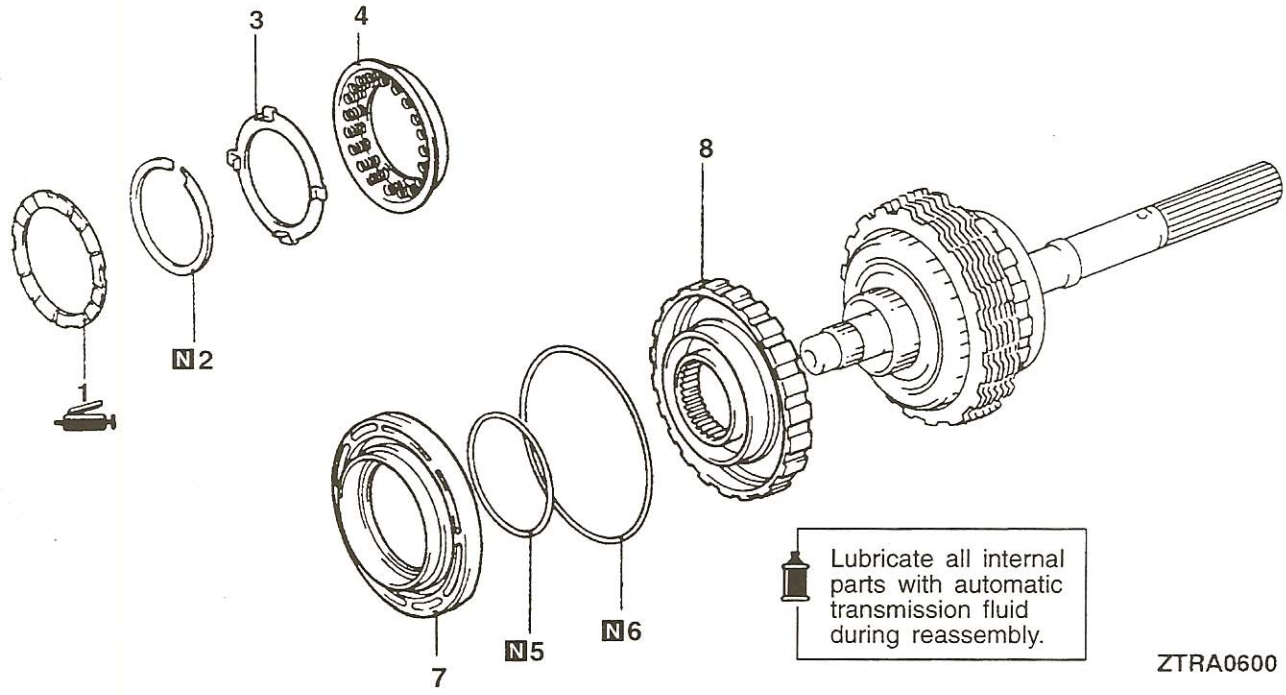
(1) While holding planetary sun gear, turn the one-way clutch clockwise to see that the clutch turns smoothly and turn it counterclockwise to see that the clutch is locked.

NOTE
(1) If the one-way clutch turns or locks in both directions, replace the one-way clutch.
(2) If the one-way clutch turns counterclockwise while it doesn't turn clockwise, the one-way clutch may have been installed in the reverse direction.

SECOND BRAKE

23302180020

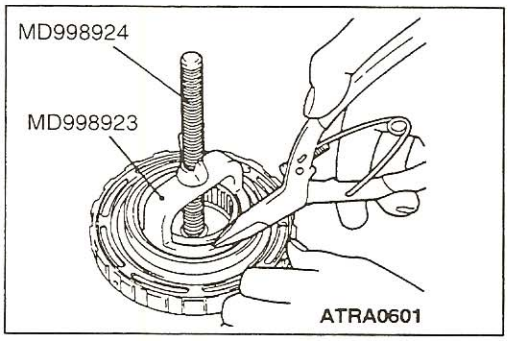
DISASSEMBLY AND REASSEMBLY

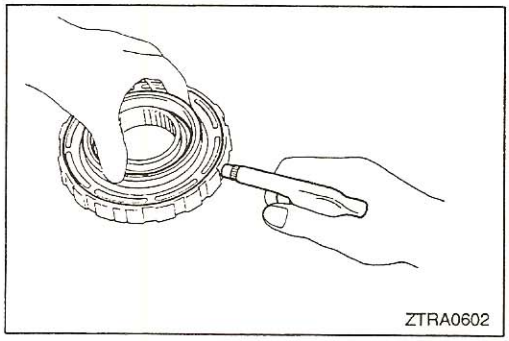


Disassembly steps

◀A▶ ▶A◀
1. One-way clutch thrust washer No.2
2. Snap ring
3. Return spring seat
4. Return spring assembly

◀B▶
5. O-ring
6. O-ring
7. Second brake piston
8. Second brake drum assembly





DISASSEMBLY SERVICE POINTS

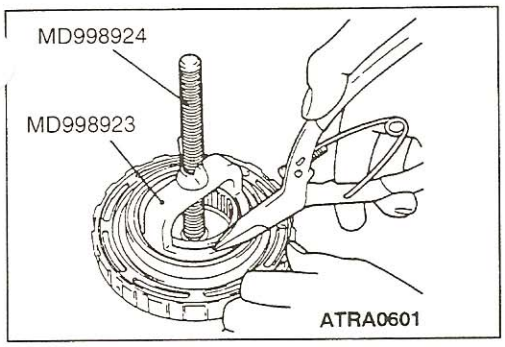
◀A▶ SNAP RING REMOVAL

◀B▶ SECOND BRAKE PISTON REMOVAL

(1) With the second brake piston held, blow air into the second brake drum through the oil hole to remove the second brake piston.

Caution
Do not blow air suddenly because the piston may be tipped and become hard to remove.

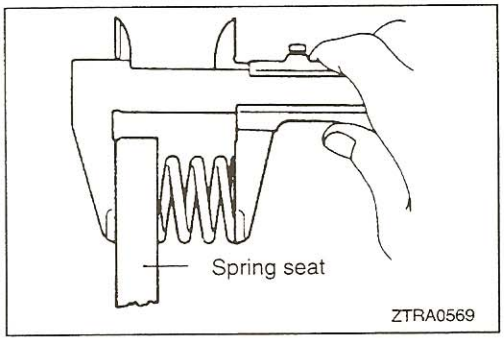
TSB Revision



REASSEMBLY SERVICE POINT

▶A◀ SNAP RING INSTALLATION

Caution
Be sure the end gap of the snap ring is not aligned with the stopper of the spring seat.



INSPECTION

23302190016

RETURN SPRING ASSEMBLY

(1) Measure the free length of the spring including the spring seat.

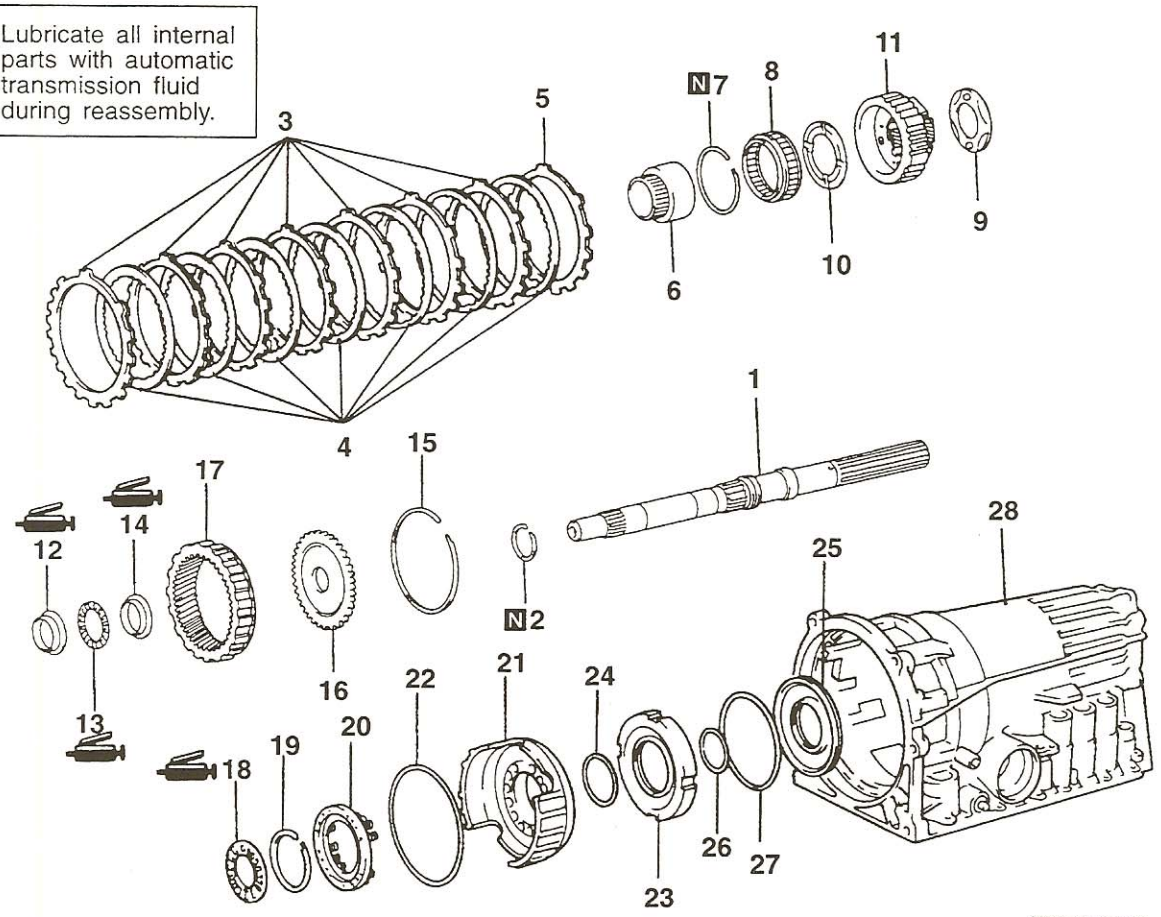
Standard value: Approx. 15.05 mm (.5925 in.)

REAR PLANETARY GEAR, OUTPUT SHAFT AND FIRST & REVERSE BRAKE

2330105

DISASSEMBLY AND REASSEMBLY

Lubricate all internal parts with automatic transmission fluid during reassembly.

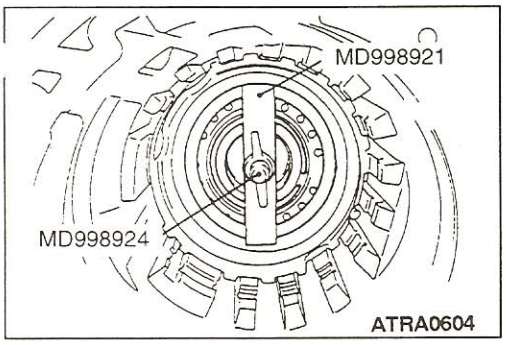


ZTRA0603

Disassembly steps

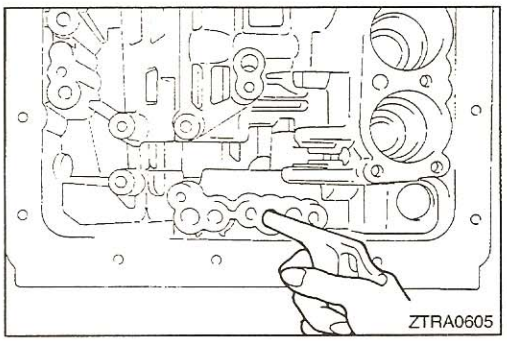
1. Output shaft
▶I◀ 2. Seal ring
3. Brake plate
4. Brake disc
5. Brake flange
▶H◀ 6. One-way clutch inner race
7. Snap ring
▶G◀ 8. One-way clutch No.2
▶F◀ 9. Planetary carrier thrust washer No.1
▶F◀ 10. Planetary carrier thrust washer No.2
11. Rear planetary gear assembly
▶E◀ 12. Thrust race
▶E◀ 13. Thrust bearing
▶E◀ 14. Thrust race
15. Snap ring
16. Rear planetary ring gear flange
17. Rear planetary ring gear
▶D◀ 18. Thrust bearing with race
◀A▶ ▶C◀ 19. Snap ring
20. Return spring assembly
◀B▶ ▶B◀ 21. First & Reverse brake piston No.2
22. O-ring
◀C▶ ▶A◀ 23. Brake reaction sleeve
24. O-ring
◀D▶ ▶A◀ 25. First & Reverse brake piston No.1
26. O-ring
27. O-ring
28. Transmission case assembly

TSB Revision



DISASSEMBLY SERVICE POINTS

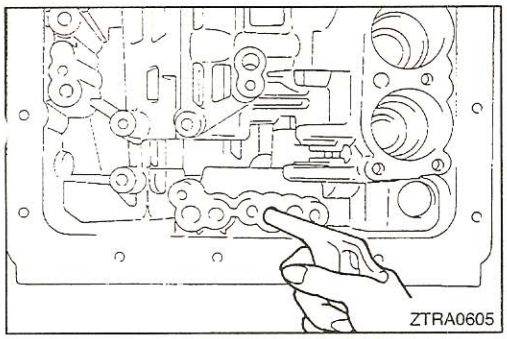
◀A▶ SNAP RING INSTALLATION



◀B▶ FIRST & REVERSE BRAKE PISTON NO.2 REMOVAL

(1) With the first & reverse brake piston No.2 held, blow air into the transmission case through the oil hole to remove the first & reverse brake piston No.2.

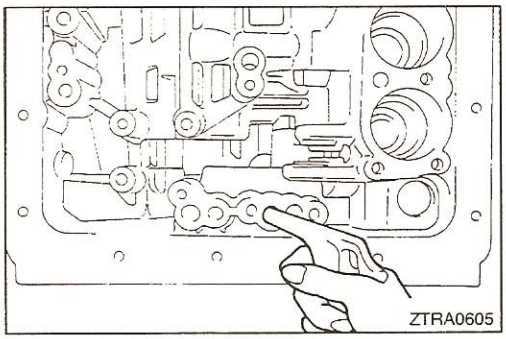
Caution
Do not blow air suddenly because the piston may be tipped and become hard to remove.



◀C▶ BRAKE REACTION SLEEVE REMOVAL

(1) With the brake reaction sleeve held, blow air into the transmission case through the oil hole to remove the brake reaction sleeve.

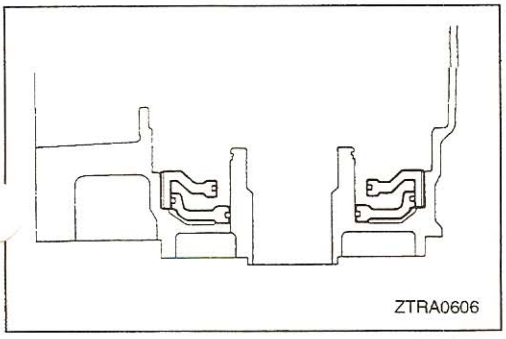
Caution
Do not blow air suddenly because the sleeve may be tipped and become hard to remove.



◀D▶ FIRST & REVERSE BRAKE PISTON NO.1 REMOVAL

(1) With the first & reverse brake piston No.1 held, blow air into the transmission case through the oil hole to remove the piston.

Caution
Do not blow air suddenly because the piston may be tipped and become hard to remove.

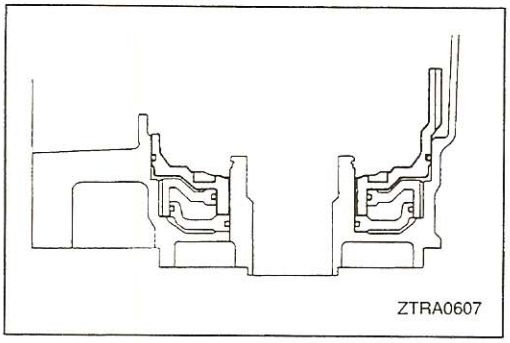


REASSEMBLY SERVICE POINTS

▶A◀ FIRST & REVERSE BRAKE PISTON NO.1 / REVERSE BRAKE SLEEVE INSTALLATION

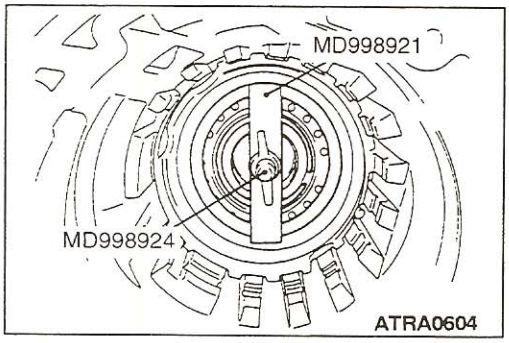
(1) Install the first & reverse brake piston No.1 and the reverse brake sleeve together to the transmission case.

TSB Revision



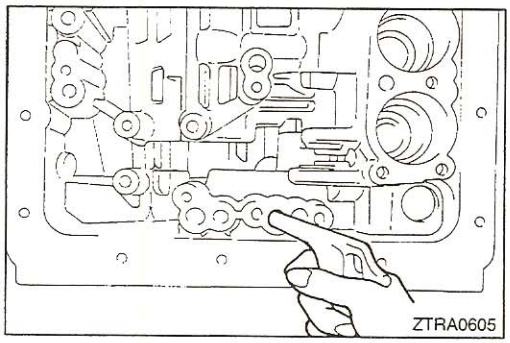
▶B◀ FIRST & REVERSE BRAKE PISTON NO.2 INSTALLATION

(1) Aligning the convex of the first & reverse brake piston No.2 with the concave of the transmission case, install the piston to the case.

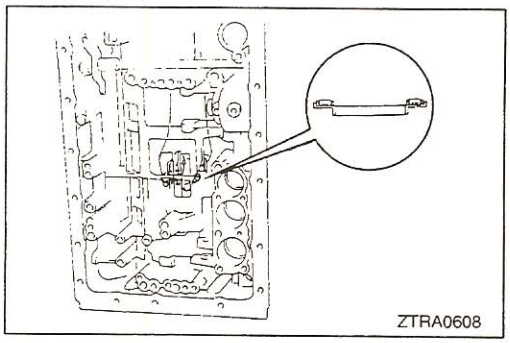


▶C◀ SNAP RING INSTALLATION

Caution
Be sure the end gap of the snap ring is not aligned with the stopper of the spring seat.

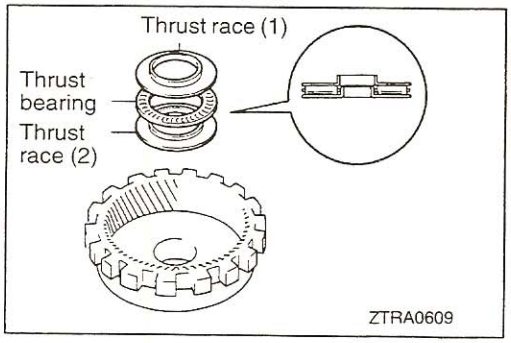


(1) After the snap ring is installed, check the operation of the first & reverse brake piston as follows:
(2) By applying compressed air (400–800 kPa, 57–113 psi) into the oil hole of the transmission case as illustrated, check that the first & reverse brake piston slides smoothly.



▶D◀ THRUST BEARING WITH RACE INSTALLATION

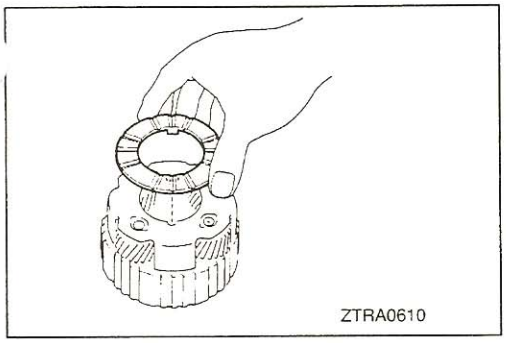
(1) Apply petrolatum to the thrust bearing with race and attach it so that the race side is oriented to the transmission case side.



▶E◀ THRUST RACE / THRUST BEARING / THRUST RACE INSTALLATION

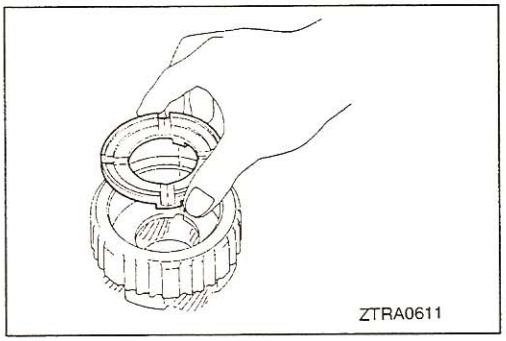
(1) Apply petrolatum to the thrust bearing, thrust race [28.8 mm (1.13 in.) in inner diameter] and thrust race [27.6 mm (1.09 in.) in inner diameter] and attach them to the rear planetary ring gear in the illustrated order and direction.

TSB Revision

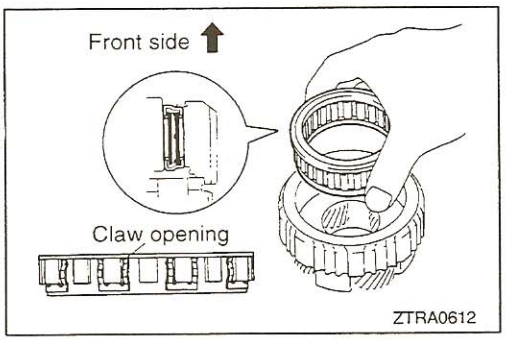


▶F◀ PLANETARY CARRIER THRUST WASHERS NO.1 AND NO.2 INSTALLATION

(1) Aligning the convex of the thrust washer No.1 with the hole of the rear planetary gear, install the washer to the gear.

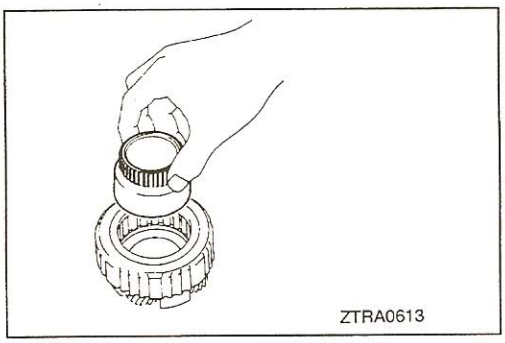


(2) Turn the rear planetary gear over. Aligning the convex of the thrust washer No.2 with the hole of the rear planetary gear, install the washer to the gear.



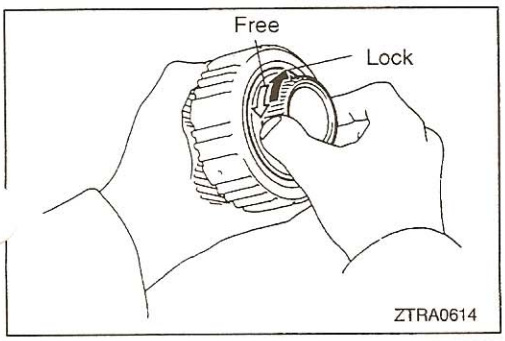
▶G◀ ONE-WAY CLUTCH NO.2 INSTALLATION

(1) Install the one-way clutch No.2 to the rear planetary gear in the illustrated direction.



▶H◀ ONE-WAY CLUTCH INNER RACE INSTALLATION

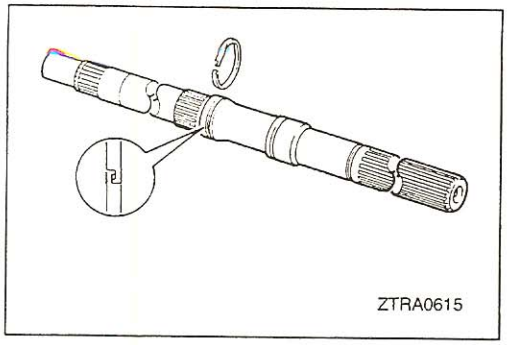
(1) After the one-way clutch inner race is installed, check the operation of the one-way clutch No.2 as follows:



(2) While holding the rear planetary gear, turn the one-way clutch clockwise to see that the clutch is locked and turn it counterclockwise to see that the clutch turns.

NOTE
(1) If the one-way clutch turns or locks in both directions, replace the one-way clutch.
(2) If the one-way clutch turns clockwise while it doesn't counterclockwise, the one-way clutch may have been assembled in the reverse direction.

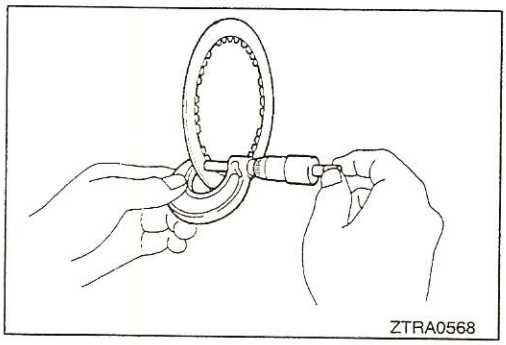
TSB Revision


ZTRA0615

▶I◀ SEAL RING INSTALLATION

(1) Apply ATF to the seal ring and attach it to the ou shaft.

Caution
1. **Do not bend the claw of the seal ring.**
2. **Do not open the seal ring wider than necessary.**


ZTRA0568

INSPECTION

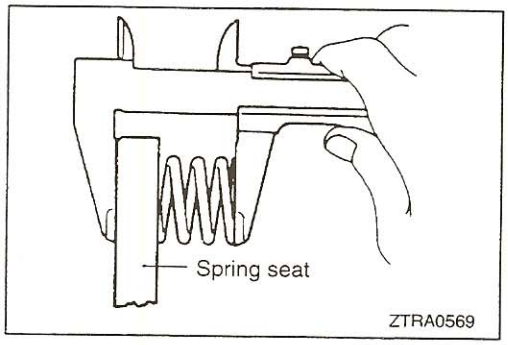
23301100010

FIRST & REVERSE BRAKE DISC

(1) Using a micrometer, measure the thickness of the brake disc.

Limit: 1.51 mm (.0594 in.)

NOTE
The thickness must be measured at two or three points. Compare the average value with the limit.



ZTRA0569

RETURN SPRING ASSEMBLY

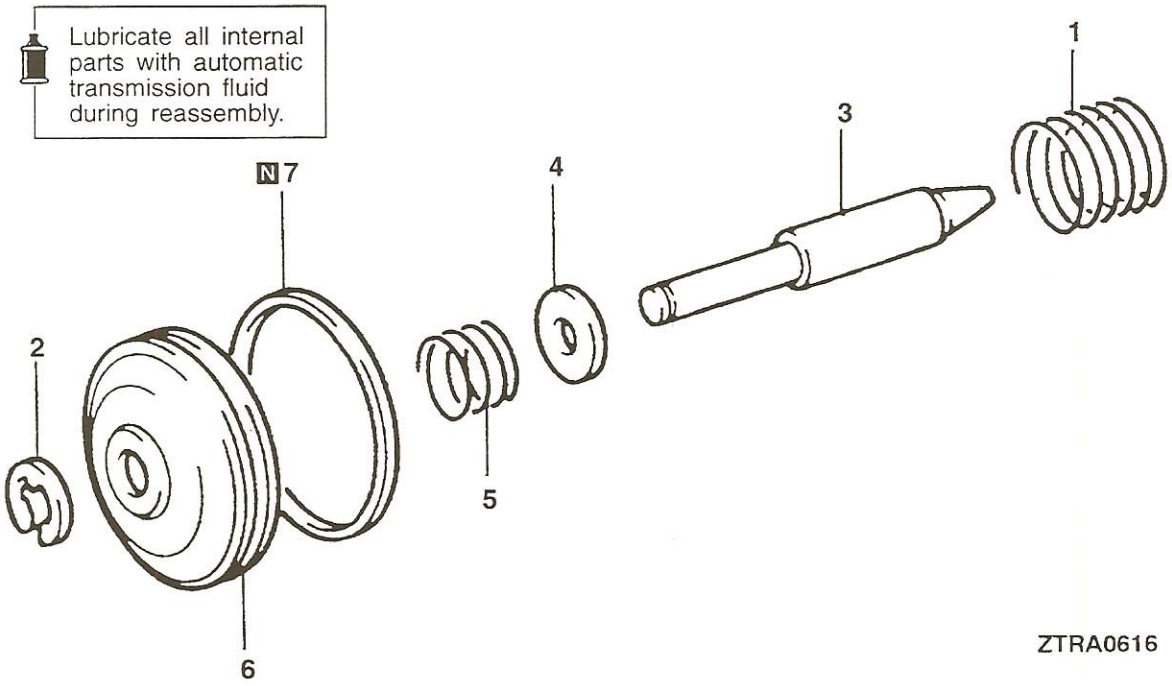
(1) Measure the free length of the spring including the spring seat.

Standard value: Approx. 13.09 mm (.5154 in.)

SECOND COAST BRAKE PISTON

23302380017

DISASSEMBLY AND REASSEMBLY



Disassembly steps

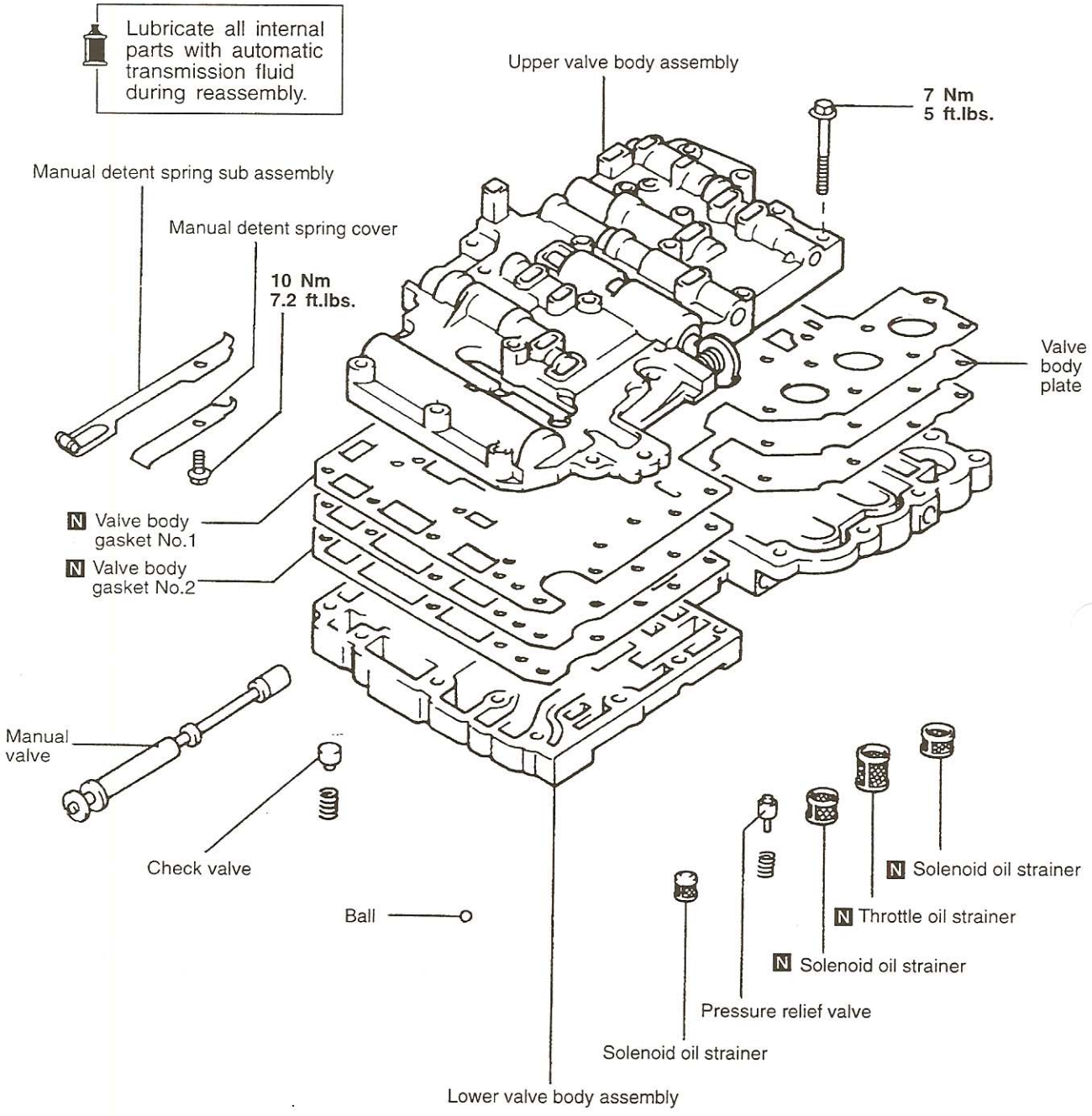
1. Spring
2. E-ring
3. Second coast brake piston rod
4. Plate washer
5. Spring
6. Second coast brake piston
7. Seal ring

TSB Revision

VALVE BODY

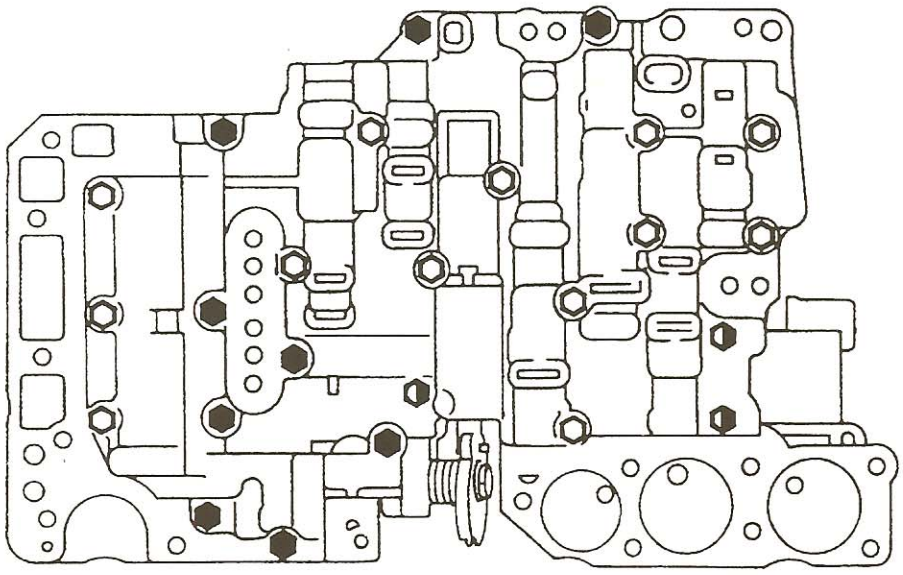
2330121

DISASSEMBLY AND REASSEMBLY



ZTRA0617

TSB Revision



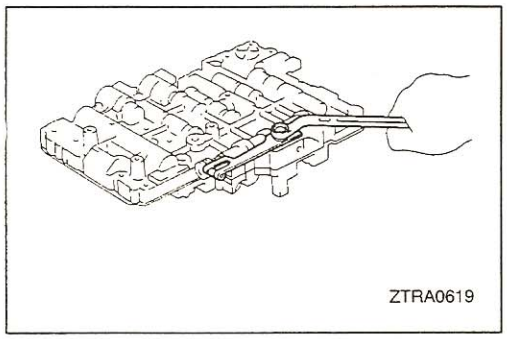
Bolt shank length

⬡ : 38 mm (1.50 in.)

⬢ : 20 mm (.79 in.)

◑ : 28 mm (1.10 in.)

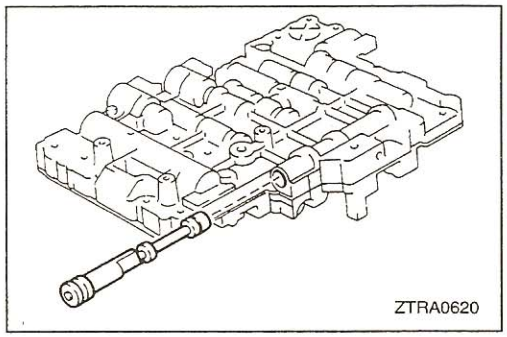
ZTRA0618



ZTRA0619

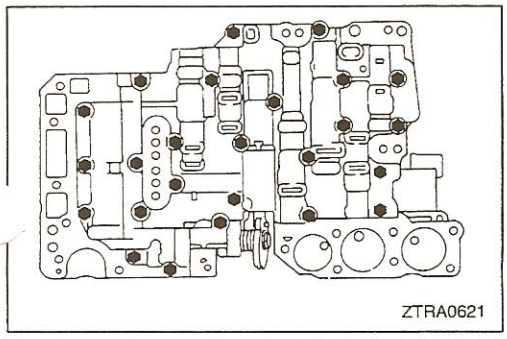
DISASSEMBLY

(1) Remove the bolt and then remove the detent spring and cover.



ZTRA0620

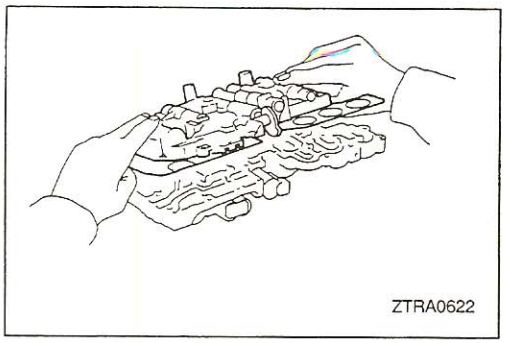
(2) Remove the manual valve from the lower valve body.



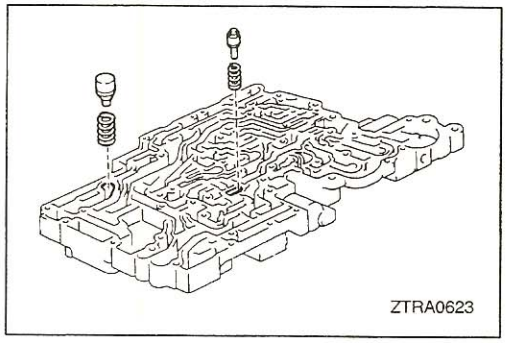
ZTRA0621

(3) Using a deep socket wrench [8 mm (.31 in.)], remove the 25 bolts from the upper valve body.

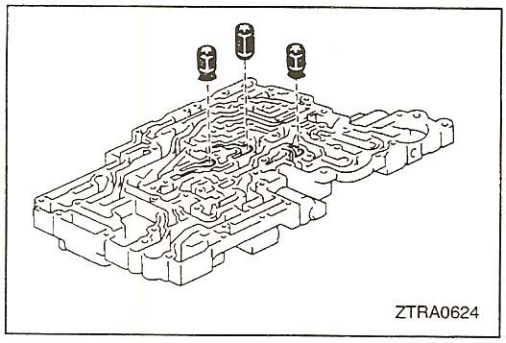
TSB Revision



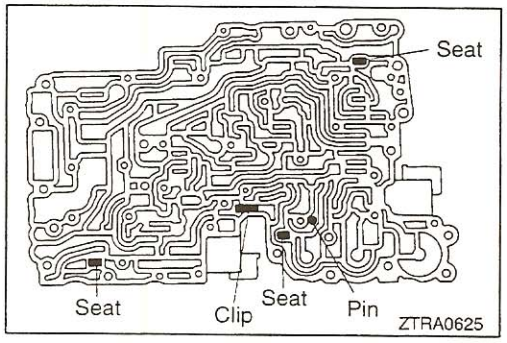
(4) Separate the upper valve body from the lower valve body by pushing the valve body plate and gasket toward upper valve body.
(5) Place the upper valve body on the workbench with the side having the gasket and plate upward.



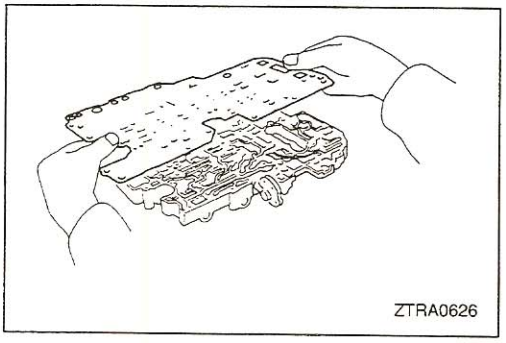
(6) Remove the check valve and spring from the lower valve body.
(7) Remove the pressure relief valve and spring from the lower valve body.



(8) Remove the three strainers from the lower valve body.

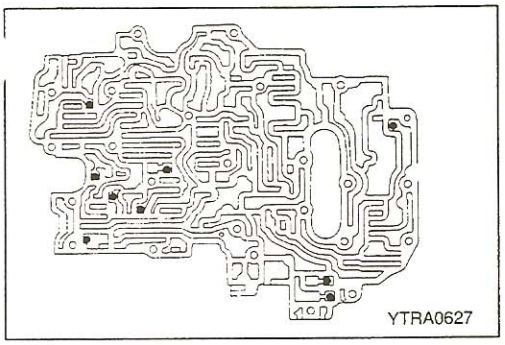


(9) Check that the three seats, one pin and one clip are in position on the lower valve body.

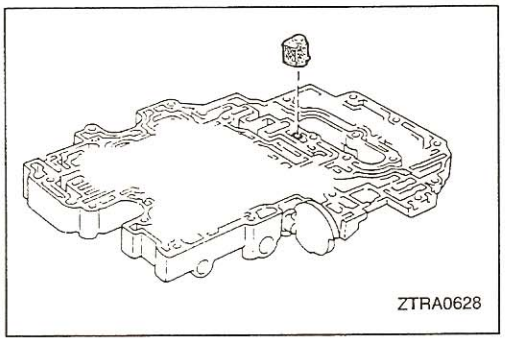


(10) Remove the two valve body gaskets and the plate from the upper valve body.

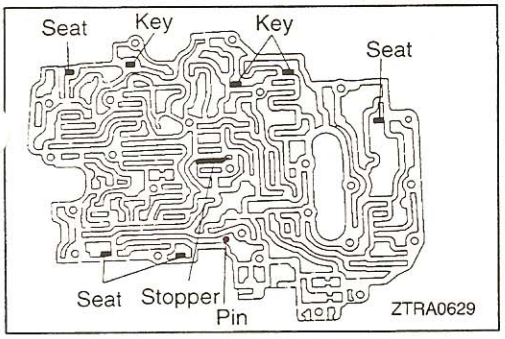
TSB Revision



(11) Remove the 9 balls from the upper valve body.



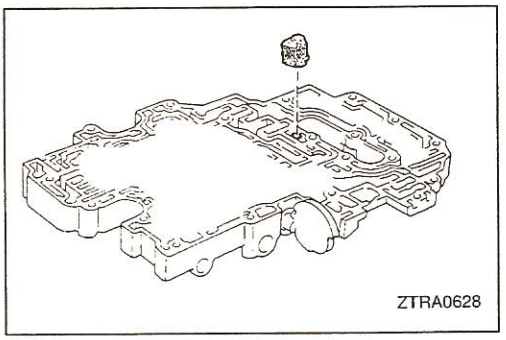
(12) Remove the strainer from the upper valve body.

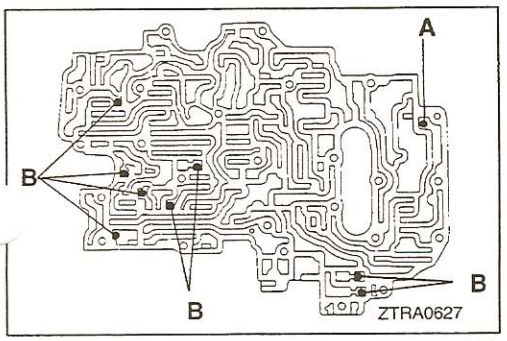


(13) Check that the one pin, four seats, three keys and one vibrating stopper are all in position.

REASSEMBLY

(1) Install the solenoid oil strainer to the upper valve body.



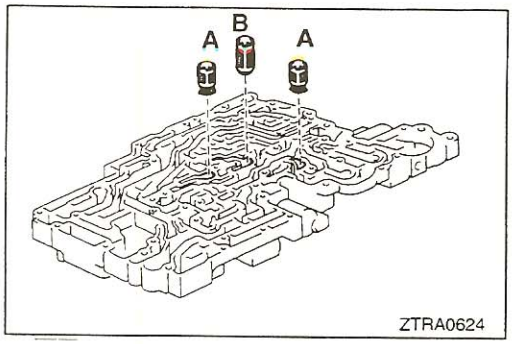


(2) Install two types of 9 balls to the upper valve body.

mm (in.)

Place	Outer diameter
Rubber ball A	6.35 (2.500)
Rubber ball B	5.56 (2.189)

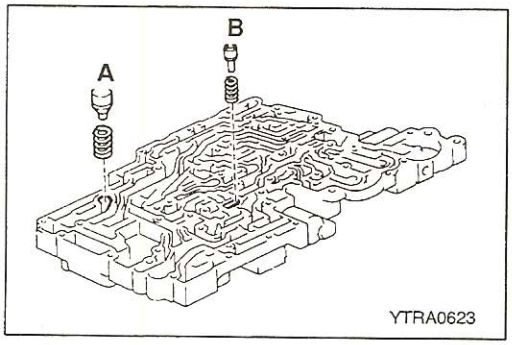
TSB Revision



(3) Install the two solenoid oil strainers and one throttle oil strainer to the lower valve body.

mm (in.)

Type	Outer diameter	Height
Solenoid oil strainer A	10.2 – 10.4 (.401 – .409)	12.2 – 12.6 (.480 – .488)
Throttle oil strainer B	10.2 – 10.4 (.401 – .409)	19.3 – 19.7 (.760 – .776)



(4) Install the two springs and then the check valve and pressure relief valve to the lower valve body.

Spring

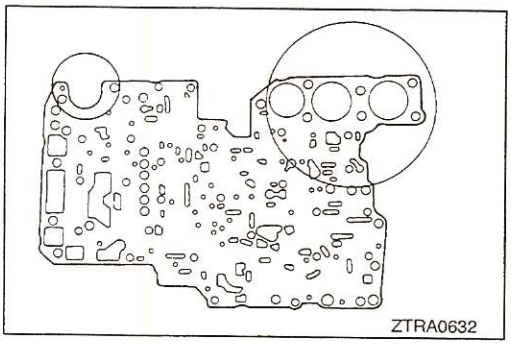
mm (in.)

Place	Free height	Outside diameter	Number of loops	Wire diameter
Check valve	17.53 (.6902)	12.1 (.476)	3.2	1.1 (.043)
Relief valve	11.2 (.441)	6.4 (.252)	7.5	0.9 (.035)

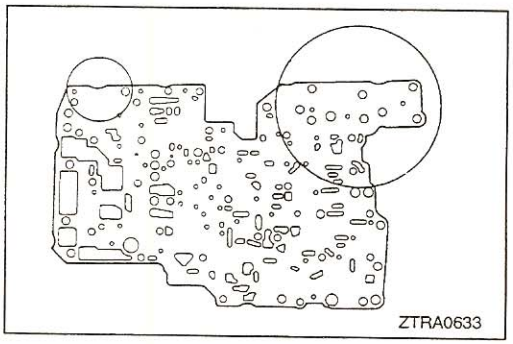
Valve

mm (in.)

Type	Outer diameter	Height
Check valve A	12.8 (.504)	17.5 (.689)
Presure relief valve B	6.7 (.264)	16.5 (.650)

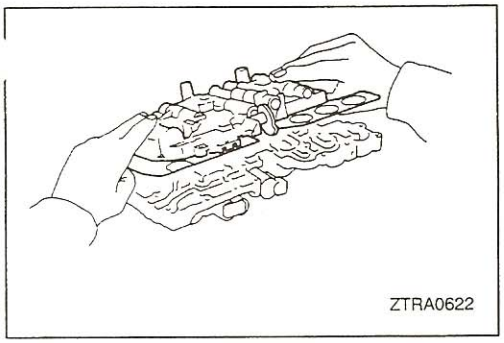


(5) In alignment with the bolt holes, install a new valve body gasket No.1 on the upper valve body.
(6) In alignment with the bolt holes, put the plate on the gasket No.1.



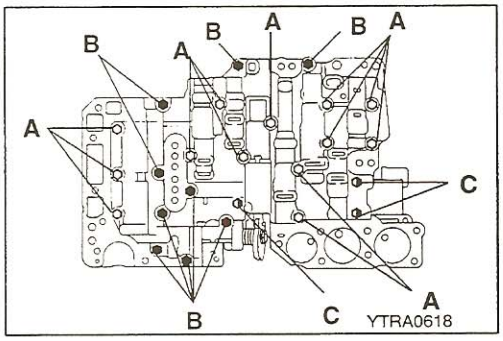
(7) Put a new valve body gasket No.2 on the plate.

TSB Revision


ZTRA0622

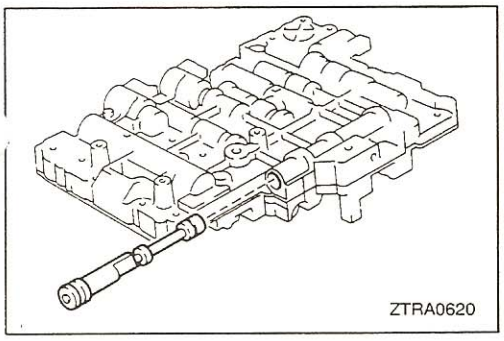
(8) While pushing the gaskets and the plate against the upper valve body, put the upper valve body on the lower valve body.

Caution
Be careful not to drop the check balls and strainers from the upper valve body.

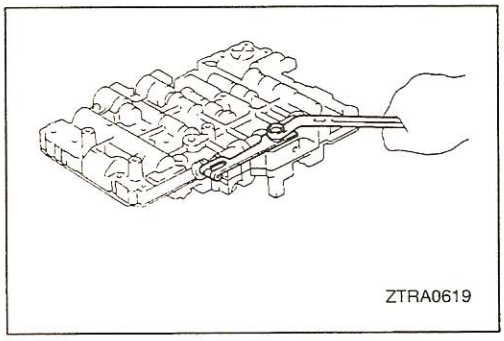


(9) Insert the 25 bolts from the upper valve body side.

A: 38 mm (1.50 in.)
B: 20 mm (.79 in.)
C: 28 mm (1.10 in.)


ZTRA0620

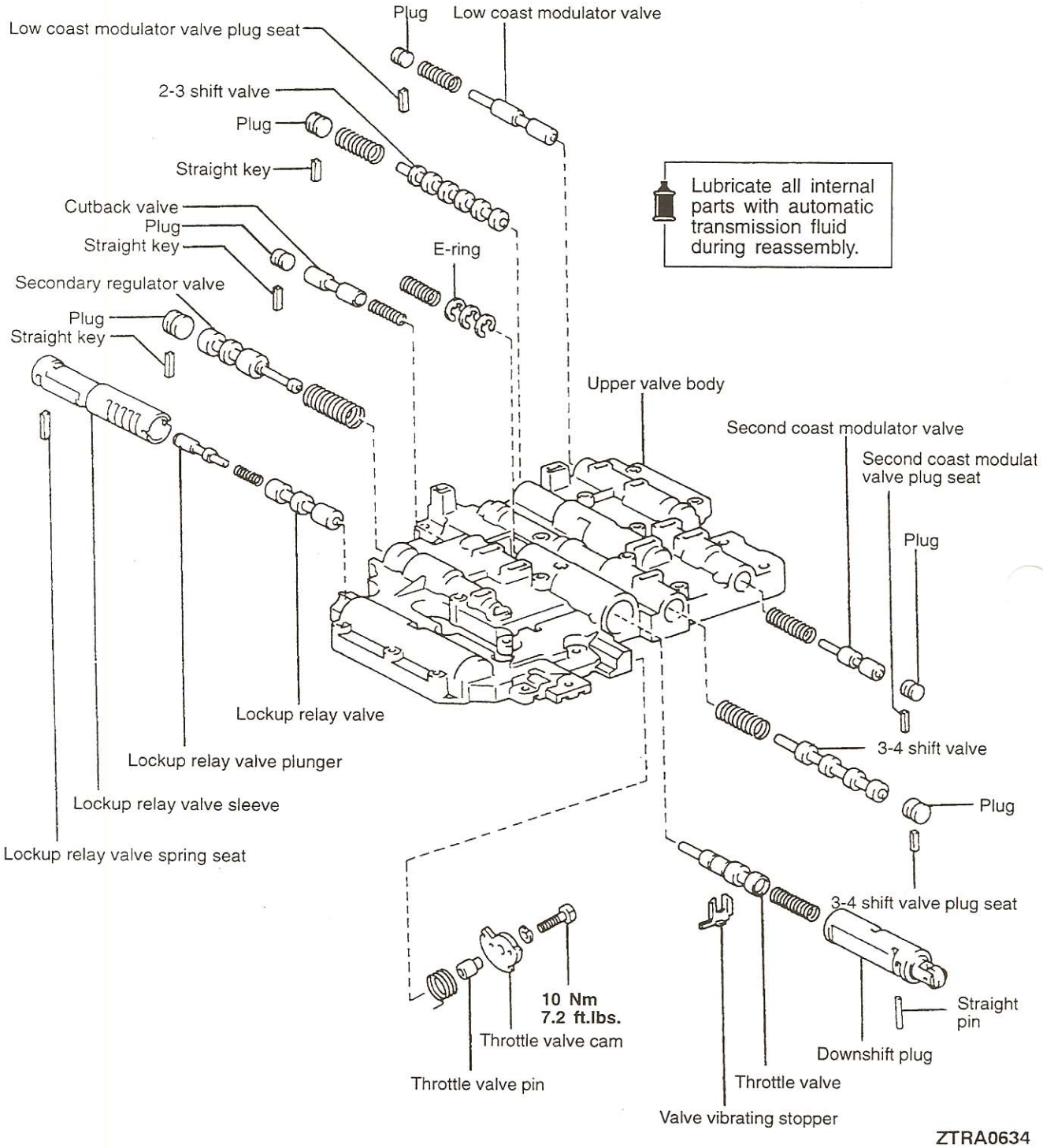
(10) Install the manual valve to the lower valve body.


ZTRA0619

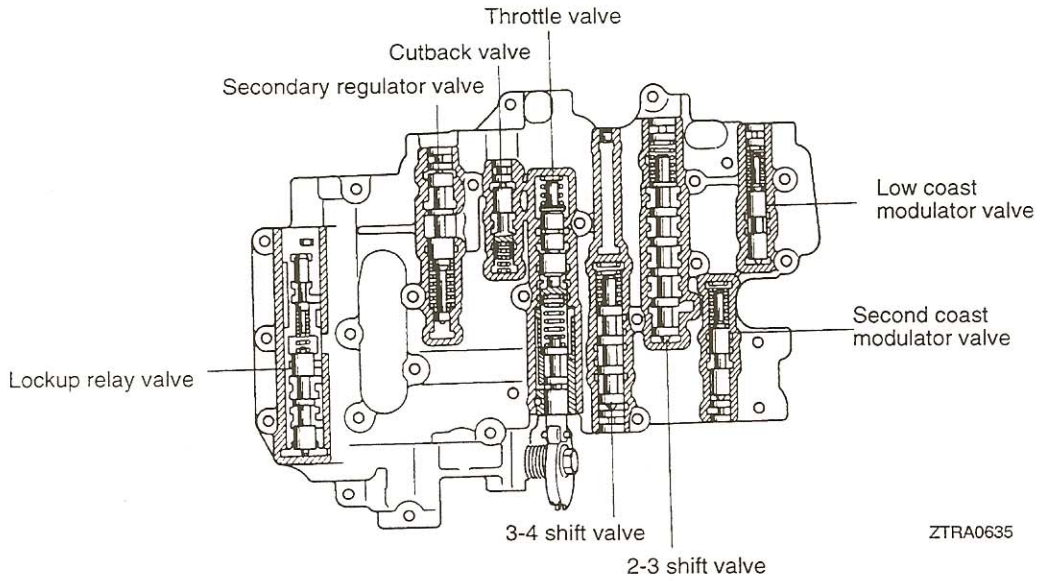
(11) Install the detent spring and cover by tightening the bolt.

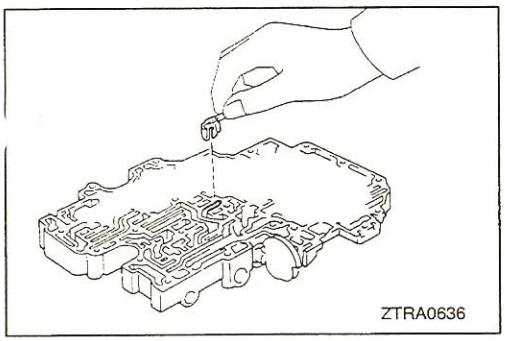
UPPER VALVE BODY

DISASSEMBLY AND REASSEMBLY



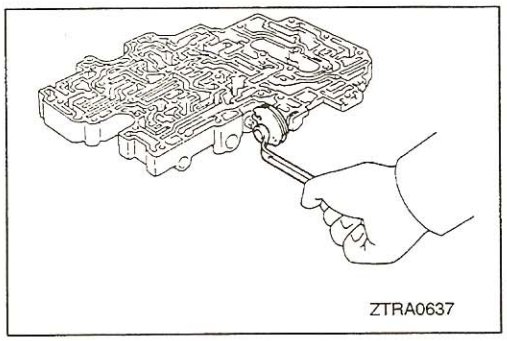
TSB Revision



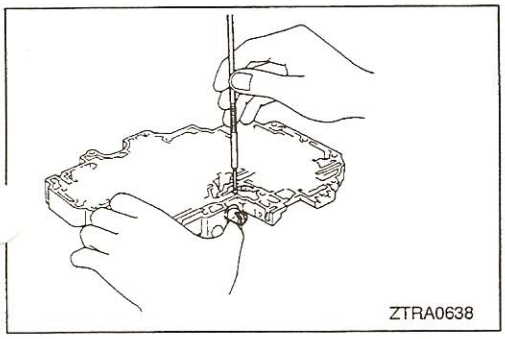


DISASSEMBLY

(1) Remove the valve vibrating stopper.

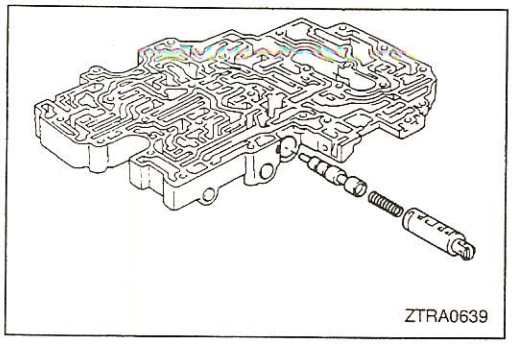


(2) Remove the bolt and washer and then the throttle valve cam, pin and spring.

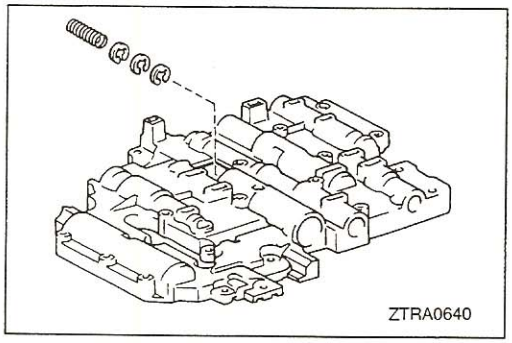


(3) While pushing the downshift plug with a finger, use a magnet to remove the pin.

TSB Revision

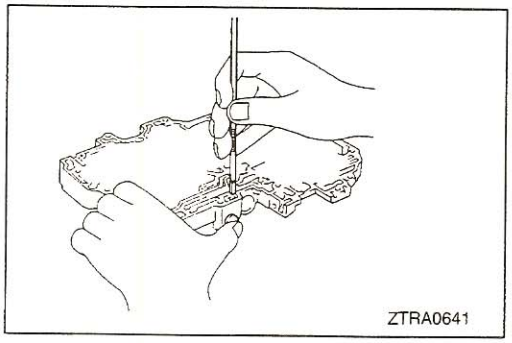

ZTRA0639

(4) Remove the downshift plug, spring and throttle valve.

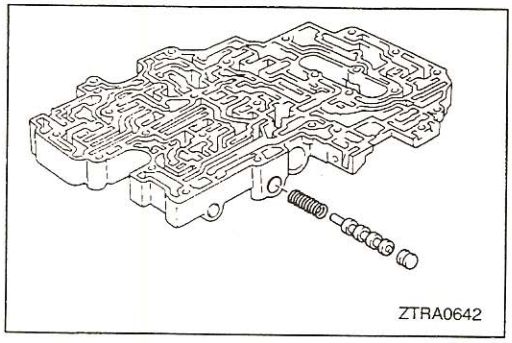

ZTRA0640

(5) Remove the spring and E-rings from the rear of the valve body.

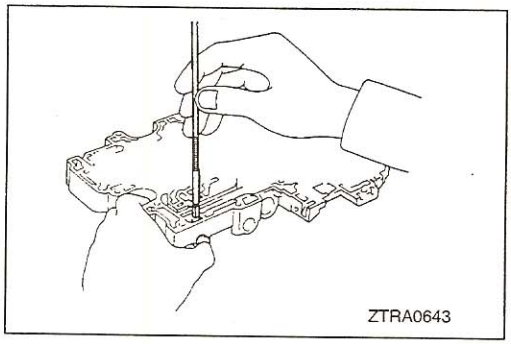
Caution
Because the throttle pressure changes depending on the number of E-rings, remember how many E-rings have been used (sometimes zero).


ZTRA0641

(6) While pushing the plug with a finger, use a magnet to remove the seat.

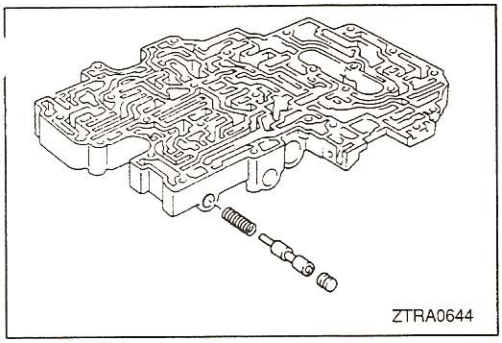

ZTRA0642

(7) Remove the plug, 3-4 shift valve and spring.

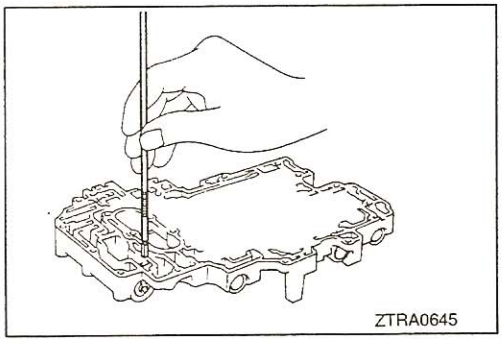

ZTRA0643

(8) While pushing the plug with a finger, use a magnet to remove the seat.

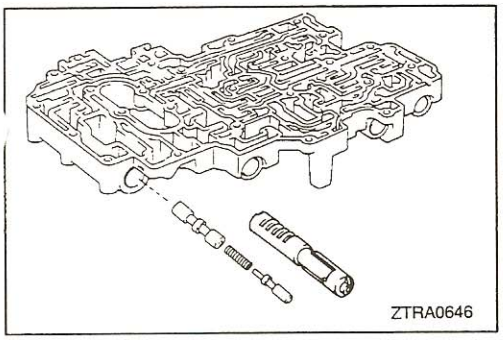
TSB Revision


ZTRA0644

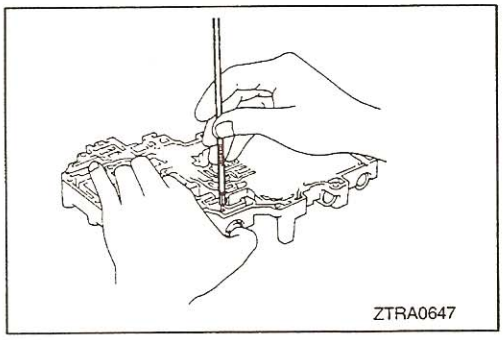
(9) Remove the plug, second coast modulator valve and spring.


ZTRA0645

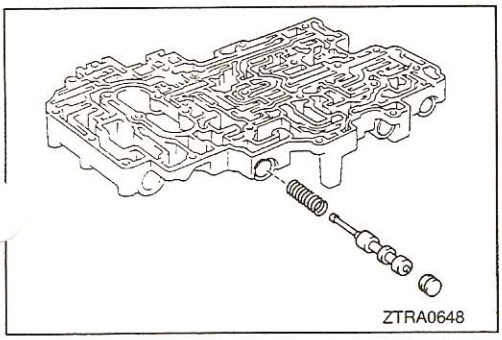
(10) Using a magnet, remove the seat.


ZTRA0646

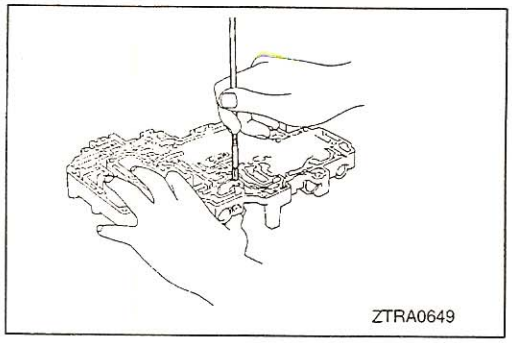
(11) Remove the lockup relay valve sleeve, lockup relay plunger, spring and lockup relay valve together.
(12) Remove the lockup relay valve, spring and lockup relay valve plunger from the lockup relay valve sleeve.


ZTRA0647

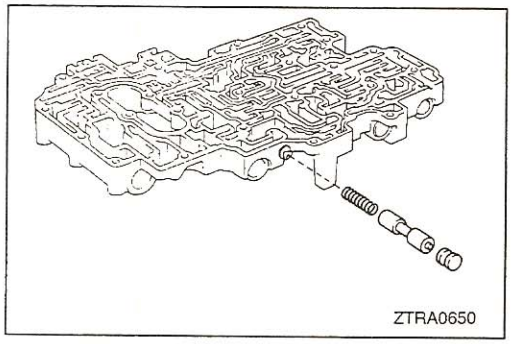
(13) While pushing the plug with a finger, use a magnet to remove the key.


ZTRA0648

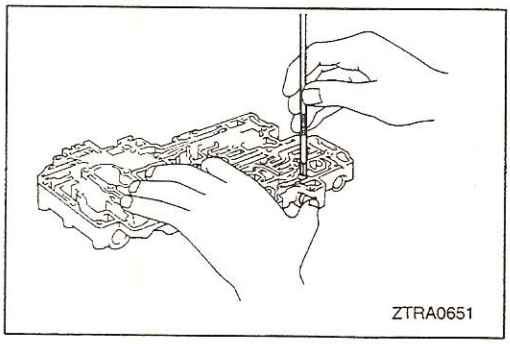
(14) Remove the plug, second regulator valve and spring.


ZTRA0649

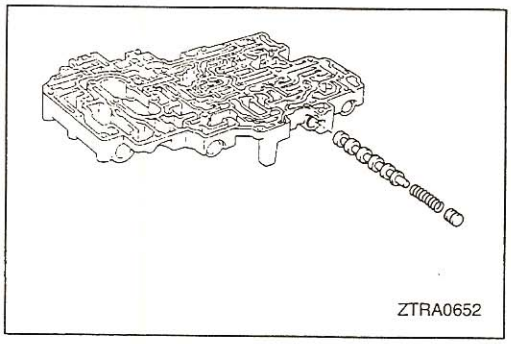
(15)While pushing the plug with a finger, use a magnet to remove the key.


ZTRA0650

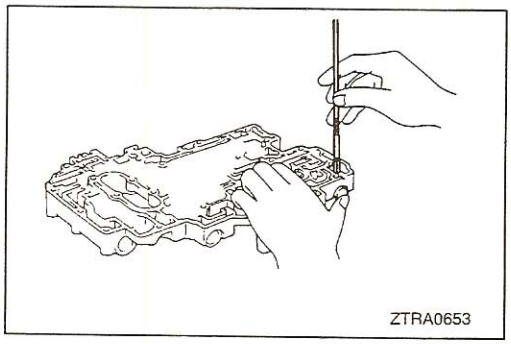
(16)Remove the plug, cutback valve and spring.


ZTRA0651

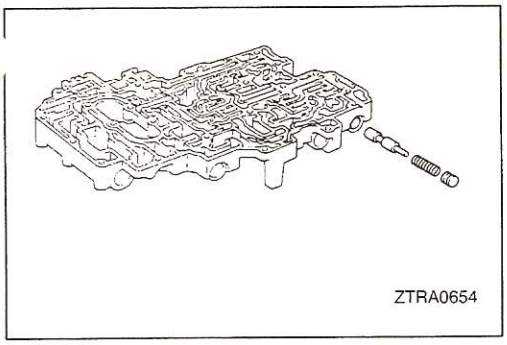
(17)While pushing the plug with a finger, use a magnet to remove the key.


ZTRA0652

(18)Remove the plug, spring and 2-3 shift valve.

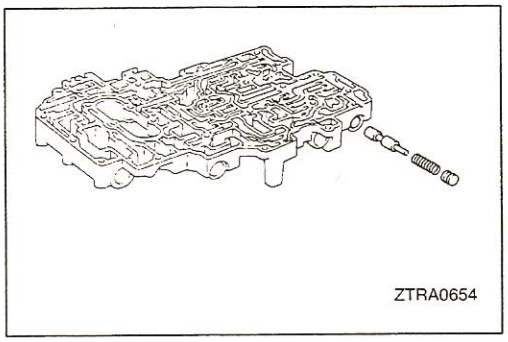

ZTRA0653

(19)While pushing the plug with a finger, use a magnet to remove the seat.

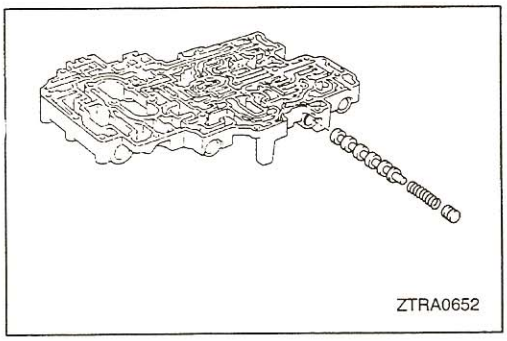

ZTRA0654

(20)Remove the plug, spring and low coast modulator valve.

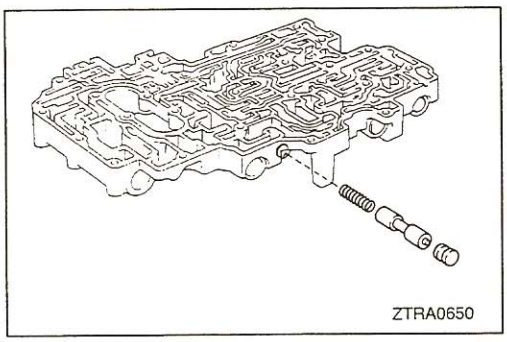
REASSEMBLY


ZTRA0654

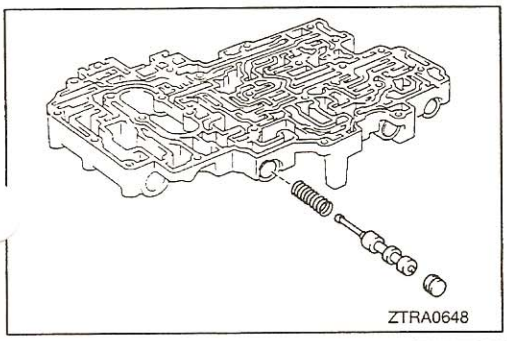
(1) Install the low coast modulator valve, spring and plug as illustrated.
(2) While pushing the plug with a finger, install the seat.


ZTRA0652

(3) Install the 2-3 shift valve, spring and plug as illustrated.
(4) While pushing the plug with a finger, install the key.

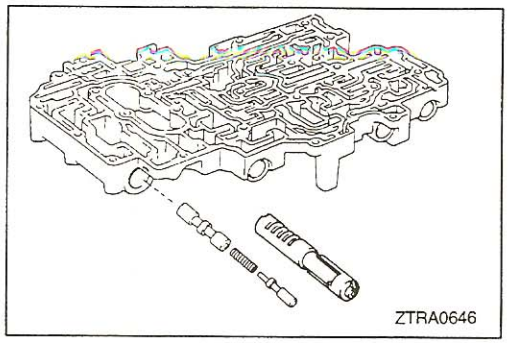

ZTRA0650

(5) Install the spring, cutback valve and plug as illustrated.
(6) While pushing the plug with a finger, install the key.

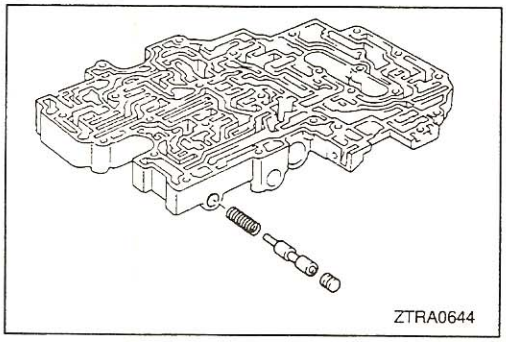

ZTRA0648

(7) Install the spring, secondary regulator valve and plug as illustrated.
(8) While pushing the plug with a finger, install the key.

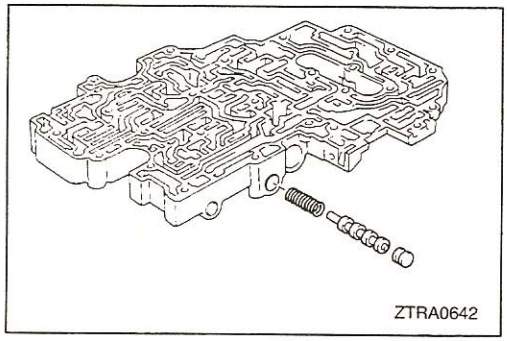
TSB Revision



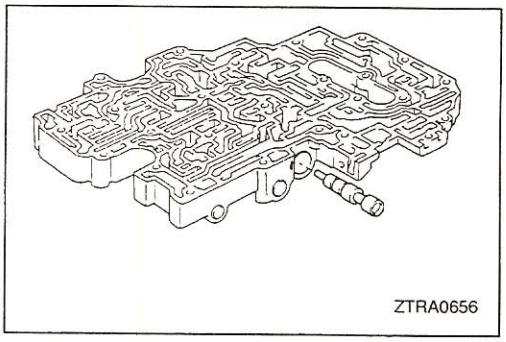
(9) Install the lockup relay valve plunger and spring to the lockup relay valve sleeve as illustrated.
(10) Install the lockup relay valve to the lockup relay valve sleeve.
(11) Install the lockup relay valve sleeve, lockup relay valve, spring, and lockup relay valve plunger together as illustrated.
(12) Install the seat.



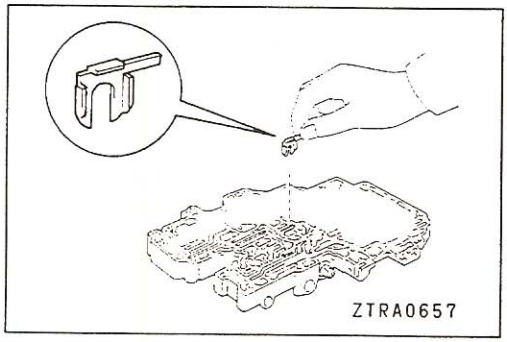
(13) Install the spring, second coast modulator valve and plug as illustrated.
(14) While pushing the plug with a finger, install the seat.



(15) Install the spring, 3-4 shift valve and plug as illustrated.
(16) While pushing the plug with a finger, install the seat.

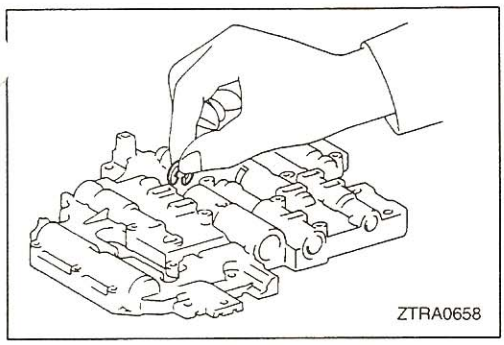


(17) Install the throttle valve to the valve body as illustrated.



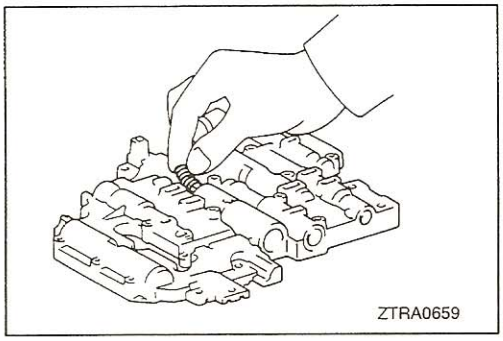
(18) Install the valve vibrating stopper in the illustrated position.

TSB Revision

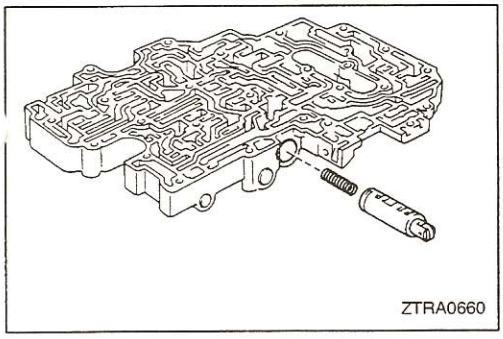

ZTRA0658

(19)With the valve vibrating stopper held with a finger, turn the valve body over. Install the E-rings to the throttle valve.

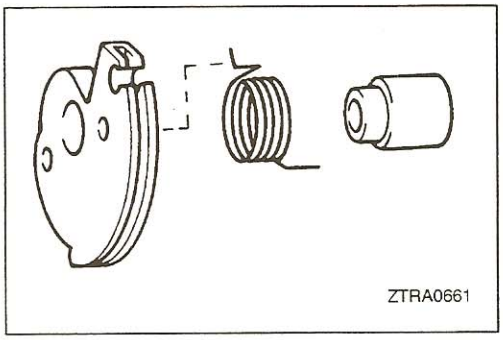
Caution
The number of E-rings to be installed must be equal to that of the E-rings which were removed.


ZTRA0659

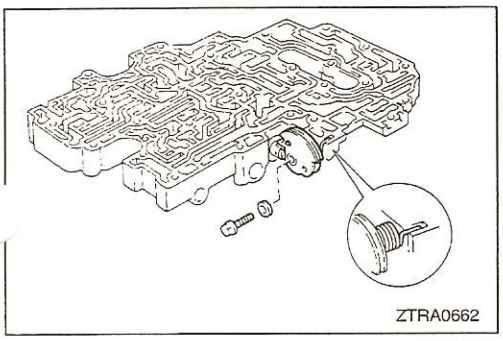
(20)Install the spring to the throttle valve.


ZTRA0660

(21)Turn the valve body over again. Install the spring and downshift valve as illustrated.
(22)While pushing the downshift valve with a finger, install the pin.

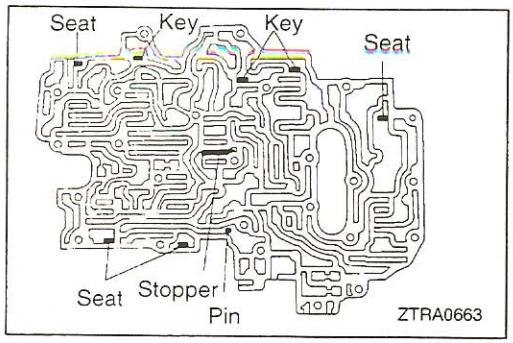

ZTRA0661

(23)Install the spring and collar to the throttle valve cam.

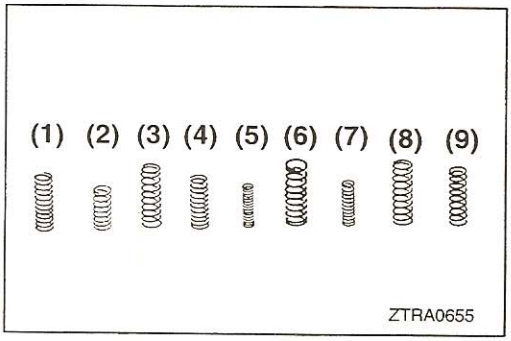

ZTRA0662

(24)Install the throttle valve cam to the valve body and check that the spring is anchored to the valve body by the claw.
(25)Tighten the bolt together with the washer.

TSB Revision



(26) Check that the one pin, four seats, three keys and one vibrating stopper are installed as illustrated.



INSPECTION

23301280028

VALVE SPRING

(1) Check the free height and outside diameter of each spring.

Standard value

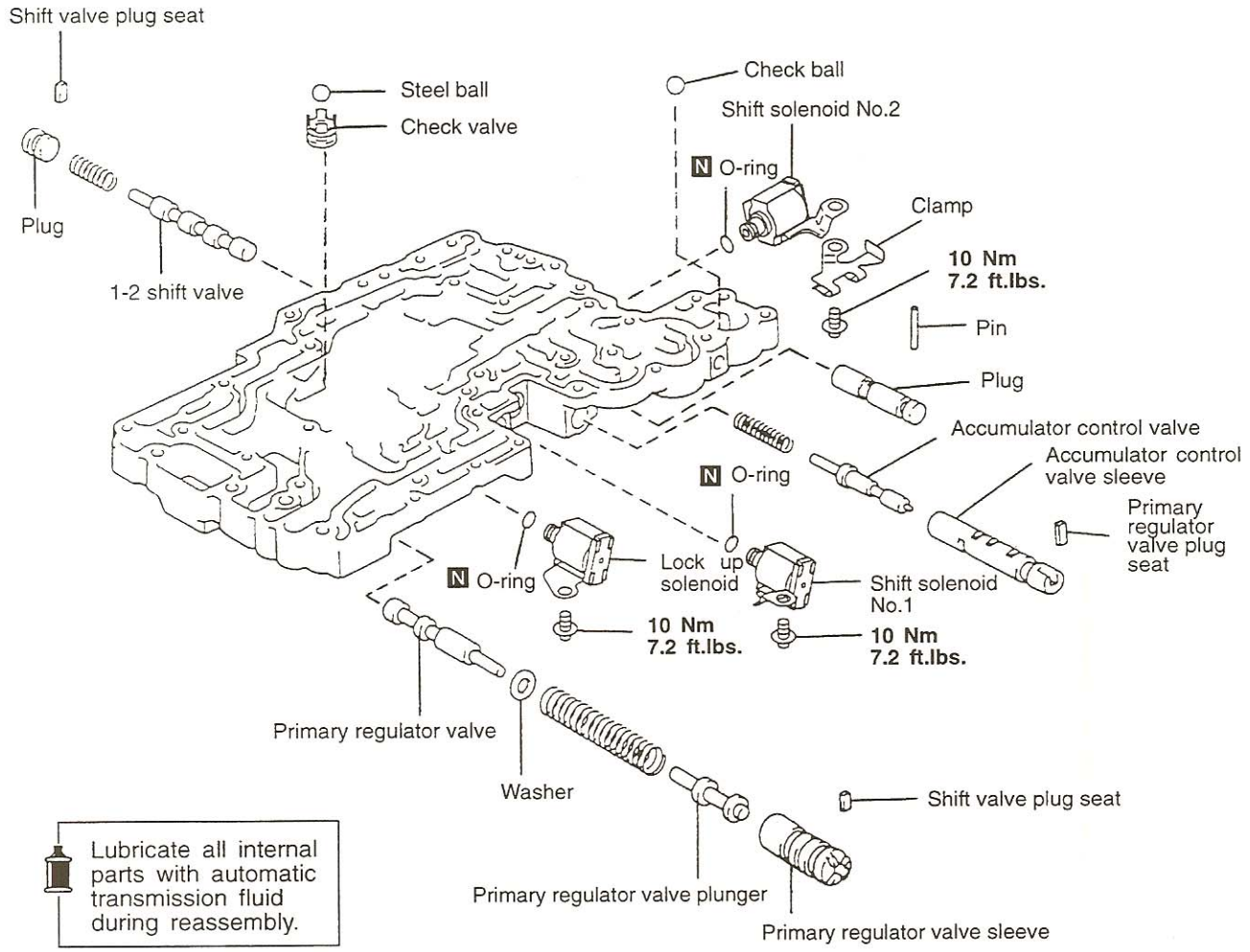
Place	Free height	Outside diameter	Number of loops	Wire diameter
(1) Downshift plug	27.3 (1.075)	8.7 (.343)	10.5	1.0 (.039)
(2) Throttle valve	20.6 (.811)	9.2 (.362)	7.5	0.7 (.028)
(3) 3-4 shift valve	30.8 (1.213)	9.7 (.381)	8.5	0.9 (.035)
(4) Second coast modulator valve	30.9 (1.217)	8.6 (.339)	9.5	1.1 (.043)
(5) Lockup relay valve	21.4 (.843)	5.5 (.217)	15.5	0.6 (.024)
(6) Secondary regulator valve	30.9 (1.217)	11.2 (.441)	8.5	1.5 (.059)
(7) Cutback valve	21.8 (.858)	6.0 (.236)	11.5	0.6 (.024)
(8) 2-3 shift valve	30.8 (1.213)	9.7 (.381)	8.5	0.9 (.035)
(9) Low coast modulator valve	30.4 (1.197)	8.3 (.327)	8.5	0.8 (.031)

Unit of free height, outside diameter and wire diameter: mm (in.)

LOWER VALVE BODY

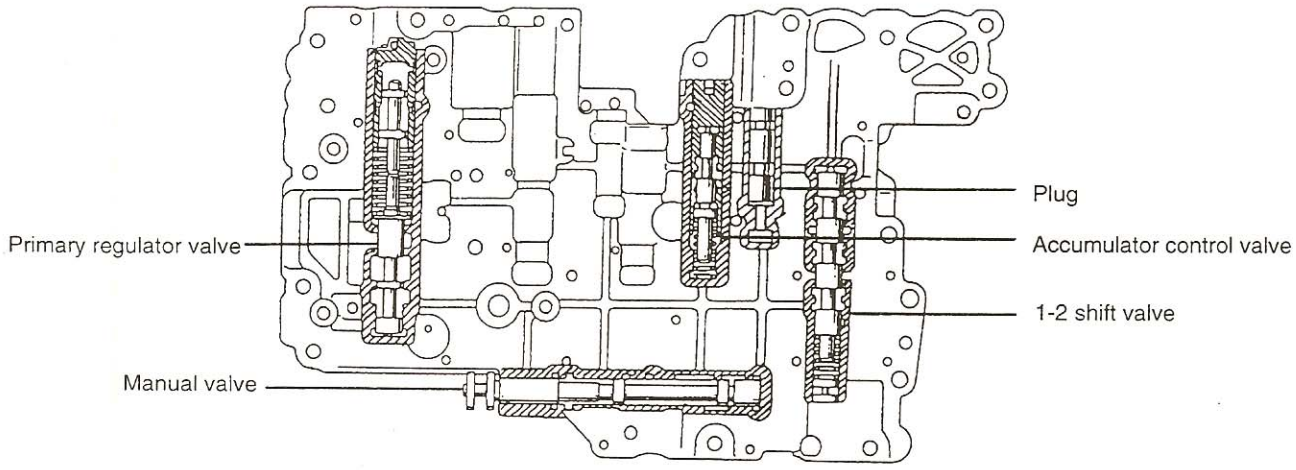
23301240033

DISASSEMBLY AND REASSEMBLY

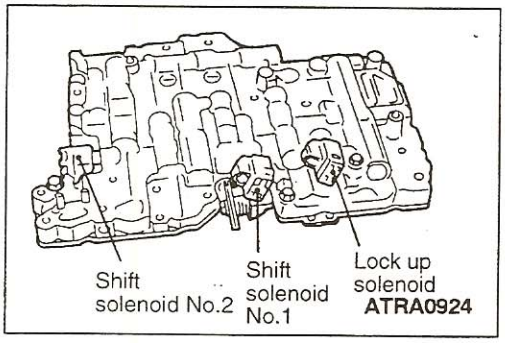


ATRA0923

TSB Revision



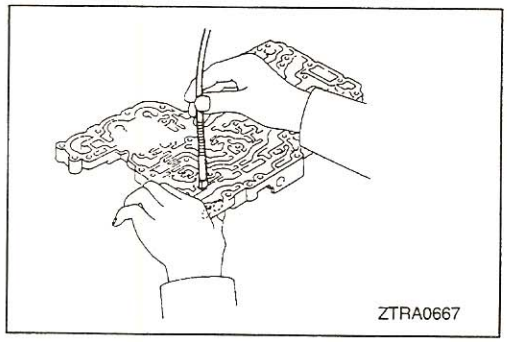
ATRA0925



ATRA0924

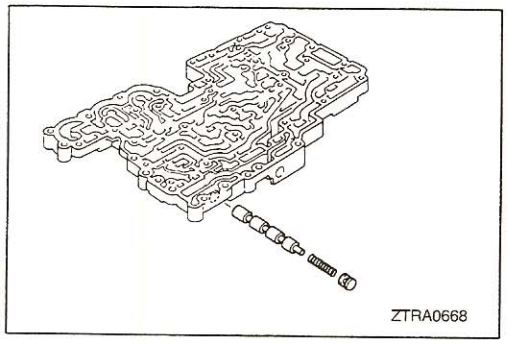
DISASSEMBLY

(1) Remove the steel ball and the check ball.
(2) Remove the check ball.
(3) Remove each bolt and then remove the shift solen No.1, No.2 and lock up solenoid.
(4) Remove the O-ring from each solenoid.



ZTRA0667

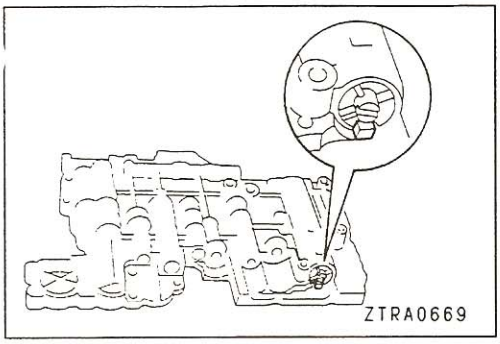
(5) While pushing the plug with a finger, use a magnet to remove the seat.



ZTRA0668

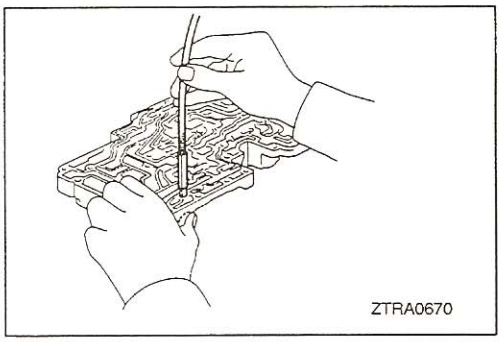
(6) Remove the plug, spring and 1-2 shift valve.

TSB Revision

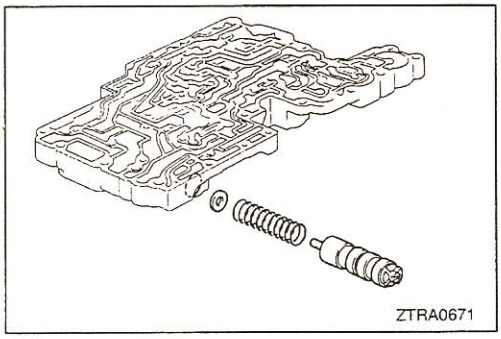


(7) Examine which groove of the primary regulator valve sleeve engages with the seat.

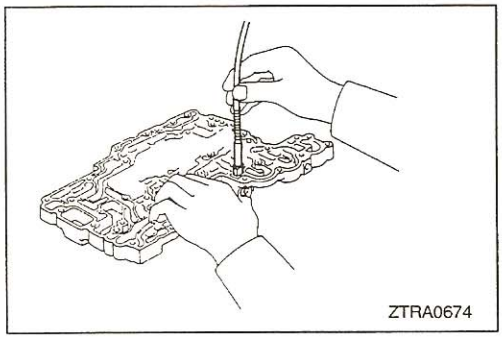
Caution
Because this has influence on the line pressure, make a note of it.



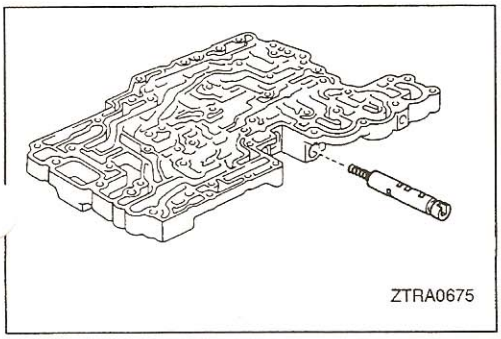
(8) While pushing the sleeve with a finger, use a magnet to remove the seat.



(9) Remove the primary regulator valve sleeve and primary regulator valve plunger together and then remove the spring, washer and primary regulator valve.
(10) Remove the primary regulator valve plunger from the primary regulator valve sleeve.

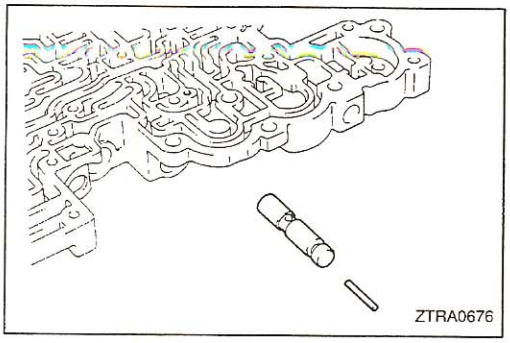


(11) While pushing the sleeve with a finger, use a magnet to remove the seat.

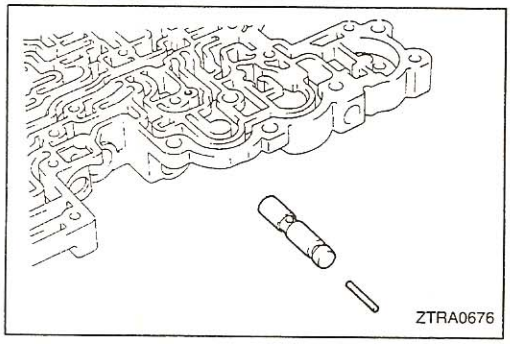


(12) Remove the accumulator control valve sleeve, accumulator control valve and spring together.
(13) Remove the spring and accumulator control valve from the accumulator control valve sleeve.

TSB Revision

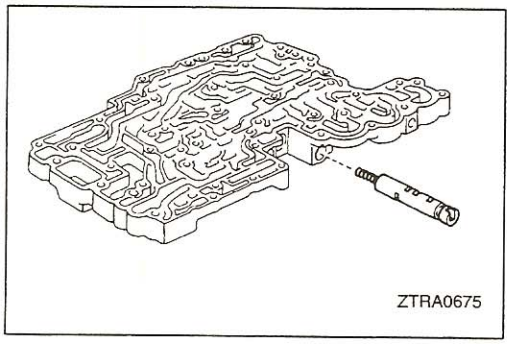


(14)Using a magnet, remove the pin.
(15)Remove the plug.

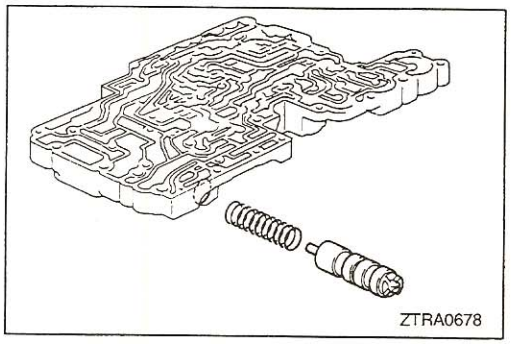


REASSEMBLY

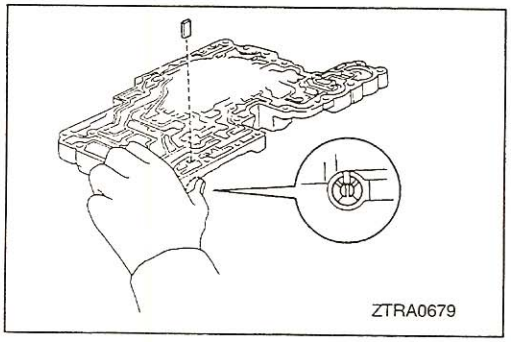
(1) Install the plug as illustrated.
(2) Install the pin.



(3) Install the accumulator control valve and spring to the accumulator control valve sleeve as illustrated.
(4) Install the accumulator control valve sleeve, accumulator control valve and spring together.
(5) While pushing the accumulator control valve sleeve w a finger, install the seat.



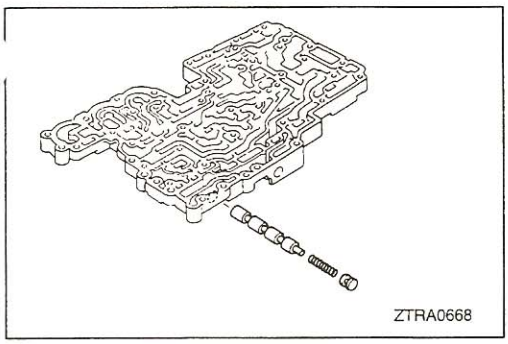
(6) Install the washer to the primary regulator valve.
(7) Install the washer and primary regulator valve together.
(8) Install the primary regulator valve plunger to the pressure regulator valve sleeve as illustrated.
(9) Install the spring, pressure regulator valve sleeve and primary regulator valve plunger together.



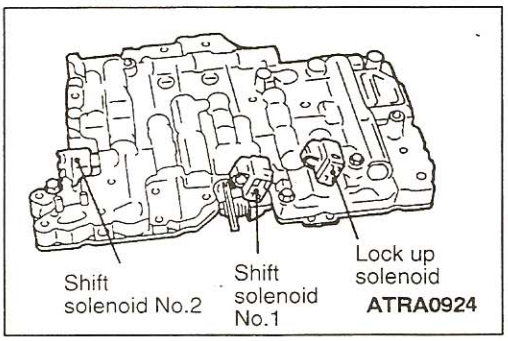
(10)While pushing the pressure regulator valve sleeve with a finger, install the seat.

Caution
The seat must engage with the same groove of the primary regulator valve sleeve as before.

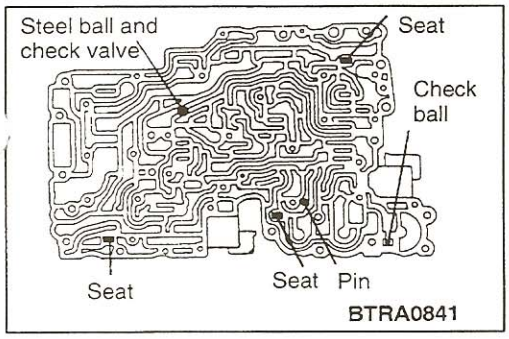
TSB Revision



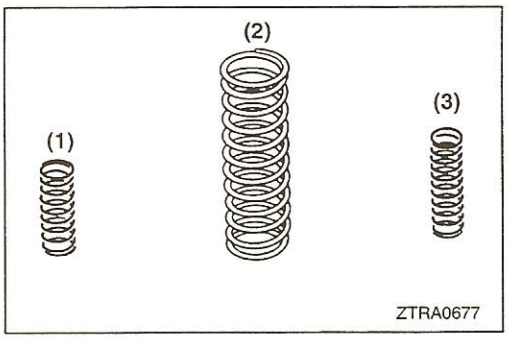
(11) Install the 1-2 shift valve, spring and plug as illustrated.
(12) While pushing the plug, install the seat.



(13) Apply ATF to three new O-rings and install them to the solenoids respectively.
(14) Put the shift solenoids No.1, No.2 and lock up solenoid as illustrated and tighten the bolts.



(15) Check that the three seats are installed as illustrated.
(16) Install the check ball.
(17) Install the steel ball and the check valve.



INSPECTION

23301250029

VALVE SPRING

(1) Check the free height and outside diameter of each spring.

Standard value

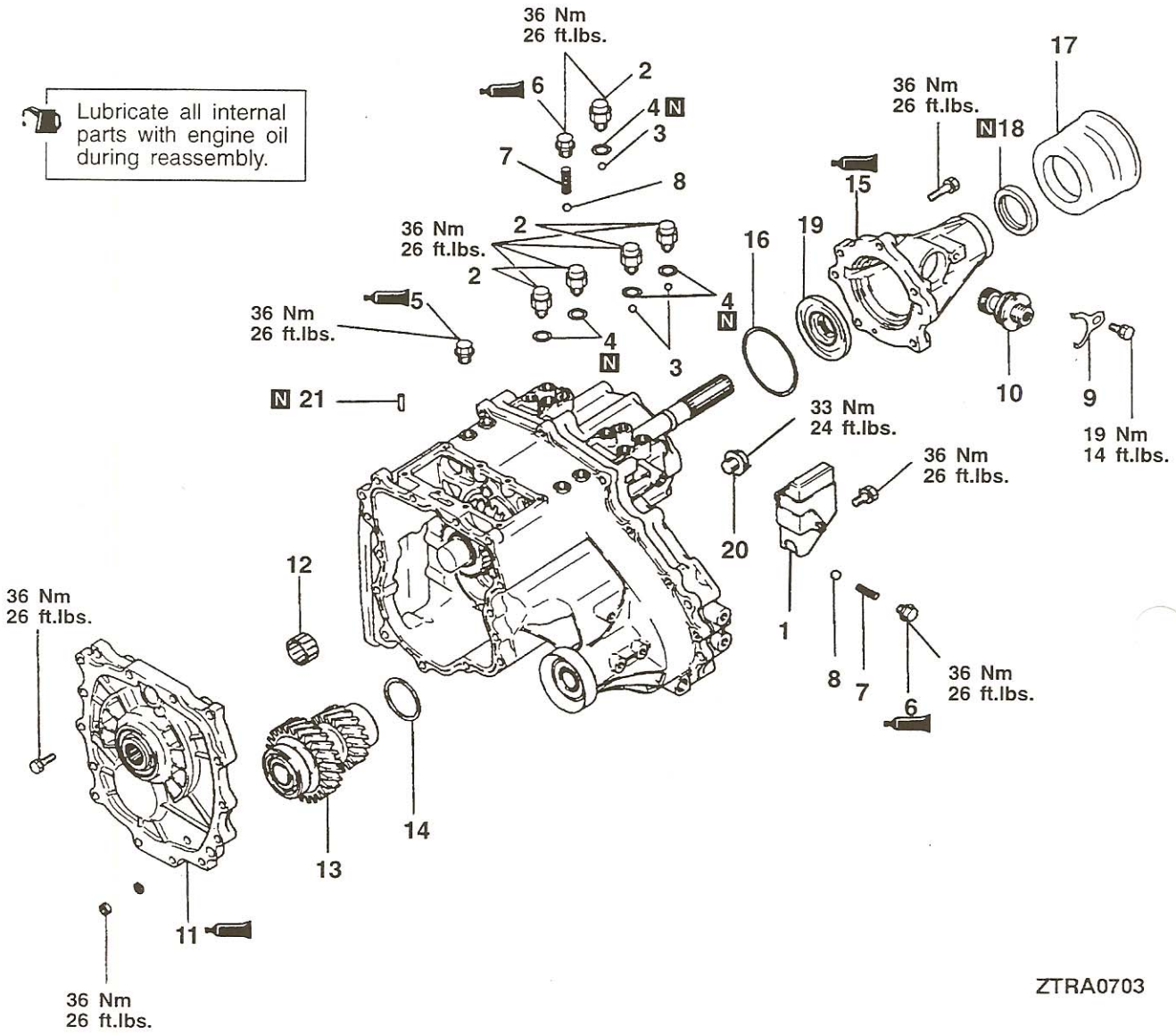
Place	Free height	Outside diameter	Number of loops	Wire diameter
(1) 1-2 shift valve	30.8 (1.213)	9.7 (.381)	8.5	0.9 (.035)
(2) primary regulator valve	62.3 (2.453)	18.6 (.732)	12.5	1.7 (.067)
(3) accumulator control valve	33.9 (1.335)	8.8 (.346)	10.0	0.8 (.031)

Unit of free height, outside diameter and wire diameter: mm (in.)

TSB Revision

TRANSFER

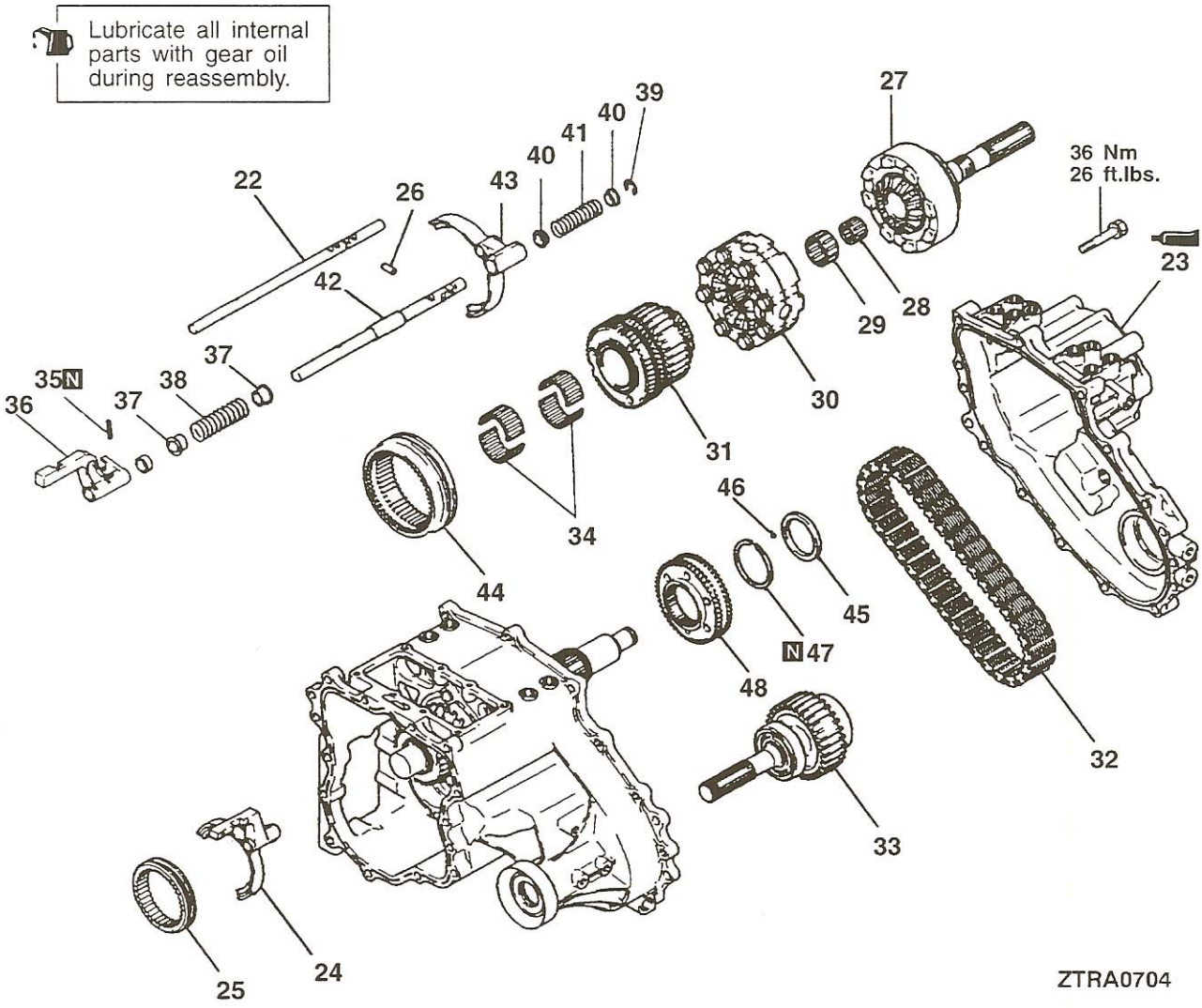
DISASSEMBLY AND REASSEMBLY



Disassembly steps

1. Dynamic damper
▶U◀ 2. Detection switch (5)
3. Steel ball
4. Gasket
▶T◀ 5. Plug (7)
▶S◀ 6. Poppet plug
▶R◀ 7. Poppet spring
8. Steel ball
9. Sleeve clamp
▶Q◀ 10. Speedometer gear assembly
▶P◀ 11. Transfer case plate
12. Needle bearing
13. Countershaft gear
▶O◀ 14. Spacer
▶N◀ 15. Rear cover
▶M◀ 16. Spacer
17. Dust seal guard
▶L◀ 18. Oil seal
▶K◀ 19. Oil seal
20. H-L shift rail plug
▶J◀ 21. Spring pin (H-L shift fork)

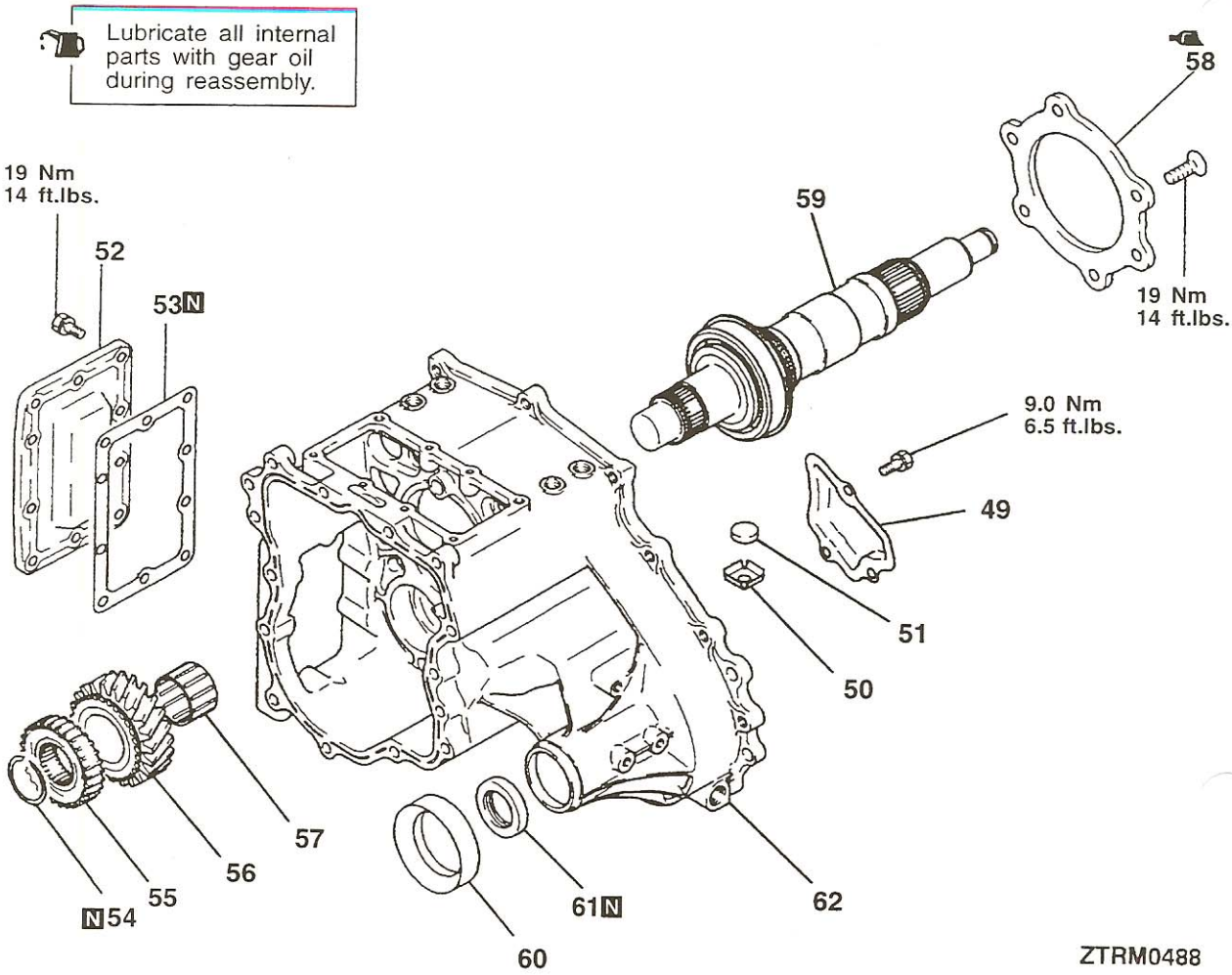
TSB Revision



Disassembly steps

- ◀A▶ ▶J◀ 22. H-L shift rail
- ◀A▶ ▶I◀ 23. Chain cover
- 24. H-L shift fork
- 25. H-L clutch sleeve
- ▶I◀ 26. Interlock plunger
- 27. Rear output shaft
- 28. Needle bearing
- 29. Needle bearing
- 30. Center differential case
- ◀B▶ ▶H◀ 31. 2-4WD synchronizer
- ◀B▶ ▶H◀ 32. Chain
- ◀B▶ ▶H◀ 33. Front output shaft
- 34. Needle bearing
- ◀C▶ ▶G◀ 35. Spring pin (2-4WD shift lug)
- ▶G◀ 36. 2-4WD shift lug
- ▶G◀ 37. Spring seat
- ▶G◀ 38. Spring
- 39. E-ring
- 40. Spring seat
- 41. Spring
- ▶G◀ 42. 2-4WD shift rail
- 43. 2-4WD shift fork
- 44. 2-4WD synchronizer sleeve
- 45. Sleeve
- 46. Steel ball
- ▶F◀ 47. Snap ring
- 48. Differential lock hub

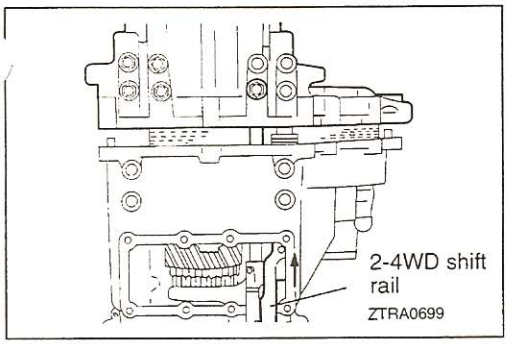
TSB Revision



Disassembly steps

- 49. Oil pool cover
- ▶E◀ 50. Magnet holder
- ▶E◀ 51. Magnet
- 52. Side cover
- 53. Side cover gasket
- ▶D◀ 54. Snap ring
- ▶C◀ 55. H-L clutch hub
- 56. Low speed gear
- 57. Needle bearing
- ▶B◀ 58. Rear bearing retainer
- 59. Transfer drive shaft
- 60. Dust seal guard
- ▶A◀ 61. Oil seal
- 62. Transfer case

TSB Revision



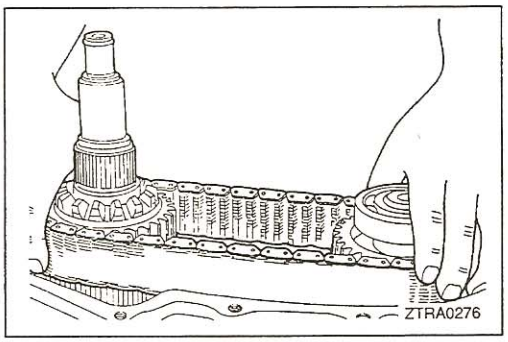
DISASSEMBLY SERVICE POINTS

◀A▶ H-L SHIFT RAIL / CHAIN COVER REMOVAL

(1) Fix the H-L shift rail at the High side.
(2) Place the 2-4WD shift rail at the AWD position.

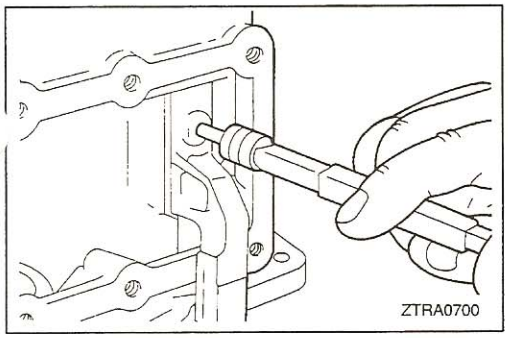
NOTE
If the 2-4WD shift rail is placed at the RWD position, the chain cover cannot be removed because of interlocking.

(3) Remove the chain cover and remove H-L shift rail.



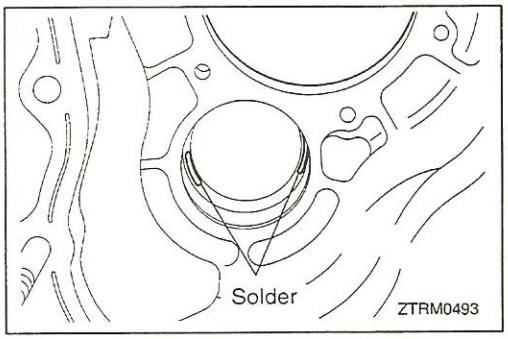
◀B▶ 2-4WD SYNCHRONIZER / CHAIN / FRONT OUTPUT SHAFT REMOVAL

(1) Remove the 2-4WD synchronizer, chain and front output shaft as a set.



◀C▶ SPRING PIN REMOVAL

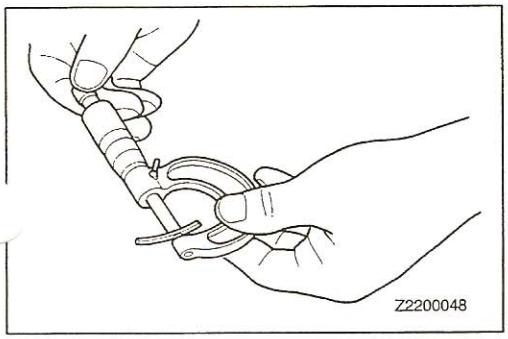
Caution
The spring may fly out.



ADJUSTMENT BEFORE REASSEMBLY

SPACER SELECTION FOR ADJUSTMENT OF COUNTERSHAFT GEAR END PLAY

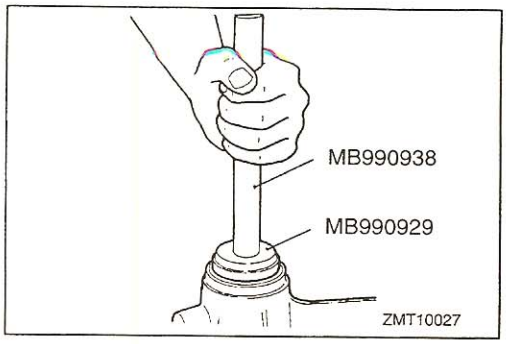
(1) Place a solder bar [about 10 mm (.39 in.) in length and 1.6 mm (.063 in.) in diameter] on the transfer case as illustrated.
(2) Install the countershaft gear and transfer case plate and tighten the bolts to the specified torque.
(3) If the solder is not deformed, repeat the steps (1) and (2) using a thicker solder bar.



(4) Using a micrometer, measure the thickness of the crushed solder bar. Based on the result, select a spacer which adjust the end play to the standard value shown below:

Standard value: 0 – 0.15 mm (0 – .0006 in.)

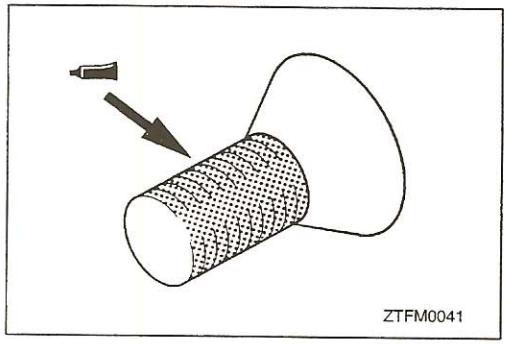
TSB Revision



REASSEMBLY SERVICE POINTS

▶A◀ OIL SEAL INSTALLATION

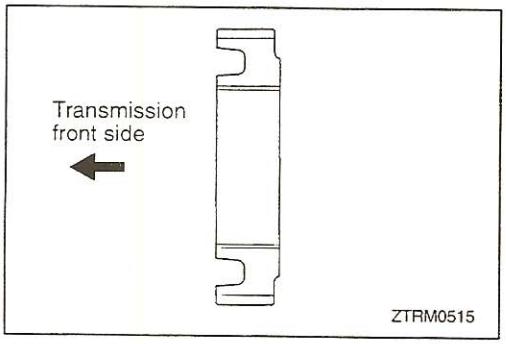
(1) Apply gear oil to the lip of the oil seal after press-fitting.



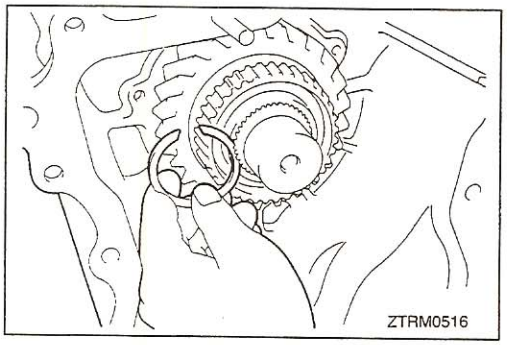
▶B◀ REAR BEARING RETAINER INSTALLATION

(1) The rear bearing retainer screw is a precoated screw. When it is to be reused, apply sealant beforehand.

Specified sealant:
3M STUD Locking No. 4170 or equivalent



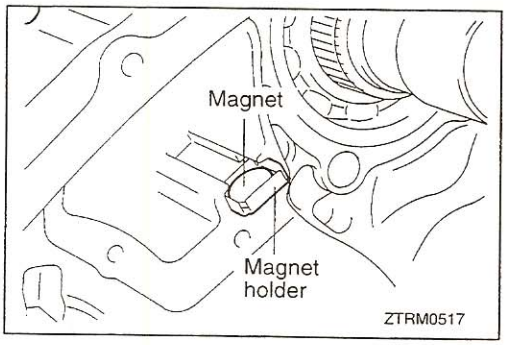
▶C◀ H-L CLUTCH HUB INSTALLATION



▶D◀ SNAP RING INSTALLATION

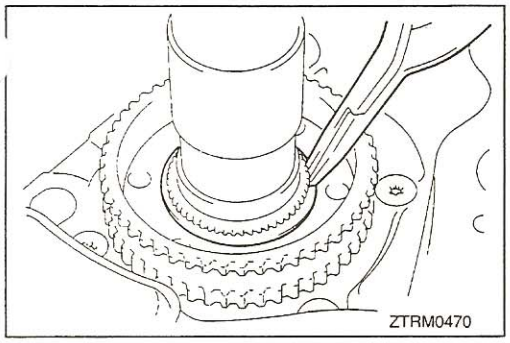
(1) Select and install the snap ring which adjusts the H-L clutch hub end play to the standard value.

Standard value: 0 – 0.08 mm (0 – .0031 in.)



▶E◀ MAGNET / MAGNET HOLDER INSTALLATION

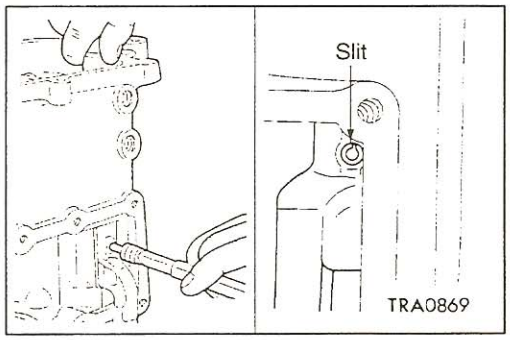
TSB Revision



▶F◀ SNAP RING INSTALLATION

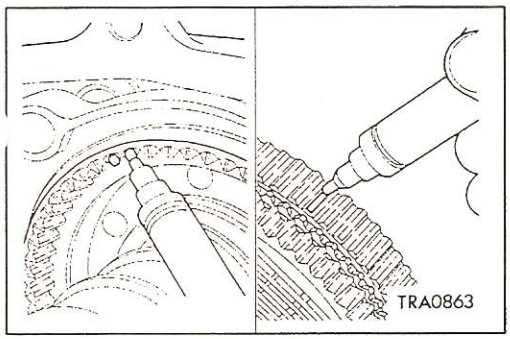
(1) Select a snap ring which adjusts the differential lock hub end play to the standard value shown below:

Standard value: 0 – 0.08 mm (0 – .0031 in.)



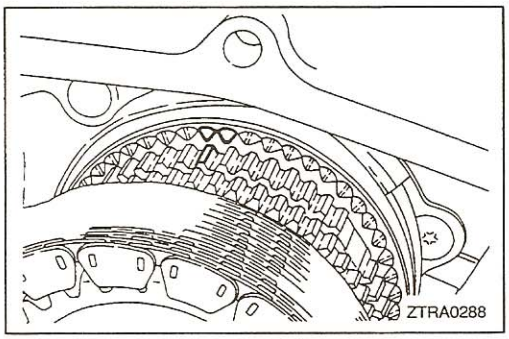
▶G◀ 2-4WD SHIFT RAIL / 2-4WD SHIFT LUG / SPRING SEAT / SPRING / SPRING PIN INSTALLATION

(1) Slide the spring seats and spring over the shift rail and set the shift lug in position in the transfer case.
(2) While paying attention to the direction of the shift rail, insert the shift rail in the shift lug and line up the shift lug and shift rail spring pin holes.
(3) While pressing the rail, install the spring pin in such a way that the slit of the spring pin will face the axial center of the shift rail.

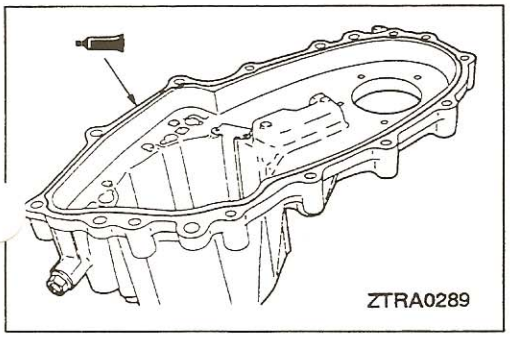


▶H◀ FRONT OUTPUT SHAFT / CHAIN / 2-4WD SYNCHRONIZER INSTALLATION

(1) Make a white paint mark on the deep groove portions (three places) of the 2-4WD synchronizer.
(2) Make a white paint mark on the projections (three places) of the 2-4WD synchronizer sleeve splines.



(3) Place the chain in tight mesh with the 2-4WD synchronizer and front output shaft sprockets.
(4) With both sprockets spaced the farthest apart, install them on the transfer case simultaneously.



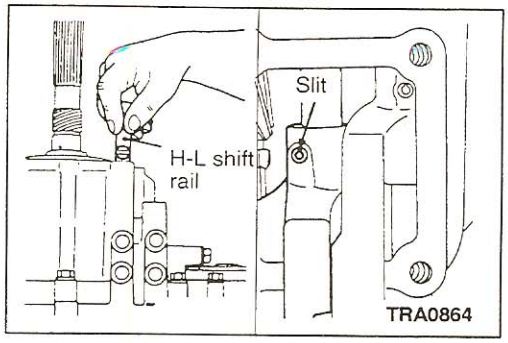
▶I◀ INTERLOCK PLUNGER / CHAIN COVER INSTALLATION

(1) Insert the interlock plunger into a position where it does not interfere with the 2-4WD shift rail.
(2) Apply a sealant to the illustrated position of the chain cover.

Specified sealant:
Mitsubishi genuine sealant Part No. MD997740 or equivalent

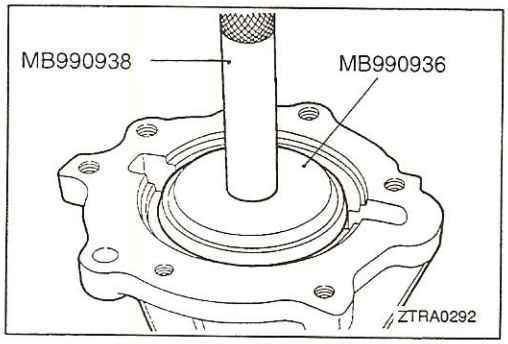
Caution
Squeeze the sealant out evenly to make sure that it is not broken or excessively supplied.

TSB Revision



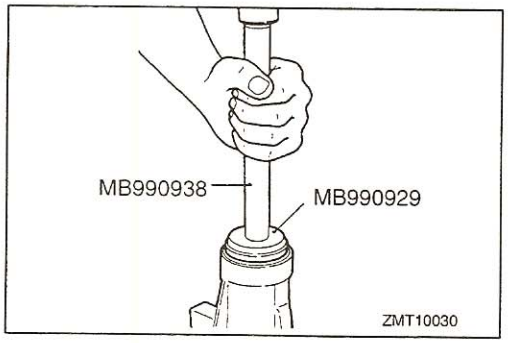
▶J◀ H-L SHIFT RAIL / SPRING PIN INSTALLATION

(1) Insert the H-L shift rail in the transfer case, while pa attention to its direction.
(2) Line up the shift rail and shift fork spring pin holes and install the spring pin so that the slit of the spring pin will face the axial center of the shift rail.



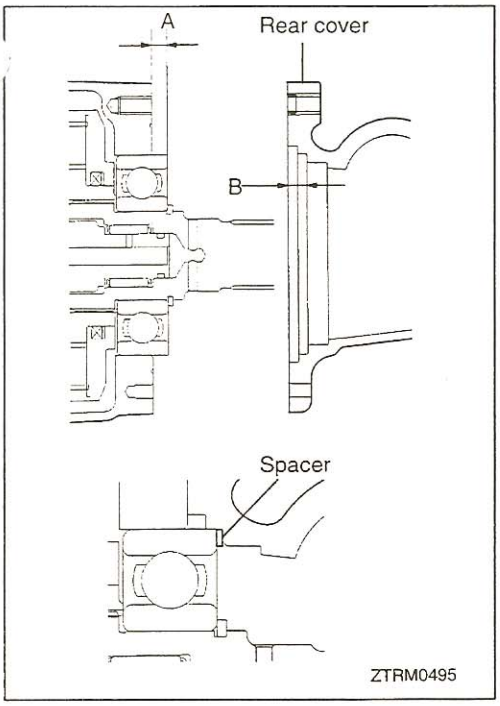
▶K◀ OIL SEAL INSTALLATION

(1) Apply gear oil to the lip of the oil seal after press-fitting.



▶L◀ OIL SEAL INSTALLATION

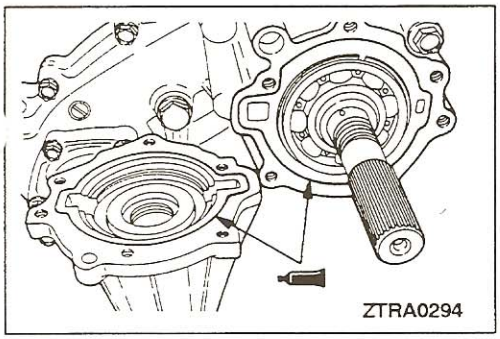
(1) Apply gear oil to the lip of the oil seal after press-fitting.



▶M◀SPACER INSTALLATION

(1) Measure projection "A" of the rear output shaft bearing and depth "B" to the second stage in the rear cover recess.
(2) Subtract A from B and let the answer be C. Subtract the thickness of the spacer from C, and select a spacer so that the subtracted value will be the standard value shown below.

Standard value:
0.025 – 0.150 mm (.00098 – .00591 in.)



▶N◀REAR COVER INSTALLATION

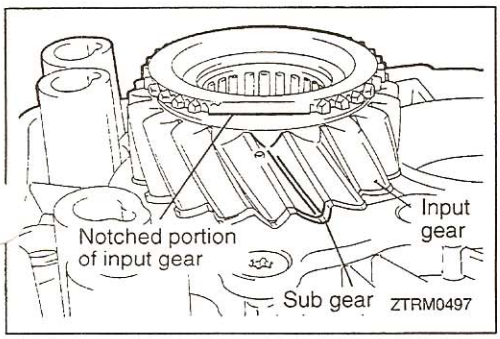
(1) Apply sealant to the rear cover as illustrated.

Specified sealant:
Mitsubishi genuine sealant Part No. MD997740 or equivalent

Caution
Squeeze the sealant out evenly to make sure that it is not broken or excessively supplied.

▶O◀SPACER INSTALLATION

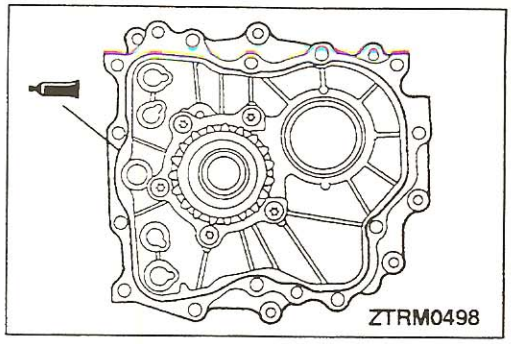
(1) Install the previously selected spacer (see "ADJUSTMENT BEFORE REASSEMBLY").



▶P◀TRANSFER CASE PLATE INSTALLATION

(1) Align one of the sub gear teeth with the notched tooth of the input gear.

TSB Revision



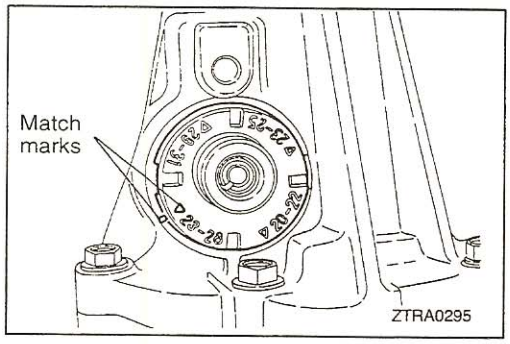
(2) Apply a bead of sealant to the transfer case plate as illustrated.

Specified sealant:
Mitsubishi genuine sealant Part No. MD997740 or equivalent

Caution
Squeeze the sealant out evenly to make sure that it is not broken or excessively supplied.

(3) Install the transfer case plate together with the input gear, while sliding the input gear tooth aligned in Step (1) along the tooth space of the countershaft cluster gear.

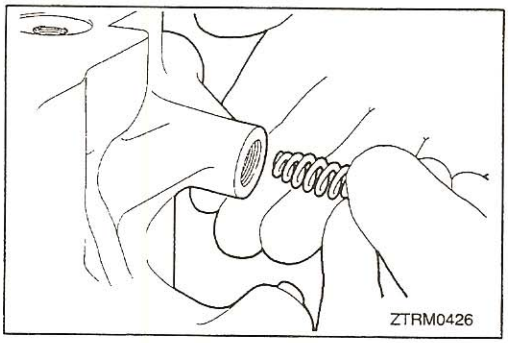
NOTE
The transfer case plate must be installed smoothly without hitch.



▶Q◀ SPEEDOMETER GEAR INSTALLATION

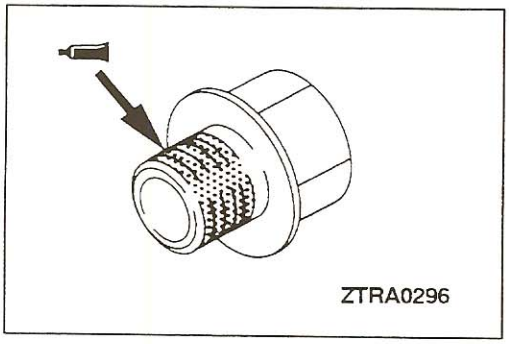
(1) Align the match marks according to the number of teeth.

Caution
The number marked on the sleeve is the number teeth of the driven gear.



▶R◀ POPPET SPRING INSTALLATION

(1) Install the spring with its tapered end oriented to the ball side.

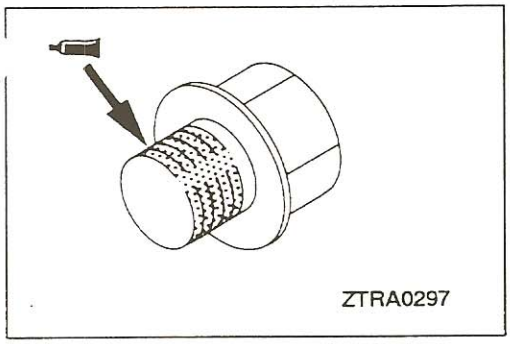


▶S◀ POPPET PLUG INSTALLATION

(1) The poppet plug is a precoated plug. When it is to be reused, apply sealant beforehand.

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

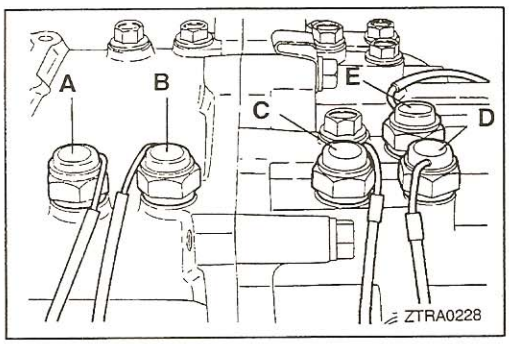
TSB Revision



▶T◀ PLUG INSTALLATION

(1) The plug is precoated. When it is to be reused, apply sealant beforehand.

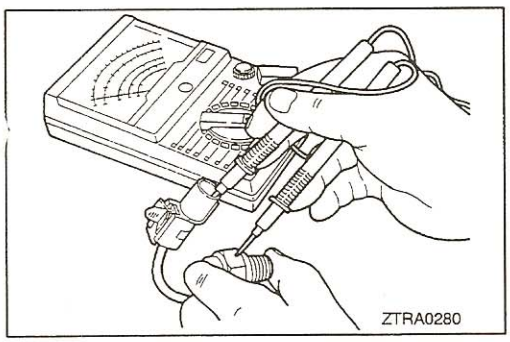
Specified sealant: 3M ATD Part No. 8660 or equivalent



▶U◀ DETECTION SWITCH INSTALLATION

(1) Mount detection switches in the right positions, while using care to prevent confusion.

A: Ball built in, connector brown
B: Ball built in, connector black
C: Ball separate, connector brown
D: Ball separate, connector black
E: Ball separate, connector white



INSPECTION

23301340023

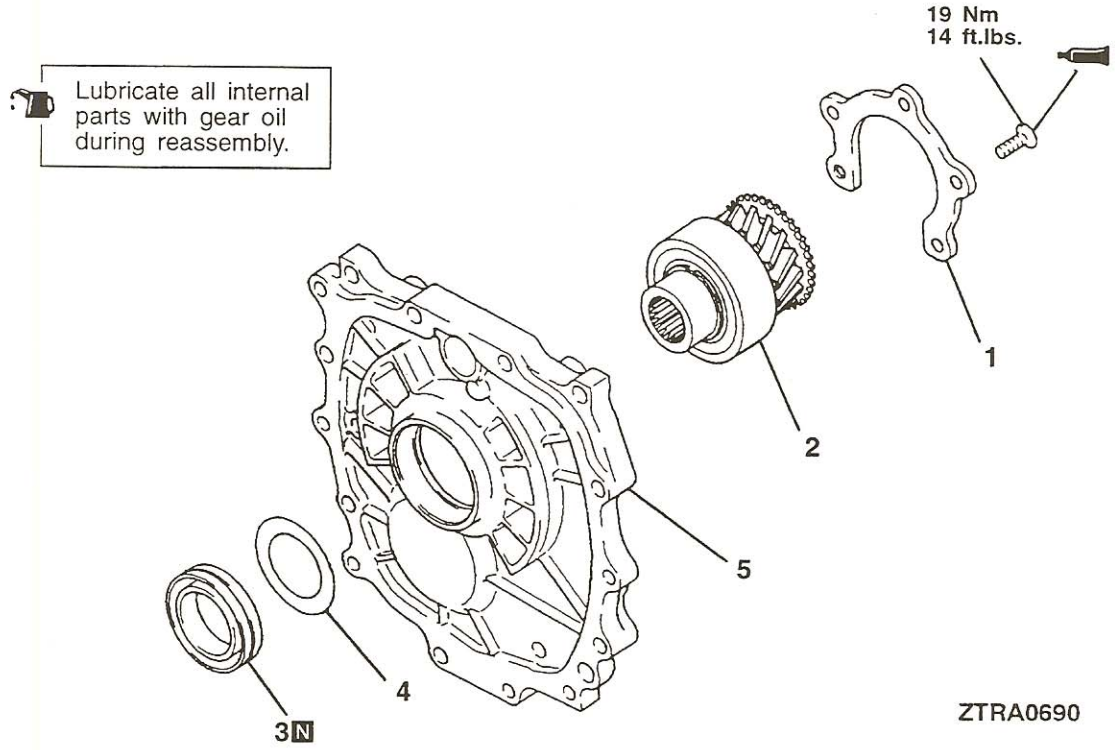
DETECTION SWITCH

(1) Check for continuity between the connector terminal and switch body.

Switch state	Continuity
Switch end pressed	No
Switch end released	Yes

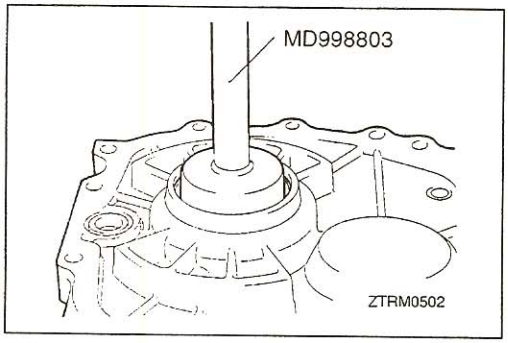
TRANSFER CASE PLATE

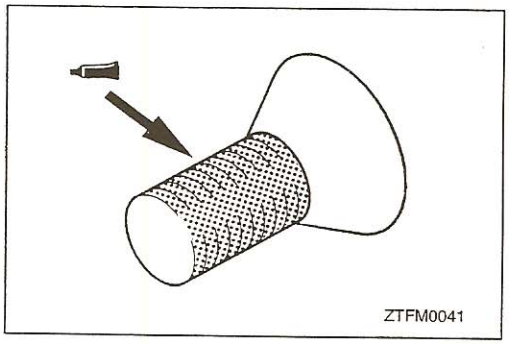
DISASSEMBLY AND REASSEMBLY



Disassembly steps

▶B◀ 1. Bearing retainer
2. Transfer input gear
▶A◀ 3. Oil seal
4. Baffle plate
5. Transfer case plate





REASSEMBLY SERVICE POINTS

▶A◀ OIL SEAL INSTALLATION

(1) After installing, apply gear oil to the lip of the oil seal.

▶B◀ BEARING RETAINER INSTALLATION

(1) The rear bearing retainer bolt is a precoated bolt. When it is to be reused, apply sealant beforehand.

Specified sealant:
Mitsubishi genuine sealant Part No. MD997740 or equivalent

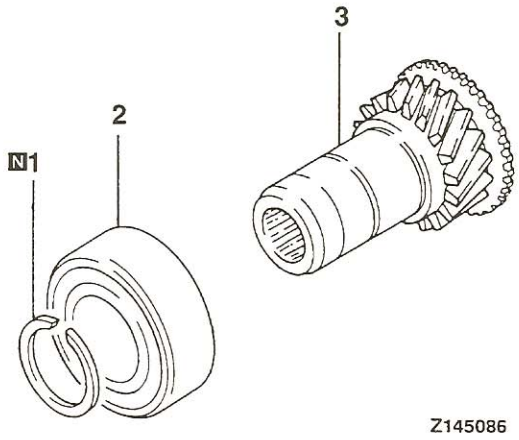
TSB Revision

TRANSFER INPUT GEAR

23301510028

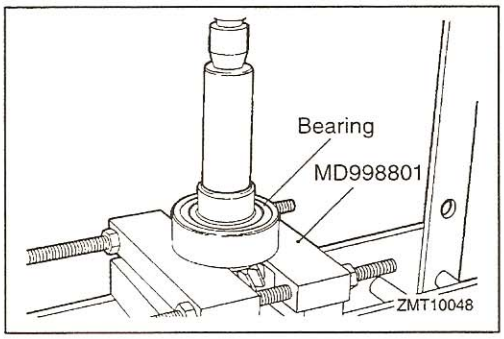
DISASSEMBLY AND REASSEMBLY

Lubricate all internal parts with gear oil during reassembly.



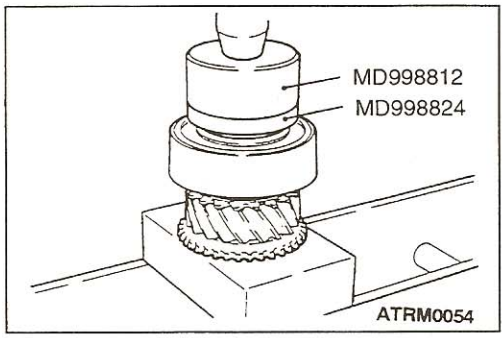
Disassembly steps

◀A▶ ▶B◀ 1. Snap ring
◀A▶ ▶A◀ 2. Ball bearing
3. Transfer input gear



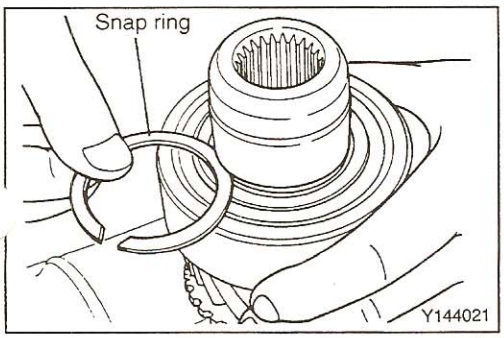
DISASSEMBLY SERVICE POINT

◀A▶ BALL BEARING REMOVAL



REASSEMBLY SERVICE POINTS

▶A◀ BALL BEARING INSTALLATION



▶B◀ SNAP RING INSTALLATION

(1) Select and install the snap ring which adjust the transfer input gear bearing end play to the standard value.

Standard value: 0 – 0.06 mm (0 – .0024 in.)

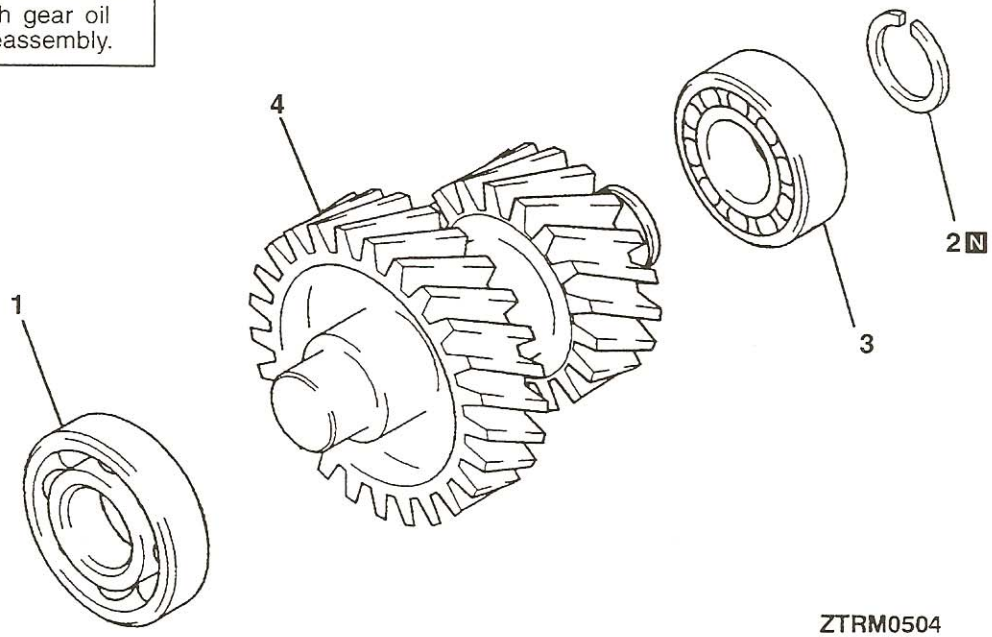
TSB Revision

COUNTERSHAFT GEAR

2330240

DISASSEMBLY AND REASSEMBLY

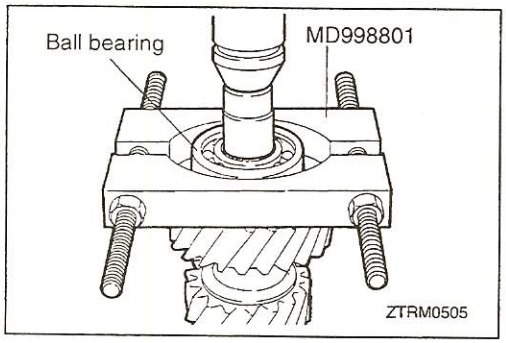
Lubricate all internal parts with gear oil during reassembly.



ZTRM0504

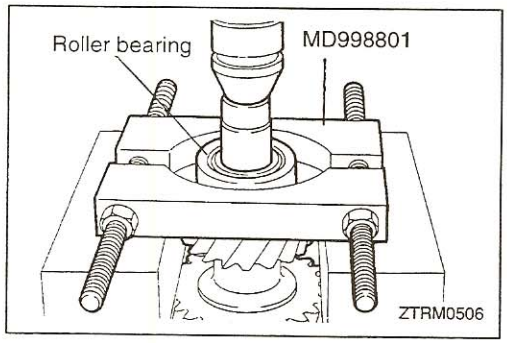
Disassembly steps

◀A▶ ▶C◀ 1. Ball bearing
▶B◀ 2. Snap ring
◀B▶ ▶A◀ 3. Roller bearing
4. Countershaft gear



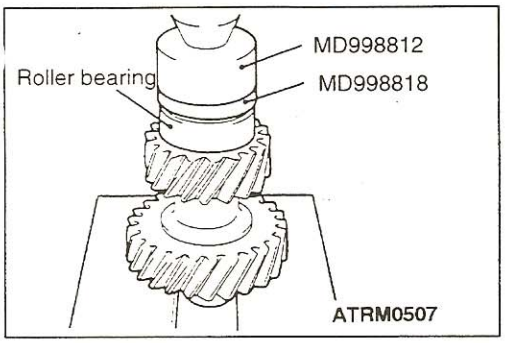
DISASSEMBLY SERVICE POINTS

◀A▶ BALL BEARING REMOVAL



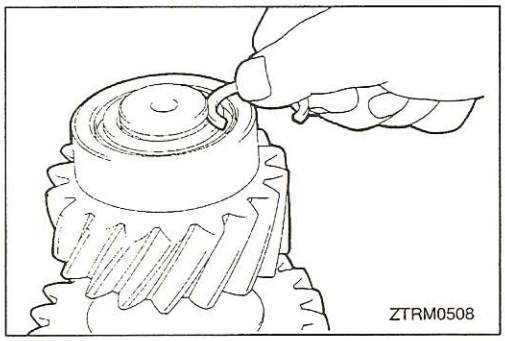
◀B▶ ROLLER BEARING REMOVAL

TSB Revision



REASSEMBLY SERVICE POINTS

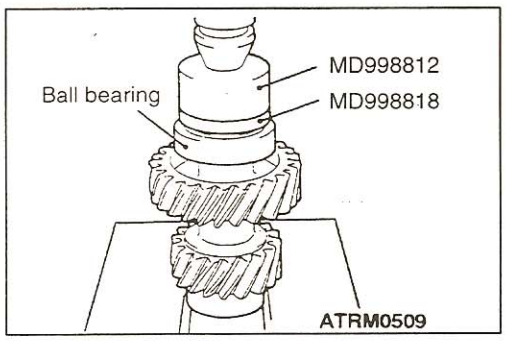
▶A◀ ROLLER BEARING INSTALLATION



▶B◀ SNAP RING INSTALLATION

(1) Select a snap ring that adjusts the end play of the countershaft gear roller bearing to the standard value shown below:

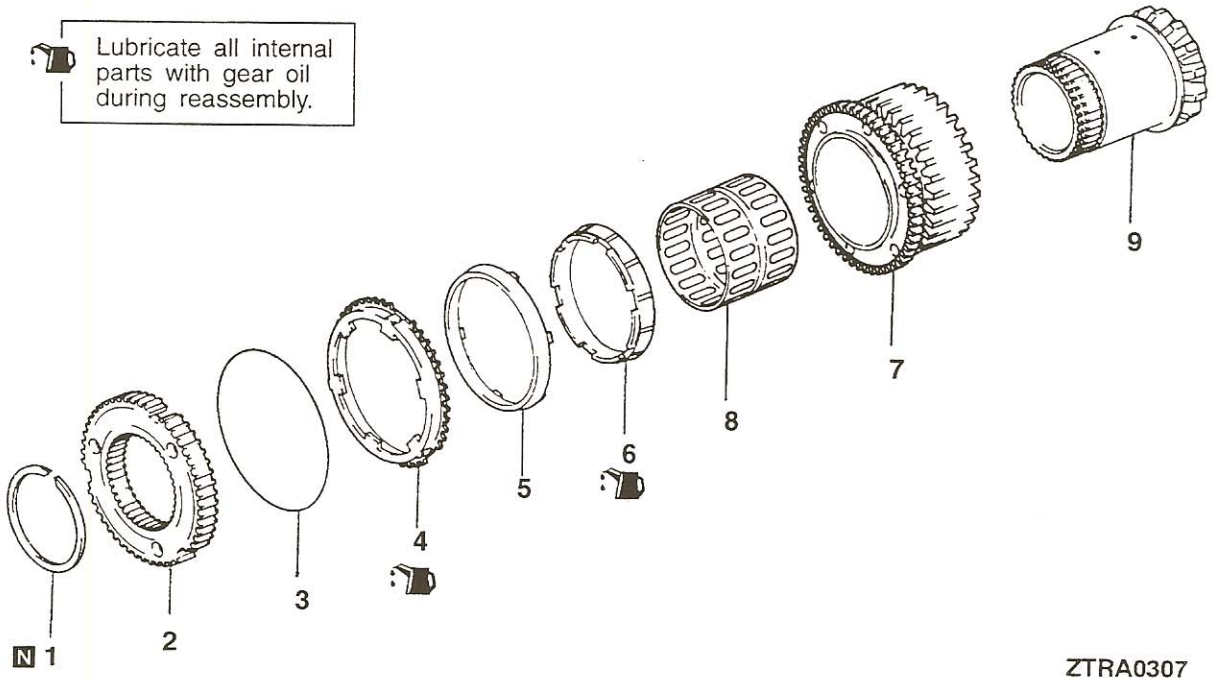
Standard value: 0 – 0.08 mm (0 – .0031 in.)



▶C◀ BALL BEARING INSTALLATION

2-4WD SYNCHRONIZER

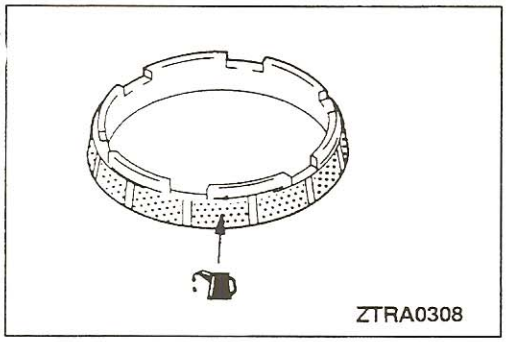
DISASSEMBLY AND REASSEMBLY



Disassembly steps

- ▶C◀ 1. Snap ring
- 2. 2-4WD synchronizer hub
- 3. Synchronizer spring
- ▶B◀ 4. Outer synchronizer ring
- 5. Synchronizer cone
- ▶A◀ 6. Inner synchronizer ring
- 7. Drive sprocket
- 8. Needle bearing
- 9. Front side gear

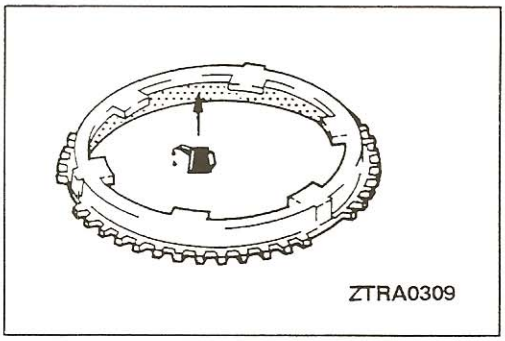
TSB Revision


ZTRA0308

REASSEMBLY SERVICE POINTS

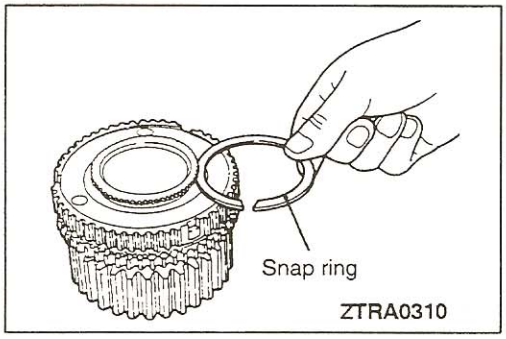
▶A◀ INNER SYNCHRONIZER RING INSTALLATION

(1) Apply gear oil to the synchronizer ring cone surface before installation.


ZTRA0309

▶B◀ OUTER SYNCHRONIZER RING INSTALLATION

(1) Apply gear oil to the synchronizer ring cone surface before installation.

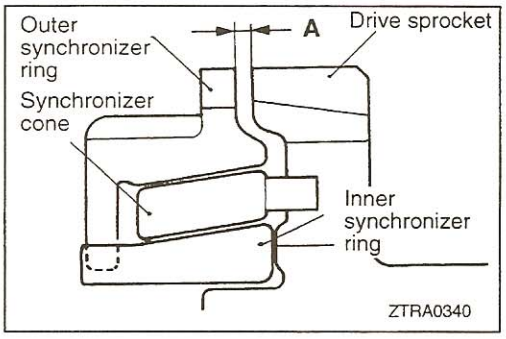


ZTRA0310

▶C◀ SNAP RING INSTALLATION

(1) Select and install the snap ring which adjusts the 2-4WD synchronizer hub end play to the standard value.

Standard value: 0 – 0.08 mm (0 – .0031 in.)



ZTRA0340

INSPECTION

23301430027

SYNCHRONIZER RING AND SYNCHRONIZER CONE

(1) Combine the inner and outer synchronizer rings and cone with the drive sprocket and measure the dimension A in the illustration. If the dimension A is less than the limit, replace them as a set.

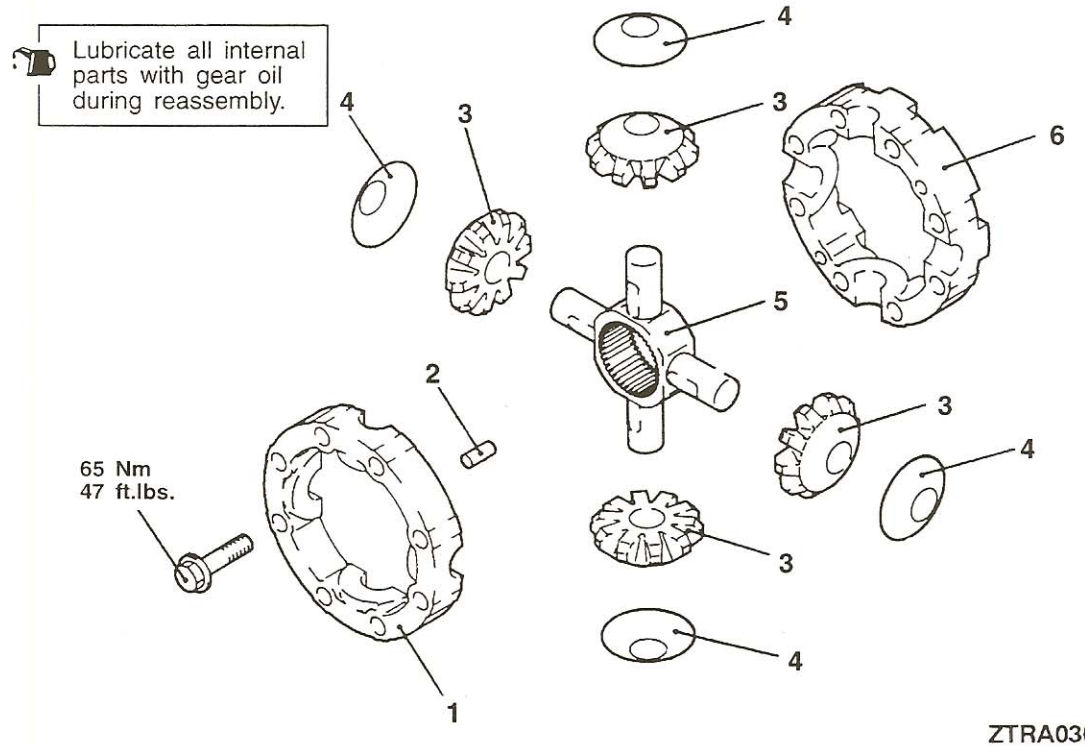
Limit: 0.3 mm (.012 in.)

NOTE

Scratches may be found on the cone surface in the rotating direction these are produced by the liners of the synchronizer rings and do not mean the malfunction. Therefore, the parts need not be replaced if the above-mentioned clearance is satisfied.

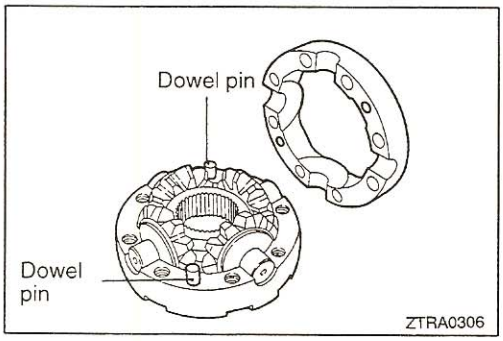
CENTER DIFFERENTIAL CASE

REASSEMBLY AND DISASSEMBLY



Disassembly steps

▶A◀ 1. Center differential case front
2. Dowel pin
3. Pinion
4. Thrust washer
5. Pinion shaft
6. Center differential case rear



REASSEMBLY SERVICE POINT

▶A◀ CENTER DIFFERENTIAL CASE INSTALLATION

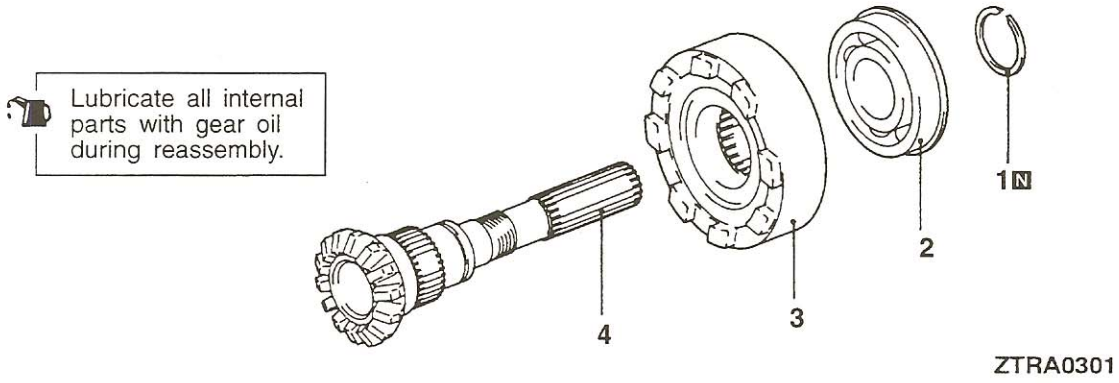
(1) Pay attention to the positions of the dowel pins when reassembling, and make sure that the match marks on the outside circumference are in alignment.

TSB Revision

REAR OUTPUT SHAFT

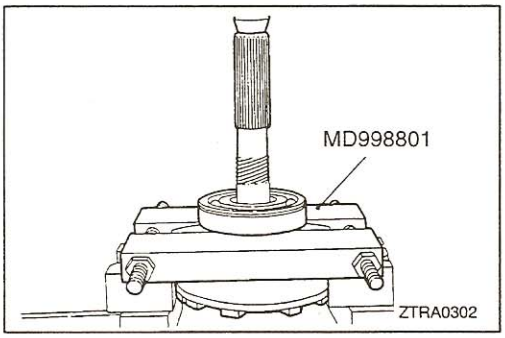
23301360029

DISASSEMBLY AND REASSEMBLY



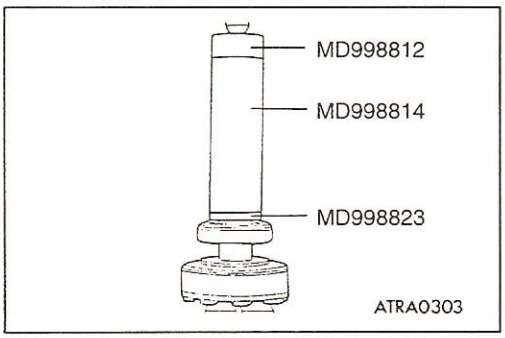
Disassembly steps

▶B◀ 1. Snap ring
◀A▶ ▶A◀ 2. Ball bearing
3. Viscous coupling
4. Rear output shaft



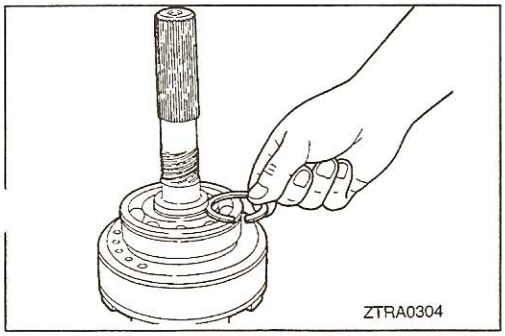
DISASSEMBLY SERVICE POINT

◀A▶ BALL BEARING REMOVAL



REASSEMBLY SERVICE POINTS

▶A◀ BALL BEARING INSTALLATION



▶B◀ SNAP RING INSTALLATION

(1) Select and install the snap ring which adjusts the rear output shaft bearing end play to the standard value.

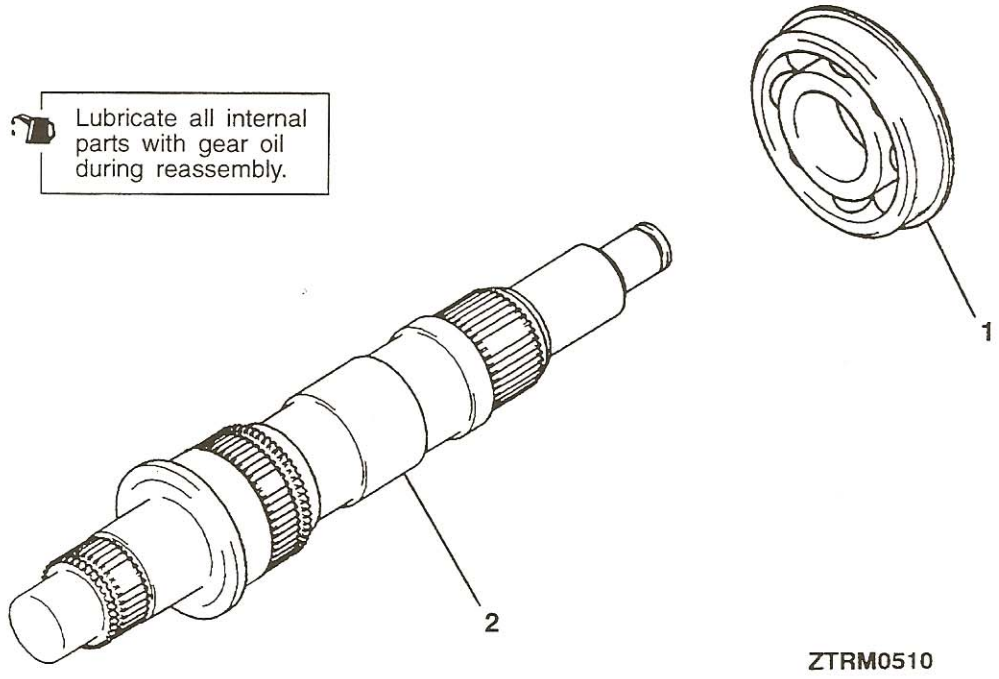
Standard value: 0 – 0.08 mm (0 – .0031 in.)

TSB Revision

TRANSFER DRIVE SHAFT

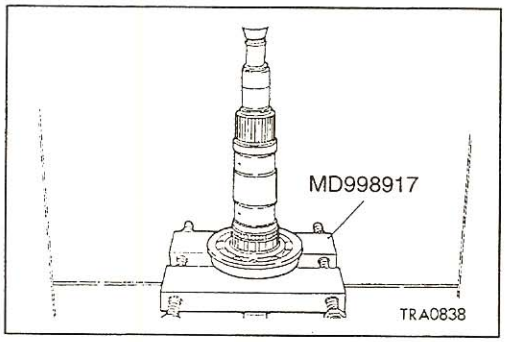
2330145

DISASSEMBLY AND REASSEMBLY



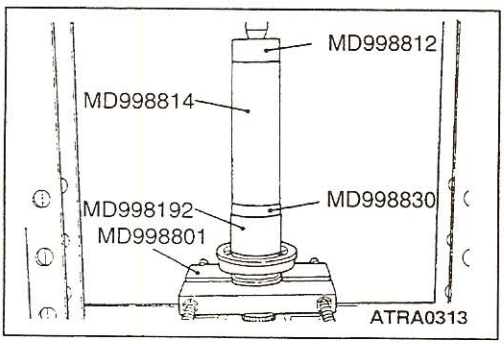
Disassembly steps

◀A▶ ▶A◀ 1. Ball bearing
2. Transfer drive shaft



DISASSEMBLY SERVICE POINT

◀A▶ BALL BEARING REMOVAL



REASSEMBLY SERVICE POINT

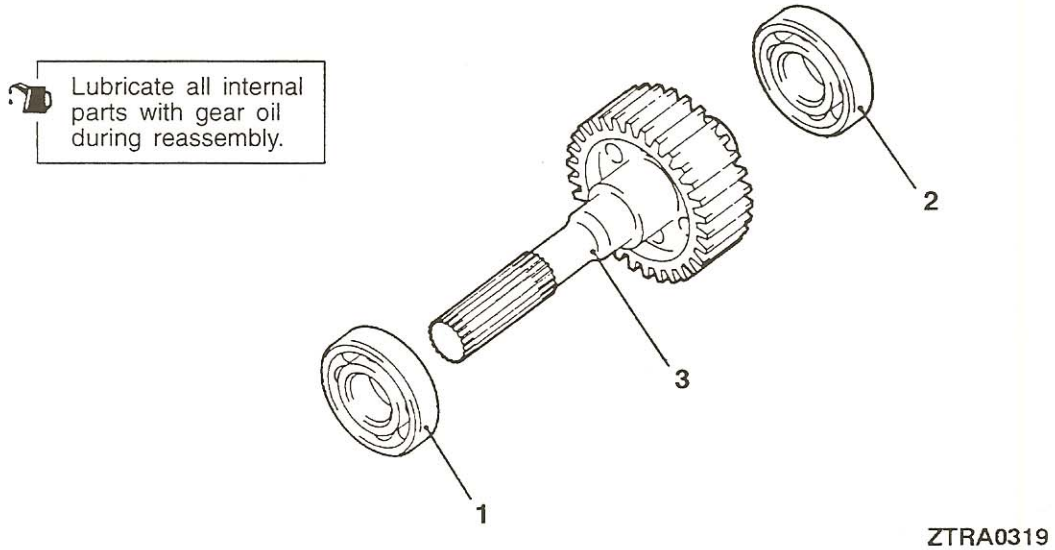
▶A◀ BALL BEARING INSTALLATION

TSB Revision

FRONT OUTPUT SHAFT

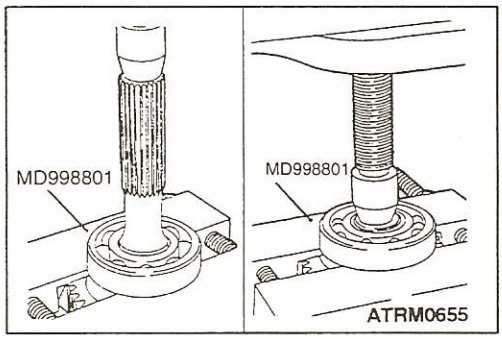
23301480022

DISASSEMBLY AND REASSEMBLY



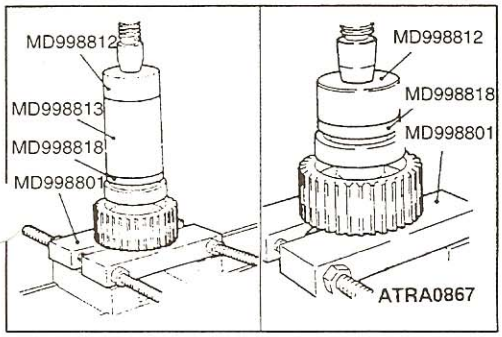
Disassembly steps

◀A▶ ▶A◀ 1. Ball bearing
◀A▶ ▶A◀ 2. Ball bearing
3. Front output shaft



DISASSEMBLY SERVICE POINT

◀A▶ BALL BEARING REMOVAL



REASSEMBLY SERVICE POINT

▶A◀ BALL BEARING INSTALLATION

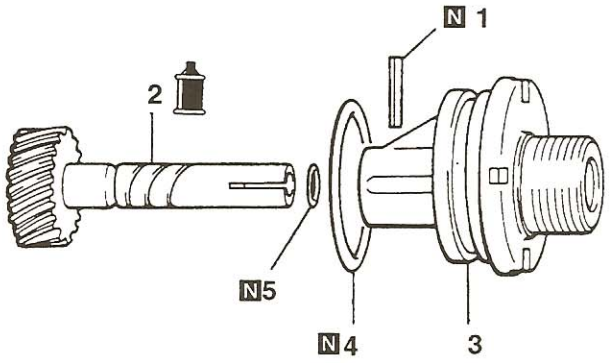
TSB Revision

SPEEDOMETER GEAR

2330157000

DISASSEMBLY AND REASSEMBLY

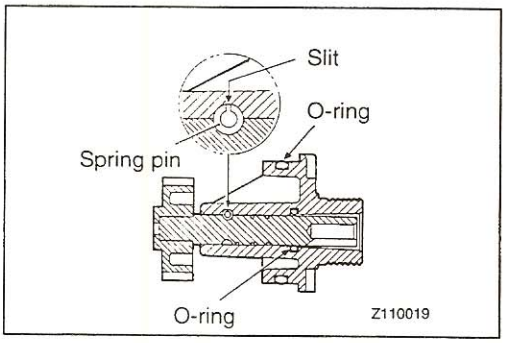
Lubricate all internal parts with gear oil during reassembly.



Z110008

Disassembly steps

▶A◀ 1. Spring pin
2. Speedometer driven gear
3. Speedometer sleeve
4. O-ring
5. O-ring



REASSEMBLY SERVICE POINT

▶A◀ SPRING PIN INSTALLATION

(1) Drive the spring pin into position so that its slit faces the direction shown in the illustration.

TSB Revision

A

B

C

D

E

F

G

H

I

J

K

L

M

O

P

Q

R

S

T

U

V

W

QUICK REFERENCE CHART

VIN Identification Chart		
No.	*Item*	*Contents*
1	Country	J: Japan
2	Make	A: Mitsubishi
3	Vehicle Type	4: Multi-Purpose Vehicle (MPV)
4	Other	M: Montero
5	Model Line	R: Montero (All)
6	Series	5: Premium
7	Body Type	1: 5-Door Wagon
8	Engine Type	R: 6G74 3.5L SOHC MFI
9	Check Digit	*1 2 3 4 5 6 7 8 9 X*
10	Model Year	W: 1998
11	Plant	J: Nagoya-3
12	Serial Number	Digits 12-17 (000001 - 999999)

Fluid Capacities		
Description	*U.S. Measure*	*Liter Measure*
Engine Oil w/Filter & Cooler	5.5 qts.	4.9 L
Cooling System	10.0 qts.	9.5 L
Manual Transmission	3.3 qts.	3.2 L
Auto Transmission	8.9 qts.	8.5 L
Transfer Case	2.6 qts.	2.5 L
Rear Axle	3.3 qts.	3.2 L
Front Axle	1.22 qts.	1.15 L
Power Steering	1.12 qts.	1.06 L
Fuel Tank	24.3 gallons	92 L

Engine Specifications	
Engine Type	6G74 3.5L SOHC MFI
Power	200 hp @ 5000 rpm
Torque	228 lbs-ft @ 3500 rpm
Firing Order	1-2-3-4-5-6
Compression Ratio	9.0:1
Compression Pressure (psi)	171 std./127 min.
Spark Plug Type (NGK)	PFR5J-11
Spark Plug Gap (mm/in)	1.0-1.1 / .039-.043
Basic Ignition Timing	5 deg. BTDC +/- 3 deg.
Curb Idle Speed	700 rpm +/- 100 rpm

Wheel & Tire	
Tire Size	265/70HR15
Wheel Size	15 x 7 JJ
Inflation Pressure (psi)	26 Front / 29 Rear#
Wheel Tightening Torque	72-87 ft. lbs.

 # 32 psi rear with excess load or trailer

MITSUBISHI MOTORS

1998 Montero Service Manual
Published by Mitsubishi Motor Sales of America, Inc.

Printed in U.S.A.
Pub. No. MSSP-004B-98 (1/2)